Biotechnology Foundations in Technology Education

8468 36 weeks

Instructional Framework for Technology Education

Developed by

Developed for

Foreword

Acknowledgments

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Office of Career, Technical, and Adult Education
Introduction

Cluster, pathway, and occupation information, as updated in the APG and CPG, will appear here.

Template material omitted: A general description of the elements of a course framework and links to generally applicable Web resources appear here.
Course Description

Suggested Grade Level: 10 or 11 or 12
Prerequisites:

NEW for 2019:
This course focuses on various techniques that are used to modify living organisms, or parts of organisms, to improve plants and animals, and the development of microorganisms for specific purposes. Student activities range from bioprocessing and deoxyribonucleic acid (DNA) analysis, to medicine, and the environment. Students gain insight and understanding about biotechnology career fields.
Industry Certifications

No certifications have been identified.
# Task/Competency List

**Template material omitted:** General material used to introduce the task list has been omitted.

For the indicated course(s):

- Tasks/competencies designated by plus icons (⊕) in the left-hand column(s) are essential
- Tasks/competencies designated by empty-circle icons (⊙) are optional
- Tasks/competencies designated by minus icons (⊖) are omitted
- Tasks marked with an asterisk (*) are sensitive.

<table>
<thead>
<tr>
<th>Task Number</th>
<th>8468</th>
<th>Tasks/Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exploring Foundations in Biotechnology</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>001</td>
<td>⊕</td>
<td>Define <em>biotechnology</em>.</td>
</tr>
<tr>
<td>002</td>
<td>⊕</td>
<td>Give examples of biotechnology milestones.</td>
</tr>
<tr>
<td>003</td>
<td>⊕</td>
<td>Describe social implications of biotechnology.</td>
</tr>
<tr>
<td>004</td>
<td>⊕</td>
<td>Describe technology transfer in biotechnology.</td>
</tr>
<tr>
<td>005</td>
<td>⊕</td>
<td>Identify careers related to biotechnology.</td>
</tr>
<tr>
<td><strong>Preparing for Biotechnology Experiences</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>006</td>
<td>⊕</td>
<td>Demonstrate understanding of required safety practices and procedures in the classroom and laboratory environment.</td>
</tr>
<tr>
<td>007</td>
<td>⊕</td>
<td>Use the scientific method and the technological/engineering method to solve biotechnology problems.</td>
</tr>
<tr>
<td>008</td>
<td>⊕</td>
<td>Analyze data generated from lab activities.</td>
</tr>
<tr>
<td><strong>Exploring Biochemistry</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>009</td>
<td>⊕</td>
<td>Explain the roles of sciences applicable to biotechnology, including organic chemistry, biochemistry, and microbiology.</td>
</tr>
<tr>
<td>010</td>
<td>⊕</td>
<td>Prepare buffer stock solutions and reagents.</td>
</tr>
<tr>
<td>011</td>
<td>⊕</td>
<td>Explain the structure and cellular function of organic macromolecules.</td>
</tr>
<tr>
<td>012</td>
<td>⊕</td>
<td>Analyze how organic macromolecules are manipulated and detected, using biotechnological tools.</td>
</tr>
<tr>
<td>013</td>
<td>⊕</td>
<td>Explain the function of carbohydrates and lipids.</td>
</tr>
<tr>
<td>014</td>
<td>⊕</td>
<td>Differentiate among the types of proteins found in organisms.</td>
</tr>
<tr>
<td>015</td>
<td>⊕</td>
<td>Explain the basic principles of protein utilization in organisms.</td>
</tr>
<tr>
<td>016</td>
<td>⊕</td>
<td>Explain the advantages of protein utilization in organisms.</td>
</tr>
<tr>
<td>017</td>
<td>⊕</td>
<td>Illustrate the function or use of an enzyme, using a prototype or model.</td>
</tr>
<tr>
<td><strong>Investigating Genetic Engineering</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>018</td>
<td>⊕</td>
<td>Define <em>genetic engineering</em>.</td>
</tr>
<tr>
<td>019</td>
<td>⊕</td>
<td>Develop a timeline of genetic engineering milestones.</td>
</tr>
<tr>
<td>020</td>
<td>⊕</td>
<td>Model deoxyribonucleic acid (DNA).</td>
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<tr>
<td>Task Number</td>
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<tr>
<td>021</td>
<td></td>
<td>Assess the importance of the genetic information contained in DNA.</td>
</tr>
<tr>
<td>022</td>
<td></td>
<td>Describe the function of DNA, ribonucleic acid (RNA), and protein in living cells.</td>
</tr>
<tr>
<td>023</td>
<td></td>
<td>Demonstrate how the structure of DNA influences its function, analysis, and manipulation.</td>
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<tr>
<td>024</td>
<td></td>
<td>Demonstrate how manipulation of nucleic acids through genetic engineering alters the function of proteins and subsequent cellular processes.</td>
</tr>
<tr>
<td>025</td>
<td></td>
<td>Explain how genetic engineering is used in plants, animals, and medicine.</td>
</tr>
<tr>
<td>026</td>
<td></td>
<td>Explain the importance of genetic mapping.</td>
</tr>
<tr>
<td>027</td>
<td></td>
<td>Analyze social implications of genetic engineering.</td>
</tr>
</tbody>
</table>

**Applying Biotechnology to the Environment**

<table>
<thead>
<tr>
<th>Task Number</th>
<th>8468</th>
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</thead>
<tbody>
<tr>
<td>028</td>
<td></td>
<td>Assess the social implication of environmental quality management.</td>
</tr>
<tr>
<td>029</td>
<td></td>
<td>Investigate biotreatment systems.</td>
</tr>
<tr>
<td>030</td>
<td></td>
<td>Examine the potential benefits of biological controls in plant and animal systems.</td>
</tr>
<tr>
<td>031</td>
<td></td>
<td>Design a bioremediation system.</td>
</tr>
<tr>
<td>032</td>
<td></td>
<td>Plan a bio restoration system.</td>
</tr>
<tr>
<td>033</td>
<td></td>
<td>Demonstrate the use of biotechnology to restore or remediate contaminated environments.</td>
</tr>
</tbody>
</table>

**Examining the Role of Biotechnology in Agriculture**

<table>
<thead>
<tr>
<th>Task Number</th>
<th>8468</th>
<th>Tasks/Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>034</td>
<td></td>
<td>Demonstrate various procedures used with tissue cultures.</td>
</tr>
<tr>
<td>035</td>
<td></td>
<td>Analyze social implications of biotechnology in agriculture.</td>
</tr>
<tr>
<td>036</td>
<td></td>
<td>Identify microbial applications in agriculture.</td>
</tr>
<tr>
<td>037</td>
<td></td>
<td>Summarize the role of biotechnology in crop modification.</td>
</tr>
<tr>
<td>038</td>
<td></td>
<td>Identify factors that jeopardize food safety.</td>
</tr>
<tr>
<td>039</td>
<td></td>
<td>Examine advances of biotechnology in food science.</td>
</tr>
</tbody>
</table>

**Exploring Bioprocessing**

<table>
<thead>
<tr>
<th>Task Number</th>
<th>8468</th>
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</tr>
</thead>
<tbody>
<tr>
<td>040</td>
<td></td>
<td>Define bioprocessing.</td>
</tr>
<tr>
<td>041</td>
<td></td>
<td>Describe the process of fermentation.</td>
</tr>
<tr>
<td>042</td>
<td></td>
<td>Prepare a product generated from bioprocessing.</td>
</tr>
<tr>
<td>043</td>
<td></td>
<td>Describe genetic engineering applications used in bioprocessing.</td>
</tr>
<tr>
<td>044</td>
<td></td>
<td>Demonstrate the application of microbes in bioprocessing.</td>
</tr>
<tr>
<td>045</td>
<td></td>
<td>Describe the social and environmental effects of bioprocessing.</td>
</tr>
<tr>
<td>046</td>
<td></td>
<td>Perform separation and purification techniques.</td>
</tr>
<tr>
<td>047</td>
<td></td>
<td>Illustrate the design of bioprocessing systems.</td>
</tr>
</tbody>
</table>

**Examining the Role of Biotechnology in Medicine**

<table>
<thead>
<tr>
<th>Task Number</th>
<th>8468</th>
<th>Tasks/Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>048</td>
<td></td>
<td>Identify the influence of biotechnology on medicine.</td>
</tr>
<tr>
<td>049</td>
<td></td>
<td>Describe the ethical, legal, and social implications of biomedicine.</td>
</tr>
<tr>
<td>050</td>
<td></td>
<td>Explain vaccine (i.e., immunology) research and development.</td>
</tr>
<tr>
<td>051</td>
<td></td>
<td>Describe the effects of molecular research on society.</td>
</tr>
<tr>
<td>Task Number</td>
<td>8468</td>
<td>Tasks/Competencies</td>
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</tr>
<tr>
<td>052</td>
<td>✦</td>
<td>Identify emerging healthcare technologies.</td>
</tr>
<tr>
<td>053</td>
<td>✦</td>
<td>Explain the applications of genetics in pharmacology.</td>
</tr>
<tr>
<td>054</td>
<td>✦</td>
<td>Describe the effects of biotechnology on preventive healthcare.</td>
</tr>
</tbody>
</table>

**Investigating Forensics**

<table>
<thead>
<tr>
<th>Task Number</th>
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<th>Tasks/Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>055</td>
<td>✦</td>
<td>Define <em>forensic science</em>.</td>
</tr>
<tr>
<td>056</td>
<td>✦</td>
<td>Describe situations in which medical forensics can be used.</td>
</tr>
<tr>
<td>057</td>
<td>✦</td>
<td>Describe situations in which forensic science can be used in criminal investigations.</td>
</tr>
<tr>
<td>058</td>
<td>✦</td>
<td>Describe situations in which biological forensic science can be used.</td>
</tr>
<tr>
<td>059</td>
<td>✦</td>
<td>Demonstrate the basic instrumentation used in DNA analysis for forensic purposes.</td>
</tr>
</tbody>
</table>

**Understanding Biomedical Engineering**

<table>
<thead>
<tr>
<th>Task Number</th>
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<th>Tasks/Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>060</td>
<td>✦</td>
<td>Define <em>bioengineering</em>.</td>
</tr>
<tr>
<td>061</td>
<td>✦</td>
<td>Identify uses of nanobiotechnology.</td>
</tr>
<tr>
<td>062</td>
<td>✦</td>
<td>Identify examples of biowarfare.</td>
</tr>
<tr>
<td>063</td>
<td>✦</td>
<td>Design and produce a biomechanism.</td>
</tr>
</tbody>
</table>

**Examining Social Aspects and Ethics of Biotechnology**

<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>064</td>
<td>✦</td>
<td>Define <em>bioethics</em>.</td>
</tr>
<tr>
<td>065</td>
<td>✦</td>
<td>Assess implications of biotechnology, including gene therapy, patenting of living tissue, and cloning.</td>
</tr>
<tr>
<td>066</td>
<td>✦</td>
<td>Differentiate among ethical principles that reflect social, religious, economic, and political perspectives.</td>
</tr>
<tr>
<td>067</td>
<td>✦</td>
<td>Identify regulations that affect biotechnology.</td>
</tr>
</tbody>
</table>

Legend: ✦ Essential  ○ Non-essential  △ Omitted
Exploring Foundations in Biotechnology

Task Number 001

**Define biotechnology.**

**Definition**

Definition should follow the language provided by the Office of Technology Assessment of the U.S. Congress (OTA): “Any technique that uses living organisms (or parts of an organism) to make or modify products, to improve plants or animals, or to develop microorganisms for specific use.”

**Process/Skill Questions**

- What is the origin of the word *biotechnology*?
- What resources describe biotechnology?
- What is the main component used for biotechnology?
- What are DNA and genes?

**Related Standards of Learning**

**History and Social Science**

**VUS.14**

The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

a. assessing the development of and changes in domestic policies, with emphasis on the impact of the role the United States Supreme Court played in defining a constitutional right to privacy, affirming equal rights, and upholding the rule of law;
b. evaluating and explaining the changes in foreign policies and the role of the United States in a world confronted by international terrorism, with emphasis on the American response to 9/11 (September 11, 2001);
c. evaluating the evolving and changing role of government, including its role in the American economy; and
d. explaining scientific and technological changes and evaluating their impact on American culture

**WG.17**

The student will apply social science skills to analyze the impact of globalization by

a. identifying factors, including comparative advantage, that influence the distribution of economic activities and trade;
b. describing ways that economic and social interactions change over time; and
c. mapping, describing, and evaluating economic unions.
WHII.14

The student will apply social science skills to understand the global changes during the early twenty-first century by

a. identifying contemporary political issues, with emphasis on migrations of refugees and others, ethnic/religious conflicts, and the impact of technology, including the role of social media and chemical and biological technologies;
b. assessing the link between economic and political freedom;
c. describing economic interdependence, including the rise of multinational corporations, international organizations, and trade agreements; and
d. analyzing the increasing impact of terrorism.

10.3
The student will apply knowledge of word origins, derivations, and figurative language to extend vocabulary development in authentic texts.

a. Use structural analysis of roots, affixes, synonyms, and antonyms, to understand complex words.
b. Use context, structure, and connotations to determine meanings of words and phrases.
c. Discriminate between connotative and denotative meanings and interpret the connotation.
d. Explain the meaning of common idioms.
e. Explain the meaning of literary and classical allusions and figurative language in text.
f. Extend general and cross-curricular vocabulary through speaking, listening, reading, and writing.

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c. Discriminate between connotative and denotative meanings and interpret the connotation.
d. Explain the meaning of common idioms, and literary and classical allusions in text.
e. Extend general and cross-curricular vocabulary through speaking, listening, reading, and writing.
Task Number 002

Give examples of biotechnology milestones.

Definition

Examples should include milestones from early cultures (e.g., China, Greece, Egypt) as well as more recent milestones. They should include examples from various categories, such as inventions, discoveries, artifacts, and processes.

Process/Skill Questions

- How have historical events influenced and been influenced by biotechnology?
- What discoveries have contributed to recent breakthroughs in biotechnology?
- What are some of the advances that resulted from the human genome project? How did this influence gene editing?
- How did these discoveries lead to the development of recombinant DNA technology? How are these advances used today?
- What are the future applications of biotechnology? How can the field be used for future breakthroughs in medicine and science?
- What are the implications of genomics and proteomics on biotechnology and current healthcare?

Related Standards of Learning

History and Social Science

GOVT.13
The student will apply social science skills to understand how world governments and economies compare and contrast with the government and the economy in the United States by

a. describing the distribution of governmental power;
b. explaining the relationship between the legislative and executive branches;
c. comparing and contrasting the extent of participation in the political process; and
d. comparing and contrasting economic systems.

VUS.13

The student will apply social science skills to understand the social, political, and cultural movements and changes in the United States during the second half of the twentieth century by

a. explaining the factors that led to United States expansion;
b. evaluating and explaining the impact of the *Brown v. Board of Education* decision, the roles of Thurgood Marshall and Oliver W. Hill, Sr., and how Virginia responded to the decision;
c. explaining how the National Association for the Advancement of Colored People (NAACP), the 1963 March on Washington, the Civil Rights Act of 1964, the Voting Rights Act of 1965, and the Americans with Disabilities Act (ADA) had an impact on all Americans;
d. analyzing changes in immigration policy and the impact of increased immigration;
e. evaluating and explaining the foreign and domestic policies pursued by the American government after the Cold War;
f. explaining how scientific and technological advances altered American lives; and
g. evaluating and explaining the changes that occurred in American culture.

VUS.14

The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

a. assessing the development of and changes in domestic policies, with emphasis on the impact of the role the United States Supreme Court played in defining a constitutional right to privacy, affirming equal rights, and upholding the rule of law;
b. evaluating and explaining the changes in foreign policies and the role of the United States in a world confronted by international terrorism, with emphasis on the American response to 9/11 (September 11, 2001);
c. evaluating the evolving and changing role of government, including its role in the American economy; and
d. explaining scientific and technological changes and evaluating their impact on American culture.

WG.7

The student will analyze the characteristics of the European region by

a. identifying and analyzing the location of major geographic regions and major cities on maps and globes;
b. describing major physical and environmental features;
c. explaining important economic characteristics; and
d. recognizing cultural influences and landscapes.

WG.8
The student will analyze the characteristics of the Russian and Central Asian regions by

a. identifying and analyzing the location of major geographic regions and major cities on maps and globes;
b. describing major physical and environmental features;
c. explaining important economic characteristics; and
d. recognizing cultural influences and landscapes.

WG.10

The student will analyze the characteristics of the North African and Southwest Asian regions by

a. identifying and analyzing the location of major geographic regions and major cities on maps and globes;
b. describing major physical and environmental features;
c. explaining important economic characteristics; and
d. recognizing cultural influences and landscapes.

WG.11

The student will analyze the characteristics of the South Asian and Southeast Asian regions by

a. identifying and analyzing the location of major geographic regions and major cities on maps and globes;
b. describing major physical and environmental features;
c. explaining important economic characteristics; and
d. recognizing cultural influences and landscapes.

WG.12

The student will analyze the characteristics of the East Asian region by

a. identifying and analyzing the location of major geographic regions and major cities on maps and globes;
b. describing major physical and environmental features;
c. explaining important economic characteristics; and
d. recognizing cultural influences and landscapes.

WHII.6

The student will apply social science skills to understand the political, cultural, geographic, and economic conditions in Asia from about 1500 A.D. (C.E.) to about 1800 A.D. (C.E.) by

a. locating Asian empires in time and place and identifying major geographic features;
b. describing the location and development of social and cultural patterns in the Ottoman Empire;
c. describing the location and development of social and cultural patterns in India, with emphasis on the Mughal Empire and coastal trade;
d. describing the location and development of social and cultural patterns in China, with emphasis on the Qing (Manchu) dynasty;
e. describing the location and development of social and cultural patterns in Japan, with emphasis on the Japanese shogunate; and
f. comparing and contrasting the political and economic systems of Asian empires.
WHII.8

The student will apply social science skills to understand the changes in European nations between 1800 and 1900 by

a. explaining the roles of resources, capital, and entrepreneurship in developing an industrial economy;
b. analyzing the effects of the Industrial Revolution on society and culture, with emphasis on the evolution of the nature of work and the labor force, including its effects on families and the status of women and children;
c. describing how industrialization affected economic and political systems in Europe, with emphasis on the slave trade and the labor union movement;
d. assessing the impact of Napoleon and the Congress of Vienna on political power in Europe;
e. explaining the events related to the unification of Italy and the role of Italian nationalism; and
f. explaining the events related to the unification of Germany and the role of Bismarck.

10.5

The student will read, interpret, analyze, and evaluate nonfiction texts.

a. Analyze text features and organizational patterns to evaluate the meaning of texts.
b. Recognize an author’s intended audience and purpose for writing.
c. Skim materials to develop an overview and locate information.
d. Compare and contrast informational texts for intent and content.
e. Interpret and use data and information in maps, charts, graphs, timelines, tables, and diagrams.
f. Draw conclusions and make inferences on explicit and implied information using textual support as evidence.
g. Analyze and synthesize information in order to solve problems, answer questions, and generate new knowledge.
h. Analyze ideas within and between selections providing textual evidence.
i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.
j. Use reading strategies throughout the reading process to monitor comprehension.

11.5

The student will read, interpret, analyze, and evaluate a variety of nonfiction texts including employment documents and technical writing.

a. Apply information from texts to clarify understanding of concepts.
b. Read and correctly interpret an application for employment, workplace documents, or an application for college admission.
c. Analyze technical writing for clarity.
d. Paraphrase and synthesize ideas within and between texts.
e. Draw conclusions and make inferences on explicit and implied information using textual support.
f. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.
g. Analyze false premises, claims, counterclaims, and other evidence in persuasive writing.
h. Recognize and analyze use of ambiguity, contradiction, paradox, irony, sarcasm, overstatement, and understatement in text.
i. Generate and respond logically to literal, inferential, evaluative, synthesizing, and critical thinking questions about the text(s).

12.5 The student will read, interpret, analyze, and evaluate a variety of nonfiction texts.

a. Use critical thinking to generate and respond logically to literal, inferential, and evaluative questions about the text(s).

b. Identify and synthesize resources to make decisions, complete tasks, and solve specific problems.

c. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.

d. Recognize and analyze use of ambiguity, contradiction, paradox, irony, overstatement, and understatement in text.

e. Analyze false premises claims, counterclaims, and other evidence in persuasive writing.

ITEEA National Standards

7. The Influence of Technology on History

TSA Competitive Events

Biotechnology Design

Task Number 003

Describe social implications of biotechnology.

Definition

Description should include positive and negative, desired and undesired effects. It should include cultural, economic, financial, political, ethical, legal, and other implications.

Process/Skill Questions

- What are the differences among moral, ethical, and legal biotechnology issues?
- How is biotechnology interrelated with ethical, legal, and social issues (ELSI)?
- When making biotechnology decisions, why is it important to include cultural issues in the decision-making process?
- How do attitudes about the use of biotechnology compare regionally, nationally, and internationally?
- What are historical examples of the social implications of biotechnology decisions or events?
- What is the role of biotechnology in different countries?
- How are biotechnology research and development funded?
- What are the effects of marketing and media on the public perception of biotechnology research?
The student will apply social science skills to understand the process by which public policy is made by

a. defining public policy and determining how to differentiate public and private action;
b. examining different perspectives on the role of government;
c. describing how the national government influences the public agenda and shapes public policy by examining examples such as the Equal Rights Amendment, the Americans with Disabilities Act (ADA), and Section 9524 of the Elementary and Secondary Education Act (ESEA) of 1965;
d. describing how the state and local governments influence the public agenda and shape public policy;
e. investigating and evaluating the process by which policy is implemented by the bureaucracy at each level;
f. analyzing how the incentives of individuals, interest groups, and the media influence public policy; and
g. devising a course of action to address local and/or state issues.

The student will apply social science skills to understand the role of government in the Virginia and United States economies by

a. describing the provision of government goods and services that are not readily produced by the market;
b. describing government’s establishment and maintenance of the rules and institutions in which markets operate, including the establishment and enforcement of property rights, contracts, consumer rights, labor-management relations, environmental protection, and competition in the marketplace;
c. investigating and describing the types and purposes of taxation that are used by local, state, and federal governments to pay for services provided by the government;
d. analyzing how Congress can use fiscal policy to stabilize the economy;
e. describing the effects of the Federal Reserve’s monetary policy on price stability, employment, and the economy; and
f. evaluating the trade-offs in government decisions.

The student will apply social science skills to understand the social, political, and cultural movements and changes in the United States during the second half of the twentieth century by

a. explaining the factors that led to United States expansion;
b. evaluating and explaining the impact of the *Brown v. Board of Education* decision, the roles of Thurgood Marshall and Oliver W. Hill, Sr., and how Virginia responded to the decision;
c. explaining how the National Association for the Advancement of Colored People (NAACP), the 1963 March on Washington, the Civil Rights Act of 1964, the Voting Rights Act of 1965, and the Americans with Disabilities Act (ADA) had an impact on all Americans;
d. analyzing changes in immigration policy and the impact of increased immigration;
e. evaluating and explaining the foreign and domestic policies pursued by the American
government after the Cold War;
f. explaining how scientific and technological advances altered American lives; and
g. evaluating and explaining the changes that occurred in American culture.

VUS.14

The student will apply social science skills to understand political and social conditions in the
United States during the early twenty-first century by

a. assessing the development of and changes in domestic policies, with emphasis on the impact
of the role the United States Supreme Court played in defining a constitutional right to
privacy, affirming equal rights, and upholding the rule of law;
b. evaluating and explaining the changes in foreign policies and the role of the United States in a
world confronted by international terrorism, with emphasis on the American response to 9/11
(September 11, 2001);
c. evaluating the evolving and changing role of government, including its role in the American
economy; and
d. explaining scientific and technological changes and evaluating their impact on American
culture

WG.6

The student will analyze the characteristics of the Latin American and Caribbean regions by

a. identifying and analyzing the location of major geographic regions and major cities on maps
and globes;
b. describing major physical and environmental features;
c. explaining important economic characteristics; and
d. recognizing cultural influences and landscapes.

WHII.13

The student will apply social science skills to understand of the political, economic, social, and
cultural aspects of independence movements and development efforts by

a. describing the struggles for self-rule, including Gandhi’s leadership in India and the
development of India’s democracy;
b. describing Africa’s independence movements, including Jomo Kenyatta’s leadership of
Kenya and Nelson Mandela’s role in South Africa; and
c. describing the end of the mandate system and the creation of states in the Middle East,
including the roles of Golda Meir and Gamal Abdel Nasser.

WHII.14

The student will apply social science skills to understand the global changes during the early
twenty-first century by

a. identifying contemporary political issues, with emphasis on migrations of refugees and
others, ethnic/religious conflicts, and the impact of technology, including the role of social
media and chemical and biological technologies;
b. assessing the link between economic and political freedom;
c. describing economic interdependence, including the rise of multinational corporations, international organizations, and trade agreements; and
d. analyzing the increasing impact of terrorism.

**Science**

**BIO.5**

The student will investigate and understand common mechanisms of inheritance and protein synthesis. Key concepts include

a. cell growth and division;
b. gamete formation;
c. cell specialization;
d. prediction of inheritance of traits based on the Mendelian laws of heredity;
e. historical development of the structural model of DNA;
f. genetic variation;
g. the structure, function, and replication of nucleic acids;
h. events involved in the construction of proteins;
i. use, limitations, and misuse of genetic information; and
j. exploration of the impact of DNA technologies.

**English**

**10.5**

The student will read, interpret, analyze, and evaluate nonfiction texts.

a. Analyze text features and organizational patterns to evaluate the meaning of texts.
b. Recognize an author’s intended audience and purpose for writing.
c. Skim materials to develop an overview and locate information.
d. Compare and contrast informational texts for intent and content.
e. Interpret and use data and information in maps, charts, graphs, timelines, tables, and diagrams.
f. Draw conclusions and make inferences on explicit and implied information using textual support as evidence.
g. Analyze and synthesize information in order to solve problems, answer questions, and generate new knowledge.
h. Analyze ideas within and between selections providing textual evidence.
i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.
j. Use reading strategies throughout the reading process to monitor comprehension.

**11.5**

The student will read, interpret, analyze, and evaluate a variety of nonfiction texts including employment documents and technical writing.

a. Apply information from texts to clarify understanding of concepts.
b. Read and correctly interpret an application for employment, workplace documents, or an application for college admission.
c. Analyze technical writing for clarity.
d. Paraphrase and synthesize ideas within and between texts.
e. Draw conclusions and make inferences on explicit and implied information using textual support.
f. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.
g. Analyze false premises, claims, counterclaims, and other evidence in persuasive writing.

h. Recognize and analyze use of ambiguity, contradiction, paradox, irony, sarcasm, overstatement, and understatement in text.
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e. Analyze false premises claims, counterclaims, and other evidence in persuasive writing.

Mathematics

PS.1*
The student will analyze graphical displays of univariate data, including dotplots, stemplots, boxplots, cumulative frequency graphs, and histograms, to identify and describe patterns and departures from patterns, using central tendency, spread, clusters, gaps, and outliers.

PS.7*
The student, using two-way tables and other graphical displays, will analyze categorical data to describe patterns and departures from patterns and to determine marginal frequency and relative frequencies, including conditional frequencies.

PS.11*
The student will identify and describe two or more events as complementary, dependent, independent, and/or mutually exclusive.

ITEEA National Standards

4. The Cultural, Social, Economic, and Political Effects of Technology

TSA Competitive Events

Biotechnology Design

Engineering Design

Essays on Technology
Task Number 004

Describe technology transfer in biotechnology.

Definition

Description should include examples of technology transfer from outside biotechnology into biotechnology and vice versa, as well as within or among biotechnology fields.

Process/Skill Questions

- What have been important effects of technology transfer related to biotechnology?
- Why is interdisciplinary collaboration important in technology transfer?
- What is an example of spin-off technology?
- How has the coupling of technologies created new fields in biotechnology (e.g., mathematical biology, bioinformatics)?

Related Standards of Learning

History and Social Science

VUS.13

The student will apply social science skills to understand the social, political, and cultural movements and changes in the United States during the second half of the twentieth century by

a. explaining the factors that led to United States expansion;
b. evaluating and explaining the impact of the Brown v. Board of Education decision, the roles of Thurgood Marshall and Oliver W. Hill, Sr., and how Virginia responded to the decision;
c. explaining how the National Association for the Advancement of Colored People (NAACP), the 1963 March on Washington, the Civil Rights Act of 1964, the Voting Rights Act of 1965, and the Americans with Disabilities Act (ADA) had an impact on all Americans;
d. analyzing changes in immigration policy and the impact of increased immigration;
e. evaluating and explaining the foreign and domestic policies pursued by the American government after the Cold War;
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g. evaluating and explaining the changes that occurred in American culture.

VUS.14

The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

a. assessing the development of and changes in domestic policies, with emphasis on the impact of the role the United States Supreme Court played in defining a constitutional right to privacy, affirming equal rights, and upholding the rule of law;
b. evaluating and explaining the changes in foreign policies and the role of the United States in a world confronted by international terrorism, with emphasis on the American response to 9/11 (September 11, 2001);
c. evaluating the evolving and changing role of government, including its role in the American economy; and
d. explaining scientific and technological changes and evaluating their impact on American culture

ITEEA National Standards

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

TSA Competitive Events

Biotechnology Design

Engineering Design

Task Number 005

Identify careers related to biotechnology.

Definition

Identification should include careers in agriculture, medicine, and engineering. The focus should be on careers within each of the following main areas:

- Research and development
- Agriculture
- Environmental applications
- Biomanufacturing
- Teaching
- Human health and diagnostics

For each career, the following should be addressed:

- Responsibilities
- Salaries
- Working environment
- Required education/training
- Job outlook

Process/Skill Questions

- What certifications, licenses, and degrees are available for careers in biotechnology?
- What is the outlook for careers in biotechnology?
• What resources have information about careers in biotechnology?
• What educational opportunities in biotechnology are available in higher education?
• What is the role of the Technology Student Association?

Related Standards of Learning

English

10.5
The student will read, interpret, analyze, and evaluate nonfiction texts.

a. Analyze text features and organizational patterns to evaluate the meaning of texts.
b. Recognize an author’s intended audience and purpose for writing.
c. Skim materials to develop an overview and locate information.
d. Compare and contrast informational texts for intent and content.
e. Interpret and use data and information in maps, charts, graphs, timelines, tables, and diagrams.
f. Draw conclusions and make inferences on explicit and implied information using textual support as evidence.
g. Analyze and synthesize information in order to solve problems, answer questions, and generate new knowledge.
h. Analyze ideas within and between selections providing textual evidence.
i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.
j. Use reading strategies throughout the reading process to monitor comprehension.

10.8
The student will find, evaluate, and select credible resources to create a research product.

a. Verify the accuracy, validity, and usefulness of information.
b. Analyze information gathered from diverse sources by identifying misconceptions, main and supporting ideas, conflicting information, and point of view or bias.
c. Evaluate and select evidence from a variety of sources to introduce counter claims and to support claims.
d. Cite sources for both quoted and paraphrased ideas using a standard method of documentation, such as that of the Modern Language Association (MLA) or the American Psychological Association (APA).
e. Define the meaning and consequences of plagiarism and follow ethical and legal guidelines for gathering and using information.
f. Demonstrate ethical use of the Internet.

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The student will read, interpret, analyze, and evaluate a variety of nonfiction texts including employment documents and technical writing.

a. Apply information from texts to clarify understanding of concepts.
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e. Draw conclusions and make inferences on explicit and implied information using textual support.
f. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.
g. Analyze false premises, claims, counterclaims, and other evidence in persuasive writing.
h. Recognize and analyze use of ambiguity, contradiction, paradox, irony, sarcasm, overstatement, and understatement in text.
i. Generate and respond logically to literal, inferential, evaluative, synthesizing, and critical thinking questions about the text(s).

11.8
The student will analyze, evaluate, synthesize, and organize information from a variety of credible resources to produce a research product.

   b. Make sense of information gathered from diverse sources by identifying misconceptions, main and supporting ideas, conflicting information, point of view or bias.
   c. Synthesize relevant information from primary and secondary sources and present it in a logical sequence.
   d. Cite sources for both quoted and paraphrased ideas using a standard method of documentation, such as that of the Modern Language Association (MLA) or the American Psychological Association (APA).
   e. Define the meaning and consequences of plagiarism and follow ethical and legal guidelines for gathering and using information.
   f. Demonstrate ethical use of the Internet.

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   b. Identify and synthesize resources to make decisions, complete tasks, and solve specific problems.
   c. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.
   d. Recognize and analyze use of ambiguity, contradiction, paradox, irony, overstatement, and understatement in text.
   e. Analyze false premises claims, counterclaims, and other evidence in persuasive writing.

12.8
The student will analyze, evaluate, synthesize, and organize information from a variety of credible resources to produce a research product.

   a. Frame, analyze, and synthesize information to solve problems, answer questions, and generate new knowledge.
   b. Analyze information gathered from diverse sources by identifying misconceptions, main and supporting ideas, conflicting information, point of view, or bias.
   c. Critically evaluate the accuracy, quality, and validity of the information.
   d. Cite sources for both quoted and paraphrased ideas using a standard method of documentation, such as that of the Modern Language Association (MLA) or the American Psychological Association (APA).
   e. Define the meaning and consequences of plagiarism and follow ethical and legal guidelines for gathering and using information.
   f. Demonstrate ethical use of the Internet.
### ITEE National Standards

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### TSA Competitive Events

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Preparation for Biotechnology Experiences

**Task Number 006**

Demonstrate understanding of required safety practices and procedures in the classroom and laboratory environment.

**Definition**

Demonstration should

- reflect knowledge of general safety rules (e.g., those related to fire, electricity, infection prevention, transmission of diseases), aseptic technique, chemical safety, and industry-specified guidelines (e.g., Occupational Safety and Health Administration [OSHA] and Clinical Laboratory Improvement Amendment [CLIA]), Environmental Protection Agency (EPA), and right to know
- demonstrate health and safety practices to include safety data sheets (SDS) emergency equipment, storage of chemicals, and maintenance of equipment
- follow manufacturers' guidelines for equipment and material use
- include health and safety procedures related to the use and disposal of sharps, hazardous materials, personal protective equipment (PPE), and other items.

**Process/Skill Questions**

- What are specific rules and procedures involved in aseptic technique?
- Why are aseptic rules important?
- What is the chain of infection? Why is it important?
- What are appropriate cleanup procedures for hazardous materials (HAZMAT)?
- What are SDS? Why are they important?
- Why is documentation important to safety?

**Related Standards of Learning**

- **History and Social Science**

  **VUS.8**

  The student will apply social science skills to understand how the nation grew and changed from the end of Reconstruction through the early twentieth century by

  a. explaining the westward movement of the population in the United States, with emphasis on the role of the railroads, communication systems, admission of new states to the Union, and the impact on American Indians;
  b. analyzing the factors that transformed the American economy from agrarian to industrial and explaining how major inventions transformed life in the United States, including the emergence of leisure activities;
  c. examining the contributions of new immigrants and evaluating the challenges they faced,
including anti-immigration legislation;
d. analyzing the impact of prejudice and discrimination, including “Jim Crow” laws, the responses of Booker T. Washington and W.E.B. DuBois, and the practice of eugenics in Virginia;
e. evaluating and explaining the social and cultural impact of industrialization, including rapid urbanization; and
f. evaluating and explaining the economic outcomes and the political, cultural, and social developments of the Progressive Movement and the impact of its legislation.

**VUS.13**

The student will apply social science skills to understand the social, political, and cultural movements and changes in the United States during the second half of the twentieth century by

a. explaining the factors that led to United States expansion;
b. evaluating and explaining the impact of the *Brown v. Board of Education* decision, the roles of Thurgood Marshall and Oliver W. Hill, Sr., and how Virginia responded to the decision;
c. explaining how the National Association for the Advancement of Colored People (NAACP), the 1963 March on Washington, the Civil Rights Act of 1964, the Voting Rights Act of 1965, and the Americans with Disabilities Act (ADA) had an impact on all Americans;
d. analyzing changes in immigration policy and the impact of increased immigration;
e. evaluating and explaining the foreign and domestic policies pursued by the American government after the Cold War;
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**VUS.14**

The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

a. assessing the development of and changes in domestic policies, with emphasis on the impact of the role the United States Supreme Court played in defining a constitutional right to privacy, affirming equal rights, and upholding the rule of law;
b. evaluating and explaining the changes in foreign policies and the role of the United States in a world confronted by international terrorism, with emphasis on the American response to 9/11 (September 11, 2001);
c. evaluating the evolving and changing role of government, including its role in the American economy; and
d. explaining scientific and technological changes and evaluating their impact on American culture

**WHII.8**

The student will apply social science skills to understand the changes in European nations between 1800 and 1900 by

a. explaining the roles of resources, capital, and entrepreneurship in developing an industrial economy;
b. analyzing the effects of the Industrial Revolution on society and culture, with emphasis on the evolution of the nature of work and the labor force, including its effects on families and the status of women and children;
c. describing how industrialization affected economic and political systems in Europe, with emphasis on the slave trade and the labor union movement;
d. assessing the impact of Napoleon and the Congress of Vienna on political power in Europe;
e. explaining the events related to the unification of Italy and the role of Italian nationalism; and
f. explaining the events related to the unification of Germany and the role of Bismarck.

Science

BIO.1
The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

a. observations of living organisms are recorded in the lab and in the field;
b. hypotheses are formulated based on direct observations and information from scientific literature;
c. variables are defined and investigations are designed to test hypotheses;
d. graphing and arithmetic calculations are used as tools in data analysis;
e. conclusions are formed based on recorded quantitative and qualitative data;
f. sources of error inherent in experimental design are identified and discussed;
g. validity of data is determined;
h. chemicals and equipment are used in a safe manner;
i. appropriate technology including computers, graphing calculators, and probeware is used for gathering and analyzing data, communicating results, modeling concepts, and simulating experimental conditions;
j. research utilizes scientific literature;
k. differentiation is made among a scientific hypothesis, theory, and law;
l. alternative scientific explanations and models are recognized and analyzed; and
m. current applications of biological concepts are used.

CH.1
The student will investigate and understand that experiments in which variables are measured, analyzed, and evaluated produce observations and verifiable data. Key concepts include

a. designated laboratory techniques;
b. safe use of chemicals and equipment;
c. proper response to emergency situations;
d. manipulation of multiple variables, using repeated trials;
e. accurate recording, organization, and analysis of data through repeated trials;
f. mathematical and procedural error analysis;
g. mathematical manipulations including SI units, scientific notation, linear equations, graphing, ratio and proportion, significant digits, and dimensional analysis;
h. use of appropriate technology including computers, graphing calculators, and probeware for gathering data, communicating results, and using simulations to model concepts;
i. construction and defense of a scientific viewpoint; and
j. the use of current applications to reinforce chemistry concepts.

ITEEA National Standards

12. Use and Maintain Technological Products and Systems
Task Number 007

Use the scientific method and the technological/engineering method to solve biotechnology problems.

Definition

Use involves

- identifying a problem
- researching
- forming a hypothesis
- planning an experiment
- performing an experiment
- analyzing data
- forming a conclusion
- communicating results.

Use of the technological/engineering method should be based on the understanding that this method is concerned with the phenomenon of the human-designed world and with obtaining artifacts and solutions to problems. The steps include

- identifying the need or opportunity for an engineering solution
- defining a design problem
- identifying the constraints of a design problem
- researching potential solutions to a design problem
- generating multiple solutions (brainstorming) to a design problem
- sketching solutions for a design problem
- evaluating potential solutions to a design problem
- choosing the optimal solution to a design problem
- implementing the solutions to the design problem
- communicating the solution to stakeholders
- testing the solution
- evaluating the test results
- improving the initial solution
- communicating the solution to stakeholders.
Process/Skill Questions

- What are the steps in the scientific method? Why is each step important?
- What are the steps in the technological/engineering method? Why is each step important?
- What are the similarities and differences between the scientific method and the technological/engineering method?
- What conditions require using the scientific method? What conditions require using the technological/engineering method?

Related Standards of Learning

**History and Social Science**

**WHII.4**

The student will apply social science skills to understand the impact of the European Age of Exploration by

a. explaining the political and economic goals of European exploration and colonization;
b. describing the geographic expansion into Africa, Asia, and the Americas;
c. comparing and contrasting the social and cultural influences of European settlement on Africa, Asia, and the Americas;
d. analyzing how competition for colonies changed the economic system of Europe; and
e. defining and describing how the Scientific Revolution led to social and technological changes that influenced the European view of the world.

**Science**

**BIO.1**

The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

a. observations of living organisms are recorded in the lab and in the field;
b. hypotheses are formulated based on direct observations and information from scientific literature;
c. variables are defined and investigations are designed to test hypotheses;
d. graphing and arithmetic calculations are used as tools in data analysis;
e. conclusions are formed based on recorded quantitative and qualitative data;
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j. research utilizes scientific literature;
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l. alternative scientific explanations and models are recognized and analyzed; and
m. current applications of biological concepts are used.

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a. designated laboratory techniques;
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e. accurate recording, organization, and analysis of data through repeated trials;
f. mathematical and procedural error analysis;
g. mathematical manipulations including SI units, scientific notation, linear equations, graphing, ratio and proportion, significant digits, and dimensional analysis;
h. use of appropriate technology including computers, graphing calculators, and probeware for gathering data, communicating results, and using simulations to model concepts;
i. construction and defense of a scientific viewpoint; and
j. the use of current applications to reinforce chemistry concepts.

PH.3
The student will investigate and demonstrate an understanding of the nature of science, scientific reasoning, and logic. Key concepts include

a. analysis of scientific sources to develop and refine research hypotheses;
b. analysis of how science explains and predicts relationships;
c. evaluation of evidence for scientific theories;
d. examination of how new discoveries result in modification of existing theories or establishment of new paradigms; and
e. construction and defense of a scientific viewpoint.

PH.4
The student will investigate and understand how applications of physics affect the world. Key concepts include

a. examples from the real world; and
b. exploration of the roles and contributions of science and technology.

English

10.3
The student will apply knowledge of word origins, derivations, and figurative language to extend vocabulary development in authentic texts.

a. Use structural analysis of roots, affixes, synonyms, and antonyms, to understand complex words.
b. Use context, structure, and connotations to determine meanings of words and phrases.
c. Discriminate between connotative and denotative meanings and interpret the connotation.
d. Explain the meaning of common idioms.
e. Explain the meaning of literary and classical allusions and figurative language in text.
f. Extend general and cross-curricular vocabulary through speaking, listening, reading, and writing.

10.5
The student will read, interpret, analyze, and evaluate nonfiction texts.

a. Analyze text features and organizational patterns to evaluate the meaning of texts.
b. Recognize an author’s intended audience and purpose for writing.
c. Skim materials to develop an overview and locate information.
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f. Draw conclusions and make inferences on explicit and implied information using textual support as evidence.
g. Analyze and synthesize information in order to solve problems, answer questions, and generate new knowledge.
h. Analyze ideas within and between selections providing textual evidence.
i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.
j. Use reading strategies throughout the reading process to monitor comprehension.

10.8
The student will find, evaluate, and select credible resources to create a research product.

a. Verify the accuracy, validity, and usefulness of information.
b. Analyze information gathered from diverse sources by identifying misconceptions, main and supporting ideas, conflicting information, and point of view or bias.
c. Evaluate and select evidence from a variety of sources to introduce counter claims and to support claims.
d. Cite sources for both quoted and paraphrased ideas using a standard method of documentation, such as that of the Modern Language Association (MLA) or the American Psychological Association (APA).
e. Define the meaning and consequences of plagiarism and follow ethical and legal guidelines for gathering and using information.
f. Demonstrate ethical use of the Internet.

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d. Paraphrase and synthesize ideas within and between texts.
e. Draw conclusions and make inferences on explicit and implied information using textual support.
f. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.

g. Analyze false premises, claims, counterclaims, and other evidence in persuasive writing.

h. Recognize and analyze use of ambiguity, contradiction, paradox, irony, sarcasm, overstatement, and understatement in text.

i. Generate and respond logically to literal, inferential, evaluative, synthesizing, and critical thinking questions about the text(s).

11.8

The student will analyze, evaluate, synthesize, and organize information from a variety of credible resources to produce a research product.


b. Make sense of information gathered from diverse sources by identifying misconceptions, main and supporting ideas, conflicting information, point of view or bias.

c. Synthesize relevant information from primary and secondary sources and present it in a logical sequence.

d. Cite sources for both quoted and paraphrased ideas using a standard method of documentation, such as that of the Modern Language Association (MLA) or the American Psychological Association (APA).

e. Define the meaning and consequences of plagiarism and follow ethical and legal guidelines for gathering and using information.

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a. Use structural analysis of roots, affixes, synonyms, and antonyms, to understand complex words.

b. Use context, structure, and connotations to determine meanings of words and phrases.

c. Discriminate between connotative and denotative meanings and interpret the connotation.

d. Explain the meaning of common idioms, and literary and classical allusions in text.

e. Extend general and cross-curricular vocabulary through speaking, listening, reading, and writing.

12.5

The student will read, interpret, analyze, and evaluate a variety of nonfiction texts.

a. Use critical thinking to generate and respond logically to literal, inferential, and evaluative questions about the text(s).

b. Identify and synthesize resources to make decisions, complete tasks, and solve specific problems.

c. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.

d. Recognize and analyze use of ambiguity, contradiction, paradox, irony, overstatement, and understatement in text.

e. Analyze false premises claims, counterclaims, and other evidence in persuasive writing.

12.8

The student will analyze, evaluate, synthesize, and organize information from a variety of credible resources to produce a research product.
a. Frame, analyze, and synthesize information to solve problems, answer questions, and generate new knowledge.
b. Analyze information gathered from diverse sources by identifying misconceptions, main and supporting ideas, conflicting information, point of view, or bias.
c. Critically evaluate the accuracy, quality, and validity of the information.
d. Cite sources for both quoted and paraphrased ideas using a standard method of documentation, such as that of the Modern Language Association (MLA) or the American Psychological Association (APA).
e. Define the meaning and consequences of plagiarism and follow ethical and legal guidelines for gathering and using information.
f. Demonstrate ethical use of the Internet.

Mathematics

A.8
The student, given a situation in a real-world context, will analyze a relation to determine whether a direct or inverse variation exists, and represent a direct variation algebraically and graphically and an inverse variation algebraically.

A.9
The student will collect and analyze data, determine the equation of the curve of best fit in order to make predictions, and solve practical problems, using mathematical models of linear and quadratic functions.

AFDA.3
The student will collect and analyze data, determine the equation of the curve of best fit in order to make predictions, and solve practical problems using models of linear, quadratic, and exponential functions.

AFDA.8
The student will design and conduct an experiment/survey. Key concepts include

- sample size;
- sampling technique;
- controlling sources of bias and experimental error;
- data collection; and
- data analysis and reporting.

AII.9
The student will collect and analyze data, determine the equation of the curve of best fit in order to make predictions, and solve practical problems, using mathematical models of linear, quadratic, and exponential functions.

PS.1*
The student will analyze graphical displays of univariate data, including dotplots, stemplots, boxplots, cumulative frequency graphs, and histograms, to identify and describe patterns and departures from patterns, using central tendency, spread, clusters, gaps, and outliers.

PS.2*
The student will analyze numerical characteristics of univariate data sets to describe patterns and departures from patterns, using mean, median, mode, variance, standard deviation, interquartile range, range, and outliers.

PS.3*
The student will compare distributions of two or more univariate data sets, numerically and graphically, analyzing center and spread (within group and between group variations), clusters and gaps, shapes, outliers, or other unusual features.

PS.4*
The student will analyze scatterplots to identify and describe the relationship between two variables, using shape; strength of relationship; clusters; positive, negative, or no association; outliers; and influential points.

**PS.8***
The student will describe the methods of data collection in a census, sample survey, experiment, and observational study and identify an appropriate method of solution for a given problem setting.

**PS.10***
The student will plan and conduct a well-designed experiment. The plan will address control, randomization, replication, blinding, and measurement of experimental error.

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**ITEEA National Standards**

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**TSA Competitive Events**

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**Task Number 008**

**Analyze data generated from lab activities.**

**Definition**

Analysis should include

- collection of data from experiments
- comparative research
- observations
- documentation (i.e., lab journals and logs)
- application of formulas, conclusions, and quality control (e.g., identification of quality standard, data validation).

**Process/Skill Questions**

- What are quality controls, and what is the purpose of having them?
- How are quality controls maintained?
- What would be the consequences of not maintaining quality controls?
- What types of questions need to be answered when collecting data for an experiment?
• How and why are data collected from lab activities?
• How may the data be documented?
• What different methods are used to document data?
• How are data used to model biotechnical processes?
• How can the data analysis prove or disprove the question of the experiment?
• How do the results from the quality controls affect the data interpretation?

Related Standards of Learning

History and Social Science

WHII.4
The student will apply social science skills to understand the impact of the European Age of Exploration by

a. explaining the political and economic goals of European exploration and colonization;
b. describing the geographic expansion into Africa, Asia, and the Americas;
c. comparing and contrasting the social and cultural influences of European settlement on Africa, Asia, and the Americas;
d. analyzing how competition for colonies changed the economic system of Europe; and
e. defining and describing how the Scientific Revolution led to social and technological changes that influenced the European view of the world.

Science

BIO.1
The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

a. observations of living organisms are recorded in the lab and in the field;
b. hypotheses are formulated based on direct observations and information from scientific literature;
c. variables are defined and investigations are designed to test hypotheses;
d. graphing and arithmetic calculations are used as tools in data analysis;
e. conclusions are formed based on recorded quantitative and qualitative data;
f. sources of error inherent in experimental design are identified and discussed;
g. validity of data is determined;
h. chemicals and equipment are used in a safe manner;
i. appropriate technology including computers, graphing calculators, and probeware is used for gathering and analyzing data, communicating results, modeling concepts, and simulating experimental conditions;
j. research utilizes scientific literature;
k. differentiation is made among a scientific hypothesis, theory, and law;
l. alternative scientific explanations and models are recognized and analyzed; and
m. current applications of biological concepts are used.

CH.1
The student will investigate and understand that experiments in which variables are measured, analyzed, and evaluated produce observations and verifiable data. Key concepts include

a. designated laboratory techniques;
b. safe use of chemicals and equipment;
c. proper response to emergency situations;
d. manipulation of multiple variables, using repeated trials;
e. accurate recording, organization, and analysis of data through repeated trials;
f. mathematical and procedural error analysis;
g. mathematical manipulations including SI units, scientific notation, linear equations, graphing, ratio and proportion, significant digits, and dimensional analysis;
h. use of appropriate technology including computers, graphing calculators, and probeware for gathering data, communicating results, and using simulations to model concepts;
i. construction and defense of a scientific viewpoint; and
j. the use of current applications to reinforce chemistry concepts.

PH.3
The student will investigate and demonstrate an understanding of the nature of science, scientific reasoning, and logic. Key concepts include

a. analysis of scientific sources to develop and refine research hypotheses;
b. analysis of how science explains and predicts relationships;
c. evaluation of evidence for scientific theories;
d. examination of how new discoveries result in modification of existing theories or establishment of new paradigms; and
e. construction and defense of a scientific viewpoint.

English

10.5
The student will read, interpret, analyze, and evaluate nonfiction texts.

a. Analyze text features and organizational patterns to evaluate the meaning of texts.
b. Recognize an author’s intended audience and purpose for writing.
c. Skim materials to develop an overview and locate information.
d. Compare and contrast informational texts for intent and content.
e. Interpret and use data and information in maps, charts, graphs, timelines, tables, and diagrams.
f. Draw conclusions and make inferences on explicit and implied information using textual support as evidence.
g. Analyze and synthesize information in order to solve problems, answer questions, and generate new knowledge.
h. Analyze ideas within and between selections providing textual evidence.
i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.
j. Use reading strategies throughout the reading process to monitor comprehension.

10.8
The student will find, evaluate, and select credible resources to create a research product.

a. Verify the accuracy, validity, and usefulness of information.
b. Analyze information gathered from diverse sources by identifying misconceptions, main and supporting ideas, conflicting information, and point of view or bias.
c. Evaluate and select evidence from a variety of sources to introduce counter claims and to support claims.
d. Cite sources for both quoted and paraphrased ideas using a standard method of
documentation, such as that of the Modern Language Association (MLA) or the American Psychological Association (APA).
e. Define the meaning and consequences of plagiarism and follow ethical and legal guidelines for gathering and using information.
f. Demonstrate ethical use of the Internet.

11.5
The student will read, interpret, analyze, and evaluate a variety of nonfiction texts including employment documents and technical writing.

a. Apply information from texts to clarify understanding of concepts.
b. Read and correctly interpret an application for employment, workplace documents, or an application for college admission.
c. Analyze technical writing for clarity.
d. Paraphrase and synthesize ideas within and between texts.
e. Draw conclusions and make inferences on explicit and implied information using textual support.
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g. Analyze false premises, claims, counterclaims, and other evidence in persuasive writing.
h. Recognize and analyze use of ambiguity, contradiction, paradox, irony, sarcasm, overstatement, and understatement in text.
i. Generate and respond logically to literal, inferential, evaluative, synthesizing, and critical thinking questions about the text(s).

11.8
The student will analyze, evaluate, synthesize, and organize information from a variety of credible resources to produce a research product.

b. Make sense of information gathered from diverse sources by identifying misconceptions, main and supporting ideas, conflicting information, point of view or bias.
c. Synthesize relevant information from primary and secondary sources and present it in a logical sequence.
d. Cite sources for both quoted and paraphrased ideas using a standard method of documentation, such as that of the Modern Language Association (MLA) or the American Psychological Association (APA).
e. Define the meaning and consequences of plagiarism and follow ethical and legal guidelines for gathering and using information.
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The student will read, interpret, analyze, and evaluate a variety of nonfiction texts.

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Mathematics
A.4
The student will solve

a. multistep linear and quadratic equations in one variables algebraically;
b. quadratic equations in one variables algebraically;
c. literal equations for a specified variable;
d. systems of two linear equations in two variables algebraically and graphically; and
e. practical problems involving equations and systems of equations.

A.8
The student, given a situation in a real-world context, will analyze a relation to determine whether a direct or inverse variation exists, and represent a direct variation algebraically and graphically and an inverse variation algebraically.

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The student will collect and analyze data, determine the equation of the curve of best fit in order to make predictions, and solve practical problems, using mathematical models of linear and quadratic functions.

AFDA.3
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AFDA.8
The student will design and conduct an experiment/survey. Key concepts include

a. sample size;
b. sampling technique;
c. controlling sources of bias and experimental error;
d. data collection; and
e. data analysis and reporting.

AII.3
The student will solve
a. absolute value linear equations and inequalities;
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c. equations containing rational algebraic expressions; and
d. equations containing radical expressions.

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The student will collect and analyze data, determine the equation of the curve of best fit in order to make predictions, and solve practical problems, using mathematical models of linear, quadratic, and exponential functions.

PS.1*
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TSA Competitive Events

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Exploring Biochemistry

Task Number 009

Explain the roles of sciences applicable to biotechnology, including organic chemistry, biochemistry, and microbiology.

Definition

Explanation should include the comparison of each field's similarities and differences.

Process/Skill Questions

- What is the difference between basic organic chemistry and biochemistry?
- How are microbes used in biotechnology?
- What types of microbes are used in biotechnology?
- What is the importance of the type of microbe used in biotechnology?
- What criteria determine the type of microbe to be used in biotechnology?
- How are biochemical reactions used in biotechnology research?

Related Standards of Learning

Science

BIO.2
The student will investigate and understand the chemical and biochemical principles essential for life. Key concepts include

a. water chemistry and its impact on life processes;
b. the structure and function of macromolecules;
c. the nature of enzymes; and
d. the capture, storage, transformation, and flow of energy through the processes of photosynthesis and respiration.

CH.6
The student will investigate and understand how basic chemical properties relate to organic chemistry and biochemistry. Key concepts include

a. unique properties of carbon that allow multi-carbon compounds; and
b. uses in pharmaceuticals and genetics, petrochemicals, plastics, and food.

English

10.5
The student will read, interpret, analyze, and evaluate nonfiction texts.

a. Analyze text features and organizational patterns to evaluate the meaning of texts.
b. Recognize an author’s intended audience and purpose for writing.
c. Skim materials to develop an overview and locate information.
d. Compare and contrast informational texts for intent and content.
e. Interpret and use data and information in maps, charts, graphs, timelines, tables, and diagrams.
f. Draw conclusions and make inferences on explicit and implied information using textual support as evidence.
g. Analyze and synthesize information in order to solve problems, answer questions, and generate new knowledge.
h. Analyze ideas within and between selections providing textual evidence.
i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.
j. Use reading strategies throughout the reading process to monitor comprehension.

11.5

The student will read, interpret, analyze, and evaluate a variety of nonfiction texts including employment documents and technical writing.

a. Apply information from texts to clarify understanding of concepts.
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ITEEA National Standards

14. Medical Technologies
**15. Agricultural and Related Biotechnologies**

**TSA Competitive Events**

- Biotechnology Design
- Technology Bowl (Written and Oral)

**Task Number 010**

**Prepare buffer stock solutions and reagents.**

**Definition**

Preparation should include calculation of ingredients.

**Process/Skill Questions**

- What is the purpose of buffer stock solutions?
- What are reagents?
- What calculations are needed to prepare ingredients?

**Related Standards of Learning**

**Science**

**CH.4**

The student will investigate and understand that chemical quantities are based on molar relationships. Key concepts include

- a. Avogadro’s principle and molar volume;
- b. stoichiometric relationships;
- c. solution concentrations; and
- d. acid/base theory; strong electrolytes, weak electrolytes, and nonelectrolytes; dissociation and ionization; pH and pOH; and the titration process.

**Mathematics**

**A.1**

The student will

- a. represent verbal quantitative situations algebraically; and
- b. evaluate algebraic expressions for given replacement values of the variables.

**A.4**
The student will solve

a. multistep linear and quadratic equations in one variables algebraically;
b. quadratic equations in one variables algebraically;
c. literal equations for a specified variable;
d. systems of two linear equations in two variables algebraically and graphically; and
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AII.3

The student will solve

a. absolute value linear equations and inequalities;
b. quadratic equations over the set of complex numbers;
c. equations containing rational algebraic expressions; and
d. equations containing radical expressions.

ITEEA National Standards

14. Medical Technologies

Task Number 011

Explain the structure and cellular function of organic macromolecules.

Definition

Explanation should include the following four types of macromolecules:

- Lipids
- Carbohydrates
- Proteins
- Nucleic acids.

Process/Skill Questions

- What are macromolecules?
- What are the types of macromolecules? What are their purposes?
- How are macromolecules used in the cell?
- How can biotechnology techniques create macromolecules and affect cellular activities?

Related Standards of Learning

History and Social Science

WHII.4
The student will apply social science skills to understand the impact of the European Age of Exploration by

a. explaining the political and economic goals of European exploration and colonization;
b. describing the geographic expansion into Africa, Asia, and the Americas;
c. comparing and contrasting the social and cultural influences of European settlement on Africa, Asia, and the Americas;
d. analyzing how competition for colonies changed the economic system of Europe; and
e. defining and describing how the Scientific Revolution led to social and technological changes that influenced the European view of the world.

**Science**

**BIO.2**
The student will investigate and understand the chemical and biochemical principles essential for life. Key concepts include

a. water chemistry and its impact on life processes;
b. the structure and function of macromolecules;
c. the nature of enzymes; and
d. the capture, storage, transformation, and flow of energy through the processes of photosynthesis and respiration.

**English**

**10.5**
The student will read, interpret, analyze, and evaluate nonfiction texts.

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j. Use reading strategies throughout the reading process to monitor comprehension.

**11.5**
The student will read, interpret, analyze, and evaluate a variety of nonfiction texts including employment documents and technical writing.

a. Apply information from texts to clarify understanding of concepts.
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**TSA Competitive Events**

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**Task Number 012**

*Analyze how organic macromolecules are manipulated and detected,*
using biotechnological tools.

**Definition**

Analysis should describe how current research and manipulation of carbohydrates, lipids, proteins and nucleic acids have been designed within the field of biochemistry for innovative processes.

**Process/Skill Questions**

- How are organic macromolecules manipulated?
- What are some innovative uses for each group of these new macromolecules?
- What mechanisms (sensors and gauges) are used to monitor carbohydrates?
- How are cancer diagnostics and therapeutics possible?

**Related Standards of Learning**

**Science**

**BIO.1**

The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

a. observations of living organisms are recorded in the lab and in the field;
b. hypotheses are formulated based on direct observations and information from scientific literature;
c. variables are defined and investigations are designed to test hypotheses;
d. graphing and arithmetic calculations are used as tools in data analysis;
e. conclusions are formed based on recorded quantitative and qualitative data;
f. sources of error inherent in experimental design are identified and discussed;
g. validity of data is determined;
h. chemicals and equipment are used in a safe manner;
i. appropriate technology including computers, graphing calculators, and probeware is used for gathering and analyzing data, communicating results, modeling concepts, and simulating experimental conditions;
j. research utilizes scientific literature;
k. differentiation is made among a scientific hypothesis, theory, and law;
l. alternative scientific explanations and models are recognized and analyzed; and
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11.5
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e. Analyze false premises claims, counterclaims, and other evidence in persuasive writing.

ITEEA National Standards
TSA Competitive Events

Biotechnology Design
Essays on Technology
Extemporaneous Presentation

Task Number 013

Explain the function of carbohydrates and lipids.

Definition

Explanation should include the monomers and polymers of both carbohydrates and lipids and examples of both.

Process/Skill Questions

- What are the functions of carbohydrates in an organism?
- What are the functions of lipids?
- What are the types of carbohydrates?
- What are the types of lipids?

Related Standards of Learning

Science

BIO.2

The student will investigate and understand the chemical and biochemical principles essential for life. Key concepts include

a. water chemistry and its impact on life processes;
b. the structure and function of macromolecules;
c. the nature of enzymes; and
d. the capture, storage, transformation, and flow of energy through the processes of photosynthesis and respiration.

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The student will read, interpret, analyze, and evaluate nonfiction texts.

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12.5
The student will read, interpret, analyze, and evaluate a variety of nonfiction texts.

a. Use critical thinking to generate and respond logically to literal, inferential, and evaluative questions about the text(s).
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ITEEA National Standards

14. Medical Technologies

15. Agricultural and Related Biotechnologies

TSA Competitive Events

Technology Bowl (Written and Oral)

Task Number 014

Differentiate among the types of proteins found in organisms.

Definition

Differentiation should include the various types of proteins, including

- hormones
- receptors
- contractile
- structural
- storage
- transport
- defensive
- enzymatic.

Process/Skill Questions

- What are examples of the types of proteins?
- What are the functions of the types of proteins?
- How are proteins used in organisms?
- How are proteins expressed?
- What are the structures of protein, and how do they affect the functionality of the protein?

Related Standards of Learning

10.5

English
The student will read, interpret, analyze, and evaluate nonfiction texts.

a. Analyze text features and organizational patterns to evaluate the meaning of texts.
b. Recognize an author’s intended audience and purpose for writing.
c. Skim materials to develop an overview and locate information.
d. Compare and contrast informational texts for intent and content.
e. Interpret and use data and information in maps, charts, graphs, timelines, tables, and diagrams.
f. Draw conclusions and make inferences on explicit and implied information using textual support as evidence.
g. Analyze and synthesize information in order to solve problems, answer questions, and generate new knowledge.
h. Analyze ideas within and between selections providing textual evidence.
i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.
j. Use reading strategies throughout the reading process to monitor comprehension.

11.5
The student will read, interpret, analyze, and evaluate a variety of nonfiction texts including employment documents and technical writing.

a. Apply information from texts to clarify understanding of concepts.
b. Read and correctly interpret an application for employment, workplace documents, or an application for college admission.
c. Analyze technical writing for clarity.
d. Paraphrase and synthesize ideas within and between texts.
e. Draw conclusions and make inferences on explicit and implied information using textual support.
f. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.
g. Analyze false premises, claims, counterclaims, and other evidence in persuasive writing.
h. Recognize and analyze use of ambiguity, contradiction, paradox, irony, sarcasm, overstatement, and understatement in text.
i. Generate and respond logically to literal, inferential, evaluative, synthesizing, and critical thinking questions about the text(s).

12.5
The student will read, interpret, analyze, and evaluate a variety of nonfiction texts.

a. Use critical thinking to generate and respond logically to literal, inferential, and evaluative questions about the text(s).
b. Identify and synthesize resources to make decisions, complete tasks, and solve specific problems.
c. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.
d. Recognize and analyze use of ambiguity, contradiction, paradox, irony, overstatement, and understatement in text.
e. Analyze false premises claims, counterclaims, and other evidence in persuasive writing.
**TSA Competitive Events**

- Biotechnology Design
- Essays on Technology
- Extemporaneous Presentation

**Task Number 015**

**Explain the basic principles of protein utilization in organisms.**

**Definition**

Explanation should

- state that a protein is a substance consisting of amino acids, which are important in the nutrition and growth of an organism
- include the fact that the use of proteins is essential in the maturation rate of organisms
- include the fact that the process of making a protein involves DNA (gene) to RNA to protein.

**Process/Skill Questions**

- How are proteins used in genome projects?
- Why is protein structure important to function?
- How can protein structure be manipulated?

**Related Standards of Learning**

**BIO.5**

The student will investigate and understand common mechanisms of inheritance and protein synthesis. Key concepts include
a. cell growth and division;
b. gamete formation;
c. cell specialization;
d. prediction of inheritance of traits based on the Mendelian laws of heredity;
e. historical development of the structural model of DNA;
f. genetic variation;
g. the structure, function, and replication of nucleic acids;
h. events involved in the construction of proteins;
i. use, limitations, and misuse of genetic information; and
j. exploration of the impact of DNA technologies.

10.5

The student will read, interpret, analyze, and evaluate nonfiction texts.

a. Analyze text features and organizational patterns to evaluate the meaning of texts.
b. Recognize an author’s intended audience and purpose for writing.
c. Skim materials to develop an overview and locate information.
d. Compare and contrast informational texts for intent and content.
e. Interpret and use data and information in maps, charts, graphs, timelines, tables, and diagrams.
f. Draw conclusions and make inferences on explicit and implied information using textual support as evidence.
g. Analyze and synthesize information in order to solve problems, answer questions, and generate new knowledge.
h. Analyze ideas within and between selections providing textual evidence.
i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.
j. Use reading strategies throughout the reading process to monitor comprehension.

11.5

The student will read, interpret, analyze, and evaluate a variety of nonfiction texts including employment documents and technical writing.

a. Apply information from texts to clarify understanding of concepts.
b. Read and correctly interpret an application for employment, workplace documents, or an application for college admission.
c. Analyze technical writing for clarity.
d. Paraphrase and synthesize ideas within and between texts.
e. Draw conclusions and make inferences on explicit and implied information using textual support.
f. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.
g. Analyze false premises, claims, counterclaims, and other evidence in persuasive writing.
h. Recognize and analyze use of ambiguity, contradiction, paradox, irony, sarcasm, overstatement, and understatement in text.
i. Generate and respond logically to literal, inferential, evaluative, synthesizing, and critical thinking questions about the text(s).

12.5

The student will read, interpret, analyze, and evaluate a variety of nonfiction texts.
a. Use critical thinking to generate and respond logically to literal, inferential, and evaluative questions about the text(s).
b. Identify and synthesize resources to make decisions, complete tasks, and solve specific problems.
c. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.
d. Recognize and analyze use of ambiguity, contradiction, paradox, irony, overstatement, and understatement in text.
e. Analyze false premises claims, counterclaims, and other evidence in persuasive writing.

ITEEA National Standards

12. Use and Maintain Technological Products and Systems

13. Assess the Impact of Products and Systems

TSA Competitive Events

Biotechnology Design

Task Number 016

Explain the advantages of protein utilization in organisms.

Definition

Explanation should emphasize that the growth rate of an organism can be increased dramatically through the protein utilization process and that, with each new discovery, this rapidly growing field of research produces new techniques to enhance systems.

Process/Skill Questions

- What are the advantages of protein utilization?
- What effect does the protein utilization process have on the environment of an organism?
- What are current trends in research of the protein utilization process?
- How does public opinion influence research?

Related Standards of Learning

Science

BIO.4

The student will investigate and understand life functions of Archaea, Bacteria, and Eukarya.
concepts include

a. comparison of their metabolic activities;
b. maintenance of homeostasis;
c. how the structures and functions vary among and within the Eukarya kingdoms of protists, fungi, plants, and animals, including humans;
d. human health issues, human anatomy, and body systems;
e. how viruses compare with organisms; and
f. evidence supporting the germ theory of infectious disease.

BIO.7
The student will investigate and understand how populations change through time. Key concepts include

a. evidence found in fossil records;
b. how genetic variation, reproductive strategies, and environmental pressures impact the survival of populations;
c. how natural selection leads to adaptations;
d. emergence of new species; and
e. scientific evidence and explanations for biological evolution.

BIO.8
The student will investigate and understand dynamic equilibria within populations, communities, and ecosystems. Key concepts include

a. interactions within and among populations, including carrying capacities, limiting factors, and growth curves;
b. nutrient cycling with energy flow through ecosystems;
c. succession patterns in ecosystems;
d. the effects of natural events and human activities on ecosystems; and
e. analysis of the flora, fauna, and microorganisms of Virginia ecosystems.

10.5
The student will read, interpret, analyze, and evaluate nonfiction texts.

a. Analyze text features and organizational patterns to evaluate the meaning of texts.
b. Recognize an author’s intended audience and purpose for writing.
c. Skim materials to develop an overview and locate information.
d. Compare and contrast informational texts for intent and content.
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   g. Analyze false premises, claims, counterclaims, and other evidence in persuasive writing.
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   b. Identify and synthesize resources to make decisions, complete tasks, and solve specific problems.
   c. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.
   d. Recognize and analyze use of ambiguity, contradiction, paradox, irony, overstatement, and understatement in text.
   e. Analyze false premises, claims, counterclaims, and other evidence in persuasive writing.

Mathematics

AFDA.1
The student will investigate and analyze linear, quadratic, exponential, and logarithmic function families and their characteristics. Key concepts include

   a. domain and range;
   b. intervals in which the function is increasing or decreasing;
   c. absolute maxima and minima;
   d. zeros;
   e. intercepts;
   f. values of a function for elements in its domain;
   g. connections between and among multiple representations of functions using verbal descriptions, tables, equations, and graphs;
   h. end behavior; and
   i. vertical and horizontal asymptotes.

AFDA.3
The student will collect and analyze data, determine the equation of the curve of best fit in order to make predictions, and solve practical problems using models of linear, quadratic, and exponential
functions.

AII.7
The student will investigate and analyze linear, quadratic, absolute value, square root, cube root, rational, polynomial, exponential, and logarithmic function families algebraically and graphically.
Key concepts include

a. domain, range, and continuity;
b. intervals in which a function is increasing or decreasing;
c. extrema;
d. zeros;
e. intercepts;
f. values of a function for elements in its domain;
g. connections between and among multiple representations of functions using verbal descriptions, tables, equations, and graphs;
h. end behavior;
i. vertical and horizontal asymptotes;
j. inverse of a function; and
k. composition of functions algebraically and graphically.

AII.9
The student will collect and analyze data, determine the equation of the curve of best fit in order to make predictions, and solve practical problems, using mathematical models of linear, quadratic, and exponential functions.

PS.8*
The student will describe the methods of data collection in a census, sample survey, experiment, and observational study and identify an appropriate method of solution for a given problem setting.

PS.11*
The student will identify and describe two or more events as complementary, dependent, independent, and/or mutually exclusive.

ITEEA National Standards

14. Medical Technologies

15. Agricultural and Related Biotechnologies

TSA Competitive Events

Technology Bowl (Written and Oral)

Task Number 017

Illustrate the function or use of an enzyme, using a prototype or model.
**Definition**

Illustration should use a model or prototype with all the basic components for a working system and should also incorporate an explanation of how the model works, including what type of enzyme is used, how the enzyme is acquired, what molecular process takes place during data storage, and what the advantages are for using this type of biotechnology.

**Process/Skill Questions**

- What is an organism that can be used for a model?
- What are the characteristics of the model? What are the parts, and how do they work?
- What mechanisms are used to monitor the system? How is the output of the enzyme system measured?
- What is the real-life application of the enzyme?

**Related Standards of Learning**

**Science**

**BIO.2**

The student will investigate and understand the chemical and biochemical principles essential for life. Key concepts include

- water chemistry and its impact on life processes;
- the structure and function of macromolecules;
- the nature of enzymes; and
- the capture, storage, transformation, and flow of energy through the processes of photosynthesis and respiration.

**ITEEA National Standards**

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**TSA Competitive Events**

- Biotechnology Design
Investigating Genetic Engineering

Task Number 018

Define genetic engineering.

Definition

Definition should include the direct manipulation of an organism’s genome by introducing or eliminating specific genes using biotechnology techniques.

Process/Skill Questions

- What is recombinant DNA?
- How is the exact code of the desired gene determined when starting a gene manipulation experiment?
- How are genes introduced or eliminated from the genome of an organism using biotechnology techniques?
- What are restriction enzymes?

Related Standards of Learning

History and Social Science

VUS.14

The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

a. assessing the development of and changes in domestic policies, with emphasis on the impact of the role the United States Supreme Court played in defining a constitutional right to privacy, affirming equal rights, and upholding the rule of law;
b. evaluating and explaining the changes in foreign policies and the role of the United States in a world confronted by international terrorism, with emphasis on the American response to 9/11 (September 11, 2001);
c. evaluating the evolving and changing role of government, including its role in the American economy; and
d. explaining scientific and technological changes and evaluating their impact on American culture

WG.17

The student will apply social science skills to analyze the impact of globalization by

a. identifying factors, including comparative advantage, that influence the distribution of economic activities and trade;
b. describing ways that economic and social interactions change over time; and
c. mapping, describing, and evaluating economic unions.
WHII.14

The student will apply social science skills to understand the global changes during the early twenty-first century by

a. identifying contemporary political issues, with emphasis on migrations of refugees and others, ethnic/religious conflicts, and the impact of technology, including the role of social media and chemical and biological technologies;
b. assessing the link between economic and political freedom;
c. describing economic interdependence, including the rise of multinational corporations, international organizations, and trade agreements; and
d. analyzing the increasing impact of terrorism.

BIO.5

The student will investigate and understand common mechanisms of inheritance and protein synthesis. Key concepts include

a. cell growth and division;
b. gamete formation;
c. cell specialization;
d. prediction of inheritance of traits based on the Mendelian laws of heredity;
e. historical development of the structural model of DNA;
f. genetic variation;
g. the structure, function, and replication of nucleic acids;
h. events involved in the construction of proteins;
i. use, limitations, and misuse of genetic information; and
j. exploration of the impact of DNA technologies.

English

10.3

The student will apply knowledge of word origins, derivations, and figurative language to extend vocabulary development in authentic texts.

a. Use structural analysis of roots, affixes, synonyms, and antonyms, to understand complex words.
b. Use context, structure, and connotations to determine meanings of words and phrases.
c. Discriminate between connotative and denotive meanings and interpret the connotation.
d. Explain the meaning of common idioms.
e. Explain the meaning of literary and classical allusions and figurative language in text.
f. Extend general and cross-curricular vocabulary through speaking, listening, reading, and writing.

11.3

The student will apply knowledge of word origins, derivations, and figurative language to extend vocabulary development in authentic texts.

a. Use structural analysis of roots, affixes, synonyms, and antonyms to understand complex words.
b. Use context, structure, and connotations to determine meanings of words and phrases.
c. Discriminate between connotative and denotive meanings and interpret the connotation.
d. Explain the meaning of common idioms.

e. Explain the meaning of literary and classical allusions and figurative language in text.

f. Extend general and cross-curricular vocabulary through speaking, listening, reading, and writing.

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The student will apply knowledge of word origins, derivations, and figurative language to extend vocabulary development in authentic texts.

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b. Use context, structure, and connotations to determine meanings of words and phrases.

c. Discriminate between connotative and denotative meanings and interpret the connotation.

d. Explain the meaning of common idioms, and literary and classical allusions in text.

e. Extend general and cross-curricular vocabulary through speaking, listening, reading, and writing.

ITEEA National Standards

14. Medical Technologies

15. Agricultural and Related Biotechnologies

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

TSA Competitive Events

Biotechnology Design

Technology Bowl (Written and Oral)

Task Number 019

Develop a timeline of genetic engineering milestones.

Definition

Development should include major events in genetic engineering such as

- Mendel's discovery
- DNA modeling
- gene therapy
cloning
DNA sequencing.

Process/Skill Questions

- What was Mendel's contribution to the field of genetic engineering?
- What is the importance of DNA modeling?
- What is the importance of gene therapy in modern medicine?
- What is cloning, and why is it controversial?
- How have DNA sequencing techniques evolved?

Related Standards of Learning

History and Social Science

GOVT.9

The student will apply social science skills to understand the process by which public policy is made by

a. defining public policy and determining how to differentiate public and private action;
b. examining different perspectives on the role of government;
c. describing how the national government influences the public agenda and shapes public policy by examining examples such as the Equal Rights Amendment, the Americans with Disabilities Act (ADA), and Section 9524 of the Elementary and Secondary Education Act (ESEA) of 1965;
d. describing how the state and local governments influence the public agenda and shape public policy;
e. investigating and evaluating the process by which policy is implemented by the bureaucracy at each level;
f. analyzing how the incentives of individuals, interest groups, and the media influence public policy; and
g. devising a course of action to address local and/or state issues.

GOVT.15

The student will apply social science skills to understand the role of government in the Virginia and United States economies by

a. describing the provision of government goods and services that are not readily produced by the market;
b. describing government’s establishment and maintenance of the rules and institutions in which markets operate, including the establishment and enforcement of property rights, contracts, consumer rights, labor-management relations, environmental protection, and competition in the marketplace;
c. investigating and describing the types and purposes of taxation that are used by local, state, and federal governments to pay for services provided by the government;
d. analyzing how Congress can use fiscal policy to stabilize the economy;
e. describing the effects of the Federal Reserve’s monetary policy on price stability, employment, and the economy; and
f. evaluating the trade-offs in government decisions.
The student will apply social science skills to understand early European colonization by

a. evaluating the economic characteristics of the colonies;
b. analyzing how social and political factors impacted the culture of the colonies; and
c. explaining the impact of the development of indentured servitude and slavery in the colonies.

The student will apply social science skills to understand major events in Virginia and United States history during the first half of the nineteenth century by

a. explaining territorial expansion and its impact on the American Indians;
b. describing the political results of territorial expansion;
c. assessing the political and economic changes that occurred during this period, with emphasis on James Madison and the War of 1812;
d. analyzing the social and cultural changes during the period, with emphasis on “the age of the common man” (Jacksonian Era);
e. evaluating the cultural, economic, and political issues that divided the nation, including tariffs, slavery, the abolitionist and women’s suffrage movements, and the role of the states in the Union;
f. explaining how Manifest Destiny and President James K. Polk’s policies impacted the nation; and
g. evaluating and explaining the multiple causes and compromises leading to the Civil War, including the role of the institution of slavery.

The student will apply social science skills to understand the social, political, and cultural movements and changes in the United States during the second half of the twentieth century by

a. explaining the factors that led to United States expansion;
b. evaluating and explaining the impact of the Brown v. Board of Education decision, the roles of Thurgood Marshall and Oliver W. Hill, Sr., and how Virginia responded to the decision;
c. explaining how the National Association for the Advancement of Colored People (NAACP), the 1963 March on Washington, the Civil Rights Act of 1964, the Voting Rights Act of 1965, and the Americans with Disabilities Act (ADA) had an impact on all Americans;
d. analyzing changes in immigration policy and the impact of increased immigration;
e. evaluating and explaining the foreign and domestic policies pursued by the American government after the Cold War;
f. explaining how scientific and technological advances altered American lives; and
g. evaluating and explaining the changes that occurred in American culture.

The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

a. assessing the development of and changes in domestic policies, with emphasis on the impact of the role the United States Supreme Court played in defining a constitutional right to privacy, affirming equal rights, and upholding the rule of law;
b. evaluating and explaining the changes in foreign policies and the role of the United States in a
world confronted by international terrorism, with emphasis on the American response to 9/11 (September 11, 2001);
c. evaluating the evolving and changing role of government, including its role in the American economy; and
d. explaining scientific and technological changes and evaluating their impact on American culture

WHI.1

The student will demonstrate skills for historical thinking, geographical analysis, economic decision making, and responsible citizenship by

a. synthesizing evidence from artifacts and primary and secondary sources to obtain information about events in world history;
b. using geographic information to determine patterns and trends to understand world history;
c. interpreting charts, graphs, and pictures to determine characteristics of people, places, or events in world history;
d. evaluating sources for accuracy, credibility, bias, and propaganda;
e. comparing and contrasting historical, cultural, economic, and political perspectives in world history;
f. explaining how indirect cause-and-effect relationships impacted people, places, and events in world history;
g. analyzing multiple connections across time and place;
h. using a decision-making model to analyze and explain the incentives for and consequences of a specific choice made;
i. identifying the rights and responsibilities of citizens and ethical use of materials and intellectual property; and
j. investigating and researching to develop products orally and in writing.

WHI.2

The student will apply social science skills to understand the period from the Paleolithic Era to the agricultural revolution by

a. explaining the impact of geographic environment on hunter-gatherer societies;
b. describing characteristics of hunter-gatherer societies, including their use of tools and fire;
c. analyzing how technological and social developments gave rise to sedentary communities; and
d. analyzing how archaeological discoveries are changing current understanding of early societies.

WHI.3

The student will apply social science skills to understand the ancient river valley civilizations, including those of Mesopotamia, Egypt, the Indus River Valley, and China and the civilizations of the Hebrews and Phoenicians, by

a. locating these civilizations in time and place and describing their major geographic features;
b. describing the development of social, political, and economic patterns, including slavery;
c. explaining the development and interactions of religious traditions;
d. describing the origins, beliefs, traditions, customs, and spread of Judaism; and
e. explaining the development of language and writing.
WHI.4

The student will apply social science skills to understand the civilizations of Persia, India, and China in terms of chronology, geography, social structures, government, economy, religion, and contributions to later civilizations by

a. locating Persia in time and place, including Zoroastrianism and the development of an imperial bureaucracy;
b. locating India in time and place, including its origins, early development, and the debate over the Aryan migrations;
c. describing the origins, beliefs, traditions, customs, and spread of Hinduism;
d. describing the origins, beliefs, traditions, customs, and spread of Buddhism;
e. locating China in time and place, including the development of an empire and the construction of the Great Wall; and
f. describing the impact of Confucianism, Taoism, and Buddhism.

WHI.5

The student will apply social science skills to understand ancient Greece in terms of its impact on Western civilization by

a. locating Greek civilizations in time and place and describing their major geographic features;
b. describing the social and religious structure of ancient Greece;
c. describing the cultural development of Athens and Sparta, with emphasis on the significance of citizenship and the development of democracy;
d. evaluating the political and economic development of Greece, with emphasis on the Persian and Peloponnesian wars;
e. evaluating the significance of the conquest of Greece by Macedonia and the formation and spread of Hellenistic culture by Alexander the Great; and
f. citing and explaining contributions in drama, poetry, history, sculpture, architecture, science, mathematics, and philosophy, with emphasis on Socrates, Plato, and Aristotle.

WHI.8

The student will apply social science skills to understand the Byzantine Empire and Eastern Europe from about 300 to 1000 A.D. (C.E.) by

a. explaining the influence of geography on the establishment of Constantinople as the capital of the Eastern Roman Empire and describing the Byzantine Empire in time and place;
b. describing Justinian and his contributions, including the codification of Roman law, and the expansion of the Byzantine Empire and economy;
c. characterizing the role Byzantine art and architecture played in the preservation of Greek and Roman traditions;
d. explaining the disputes that led to the split between the Roman Catholic Church and the Greek Orthodox Church; and
e. analyzing and explaining the influence of Byzantine culture on Eastern Europe.

WHI.9

The student will apply social science skills to understand the Islamic civilization from about 600 to 1000 A.D. (C.E.) by

a. describing the origin, location, beliefs, traditions, customs, and spread of Islam, with
emphasizes the Sunni-Shi’a division and the Battle of Tours;
b. assessing the influence of geography on Islamic economic, social, and political development,
   including the impact of conquest and trade; and

c. explaining the cultural and scientific contributions and achievements of Islamic civilization.

**WHI.11**

The student will apply social science skills to understand the civilizations and empires of Asia, with
emphasis on Japan and China, by

a. locating and explaining major global and regional trade routes;
b. explaining technological advances and transfers, networks of economic interdependence, and
cultural interactions;
c. explaining the impact of Shinto and Buddhist traditions and the influence of Chinese culture
   on the region; and
d. evaluating the impact of the Mongol Empire throughout Asia.

**WHI.12**

The student will apply social science skills to understand the civilizations and empires of Africa,
with emphasis on the African kingdoms of Axum and Zimbabwe and the West African civilizations
of Ghana, Mali, and Songhai, by

a. locating early civilizations and kingdoms in time and place and describing major geographic
   features;
b. explaining the development of social, political, economic, religious, and cultural patterns in
each region; and

c. evaluating and explaining the European interactions with these societies, with emphasis on
   trading and economic interdependence.

**WHI.13**

The student will apply social science skills to understand the major civilizations of the Western
Hemisphere, including the Mayan, Aztec, and Incan, by

a. locating early civilizations in time and place and describing major geographic features;
b. explaining the development of social, political, economic, religious, and cultural patterns in
   the civilizations of the Americas; and

c. evaluating and explaining the European interactions with these societies, with emphasis on
   trading and economic interdependence.

**WHII.1**

The student will demonstrate skills for historical thinking, geographical analysis, economic decision
making, and responsible citizenship by

a. synthesizing evidence from artifacts and primary and secondary sources to obtain information
   about events and life in world history;
b. using geographic information to determine patterns and trends in world history;
c. interpreting charts, graphs, and pictures to determine characteristics of people, places, or
   events in world history;
d. evaluating sources for accuracy, credibility, bias, and propaganda;
e. comparing and contrasting historical, cultural, economic, and political perspectives in world
history;
f. explaining how indirect cause-and-effect relationships impacted people, places, and events in world history;
g. analyzing multiple connections across time and place;
h. using a decision-making model to analyze and explain the incentives for and consequences of a specific choice made;
i. identifying the rights and responsibilities of citizens and ethical use of materials and intellectual property; and
j. investigating and researching to develop products orally and in writing.

WHII.2

The student will apply social science skills to understand the political, cultural, geographic, and economic conditions in the world about 1500 A.D. (C.E.) by

a. locating major states and empires;
b. describing artistic, literary, and intellectual ideas of the Renaissance;
c. describing the distribution of major religions;
d. analyzing major trade patterns; and

e. citing major technological and scientific exchanges in the Eastern Hemisphere.

WHII.5

The student will apply social science skills to understand the political, cultural, geographic, and economic conditions in Europe and Russia from about 1500 A.D. (C.E.) to about 1800 A.D. (C.E.) by

a. locating European nations and their empires in time and place and identifying major geographic features of Europe;
b. describing the development of social and cultural patterns in the Hapsburg empire, with emphasis on Charles V;
c. describing the development of social and cultural patterns in France, with emphasis on the Age of Absolutism, Louis XIV, and the Enlightenment period;
d. describing the development of social and cultural patterns in Great Britain, with emphasis on the English Civil War and the Glorious Revolution and their impacts on democracy;
e. explaining the causes and effects of the American and French Revolutions;
f. describing the development of social and cultural patterns in the German states;
g. describing the development of social and cultural patterns in the Italian states; and
h. describing the development of social and cultural patterns in Russia, with emphasis on Peter the Great.

WHII.6

The student will apply social science skills to understand the political, cultural, geographic, and economic conditions in Asia from about 1500 A.D. (C.E.) to about 1800 A.D. (C.E.) by

a. locating Asian empires in time and place and identifying major geographic features;
b. describing the location and development of social and cultural patterns in the Ottoman Empire;
c. describing the location and development of social and cultural patterns in India, with emphasis on the Mughal Empire and coastal trade;
d. describing the location and development of social and cultural patterns in China, with
emphasis on the Qing (Manchu) dynasty;
e. describing the location and development of social and cultural patterns in Japan, with
emphasis on the Japanese shogunate; and
f. comparing and contrasting the political and economic systems of Asian empires.

WHII.7

The student will demonstrate an understanding of the political, cultural, geographic, and economic
conditions in sub-Saharan Africa from about 1500 A.D. (C.E.) to about 1800 A.D. (C.E.) by
a. locating major societies in Africa in time and place and identifying major geographic
features;
b. comparing and contrasting the development of social and cultural patterns in East Africa and
West Africa;
c. comparing and contrasting the development of social and cultural patterns in Central and
Southern Africa; and
d. explaining the development of political and economic systems in African societies.

WHII.13

The student will apply social science skills to understand of the political, economic, social, and
cultural aspects of independence movements and development efforts by
a. describing the struggles for self-rule, including Gandhi’s leadership in India and the
development of India’s democracy;
b. describing Africa’s independence movements, including Jomo Kenyatta’s leadership of
Kenya and Nelson Mandela’s role in South Africa; and
c. describing the end of the mandate system and the creation of states in the Middle East,
including the roles of Golda Meir and Gamal Abdel Nasser.

WHII.14

The student will apply social science skills to understand the global changes during the early
twenty-first century by
a. identifying contemporary political issues, with emphasis on migrations of refugees and
others, ethnic/religious conflicts, and the impact of technology, including the role of social
media and chemical and biological technologies;
b. assessing the link between economic and political freedom;
c. describing economic interdependence, including the rise of multinational corporations,
international organizations, and trade agreements; and
d. analyzing the increasing impact of terrorism.

BIO.1

The student will demonstrate an understanding of scientific reasoning, logic, and the nature of
science by planning and conducting investigations in which
a. observations of living organisms are recorded in the lab and in the field;
b. hypotheses are formulated based on direct observations and information from scientific
literature;
c. variables are defined and investigations are designed to test hypotheses;
d. graphing and arithmetic calculations are used as tools in data analysis;
e. conclusions are formed based on recorded quantitative and qualitative data;
f. sources of error inherent in experimental design are identified and discussed;
g. validity of data is determined;
h. chemicals and equipment are used in a safe manner;
i. appropriate technology including computers, graphing calculators, and probeware is used for gathering and analyzing data, communicating results, modeling concepts, and simulating experimental conditions;
j. research utilizes scientific literature;
k. differentiation is made among a scientific hypothesis, theory, and law;
l. alternative scientific explanations and models are recognized and analyzed; and
m. current applications of biological concepts are used.

BIO.5
The student will investigate and understand common mechanisms of inheritance and protein synthesis. Key concepts include

a. cell growth and division;
b. gamete formation;
c. cell specialization;
d. prediction of inheritance of traits based on the Mendelian laws of heredity;
e. historical development of the structural model of DNA;
f. genetic variation;
g. the structure, function, and replication of nucleic acids;
h. events involved in the construction of proteins;
i. use, limitations, and misuse of genetic information; and
j. exploration of the impact of DNA technologies.

10.5
The student will read, interpret, analyze, and evaluate nonfiction texts.

a. Analyze text features and organizational patterns to evaluate the meaning of texts.
b. Recognize an author’s intended audience and purpose for writing.
c. Skim materials to develop an overview and locate information.
d. Compare and contrast informational texts for intent and content.
e. Interpret and use data and information in maps, charts, graphs, timelines, tables, and diagrams.
f. Draw conclusions and make inferences on explicit and implied information using textual support as evidence.
g. Analyze and synthesize information in order to solve problems, answer questions, and generate new knowledge.
h. Analyze ideas within and between selections providing textual evidence.
i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.
j. Use reading strategies throughout the reading process to monitor comprehension.

10.8
The student will find, evaluate, and select credible resources to create a research product.

a. Verify the accuracy, validity, and usefulness of information.
b. Analyze information gathered from diverse sources by identifying misconceptions, main and supporting ideas, conflicting information, and point of view or bias.

c. Evaluate and select evidence from a variety of sources to introduce counter claims and to support claims.

d. Cite sources for both quoted and paraphrased ideas using a standard method of documentation, such as that of the Modern Language Association (MLA) or the American Psychological Association (APA).

e. Define the meaning and consequences of plagiarism and follow ethical and legal guidelines for gathering and using information.

f. Demonstrate ethical use of the Internet.

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The student will read, interpret, analyze, and evaluate a variety of nonfiction texts including employment documents and technical writing.

a. Apply information from texts to clarify understanding of concepts.

b. Read and correctly interpret an application for employment, workplace documents, or an application for college admission.

c. Analyze technical writing for clarity.

d. Paraphrase and synthesize ideas within and between texts.

e. Draw conclusions and make inferences on explicit and implied information using textual support.

f. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.

g. Analyze false premises, claims, counterclaims, and other evidence in persuasive writing.

h. Recognize and analyze use of ambiguity, contradiction, paradox, irony, sarcasm, overstatement, and understatement in text.

i. Generate and respond logically to literal, inferential, evaluative, synthesizing, and critical thinking questions about the text(s).

11.8
The student will analyze, evaluate, synthesize, and organize information from a variety of credible resources to produce a research product.


b. Make sense of information gathered from diverse sources by identifying misconceptions, main and supporting ideas, conflicting information, point of view or bias.

c. Synthesize relevant information from primary and secondary sources and present it in a logical sequence.

d. Cite sources for both quoted and paraphrased ideas using a standard method of documentation, such as that of the Modern Language Association (MLA) or the American Psychological Association (APA).

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12.8
The student will analyze, evaluate, synthesize, and organize information from a variety of credible
resources to produce a research product.

a. Frame, analyze, and synthesize information to solve problems, answer questions, and
generate new knowledge.
b. Analyze information gathered from diverse sources by identifying misconceptions, main and
supporting ideas, conflicting information, point of view, or bias.
c. Critically evaluate the accuracy, quality, and validity of the information.
d. Cite sources for both quoted and paraphrased ideas using a standard method of
documentation, such as that of the Modern Language Association (MLA) or the American
Psychological Association (APA).
e. Define the meaning and consequences of plagiarism and follow ethical and legal guidelines
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ITEEA National Standards

6. The Role of Society in the Development and Use of Technology

7. The Influence of Technology on History

TSA Competitive Events

Biotechnology Design

Essays on Technology

Task Number 020

Model deoxyribonucleic acid (DNA).

Definition

Modeling should include a physical representation of genes and an explanation of each.
Process/Skill Questions

- How can the DNA structure be represented in a model?
- What shape will the model produce?
- Where are specific genes located?

Related Standards of Learning

**History and Social Science**

**WHII.4**

The student will apply social science skills to understand the impact of the European Age of Exploration by

a. explaining the political and economic goals of European exploration and colonization;
b. describing the geographic expansion into Africa, Asia, and the Americas;
c. comparing and contrasting the social and cultural influences of European settlement on Africa, Asia, and the Americas;
d. analyzing how competition for colonies changed the economic system of Europe; and
e. defining and describing how the Scientific Revolution led to social and technological changes that influenced the European view of the world.

**Science**

**BIO.5**

The student will investigate and understand common mechanisms of inheritance and protein synthesis. Key concepts include

a. cell growth and division;
b. gamete formation;
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d. prediction of inheritance of traits based on the Mendelian laws of heredity;
e. historical development of the structural model of DNA;
f. genetic variation;
g. the structure, function, and replication of nucleic acids;
h. events involved in the construction of proteins;
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j. exploration of the impact of DNA technologies.

**ITEEA National Standards**

**14. Medical Technologies**

**TSA Competitive Events**
Task Number 021

Assess the importance of the genetic information contained in DNA.

Definition

Assessment should include having the student construct the components of a DNA model and explain DNA's importance to genetic information.

Process/Skill Questions

- How is the DNA molecule different in prokaryotes and eukaryotes?
- What are the components of a DNA molecule?
- How does DNA affect the genetic makeup of a living organism?
- What options does one have if one does not have DNA? What techniques can be used to get the desired gene?

Related Standards of Learning

**History and Social Science**

**VUS.14**

The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

a. assessing the development of and changes in domestic policies, with emphasis on the impact of the role the United States Supreme Court played in defining a constitutional right to privacy, affirming equal rights, and upholding the rule of law;
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**WG.17**

The student will apply social science skills to analyze the impact of globalization by

a. identifying factors, including comparative advantage, that influence the distribution of economic activities and trade;
b. describing ways that economic and social interactions change over time; and
c. mapping, describing, and evaluating economic unions.
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English

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   thinking questions about the text(s).

12.5
The student will read, interpret, analyze, and evaluate a variety of nonfiction texts.

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ITEEA National Standards

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TSA Competitive Events

| Essays on Technology |

Task Number 022

Describe the function of DNA, ribonucleic acid (RNA), and protein in living cells.
Definition

Description should include

- definition of *deoxyribonucleic acid* (DNA)
- definition of *ribonucleic acid* (RNA)
- the relationship among protein, DNA, and RNA in living cells.

Process/Skill Questions

- What are the monomers of nucleic acids?
- What is gene expression?
- What techniques are used to assure one has the correct DNA gene prior to beginning genetic engineering experiments?

Related Standards of Learning

**History and Social Science**

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**Science**

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**ITEEA National Standards**
**TSA Competitive Events**

**Biotechnology Design**

**Task Number 023**

**Demonstrate how the structure of DNA influences its function, analysis, and manipulation.**

**Definition**

Demonstration should include a representation of how the structure of DNA influences its function, analysis, and manipulation.

**Process/Skill Questions**

- What is the function of DNA?
- How can DNA be analyzed?
- What is the purpose of manipulating DNA?

**Related Standards of Learning**

**History and Social Science**

**WHII.4**

The student will apply social science skills to understand the impact of the European Age of Exploration by

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ITEEA National Standards

14. Medical Technologies

TSA Competitive Events

Biotechnology Design

Task Number 024

Demonstrate how manipulation of nucleic acids through genetic engineering alters the function of proteins and subsequent cellular processes.

Definition

Demonstration may include the following techniques of DNA extraction, manipulation, and analysis:

- Centrifugation
- Precipitation
- Spooling
- Electrophoresis
- Restriction enzymes
- Karyotypes
- Polymerase chain reaction (PCR)

Process/Skill Questions

- What laboratory equipment is used for the extraction of DNA?
- What lab safety precautions should be taken when performing DNA extraction?
- What part do centrifugation, precipitation, and spooling play in extraction of DNA?
- What is PCR?
Related Standards of Learning

BIO.1
The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

a. observations of living organisms are recorded in the lab and in the field;
b. hypotheses are formulated based on direct observations and information from scientific literature;
c. variables are defined and investigations are designed to test hypotheses;
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ITEEA National Standards

11. Apply the Design Processes

12. Use and Maintain Technological Products and Systems

14. Medical Technologies
Task Number 025

Explain how genetic engineering is used in plants, animals, and medicine.

Definition

Explanation should include current information on the contribution of genetic engineering in developing disease prevention through diagnostics and therapeutics.

Process/Skill Questions

- How is genetic engineering used to diagnose disease?
- How is genetic engineering used to treat disease?
- How is genetic engineering used to personalize therapeutics?

Related Standards of Learning

History and Social Science

VUS.14

The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

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WG.17

The student will apply social science skills to analyze the impact of globalization by

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TSA Competitive Events

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Task Number 026

**Explain the importance of genetic mapping.**

**Definition**

Explanation should include descriptions of genome mapping projects and their contributions to genetic engineering.

**Process/Skill Questions**

- What is genetic mapping?
- What are the steps of a genetic mapping project?
- What value does this information have to biotechnology research?
- What products are on the market as a result of the genome projects?
- What are examples of genome projects?
- What is the value of informational components of genetic mapping projects?
Related Standards of Learning

**History and Social Science**

**VUS.14**

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ITEEA National Standards

14. Medical Technologies

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

TSA Competitive Events

Digital Video Production

Technology Bowl (Written and Oral)

Task Number 027

Analyze social implications of genetic engineering.

Definition

Analysis should include ethical, humanitarian, economic, and legal implications.

Process/Skill Questions

- Who benefits from genetic engineering?
- How do government regulations affect product development and distribution?
- How does consumer confidence affect product development and distribution?
- How do public perceptions affect product development and distribution?

Related Standards of Learning

History and Social Science

GOVT.9

The student will apply social science skills to understand the process by which public policy is made by
a. defining public policy and determining how to differentiate public and private action;
b. examining different perspectives on the role of government;
c. describing how the national government influences the public agenda and shapes public policy by examining examples such as the Equal Rights Amendment, the Americans with Disabilities Act (ADA), and Section 9524 of the Elementary and Secondary Education Act (ESEA) of 1965;
d. describing how the state and local governments influence the public agenda and shape public policy;
e. investigating and evaluating the process by which policy is implemented by the bureaucracy at each level;
f. analyzing how the incentives of individuals, interest groups, and the media influence public policy; and
g. devising a course of action to address local and/or state issues.

**GOVT.15**

The student will apply social science skills to understand the role of government in the Virginia and United States economies by

a. describing the provision of government goods and services that are not readily produced by the market;
b. describing government’s establishment and maintenance of the rules and institutions in which markets operate, including the establishment and enforcement of property rights, contracts, consumer rights, labor-management relations, environmental protection, and competition in the marketplace;
c. investigating and describing the types and purposes of taxation that are used by local, state, and federal governments to pay for services provided by the government;
d. analyzing how Congress can use fiscal policy to stabilize the economy;
e. describing the effects of the Federal Reserve’s monetary policy on price stability, employment, and the economy; and
f. evaluating the trade-offs in government decisions.

**VUS.3**

The student will apply social science skills to understand early European colonization by

a. evaluating the economic characteristics of the colonies;
b. analyzing how social and political factors impacted the culture of the colonies; and
c. explaining the impact of the development of indentured servitude and slavery in the colonies.

**VUS.6**

The student will apply social science skills to understand major events in Virginia and United States history during the first half of the nineteenth century by

a. explaining territorial expansion and its impact on the American Indians;
b. describing the political results of territorial expansion;
c. assessing the political and economic changes that occurred during this period, with emphasis on James Madison and the War of 1812;
d. analyzing the social and cultural changes during the period, with emphasis on “the age of the common man” (Jacksonian Era);
e. evaluating the cultural, economic, and political issues that divided the nation, including
VUS.13

The student will apply social science skills to understand the social, political, and cultural movements and changes in the United States during the second half of the twentieth century by

a. explaining the factors that led to United States expansion;
b. evaluating and explaining the impact of the *Brown v. Board of Education* decision, the roles of Thurgood Marshall and Oliver W. Hill, Sr., and how Virginia responded to the decision;
c. explaining how the National Association for the Advancement of Colored People (NAACP), the 1963 March on Washington, the Civil Rights Act of 1964, the Voting Rights Act of 1965, and the Americans with Disabilities Act (ADA) had an impact on all Americans;
d. analyzing changes in immigration policy and the impact of increased immigration;
e. evaluating and explaining the foreign and domestic policies pursued by the American government after the Cold War;
f. explaining how scientific and technological advances altered American lives; and
g. evaluating and explaining the changes that occurred in American culture.

VUS.14

The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

a. assessing the development of and changes in domestic policies, with emphasis on the impact of the role the United States Supreme Court played in defining a constitutional right to privacy, affirming equal rights, and upholding the rule of law;
b. evaluating and explaining the changes in foreign policies and the role of the United States in a world confronted by international terrorism, with emphasis on the American response to 9/11 (September 11, 2001);
c. evaluating the evolving and changing role of government, including its role in the American economy; and
d. explaining scientific and technological changes and evaluating their impact on American culture

WHII.13

The student will apply social science skills to understand of the political, economic, social, and cultural aspects of independence movements and development efforts by

a. describing the struggles for self-rule, including Gandhi’s leadership in India and the development of India’s democracy;
b. describing Africa’s independence movements, including Jomo Kenyatta’s leadership of Kenya and Nelson Mandela’s role in South Africa; and
c. describing the end of the mandate system and the creation of states in the Middle East, including the roles of Golda Meir and Gamal Abdel Nasser.

WHII.14
The student will apply social science skills to understand the global changes during the early twenty-first century by

a. identifying contemporary political issues, with emphasis on migrations of refugees and others, ethnic/religious conflicts, and the impact of technology, including the role of social media and chemical and biological technologies;
b. assessing the link between economic and political freedom;
c. describing economic interdependence, including the rise of multinational corporations, international organizations, and trade agreements; and
d. analyzing the increasing impact of terrorism.

10.5
The student will read, interpret, analyze, and evaluate nonfiction texts.

a. Analyze text features and organizational patterns to evaluate the meaning of texts.
b. Recognize an author’s intended audience and purpose for writing.
c. Skim materials to develop an overview and locate information.
d. Compare and contrast informational texts for intent and content.
e. Interpret and use data and information in maps, charts, graphs, timelines, tables, and diagrams.
f. Draw conclusions and make inferences on explicit and implied information using textual support as evidence.
g. Analyze and synthesize information in order to solve problems, answer questions, and generate new knowledge.
h. Analyze ideas within and between selections providing textual evidence.
i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.
j. Use reading strategies throughout the reading process to monitor comprehension.

11.5
The student will read, interpret, analyze, and evaluate a variety of nonfiction texts including employment documents and technical writing.

a. Apply information from texts to clarify understanding of concepts.
b. Read and correctly interpret an application for employment, workplace documents, or an application for college admission.
c. Analyze technical writing for clarity.
d. Paraphrase and synthesize ideas within and between texts.
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g. Analyze false premises, claims, counterclaims, and other evidence in persuasive writing.
h. Recognize and analyze use of ambiguity, contradiction, paradox, irony, sarcasm, overstatement, and understatement in text.
i. Generate and respond logically to literal, inferential, evaluative, synthesizing, and critical thinking questions about the text(s).

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The student will read, interpret, analyze, and evaluate a variety of nonfiction texts.
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b. Identify and synthesize resources to make decisions, complete tasks, and solve specific problems.
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ITEEA National Standards

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Applying Biotechnology to the Environment

Task Number 028

Assess the social implication of environmental quality management.

Definition

Assessment should include the history, legislation, and organizations associated with environmental quality management, as well as the effects of environmental quality management on society.

Process/Skill Questions

- What are some current environmental issues associated with biotechnology?
- What is the definition of GMO?
- How has media/social media affected the public perception of GMO?
- How might current environmental issues associated with biotechnology be categorized?
- Which environmental issues in biotechnology are most likely to be used for quality management?
- What would be the consequences of not having environmental quality management?
- How has society benefited from environmental quality management?

Related Standards of Learning

History and Social Science

GOVT.9

The student will apply social science skills to understand the process by which public policy is made by

a. defining public policy and determining how to differentiate public and private action;
b. examining different perspectives on the role of government;
c. describing how the national government influences the public agenda and shapes public policy by examining examples such as the Equal Rights Amendment, the Americans with Disabilities Act (ADA), and Section 9524 of the Elementary and Secondary Education Act (ESEA) of 1965;
d. describing how the state and local governments influence the public agenda and shape public policy;
e. investigating and evaluating the process by which policy is implemented by the bureaucracy at each level;
f. analyzing how the incentives of individuals, interest groups, and the media influence public policy; and
  g. devising a course of action to address local and/or state issues.

GOVT.15

The student will apply social science skills to understand the role of government in the Virginia and
United States economies by

a. describing the provision of government goods and services that are not readily produced by the market;
b. describing government’s establishment and maintenance of the rules and institutions in which markets operate, including the establishment and enforcement of property rights, contracts, consumer rights, labor-management relations, environmental protection, and competition in the marketplace;
c. investigating and describing the types and purposes of taxation that are used by local, state, and federal governments to pay for services provided by the government;
d. analyzing how Congress can use fiscal policy to stabilize the economy;
e. describing the effects of the Federal Reserve’s monetary policy on price stability, employment, and the economy; and
f. evaluating the trade-offs in government decisions.

VUS.13

The student will apply social science skills to understand the social, political, and cultural movements and changes in the United States during the second half of the twentieth century by

a. explaining the factors that led to United States expansion;
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The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

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c. evaluating the evolving and changing role of government, including its role in the American economy; and
d. explaining scientific and technological changes and evaluating their impact on American culture

WG.14

The student will apply social science skills to compare and contrast the distribution, growth rates, and characteristics of human population by
a. examining demographic data to determine the relative level of development;  
b. distinguishing between developed and developing countries; and  
c. comparing and contrasting the level of economic development to the standard of living and quality of life.

WG.15

The student will apply social science skills to analyze past and present trends in human migration and cultural diffusion by

a. determining how human migration and cultural diffusion are influenced by social, economic, political, and environmental factors and  
b. determining how human migration and cultural diffusion influence the current human characteristics of places and regions.

WG.17

The student will apply social science skills to analyze the impact of globalization by

a. identifying factors, including comparative advantage, that influence the distribution of economic activities and trade;  
b. describing ways that economic and social interactions change over time; and  
c. mapping, describing, and evaluating economic unions.

WHII.13

The student will apply social science skills to understand of the political, economic, social, and cultural aspects of independence movements and development efforts by

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b. assessing the link between economic and political freedom;  
c. describing economic interdependence, including the rise of multinational corporations, international organizations, and trade agreements; and  
d. analyzing the increasing impact of terrorism.

English

10.5

The student will read, interpret, analyze, and evaluate nonfiction texts.
a. Analyze text features and organizational patterns to evaluate the meaning of texts.
b. Recognize an author’s intended audience and purpose for writing.
c. Skim materials to develop an overview and locate information.
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g. Analyze and synthesize information in order to solve problems, answer questions, and generate new knowledge.
h. Analyze ideas within and between selections providing textual evidence.
i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.
j. Use reading strategies throughout the reading process to monitor comprehension.

11.5
The student will read, interpret, analyze, and evaluate a variety of nonfiction texts including employment documents and technical writing.

a. Apply information from texts to clarify understanding of concepts.
b. Read and correctly interpret an application for employment, workplace documents, or an application for college admission.
c. Analyze technical writing for clarity.
d. Paraphrase and synthesize ideas within and between texts.
e. Draw conclusions and make inferences on explicit and implied information using textual support.
f. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.
g. Analyze false premises, claims, counterclaims, and other evidence in persuasive writing.
h. Recognize and analyze use of ambiguity, contradiction, paradox, irony, sarcasm, overstatement, and understatement in text.
i. Generate and respond logically to literal, inferential, evaluative, synthesizing, and critical thinking questions about the text(s).

12.5
The student will read, interpret, analyze, and evaluate a variety of nonfiction texts.

a. Use critical thinking to generate and respond logically to literal, inferential, and evaluative questions about the text(s).
b. Identify and synthesize resources to make decisions, complete tasks, and solve specific problems.
c. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.
d. Recognize and analyze use of ambiguity, contradiction, paradox, irony, overstatement, and understatement in text.
e. Analyze false premises claims, counterclaims, and other evidence in persuasive writing.

ITEEA National Standards
Task Number 029

Investigate biotreatment systems.

Definition

Investigation should include

- the purpose of biotreatment systems
- the function of various types of biotreatment systems (e.g., solid wastes, hazardous wastes, wastewater treatment, soil reclamation, treatment of airborne contaminants)
- design considerations in the application each.

Process/Skill Questions

- What are the key characteristics of biotreatment systems?
- How does the method of biotreatment affect the design of the system?
- What biotechnology techniques are used in biotreatment systems?
- How can biotreatment systems benefit the environment?
- What is the current public perception of biotreatment systems?
- How has the lack of biotreatment systems in underdeveloped countries affected the environment?

Related Standards of Learning

**History and Social Science**

**VUS.14**

The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

a. assessing the development of and changes in domestic policies, with emphasis on the impact of the role the United States Supreme Court played in defining a constitutional right to privacy, affirming equal rights, and upholding the rule of law;
b. evaluating and explaining the changes in foreign policies and the role of the United States in a world confronted by international terrorism, with emphasis on the American response to 9/11
c. evaluating the evolving and changing role of government, including its role in the American
economy; and
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culture

WG.17

The student will apply social science skills to analyze the impact of globalization by

a. identifying factors, including comparative advantage, that influence the distribution of
economic activities and trade;
b. describing ways that economic and social interactions change over time; and
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others, ethnic/religious conflicts, and the impact of technology, including the role of social
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international organizations, and trade agreements; and
d. analyzing the increasing impact of terrorism.

The student will read, interpret, analyze, and evaluate nonfiction texts.

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b. Recognize an author’s intended audience and purpose for writing.
c. Skim materials to develop an overview and locate information.
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e. Interpret and use data and information in maps, charts, graphs, timelines, tables, and
diagrams.
f. Draw conclusions and make inferences on explicit and implied information using textual
support as evidence.
g. Analyze and synthesize information in order to solve problems, answer questions, and
generate new knowledge.
h. Analyze ideas within and between selections providing textual evidence.
i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical
sequence of events, within and between texts.
j. Use reading strategies throughout the reading process to monitor comprehension.

The student will find, evaluate, and select credible resources to create a research product.

a. Verify the accuracy, validity, and usefulness of information.
b. Analyze information gathered from diverse sources by identifying misconceptions, main and
supporting ideas, conflicting information, and point of view or bias.
c. Evaluate and select evidence from a variety of sources to introduce counter claims and to
support claims.
d. Cite sources for both quoted and paraphrased ideas using a standard method of
documentation, such as that of the Modern Language Association (MLA) or the American
Psychological Association (APA).
e. Define the meaning and consequences of plagiarism and follow ethical and legal guidelines
for gathering and using information.
f. Demonstrate ethical use of the Internet.

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The student will read, interpret, analyze, and evaluate a variety of nonfiction texts including
employment documents and technical writing.

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different conclusions.
g. Analyze false premises, claims, counterclaims, and other evidence in persuasive writing.
h. Recognize and analyze use of ambiguity, contradiction, paradox, irony, sarcasm,
overstatement, and understatement in text.
i. Generate and respond logically to literal, inferential, evaluative, synthesizing, and critical
thinking questions about the text(s).

11.8

The student will analyze, evaluate, synthesize, and organize information from a variety of credible
resources to produce a research product.

b. Make sense of information gathered from diverse sources by identifying misconceptions,
main and supporting ideas, conflicting information, point of view or bias.
c. Synthesize relevant information from primary and secondary sources and present it in a
logical sequence.
d. Cite sources for both quoted and paraphrased ideas using a standard method of
documentation, such as that of the Modern Language Association (MLA) or the American
Psychological Association (APA).
e. Define the meaning and consequences of plagiarism and follow ethical and legal guidelines
for gathering and using information.
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The student will read, interpret, analyze, and evaluate a variety of nonfiction texts.

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e. Analyze false premises claims, counterclaims, and other evidence in persuasive writing.

12.8
The student will analyze, evaluate, synthesize, and organize information from a variety of credible resources to produce a research product.

a. Frame, analyze, and synthesize information to solve problems, answer questions, and generate new knowledge.
b. Analyze information gathered from diverse sources by identifying misconceptions, main and supporting ideas, conflicting information, point of view, or bias.
c. Critically evaluate the accuracy, quality, and validity of the information.
d. Cite sources for both quoted and paraphrased ideas using a standard method of documentation, such as that of the Modern Language Association (MLA) or the American Psychological Association (APA).
e. Define the meaning and consequences of plagiarism and follow ethical and legal guidelines for gathering and using information.
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ITEEA National Standards

1. The Characteristics and Scope of Technology

TSA Competitive Events

Technology Bowl (Written and Oral)

Task Number 030

Examine the potential benefits of biological controls in plant and animal systems.

Definition

Examination should

- include explanations of plant structures (e.g., photoreceptors) and animal structures (e.g., the endocrine system) that contribute to biological control systems in those organisms
- distinguish between naturally occurring controls and modified systems.

Process/Skill Questions
• What basic control mechanisms are found in plant systems?
• What are the components of a control system in an animal?
• How can naturally occurring plant and animal control systems be beneficial to the environment?
• What alterations can be made to plant and animal control systems?
• How can biotechnology be used to positively affect plant and animal biocontrol systems?

Related Standards of Learning

10.5
The student will read, interpret, analyze, and evaluate nonfiction texts.

   a. Analyze text features and organizational patterns to evaluate the meaning of texts.
   b. Recognize an author’s intended audience and purpose for writing.
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ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

5. The Effects of Technology on the Environment

TSA Competitive Events

Biotechnology Design

Task Number 031

Design a bioremediation system.

Definition

Design should include a portfolio, drawings, model, and presentation of a bioremediation system. Student commentary on the design should include a distinction between bioremediation (i.e., the use of living organisms or their products to degrade waste into less-toxic or nontoxic products) and biorestoration (i.e., the use of living organisms or their products to return an environment to its original state).

Process/Skill Questions

- What are examples of bioremediation systems?
- What is the difference between bioremediation and biorestoration?
- What are some circumstances when one system may be chosen over the other?
- How can a bioremediation system positively and/or negatively affect the environment?

Related Standards of Learning

History and Social Science

VUS.14
The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

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WG.17

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b. assessing the link between economic and political freedom;
c. describing economic interdependence, including the rise of multinational corporations, international organizations, and trade agreements; and
d. analyzing the increasing impact of terrorism.

BIO.1

The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

a. observations of living organisms are recorded in the lab and in the field;
b. hypotheses are formulated based on direct observations and information from scientific literature;
c. variables are defined and investigations are designed to test hypotheses;
d. graphing and arithmetic calculations are used as tools in data analysis;
e. conclusions are formed based on recorded quantitative and qualitative data;
f. sources of error inherent in experimental design are identified and discussed;
g. validity of data is determined;
h. chemicals and equipment are used in a safe manner;
i. appropriate technology including computers, graphing calculators, and probeware is used for gathering and analyzing data, communicating results, modeling concepts, and simulating
experimental conditions;
j. research utilizes scientific literature;
k. differentiation is made among a scientific hypothesis, theory, and law;
l. alternative scientific explanations and models are recognized and analyzed; and
m. current applications of biological concepts are used.

10.1
The student will make planned multimodal, interactive presentations collaboratively and individually.

a. Make strategic use of multimodal tools.
b. Credit information sources.
c. Demonstrate the ability to work effectively with diverse teams including setting rules and goals for group work such as coming to informal consensus, taking votes on key issues, and presenting alternate views.
d. Assume responsibility for specific group tasks.
e. Include all group members and value individual contributions made by each group member.
f. Use a variety of strategies to listen actively and speak using appropriate discussion rules with awareness of verbal and nonverbal cues.
g. Respond thoughtfully and tactfully to diverse perspectives, summarizing points of agreement and disagreement.
h. Choose vocabulary, language, and tone appropriate to the topic, audience, and purpose.
i. Access, critically evaluate, and use information accurately to solve problems.
j. Use reflection to evaluate one’s own role and the group process in small-group activities.
k. Evaluate a speaker’s point of view, reasoning, use of evidence, rhetoric, and identify any faulty reasoning.

10.5
The student will read, interpret, analyze, and evaluate nonfiction texts.

a. Analyze text features and organizational patterns to evaluate the meaning of texts.
b. Recognize an author’s intended audience and purpose for writing.
c. Skim materials to develop an overview and locate information.
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h. Analyze ideas within and between selections providing textual evidence.
i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.
j. Use reading strategies throughout the reading process to monitor comprehension.

10.6
The student will write in a variety of forms to include persuasive, reflective, interpretive, and analytic with an emphasis on persuasion and analysis.

a. Engage in writing as a recursive process.
b. Plan and organize writing to address a specific audience and purpose.
c. Adjust writing content, technique, and voice for a variety of audiences and purposes.
d. Communicate clearly the purpose of the writing using a thesis statement.
e. Objectively introduce and develop topics, incorporating evidence and maintaining an organized structure and a formal style.
f. Compose a thesis statement for persuasive writing that advocates a position.
g. Clearly state and defend a position using reasons and sufficient evidence from credible sources as support.
h. Identify counterclaims and provide counter-arguments.
i. Show relationships among claims, reasons, and evidence and include a conclusion that follows logically from the information presented.

j. Blend multiple forms of writing including embedding a narrative to produce effective essays.
k. Elaborate ideas clearly through word choice.
l. Use textual evidence to compare and contrast multiple texts.
m. Revise writing for clarity of content, accuracy, and depth of information.
n. Write and revise to a standard acceptable both in the workplace and in postsecondary education.

10.7

The student will self- and peer-edit writing for capitalization, punctuation, spelling, sentence structure, paragraphing, and Standard English.

a. Use parallel structure across sentences and paragraphs.
b. Use complex sentence structure to infuse sentence variety in writing.
c. Distinguish between active and passive voice.
d. Use colons correctly.
e. Analyze the writing of others and suggest how writing might be improved.

11.1

The student will make planned informative and persuasive multimodal, interactive presentations collaboratively and individually.

a. Select and effectively use multimodal tools to design and develop presentation content.
b. Credit information sources.
c. Demonstrate the ability to work collaboratively with diverse teams.
d. Respond thoughtfully and tactfully to diverse perspectives, summarizing points of agreement and disagreement.
e. Use a variety of strategies to listen actively and speak using appropriate discussion rules with awareness of verbal and nonverbal cues.
f. Anticipate and address alternative or opposing perspectives and counterclaims.
g. Evaluate the various techniques used to construct arguments in multimodal presentations.
h. Use vocabulary appropriate to the topic, audience, and purpose.
i. Evaluate effectiveness of multimodal presentations.

11.5

The student will read, interpret, analyze, and evaluate a variety of nonfiction texts including employment documents and technical writing.

a. Apply information from texts to clarify understanding of concepts.
b. Read and correctly interpret an application for employment, workplace documents, or an application for college admission.
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i. Generate and respond logically to literal, inferential, evaluative, synthesizing, and critical thinking questions about the text(s).

11.6
The student will write in a variety of forms, to include persuasive/argumentative, reflective, interpretive, and analytic with an emphasis on persuasion/argumentation.

a. Apply components of a recursive writing process for multiple purposes to create a focused, organized, and coherent piece of writing to address a specific audience and purpose.
b. Produce arguments in writing developing a thesis that demonstrates knowledgeable judgments, addresses counterclaims, and provides effective conclusions.
c. Organize claims, counterclaims, and evidence in a sustained and logical sequence.
d. Adapt evidence, vocabulary, voice, and tone to audience, purpose, and situation.
e. Use words, phrases, clauses, and varied syntax to create a cohesive argument.
f. Blend multiple forms of writing including embedding narratives to produce effective essays.
g. Revise writing for clarity of content, accuracy and depth of information.
h. Write and revise to a standard acceptable both in the workplace and in postsecondary education.

11.7
The student will self- and peer-edit writing for capitalization, punctuation, spelling, sentence structure, paragraphing, and Standard English.

a. Use complex sentence structure to infuse sentence variety in writing.
b. Use verbals and verbal phrases correctly to achieve sentence conciseness and variety.
c. Distinguish between active and passive voice.

12.1
The student will make planned persuasive/argumentative, multimodal, interactive presentations collaboratively and individually.

a. Select and effectively use multimodal tools to design and develop presentation content.
b. Credit information sources.
c. Demonstrate the ability to work collaboratively with diverse teams.
d. Anticipate and address alternative or opposing perspectives and counterclaims.
e. Evaluate the various techniques used to construct arguments in multimodal presentations.
f. Use a variety of strategies to listen actively and speak using appropriate discussion rules with awareness of verbal and nonverbal cues.
g. Critique effectiveness of multimodal presentations.

12.5
The student will read, interpret, analyze, and evaluate a variety of nonfiction texts.

a. Use critical thinking to generate and respond logically to literal, inferential, and evaluative
b. Identify and synthesize resources to make decisions, complete tasks, and solve specific problems.
c. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.
d. Recognize and analyze use of ambiguity, contradiction, paradox, irony, overstatement, and understatement in text.
e. Analyze false premises claims, counterclaims, and other evidence in persuasive writing.

12.6
The student will write in a variety of forms to include persuasive/argumentative reflective, interpretive, and analytic with an emphasis on persuasion/argumentation.

a. Apply components of a recursive writing process for multiple purposes to create a focused, organized, and coherent piece of writing to address a specific audience and purpose.
b. Produce arguments in writing that develop a thesis to demonstrate knowledgeable judgments, address counterclaims, and provide effective conclusions.
c. Use a variety of rhetorical strategies to clarify and defend a position organizing claims, counterclaims, and evidence in a sustained and logical sequence.
d. Blend multiple forms of writing including embedding a narrative to produce effective essays.
e. Adapt evidence, vocabulary, voice, and tone to audience, purpose, and situation.
f. Use words, phrases, clauses, and varied syntax to connect all parts of the argument creating cohesion from the information presented.
g. Revise writing for clarity of content, depth of information, and technique of presentation.
h. Write and revise to a standard acceptable both in the workplace and in postsecondary education.
i. Write to clearly describe personal qualifications for potential occupational or educational opportunities.

12.7
The student will self- and peer-edit writing for Standard English.

a. Use complex sentence structure to infuse sentence variety in writing.
b. Edit, proofread, and prepare writing for intended audience and purpose.
c. Use a style manual, such as that of the Modern Language Association (MLA) or the American Psychological Association (APA), to apply rules for punctuation and formatting of direct quotations.

ITEEA National Standards

1. The Characteristics and Scope of Technology

TSA Competitive Events

Biotechnology Design
Task Number 032

Plan a biorestoration system.

Definition

Plan should include a portfolio, drawings, model, and presentation of a biorestoration system. Plan should also include a distinction between bioremediation and biorestoration.

Process/Skill Questions

- What are examples of biorestoration systems?
- Why is biorestoration considered a biotechnology?
- What biological processes are involved in biorestoration?
- Why is it necessary to understand the biological processes involved when designing biorestoration systems?

Related Standards of Learning

**History and Social Science**

**VUS.14**

The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

a. assessing the development of and changes in domestic policies, with emphasis on the impact of the role the United States Supreme Court played in defining a constitutional right to privacy, affirming equal rights, and upholding the rule of law;
b. evaluating and explaining the changes in foreign policies and the role of the United States in a world confronted by international terrorism, with emphasis on the American response to 9/11 (September 11, 2001);
c. evaluating the evolving and changing role of government, including its role in the American economy; and
d. explaining scientific and technological changes and evaluating their impact on American culture

**WG.17**

The student will apply social science skills to analyze the impact of globalization by

a. identifying factors, including comparative advantage, that influence the distribution of economic activities and trade;
b. describing ways that economic and social interactions change over time; and
c. mapping, describing, and evaluating economic unions.
WHII.14

The student will apply social science skills to understand the global changes during the early twenty-first century by

a. identifying contemporary political issues, with emphasis on migrations of refugees and others, ethnic/religious conflicts, and the impact of technology, including the role of social media and chemical and biological technologies;
b. assessing the link between economic and political freedom;
c. describing economic interdependence, including the rise of multinational corporations, international organizations, and trade agreements; and
d. analyzing the increasing impact of terrorism.

Science

BIO.1

The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

a. observations of living organisms are recorded in the lab and in the field;
b. hypotheses are formulated based on direct observations and information from scientific literature;
c. variables are defined and investigations are designed to test hypotheses;
d. graphing and arithmetic calculations are used as tools in data analysis;
e. conclusions are formed based on recorded quantitative and qualitative data;
f. sources of error inherent in experimental design are identified and discussed;
g. validity of data is determined;
h. chemicals and equipment are used in a safe manner;
i. appropriate technology including computers, graphing calculators, and probeware is used for gathering and analyzing data, communicating results, modeling concepts, and simulating experimental conditions;
j. research utilizes scientific literature;
k. differentiation is made among a scientific hypothesis, theory, and law;
l. alternative scientific explanations and models are recognized and analyzed; and
m. current applications of biological concepts are used.

English

10.1

The student will make planned multimodal, interactive presentations collaboratively and individually.

a. Make strategic use of multimodal tools.
b. Credit information sources.
c. Demonstrate the ability to work effectively with diverse teams including setting rules and goals for group work such as coming to informal consensus, taking votes on key issues, and presenting alternate views.
d. Assume responsibility for specific group tasks.
e. Include all group members and value individual contributions made by each group member.
f. Use a variety of strategies to listen actively and speak using appropriate discussion rules with awareness of verbal and nonverbal cues.
g. Respond thoughtfully and tactfully to diverse perspectives, summarizing points of agreement.
and disagreement.
h. Choose vocabulary, language, and tone appropriate to the topic, audience, and purpose.
i. Access, critically evaluate, and use information accurately to solve problems.
j. Use reflection to evaluate one’s own role and the group process in small-group activities.
k. Evaluate a speaker’s point of view, reasoning, use of evidence, rhetoric, and identify any faulty reasoning.

10.5
The student will read, interpret, analyze, and evaluate nonfiction texts.

a. Analyze text features and organizational patterns to evaluate the meaning of texts.
b. Recognize an author’s intended audience and purpose for writing.
c. Skim materials to develop an overview and locate information.
d. Compare and contrast informational texts for intent and content.
e. Interpret and use data and information in maps, charts, graphs, timelines, tables, and diagrams.
f. Draw conclusions and make inferences on explicit and implied information using textual support as evidence.
g. Analyze and synthesize information in order to solve problems, answer questions, and generate new knowledge.
h. Analyze ideas within and between selections providing textual evidence.
i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.
j. Use reading strategies throughout the reading process to monitor comprehension.

10.6
The student will write in a variety of forms to include persuasive, reflective, interpretive, and analytic with an emphasis on persuasion and analysis.

a. Engage in writing as a recursive process.
b. Plan and organize writing to address a specific audience and purpose.
c. Adjust writing content, technique, and voice for a variety of audiences and purposes.
d. Communicate clearly the purpose of the writing using a thesis statement.
e. Objectively introduce and develop topics, incorporating evidence and maintaining an organized structure and a formal style.
f. Compose a thesis statement for persuasive writing that advocates a position.
g. Clearly state and defend a position using reasons and sufficient evidence from credible sources as support.
h. Identify counterclaims and provide counter-arguments.
i. Show relationships among claims, reasons, and evidence and include a conclusion that follows logically from the information presented.
j. Blend multiple forms of writing including embedding a narrative to produce effective essays.
k. Elaborate ideas clearly through word choice.
l. Use textual evidence to compare and contrast multiple texts.
m. Revise writing for clarity of content, accuracy, and depth of information.
n. Write and revise to a standard acceptable both in the workplace and in postsecondary education.

10.7
The student will self- and peer-edit writing for capitalization, punctuation, spelling, sentence structure, paragraphing, and Standard English.
a. Use parallel structure across sentences and paragraphs.
b. Use complex sentence structure to infuse sentence variety in writing.
c. Distinguish between active and passive voice.
d. Use colons correctly.
e. Analyze the writing of others and suggest how writing might be improved.

11.1
The student will make planned informative and persuasive multimodal, interactive presentations collaboratively and individually.

a. Select and effectively use multimodal tools to design and develop presentation content.
b. Credit information sources.
c. Demonstrate the ability to work collaboratively with diverse teams.
d. Respond thoughtfully and tactfully to diverse perspectives, summarizing points of agreement and disagreement.
e. Use a variety of strategies to listen actively and speak using appropriate discussion rules with awareness of verbal and nonverbal cues.
f. Anticipate and address alternative or opposing perspectives and counterclaims.
g. Evaluate the various techniques used to construct arguments in multimodal presentations.
h. Use vocabulary appropriate to the topic, audience, and purpose.
i. Evaluate effectiveness of multimodal presentations.

11.5
The student will read, interpret, analyze, and evaluate a variety of nonfiction texts including employment documents and technical writing.

a. Apply information from texts to clarify understanding of concepts.
b. Read and correctly interpret an application for employment, workplace documents, or an application for college admission.
c. Analyze technical writing for clarity.
d. Paraphrase and synthesize ideas within and between texts.
e. Draw conclusions and make inferences on explicit and implied information using textual support.
f. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.
g. Analyze false premises, claims, counterclaims, and other evidence in persuasive writing.
h. Recognize and analyze use of ambiguity, contradiction, paradox, irony, sarcasm, overstatement, and understatement in text.
i. Generate and respond logically to literal, inferential, evaluative, synthesizing, and critical thinking questions about the text(s).

11.6
The student will write in a variety of forms, to include persuasive/argumentative, reflective, interpretive, and analytic with an emphasis on persuasion/argumentation.

a. Apply components of a recursive writing process for multiple purposes to create a focused, organized, and coherent piece of writing to address a specific audience and purpose.
b. Produce arguments in writing developing a thesis that demonstrates knowledgeable judgments, addresses counterclaims, and provides effective conclusions.
c. Organize claims, counterclaims, and evidence in a sustained and logical sequence.
d. Adapt evidence, vocabulary, voice, and tone to audience, purpose, and situation.
e. Use words, phrases, clauses, and varied syntax to create a cohesive argument.
f. Blend multiple forms of writing including embedding narratives to produce effective essays.
g. Revise writing for clarity of content, accuracy and depth of information.
h. Write and revise to a standard acceptable both in the workplace and in postsecondary education.

11.7
The student will self- and peer-edit writing for capitalization, punctuation, spelling, sentence structure, paragraphing, and Standard English.

   a. Use complex sentence structure to infuse sentence variety in writing.
   b. Use verbals and verbal phrases correctly to achieve sentence conciseness and variety.
   c. Distinguish between active and passive voice.

12.1
The student will make planned persuasive/argumentative, multimodal, interactive presentations collaboratively and individually.

   a. Select and effectively use multimodal tools to design and develop presentation content.
   b. Credit information sources.
   c. Demonstrate the ability to work collaboratively with diverse teams.
   d. Anticipate and address alternative or opposing perspectives and counterclaims.
   e. Evaluate the various techniques used to construct arguments in multimodal presentations.
   f. Use a variety of strategies to listen actively and speak using appropriate discussion rules with awareness of verbal and nonverbal cues.
   g. Critique effectiveness of multimodal presentations.

12.5
The student will read, interpret, analyze, and evaluate a variety of nonfiction texts.

   a. Use critical thinking to generate and respond logically to literal, inferential, and evaluative questions about the text(s).
   b. Identify and synthesize resources to make decisions, complete tasks, and solve specific problems.
   c. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.
   d. Recognize and analyze use of ambiguity, contradiction, paradox, irony, overstatement, and understatement in text.
   e. Analyze false premises claims, counterclaims, and other evidence in persuasive writing.

12.6
The student will write in a variety of forms to include persuasive/argumentative reflective, interpretive, and analytic with an emphasis on persuasion/argumentation.

   a. Apply components of a recursive writing process for multiple purposes to create a focused, organized, and coherent piece of writing to address a specific audience and purpose.
   b. Produce arguments in writing that develop a thesis to demonstrate knowledgeable judgments, address counterclaims, and provide effective conclusions.
   c. Use a variety of rhetorical strategies to clarify and defend a position organizing claims, counterclaims, and evidence in a sustained and logical sequence.
   d. Blend multiple forms of writing including embedding a narrative to produce effective essays.
   e. Adapt evidence, vocabulary, voice, and tone to audience, purpose, and situation.
   f. Use words, phrases, clauses, and varied syntax to connect all parts of the argument creating
cohesion from the information presented.
g. Revise writing for clarity of content, depth of information, and technique of presentation.
h. Write and revise to a standard acceptable both in the workplace and in postsecondary education.
i. Write to clearly describe personal qualifications for potential occupational or educational opportunities.

12.7
The student will self- and peer-edit writing for Standard English.

a. Use complex sentence structure to infuse sentence variety in writing.
b. Edit, proofread, and prepare writing for intended audience and purpose.
c. Use a style manual, such as that of the Modern Language Association (MLA) or the American Psychological Association (APA), to apply rules for punctuation and formatting of direct quotations.

ITEEA National Standards

8. The Attributes of Design

TSA Competitive Events

Biotechnology Design

Engineering Design

Task Number 033

Demonstrate the use of biotechnology to restore or remediate contaminated environments.

Definition

Demonstration should include the design, application, and evaluation of a biorestoration or bioremediation system.

Process/Skill Questions

- What types of environmental contamination can be rectified using bioremediation?
- What design constraints are encountered in the design of either a biorestoration or bioremediation system?
- What techniques are used to assess the effectiveness of biorestoration or bioremediation systems?
- How does the current public perception affect the use of biotechnology for bioremediation or
The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

a. assessing the development of and changes in domestic policies, with emphasis on the impact of the role the United States Supreme Court played in defining a constitutional right to privacy, affirming equal rights, and upholding the rule of law;
b. evaluating and explaining the changes in foreign policies and the role of the United States in a world confronted by international terrorism, with emphasis on the American response to 9/11 (September 11, 2001);
c. evaluating the evolving and changing role of government, including its role in the American economy; and
d. explaining scientific and technological changes and evaluating their impact on American culture

The student will apply social science skills to analyze the impact of globalization by

a. identifying factors, including comparative advantage, that influence the distribution of economic activities and trade;
b. describing ways that economic and social interactions change over time; and
c. mapping, describing, and evaluating economic unions.

The student will apply social science skills to understand the global changes during the early twenty-first century by

a. identifying contemporary political issues, with emphasis on migrations of refugees and others, ethnic/religious conflicts, and the impact of technology, including the role of social media and chemical and biological technologies;
b. assessing the link between economic and political freedom;
c. describing economic interdependence, including the rise of multinational corporations, international organizations, and trade agreements; and
d. analyzing the increasing impact of terrorism.

ITEEA National Standards

14. Medical Technologies

15. Agricultural and Related Biotechnologies
5. The Effects of Technology on the Environment

TSA Competitive Events

Biotechnology Design
Examine the Role of Biotechnology in Agriculture

Task Number 034

Demonstrate various procedures used with tissue cultures.

Definition

Demonstration should include

- techniques for collection, storage, multiplication, and transportation of tissue-cultured plants
- data tracking to ensure plant identification.

Process/Skill Questions

- What is the importance of aseptic technique in tissue culture?
- What types of cells can be grown using tissue culture techniques?
- How is specimen collection accomplished in tissue culture?
- What is the advantage of growing cells through tissue culture?
- How can cells grown using tissue culture be manipulated using biotechnology techniques?
- What is the advantage of the multiplication stage in increasing plant numbers?
- How does the federal Plant Variety Protection Act (PVPA) affect tissue culture?

ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

Task Number 035

Analyze social implications of biotechnology in agriculture.

Definition

Analysis should include

- the ways biotechnology has accelerated changes in the field of agriculture throughout history and contributed to advanced research in other fields
- a description of the process and effects of the social transition from an agrarian society to a technology state.
Process/Skill Questions

- How has public, scientific, and corporate awareness affected biotechnology?
- What have been the major positive and negative social effects of biotechnology in agriculture?
- What is the GMO project, and what is its effect on society in the U.S.?

Related Standards of Learning

**History and Social Science**

**GOVT.9**

The student will apply social science skills to understand the process by which public policy is made by

a. defining public policy and determining how to differentiate public and private action;
b. examining different perspectives on the role of government;
c. describing how the national government influences the public agenda and shapes public policy by examining examples such as the Equal Rights Amendment, the Americans with Disabilities Act (ADA), and Section 9524 of the Elementary and Secondary Education Act (ESEA) of 1965;
d. describing how the state and local governments influence the public agenda and shape public policy;
e. investigating and evaluating the process by which policy is implemented by the bureaucracy at each level;
f. analyzing how the incentives of individuals, interest groups, and the media influence public policy; and
g. devising a course of action to address local and/or state issues.

**GOVT.15**

The student will apply social science skills to understand the role of government in the Virginia and United States economies by

a. describing the provision of government goods and services that are not readily produced by the market;
b. describing government’s establishment and maintenance of the rules and institutions in which markets operate, including the establishment and enforcement of property rights, contracts, consumer rights, labor-management relations, environmental protection, and competition in the marketplace;
c. investigating and describing the types and purposes of taxation that are used by local, state, and federal governments to pay for services provided by the government;
d. analyzing how Congress can use fiscal policy to stabilize the economy;
e. describing the effects of the Federal Reserve’s monetary policy on price stability, employment, and the economy; and
f. evaluating the trade-offs in government decisions.

**VUS.13**

The student will apply social science skills to understand the social, political, and cultural movements and changes in the United States during the second half of the twentieth century by
a. explaining the factors that led to United States expansion;
b. evaluating and explaining the impact of the *Brown v. Board of Education* decision, the roles of Thurgood Marshall and Oliver W. Hill, Sr., and how Virginia responded to the decision;
c. explaining how the National Association for the Advancement of Colored People (NAACP), the 1963 March on Washington, the Civil Rights Act of 1964, the Voting Rights Act of 1965, and the Americans with Disabilities Act (ADA) had an impact on all Americans;
d. analyzing changes in immigration policy and the impact of increased immigration;
e. evaluating and explaining the foreign and domestic policies pursued by the American government after the Cold War;
f. explaining how scientific and technological advances altered American lives; and
g. evaluating and explaining the changes that occurred in American culture.

**VUS.14**

The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

a. assessing the development of and changes in domestic policies, with emphasis on the impact of the role the United States Supreme Court played in defining a constitutional right to privacy, affirming equal rights, and upholding the rule of law;
b. evaluating and explaining the changes in foreign policies and the role of the United States in a world confronted by international terrorism, with emphasis on the American response to 9/11 (September 11, 2001);
c. evaluating the evolving and changing role of government, including its role in the American economy; and
d. explaining scientific and technological changes and evaluating their impact on American culture.

**WG.14**

The student will apply social science skills to compare and contrast the distribution, growth rates, and characteristics of human population by

a. examining demographic data to determine the relative level of development;
b. distinguishing between developed and developing countries; and
c. comparing and contrasting the level of economic development to the standard of living and quality of life.

**WG.15**

The student will apply social science skills to analyze past and present trends in human migration and cultural diffusion by

a. determining how human migration and cultural diffusion are influenced by social, economic, political, and environmental factors and
b. determining how human migration and cultural diffusion influence the current human characteristics of places and regions.

**WG.17**

The student will apply social science skills to analyze the impact of globalization by

a. identifying factors, including comparative advantage, that influence the distribution of
economic activities and trade;
b. describing ways that economic and social interactions change over time; and  
c. mapping, describing, and evaluating economic unions.

WHII.13

The student will apply social science skills to understand of the political, economic, social, and cultural aspects of independence movements and development efforts by

a. describing the struggles for self-rule, including Gandhi’s leadership in India and the development of India’s democracy;  
b. describing Africa’s independence movements, including Jomo Kenyatta’s leadership of Kenya and Nelson Mandela’s role in South Africa; and  
c. describing the end of the mandate system and the creation of states in the Middle East, including the roles of Golda Meir and Gamal Abdel Nasser.

WHII.14

The student will apply social science skills to understand the global changes during the early twenty-first century by

a. identifying contemporary political issues, with emphasis on migrations of refugees and others, ethnic/religious conflicts, and the impact of technology, including the role of social media and chemical and biological technologies;  
b. assessing the link between economic and political freedom;  
c. describing economic interdependence, including the rise of multinational corporations, international organizations, and trade agreements; and  
d. analyzing the increasing impact of terrorism.

10.5

The student will read, interpret, analyze, and evaluate nonfiction texts.

a. Analyze text features and organizational patterns to evaluate the meaning of texts.  
b. Recognize an author’s intended audience and purpose for writing.  
c. Skim materials to develop an overview and locate information.  
d. Compare and contrast informational texts for intent and content.  
e. Interpret and use data and information in maps, charts, graphs, timelines, tables, and diagrams.  
f. Draw conclusions and make inferences on explicit and implied information using textual support as evidence.  
g. Analyze and synthesize information in order to solve problems, answer questions, and generate new knowledge.  
h. Analyze ideas within and between selections providing textual evidence.  
i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.  
j. Use reading strategies throughout the reading process to monitor comprehension.

11.5

The student will read, interpret, analyze, and evaluate a variety of nonfiction texts including employment documents and technical writing.
a. Apply information from texts to clarify understanding of concepts.
b. Read and correctly interpret an application for employment, workplace documents, or an
   application for college admission.
c. Analyze technical writing for clarity.
d. Paraphrase and synthesize ideas within and between texts.
e. Draw conclusions and make inferences on explicit and implied information using textual
   support.
f. Analyze multiple texts addressing the same topic to determine how authors reach similar or
different conclusions.
g. Analyze false premises, claims, counterclaims, and other evidence in persuasive writing.
h. Recognize and analyze use of ambiguity, contradiction, paradox, irony, sarcasm,
   overstatement, and understatement in text.
i. Generate and respond logically to literal, inferential, evaluative, synthesizing, and critical
   thinking questions about the text(s).

12.5

The student will read, interpret, analyze, and evaluate a variety of nonfiction texts.

a. Use critical thinking to generate and respond logically to literal, inferential, and evaluative
   questions about the text(s).
b. Identify and synthesize resources to make decisions, complete tasks, and solve specific
   problems.
c. Analyze multiple texts addressing the same topic to determine how authors reach similar or
different conclusions.
d. Recognize and analyze use of ambiguity, contradiction, paradox, irony, overstatement, and
   understatement in text.
e. Analyze false premises claims, counterclaims, and other evidence in persuasive writing.

ITEEA National Standards

4. The Cultural, Social, Economic, and Political Effects of Technology

TSA Competitive Events

Biotechnology Design

Essays on Technology

Task Number 036

Identify microbial applications in agriculture.

Definition
Identification should include activities in which microbial applications are used as change agents in agricultural processes.

**Process/Skill Questions**

- What is a microbe?
- What is a microbe's traditional role in nature?
- How can a microbe be used as a change agent?
- What are the steps in using microbes as change agents?
- Which categories of microbes are used for which alterations in life processes?

**Related Standards of Learning**

**Science**

**BIO.3**
The student will investigate and understand relationships between cell structure and function. Key concepts include

a. evidence supporting the cell theory;
b. characteristics of prokaryotic and eukaryotic cells;
c. similarities between the activities of the organelles in a single cell and a whole organism;
d. the cell membrane model; and

e. the impact of surface area to volume ratio on cell division, material transport, and other life processes.

**BIO.7**
The student will investigate and understand how populations change through time. Key concepts include

a. evidence found in fossil records;
b. how genetic variation, reproductive strategies, and environmental pressures impact the survival of populations;
c. how natural selection leads to adaptations;
d. emergence of new species; and

e. scientific evidence and explanations for biological evolution.

**English**

**10.5**
The student will read, interpret, analyze, and evaluate nonfiction texts.

a. Analyze text features and organizational patterns to evaluate the meaning of texts.
b. Recognize an author’s intended audience and purpose for writing.
c. Skim materials to develop an overview and locate information.
d. Compare and contrast informational texts for intent and content.
e. Interpret and use data and information in maps, charts, graphs, timelines, tables, and diagrams.
f. Draw conclusions and make inferences on explicit and implied information using textual support as evidence.
g. Analyze and synthesize information in order to solve problems, answer questions, and
generate new knowledge.

h. Analyze ideas within and between selections providing textual evidence.

i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.

j. Use reading strategies throughout the reading process to monitor comprehension.

11.5

The student will read, interpret, analyze, and evaluate a variety of nonfiction texts including employment documents and technical writing.

a. Apply information from texts to clarify understanding of concepts.

b. Read and correctly interpret an application for employment, workplace documents, or an application for college admission.

c. Analyze technical writing for clarity.

d. Paraphrase and synthesize ideas within and between texts.

e. Draw conclusions and make inferences on explicit and implied information using textual support.

f. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.

g. Analyze false premises, claims, counterclaims, and other evidence in persuasive writing.

h. Recognize and analyze use of ambiguity, contradiction, paradox, irony, sarcasm, overstatement, and understatement in text.

i. Generate and respond logically to literal, inferential, evaluative, synthesizing, and critical thinking questions about the text(s).

12.5

The student will read, interpret, analyze, and evaluate a variety of nonfiction texts.

a. Use critical thinking to generate and respond logically to literal, inferential, and evaluative questions about the text(s).

b. Identify and synthesize resources to make decisions, complete tasks, and solve specific problems.

c. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.

d. Recognize and analyze use of ambiguity, contradiction, paradox, irony, overstatement, and understatement in text.

e. Analyze false premises claims, counterclaims, and other evidence in persuasive writing.

ITEEA National Standards

15. Agricultural and Related Biotechnologies

TSA Competitive Events

Biotechnology Design
Task Number 037

Summarize the role of biotechnology in crop modification.

Definition

Summary should be made by examining the

- production and use of biodegradable pesticides, herbicide-resistant crops and fertilizers
- development of plant byproducts.

Process/Skill Questions

- What are some examples of genetically modified organisms that are used to support crop production?
- What advantages do these genetically modified crops have over the wild-type crops?
- What innovations are the result of plant modification?

Related Standards of Learning

History and Social Science

VUS.14

The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

a. assessing the development of and changes in domestic policies, with emphasis on the impact of the role the United States Supreme Court played in defining a constitutional right to privacy, affirming equal rights, and upholding the rule of law;
b. evaluating and explaining the changes in foreign policies and the role of the United States in a world confronted by international terrorism, with emphasis on the American response to 9/11 (September 11, 2001);
c. evaluating the evolving and changing role of government, including its role in the American economy; and
d. explaining scientific and technological changes and evaluating their impact on American culture

WG.17

The student will apply social science skills to analyze the impact of globalization by

a. identifying factors, including comparative advantage, that influence the distribution of economic activities and trade;
b. describing ways that economic and social interactions change over time; and
c. mapping, describing, and evaluating economic unions.

WHII.14

The student will apply social science skills to understand the global changes during the early twenty-first century by
a. identifying contemporary political issues, with emphasis on migrations of refugees and others, ethnic-religious conflicts, and the impact of technology, including the role of social media and chemical and biological technologies;
b. assessing the link between economic and political freedom;
c. describing economic interdependence, including the rise of multinational corporations, international organizations, and trade agreements; and
d. analyzing the increasing impact of terrorism.

**Science**

**BIO.5**
The student will investigate and understand common mechanisms of inheritance and protein synthesis. Key concepts include

a. cell growth and division;
b. gamete formation;
c. cell specialization;
d. prediction of inheritance of traits based on the Mendelian laws of heredity;
e. historical development of the structural model of DNA;
f. genetic variation;
g. the structure, function, and replication of nucleic acids;
h. events involved in the construction of proteins;
i. use, limitations, and misuse of genetic information; and
j. exploration of the impact of DNA technologies.

**BIO.7**
The student will investigate and understand how populations change through time. Key concepts include

a. evidence found in fossil records;
b. how genetic variation, reproductive strategies, and environmental pressures impact the survival of populations;
c. how natural selection leads to adaptations;
d. emergence of new species; and
e. scientific evidence and explanations for biological evolution.

**English**

**10.5**
The student will read, interpret, analyze, and evaluate nonfiction texts.

a. Analyze text features and organizational patterns to evaluate the meaning of texts.
b. Recognize an author’s intended audience and purpose for writing.
c. Skim materials to develop an overview and locate information.
d. Compare and contrast informational texts for intent and content.
e. Interpret and use data and information in maps, charts, graphs, timelines, tables, and diagrams.
f. Draw conclusions and make inferences on explicit and implied information using textual support as evidence.
g. Analyze and synthesize information in order to solve problems, answer questions, and generate new knowledge.
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The student will read, interpret, analyze, and evaluate a variety of nonfiction texts including employment documents and technical writing.

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ITEEA National Standards

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

TSA Competitive Events

Biotechnology Design
Task Number 038

Identify factors that jeopardize food safety.

Definition

Identification should include factors that prevent and cause food spoilage and methods of processing, storing, and transporting foods.

Process/Skill Questions

- What steps are taken in food processing to meet safety regulations?
- What regulations and agencies govern food safety guidelines?
- What are the consequences of poor food processing, storage, and transportation?
- What are some causes of food spoilage?
- What is the rate of food-borne illnesses in the U.S.?

Related Standards of Learning

10.5

The student will read, interpret, analyze, and evaluate nonfiction texts.

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e. Analyze false premises claims, counterclaims, and other evidence in persuasive writing.

ITEEA National Standards

12. Use and Maintain Technological Products and Systems

Task Number 039

Examine advances of biotechnology in food science.

Definition

Examination should include biotechnological advances in food science, such as

- processing techniques (e.g., fermentation and irradiation)
- preservation methods (e.g., freeze drying)
- storage enhancers (e.g., food additives and preservatives).

Process/Skill Questions

- What are examples of advances in food science?
- What role has biotechnology played in food science advances?
- How can biotechnological advances in food science affect global food supplies?

Related Standards of Learning

History and Social Science
WHI.3

The student will apply social science skills to understand the ancient river valley civilizations, including those of Mesopotamia, Egypt, the Indus River Valley, and China and the civilizations of the Hebrews and Phoenicians, by

a. locating these civilizations in time and place and describing their major geographic features;
b. describing the development of social, political, and economic patterns, including slavery;
c. explaining the development and interactions of religious traditions;
d. describing the origins, beliefs, traditions, customs, and spread of Judaism; and
e. explaining the development of language and writing.

WHI.12

The student will apply social science skills to understand the civilizations and empires of Africa, with emphasis on the African kingdoms of Axum and Zimbabwe and the West African civilizations of Ghana, Mali, and Songhai, by

a. locating early civilizations and kingdoms in time and place and describing major geographic features;
b. explaining the development of social, political, economic, religious, and cultural patterns in each region; and
c. evaluating and explaining the European interactions with these societies, with emphasis on trading and economic interdependence.

ITEEA National Standards

15. Agricultural and Related Biotechnologies

TSA Competitive Events

- Biotechnology Design
- Digital Video Production
- Essays on Technology
Exploring Bioprocessing

Task Number 040

Define bioprocessing.

Definition

Definition should include that bioprocessing is the use of biological materials to carry out a process, such as bioprocessing techniques to develop

- specialty chemicals
- new drugs
- alternative fuels
- feedstocks
- biopolymers
- bioremediation.

Process/Skill Questions

- What are biopolymers?
- What is bioremediation?
- What are some examples of products made through biotechnology that are currently used for bioremediation?
- How are alternative fuels and feedstocks produced using bioprocessing?
- How can these alternative products affect global society?

Related Standards of Learning

History and Social Science

VUS.14

The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

a. assessing the development of and changes in domestic policies, with emphasis on the impact of the role the United States Supreme Court played in defining a constitutional right to privacy, affirming equal rights, and upholding the rule of law;
b. evaluating and explaining the changes in foreign policies and the role of the United States in a world confronted by international terrorism, with emphasis on the American response to 9/11 (September 11, 2001);
c. evaluating the evolving and changing role of government, including its role in the American economy; and
d. explaining scientific and technological changes and evaluating their impact on American culture
WG.17

The student will apply social science skills to analyze the impact of globalization by

a. identifying factors, including comparative advantage, that influence the distribution of economic activities and trade;
b. describing ways that economic and social interactions change over time; and
c. mapping, describing, and evaluating economic unions.

WHII.14

The student will apply social science skills to understand the global changes during the early twenty-first century by

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b. assessing the link between economic and political freedom;
c. describing economic interdependence, including the rise of multinational corporations, international organizations, and trade agreements; and
d. analyzing the increasing impact of terrorism.

10.3

The student will apply knowledge of word origins, derivations, and figurative language to extend vocabulary development in authentic texts.

a. Use structural analysis of roots, affixes, synonyms, and antonyms, to understand complex words.
b. Use context, structure, and connotations to determine meanings of words and phrases.
c. Discriminate between connotative and denotative meanings and interpret the connotation.
d. Explain the meaning of common idioms.
e. Explain the meaning of literary and classical allusions and figurative language in text.
f. Extend general and cross-curricular vocabulary through speaking, listening, reading, and writing.

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**ITEEA National Standards**

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**Task Number 041**

**Describe the process of fermentation.**

**Definition**

Description should include

- agricultural products (e.g., beer, wine, bread)
- industrial products (e.g., ethanol, butanol, acetone)
- medical products (e.g., antibiotics, antiseptics, anti-inflammatories, anticoagulants, antidepressants, vasodilators).

It should also focus on the generation of energy by the breakdown of organic compounds (aerobic and anaerobic microorganisms).

**Process/Skill Questions**

- How long and in what contexts has the fermentation process been used?
• What conditions must exist for these processes to take place?
• What steps are necessary for fermentation to take place?
• How are the final products created from fermentation purified?

**Related Standards of Learning**

**History and Social Science**

**WHI.3**

The student will apply social science skills to understand the ancient river valley civilizations, including those of Mesopotamia, Egypt, the Indus River Valley, and China and the civilizations of the Hebrews and Phoenicians, by

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**WHI.4**

The student will apply social science skills to understand the civilizations of Persia, India, and China in terms of chronology, geography, social structures, government, economy, religion, and contributions to later civilizations by

a. locating Persia in time and place, including Zoroastrianism and the development of an imperial bureaucracy;
b. locating India in time and place, including its origins, early development, and the debate over the Aryan migrations;
c. describing the origins, beliefs, traditions, customs, and spread of Hinduism;
d. describing the origins, beliefs, traditions, customs, and spread of Buddhism;
e. locating China in time and place, including the development of an empire and the construction of the Great Wall; and
f. describing the impact of Confucianism, Taoism, and Buddhism.

**Science**

**BIO.2**

The student will investigate and understand the chemical and biochemical principles essential for life. Key concepts include

a. water chemistry and its impact on life processes;
b. the structure and function of macromolecules;
c. the nature of enzymes; and
d. the capture, storage, transformation, and flow of energy through the processes of photosynthesis and respiration.

**English**

**10.5**

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15. Agricultural and Related Biotechnologies

TSA Competitive Events

- Biotechnology Design
- Technology Bowl (Written and Oral)

Task Number 042

Prepare a product generated from bioprocessing.

Definition

Preparation should include use of safety practices (e.g., Clinical Laboratory Improvement Amendment of 1988 [CLIA] guidelines), standard operating procedures, sterilization, and correct disposal of hazardous waste.

Process/Skill Questions

- What are examples of bioprocessed products?
- How are bioprocessed products used?
- What equipment is used in bioprocessing?

Related Standards of Learning

History and Social Science

VUS.14

The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

a. assessing the development of and changes in domestic policies, with emphasis on the impact of the role the United States Supreme Court played in defining a constitutional right to privacy, affirming equal rights, and upholding the rule of law;

b. evaluating and explaining the changes in foreign policies and the role of the United States in a world confronted by international terrorism, with emphasis on the American response to 9/11 (September 11, 2001);

c. evaluating the evolving and changing role of government, including its role in the American economy; and

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WG.17

The student will apply social science skills to analyze the impact of globalization by

a. identifying factors, including comparative advantage, that influence the distribution of economic activities and trade;
b. describing ways that economic and social interactions change over time; and
c. mapping, describing, and evaluating economic unions.

WHII.14

The student will apply social science skills to understand the global changes during the early twenty-first century by

a. identifying contemporary political issues, with emphasis on migrations of refugees and others, ethnic/religious conflicts, and the impact of technology, including the role of social media and chemical and biological technologies;
b. assessing the link between economic and political freedom;
c. describing economic interdependence, including the rise of multinational corporations, international organizations, and trade agreements; and
d. analyzing the increasing impact of terrorism.

ITEEA National Standards

14. Medical Technologies

15. Agricultural and Related Biotechnologies

TSA Competitive Events

Biotechnology Design

Engineering Design

Manufacturing Prototype

Task Number 043

Describe genetic engineering applications used in bioprocessing.

Definition

Description should include
• genetic applications in designer drugs
• genetically modified organisms (GMOs)
• bioremediation
• alternative fuels
• biopolymers.

Process/Skill Questions

• What are some examples of genetic engineering applications?
• What are some examples of ethical controversies surrounding genetic engineering? Why are they important?

Related Standards of Learning

History and Social Science

VUS.14

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ITEEA National Standards

14. Medical Technologies

15. Agricultural and Related Biotechnologies

TSA Competitive Events

Biotechnology Design

Engineering Design

Scientific and Technical Visualization (SciVis)

Technology Bowl (Written and Oral)

Task Number 044

Demonstrate the application of microbes in bioprocessing.

Definition

Demonstration should include use of safety practices (e.g., Clinical Laboratory Improvement Amendment of
1988 [CLIA] guidelines), standard operating procedures, sterilization, and correct disposal of hazardous waste.

**Process/Skill Questions**

- What are examples of microbes used in bioprocessing?
- What are examples of end-products of bioprocessing?
- How are these end-products purified?

### ITEEA National Standards

| 15. Agricultural and Related Biotechnologies |

### TSA Competitive Events

- Biotechnology Design

### Task Number 045

**Describe the social and environmental effects of bioprocessing.**

**Definition**

Description should address both positive and negative effects, including actual foreseen and unforeseen effects on society.

**Process/Skill Questions**

- Who might benefit from bioprocessing, and how?
- What are common misconceptions regarding bioprocessing? How can these misconceptions be addressed?
- What are the potential risks or dangers of bioprocessing?

### Related Standards of Learning

- **History and Social Science**
  - **GOVT.9**
    - The student will apply social science skills to understand the process by which public policy is made by
      a. defining public policy and determining how to differentiate public and private action;
b. examining different perspectives on the role of government;
c. describing how the national government influences the public agenda and shapes public policy by examining examples such as the Equal Rights Amendment, the Americans with Disabilities Act (ADA), and Section 9524 of the Elementary and Secondary Education Act (ESEA) of 1965;
d. describing how the state and local governments influence the public agenda and shape public policy;
e. investigating and evaluating the process by which policy is implemented by the bureaucracy at each level;
f. analyzing how the incentives of individuals, interest groups, and the media influence public policy; and
g. devising a course of action to address local and/or state issues.

GOVT.15

The student will apply social science skills to understand the role of government in the Virginia and United States economies by

a. describing the provision of government goods and services that are not readily produced by the market;
b. describing government’s establishment and maintenance of the rules and institutions in which markets operate, including the establishment and enforcement of property rights, contracts, consumer rights, labor-management relations, environmental protection, and competition in the marketplace;
c. investigating and describing the types and purposes of taxation that are used by local, state, and federal governments to pay for services provided by the government;
d. analyzing how Congress can use fiscal policy to stabilize the economy;
e. describing the effects of the Federal Reserve’s monetary policy on price stability, employment, and the economy; and
f. evaluating the trade-offs in government decisions.

VUS.13

The student will apply social science skills to understand the social, political, and cultural movements and changes in the United States during the second half of the twentieth century by

a. explaining the factors that led to United States expansion;
b. evaluating and explaining the impact of the Brown v. Board of Education decision, the roles of Thurgood Marshall and Oliver W. Hill, Sr., and how Virginia responded to the decision;
c. explaining how the National Association for the Advancement of Colored People (NAACP), the 1963 March on Washington, the Civil Rights Act of 1964, the Voting Rights Act of 1965, and the Americans with Disabilities Act (ADA) had an impact on all Americans;
d. analyzing changes in immigration policy and the impact of increased immigration;
e. evaluating and explaining the foreign and domestic policies pursued by the American government after the Cold War;
f. explaining how scientific and technological advances altered American lives; and
g. evaluating and explaining the changes that occurred in American culture.

VUS.14

The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by
a. assessing the development of and changes in domestic policies, with emphasis on the impact of the role the United States Supreme Court played in defining a constitutional right to privacy, affirming equal rights, and upholding the rule of law;
b. evaluating and explaining the changes in foreign policies and the role of the United States in a world confronted by international terrorism, with emphasis on the American response to 9/11 (September 11, 2001);
c. evaluating the evolving and changing role of government, including its role in the American economy; and
d. explaining scientific and technological changes and evaluating their impact on American culture

WG.14

The student will apply social science skills to compare and contrast the distribution, growth rates, and characteristics of human population by

a. examining demographic data to determine the relative level of development;
b. distinguishing between developed and developing countries; and
c. comparing and contrasting the level of economic development to the standard of living and quality of life.

WG.15

The student will apply social science skills to analyze past and present trends in human migration and cultural diffusion by

a. determining how human migration and cultural diffusion are influenced by social, economic, political, and environmental factors and
b. determining how human migration and cultural diffusion influence the current human characteristics of places and regions.

WG.17

The student will apply social science skills to analyze the impact of globalization by

a. identifying factors, including comparative advantage, that influence the distribution of economic activities and trade;
b. describing ways that economic and social interactions change over time; and
c. mapping, describing, and evaluating economic unions.

WHII.13

The student will apply social science skills to understand of the political, economic, social, and cultural aspects of independence movements and development efforts by

a. describing the struggles for self-rule, including Gandhi’s leadership in India and the development of India’s democracy;
b. describing Africa’s independence movements, including Jomo Kenyatta’s leadership of Kenya and Nelson Mandela’s role in South Africa; and
c. describing the end of the mandate system and the creation of states in the Middle East, including the roles of Golda Meir and Gamal Abdel Nasser.
The student will apply social science skills to understand the global changes during the early twenty-first century by

a. identifying contemporary political issues, with emphasis on migrations of refugees and others, ethnic/religious conflicts, and the impact of technology, including the role of social media and chemical and biological technologies;
b. assessing the link between economic and political freedom;
c. describing economic interdependence, including the rise of multinational corporations, international organizations, and trade agreements; and
d. analyzing the increasing impact of terrorism.

English

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The student will read, interpret, analyze, and evaluate nonfiction texts.

a. Analyze text features and organizational patterns to evaluate the meaning of texts.
b. Recognize an author’s intended audience and purpose for writing.
c. Skim materials to develop an overview and locate information.
d. Compare and contrast informational texts for intent and content.
e. Interpret and use data and information in maps, charts, graphs, timelines, tables, and diagrams.
f. Draw conclusions and make inferences on explicit and implied information using textual support as evidence.
g. Analyze and synthesize information in order to solve problems, answer questions, and generate new knowledge.
h. Analyze ideas within and between selections providing textual evidence.
i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.
j. Use reading strategies throughout the reading process to monitor comprehension.

11.5
The student will read, interpret, analyze, and evaluate a variety of nonfiction texts including employment documents and technical writing.

a. Apply information from texts to clarify understanding of concepts.
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h. Recognize and analyze use of ambiguity, contradiction, paradox, irony, sarcasm, overstatement, and understatement in text.
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**ITEEA National Standards**

| 4. The Cultural, Social, Economic, and Political Effects of Technology |
| 5. The Effects of Technology on the Environment |

**TSA Competitive Events**

| Biotechnology Design |

**Task Number 046**

**Perform separation and purification techniques.**

**Definition**

Performance should include use of safety procedures (e.g., Clinical Laboratory Improvement Amendment of 1988 [CLIA] guidelines), standard operating procedures, sterilization, and correct disposal of hazardous waste. Techniques include filtration, chromatography, and solvent extraction.

**Process/Skill Questions**

- What is the purpose of separation and purification in bioprocessing?
- What products are produced through separation and purification techniques?

**Related Standards of Learning**

**Science**

CH.1 The student will investigate and understand that experiments in which variables are measured, analyzed, and evaluated produce observations and verifiable data. Key concepts include
a. designated laboratory techniques;
b. safe use of chemicals and equipment;
c. proper response to emergency situations;
d. manipulation of multiple variables, using repeated trials;
e. accurate recording, organization, and analysis of data through repeated trials;
f. mathematical and procedural error analysis;
g. mathematical manipulations including SI units, scientific notation, linear equations, graphing, ratio and proportion, significant digits, and dimensional analysis;
h. use of appropriate technology including computers, graphing calculators, and probeware for gathering data, communicating results, and using simulations to model concepts;
i. construction and defense of a scientific viewpoint; and
j. the use of current applications to reinforce chemistry concepts.

ITEEA National Standards

14. Medical Technologies

15. Agricultural and Related Biotechnologies

TSA Competitive Events

Biotechnology Design

Task Number 047

Illustrate the design of bioprocessing systems.

Definition

Illustration should include the design process and standardized bioprocessing techniques.

Process/Skill Questions

- What are the steps in the design process?
- What are examples of bioprocessing techniques?
- Why are processing design techniques important?

ITEEA National Standards

11. Apply the Design Processes

8. The Attributes of Design
TSA Competitive Events

- Biotechnology Design
- Engineering Design
Examing the Role of Biotechnology in Medicine

Task Number 048

Identify the influence of biotechnology on medicine.

Definition

Identification should include historical, societal, cultural, and economic effects of biotechnology in the medical fields.

Process/Skill Questions

- What medical discoveries would be categorized under biotechnology as opposed to biomedical science?
- How has biotechnology in medicine improved society?

Related Standards of Learning

**History and Social Science**

**GOVT.9**

The student will apply social science skills to understand the process by which public policy is made by

a. defining public policy and determining how to differentiate public and private action;
b. examining different perspectives on the role of government;
c. describing how the national government influences the public agenda and shapes public policy by examining examples such as the Equal Rights Amendment, the Americans with Disabilities Act (ADA), and Section 9524 of the Elementary and Secondary Education Act (ESEA) of 1965;
d. describing how the state and local governments influence the public agenda and shape public policy;
e. investigating and evaluating the process by which policy is implemented by the bureaucracy at each level;
f. analyzing how the incentives of individuals, interest groups, and the media influence public policy; and
g. devising a course of action to address local and/or state issues.

**GOVT.15**

The student will apply social science skills to understand the role of government in the Virginia and United States economies by

a. describing the provision of government goods and services that are not readily produced by the market;
b. describing government’s establishment and maintenance of the rules and institutions in which
markets operate, including the establishment and enforcement of property rights, contracts, consumer rights, labor-management relations, environmental protection, and competition in the marketplace;
c. investigating and describing the types and purposes of taxation that are used by local, state, and federal governments to pay for services provided by the government;
d. analyzing how Congress can use fiscal policy to stabilize the economy;
e. describing the effects of the Federal Reserve’s monetary policy on price stability, employment, and the economy; and
f. evaluating the trade-offs in government decisions.

VUS.13

The student will apply social science skills to understand the social, political, and cultural movements and changes in the United States during the second half of the twentieth century by

a. explaining the factors that led to United States expansion;
b. evaluating and explaining the impact of the *Brown v. Board of Education* decision, the roles of Thurgood Marshall and Oliver W. Hill, Sr., and how Virginia responded to the decision;
c. explaining how the National Association for the Advancement of Colored People (NAACP), the 1963 March on Washington, the Civil Rights Act of 1964, the Voting Rights Act of 1965, and the Americans with Disabilities Act (ADA) had an impact on all Americans;
d. analyzing changes in immigration policy and the impact of increased immigration;
e. evaluating and explaining the foreign and domestic policies pursued by the American government after the Cold War;
f. explaining how scientific and technological advances altered American lives; and
g. evaluating and explaining the changes that occurred in American culture.

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The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

a. assessing the development of and changes in domestic policies, with emphasis on the impact of the role the United States Supreme Court played in defining a constitutional right to privacy, affirming equal rights, and upholding the rule of law;
b. evaluating and explaining the changes in foreign policies and the role of the United States in a world confronted by international terrorism, with emphasis on the American response to 9/11 (September 11, 2001);
c. evaluating the evolving and changing role of government, including its role in the American economy; and
d. explaining scientific and technological changes and evaluating their impact on American culture.

WHII.13

The student will apply social science skills to understand of the political, economic, social, and cultural aspects of independence movements and development efforts by

a. describing the struggles for self-rule, including Gandhi’s leadership in India and the development of India’s democracy;
b. describing Africa’s independence movements, including Jomo Kenyatta’s leadership of Kenya and Nelson Mandela’s role in South Africa; and
c. describing the end of the mandate system and the creation of states in the Middle East, including the roles of Golda Meir and Gamal Abdel Nasser.

WHII.14

The student will apply social science skills to understand the global changes during the early twenty-first century by

a. identifying contemporary political issues, with emphasis on migrations of refugees and others, ethnic/religious conflicts, and the impact of technology, including the role of social media and chemical and biological technologies;
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ITEEA National Standards

13. Assess the Impact of Products and Systems

14. Medical Technologies

TSA Competitive Events

Technology Bowl (Written and Oral)

Task Number 049

Describe the ethical, legal, and social implications of biomedicine.

Definition

Description should

- address the ethical, legal, and social effects of biomedicine throughout history
- include the ethical decision-making processes involving governmental influence on biomedical research.

Process/Skill Questions

- What are the positive and negative effects of genetic selection, gene therapy, and cloning?
- What are examples of negative effects of biomedicine?
- How is legislation developed and influenced by biomedicine?
Related Standards of Learning

History and Social Science

GOVT.9

The student will apply social science skills to understand the process by which public policy is made by

a. defining public policy and determining how to differentiate public and private action;
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d. describing how the state and local governments influence the public agenda and shape public policy;
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c. investigating and describing the types and purposes of taxation that are used by local, state, and federal governments to pay for services provided by the government;
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ITEEA National Standards

4. The Cultural, Social, Economic, and Political Effects of Technology
TSA Competitive Events

Task Number 050

Explain vaccine (i.e., immunology) research and development.

Definition

Explanation should include current information on the contributions of biotechnology to the development and improvement of vaccines.

Process/Skill Questions

- How does industry develop new vaccines?
- How can biotechnology improve the effectiveness of vaccines?
- How can biotechnology contribute to the creation of new vaccines against diseases that currently do not have any vaccine available?

Related Standards of Learning

History and Social Science

VUS.8

The student will apply social science skills to understand how the nation grew and changed from the end of Reconstruction through the early twentieth century by

a. explaining the westward movement of the population in the United States, with emphasis on the role of the railroads, communication systems, admission of new states to the Union, and the impact on American Indians;
b. analyzing the factors that transformed the American economy from agrarian to industrial and explaining how major inventions transformed life in the United States, including the emergence of leisure activities;
c. examining the contributions of new immigrants and evaluating the challenges they faced, including anti-immigration legislation;
d. analyzing the impact of prejudice and discrimination, including “Jim Crow” laws, the responses of Booker T. Washington and W.E.B. DuBois, and the practice of eugenics in Virginia;
e. evaluating and explaining the social and cultural impact of industrialization, including rapid urbanization; and
f. evaluating and explaining the economic outcomes and the political, cultural, and social developments of the Progressive Movement and the impact of its legislation.

VUS.13
The student will apply social science skills to understand the social, political, and cultural movements and changes in the United States during the second half of the twentieth century by

a. explaining the factors that led to United States expansion;
b. evaluating and explaining the impact of the Brown v. Board of Education decision, the roles of Thurgood Marshall and Oliver W. Hill, Sr., and how Virginia responded to the decision;
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VUS.14

The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

a. assessing the development of and changes in domestic policies, with emphasis on the impact of the United States Supreme Court played in defining a constitutional right to privacy, affirming equal rights, and upholding the rule of law;
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c. evaluating the evolving and changing role of government, including its role in the American economy; and
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WG.17

The student will apply social science skills to analyze the impact of globalization by

a. identifying factors, including comparative advantage, that influence the distribution of economic activities and trade;
b. describing ways that economic and social interactions change over time; and
c. mapping, describing, and evaluating economic unions.

WHII.8

The student will apply social science skills to understand the changes in European nations between 1800 and 1900 by

a. explaining the roles of resources, capital, and entrepreneurship in developing an industrial economy;
b. analyzing the effects of the Industrial Revolution on society and culture, with emphasis on the evolution of the nature of work and the labor force, including its effects on families and the status of women and children;
c. describing how industrialization affected economic and political systems in Europe, with emphasis on the slave trade and the labor union movement;
d. assessing the impact of Napoleon and the Congress of Vienna on political power in Europe;
e. explaining the events related to the unification of Italy and the role of Italian nationalism; and
f. explaining the events related to the unification of Germany and the role of Bismarck.

WHII.14

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d. analyzing the increasing impact of terrorism.

BIO.3

The student will investigate and understand relationships between cell structure and function. Key concepts include

a. evidence supporting the cell theory;
b. characteristics of prokaryotic and eukaryotic cells;
c. similarities between the activities of the organelles in a single cell and a whole organism;
d. the cell membrane model; and
e. the impact of surface area to volume ratio on cell division, material transport, and other life processes.

10.5

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ITEEA National Standards

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TSA Competitive Events

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Task Number 051

Describe the effects of molecular research on society.
Definition

Description should

- take into account ethical, legal, and social issues
- reflect an understanding that molecular research includes but is not limited to cellular manipulation of living organisms
- reflect a basic grasp of the process of cellular manipulation.

Process/Skill Questions

- How have materials, processes, and tools been developed for molecular research?
- What is the goal of molecular research?
- What is the outcome of molecular research?
- How can cells be manipulated?
- What biomedical treatments are being researched?

Related Standards of Learning

**History and Social Science**

**GOVT.9**

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Science

BIO.5

The student will investigate and understand common mechanisms of inheritance and protein synthesis. Key concepts include

a. cell growth and division;
b. gamete formation;
c. cell specialization;
d. prediction of inheritance of traits based on the Mendelian laws of heredity;
e. historical development of the structural model of DNA;
f. genetic variation;
g. the structure, function, and replication of nucleic acids;
h. events involved in the construction of proteins;
i. use, limitations, and misuse of genetic information; and
j. exploration of the impact of DNA technologies.

English

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The student will read, interpret, analyze, and evaluate nonfiction texts.

a. Analyze text features and organizational patterns to evaluate the meaning of texts.
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c. Skim materials to develop an overview and locate information.
d. Compare and contrast informational texts for intent and content.
e. Interpret and use data and information in maps, charts, graphs, timelines, tables, and diagrams.
f. Draw conclusions and make inferences on explicit and implied information using textual support as evidence.
g. Analyze and synthesize information in order to solve problems, answer questions, and generate new knowledge.
h. Analyze ideas within and between selections providing textual evidence.
i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.
j. Use reading strategies throughout the reading process to monitor comprehension.

11.5

The student will read, interpret, analyze, and evaluate a variety of nonfiction texts including employment documents and technical writing.
a. Apply information from texts to clarify understanding of concepts.
b. Read and correctly interpret an application for employment, workplace documents, or an
   application for college admission.
c. Analyze technical writing for clarity.
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h. Recognize and analyze use of ambiguity, contradiction, paradox, irony, sarcasm,
   overstatement, and understatement in text.
i. Generate and respond logically to literal, inferential, evaluative, synthesizing, and critical
   thinking questions about the text(s).

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   problems.
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   different conclusions.
d. Recognize and analyze use of ambiguity, contradiction, paradox, irony, overstatement, and
   understatement in text.
e. Analyze false premises claims, counterclaims, and other evidence in persuasive writing.

ITEEA National Standards

13. Assess the Impact of Products and Systems

14. Medical Technologies

15. Agricultural and Related Biotechnologies

Task Number 052

Identify emerging healthcare technologies.

Definition

Identification should include trends in biomedical diagnostic tools, treatment processes, and genetic materials.

Process/Skill Questions
• What are microarrays, and how do they work?
• How will microarrays affect diagnosis?
• What are the new methods of treatment in genetics and cellular research?
• How do emerging healthcare technologies affect a patient's quality of life?
• What new healthcare technologies are being developed as a result of advances in agriculture, biotechnology, and medicine?
• How can viruses be used to carry genes into cells as preventive medicine?
• How are designer immune drugs being used to treat cancer on an individual basis?
• How are these anti-cancer treatments developed?

Related Standards of Learning

**History and Social Science**

**GOVT.9**

The student will apply social science skills to understand the process by which public policy is made by

a. defining public policy and determining how to differentiate public and private action;
b. examining different perspectives on the role of government;
c. describing how the national government influences the public agenda and shapes public policy by examining examples such as the Equal Rights Amendment, the Americans with Disabilities Act (ADA), and Section 9524 of the Elementary and Secondary Education Act (ESEA) of 1965;
d. describing how the state and local governments influence the public agenda and shape public policy;
e. investigating and evaluating the process by which policy is implemented by the bureaucracy at each level;
f. analyzing how the incentives of individuals, interest groups, and the media influence public policy; and
g. devising a course of action to address local and/or state issues.

**GOVT.15**

The student will apply social science skills to understand the role of government in the Virginia and United States economies by

a. describing the provision of government goods and services that are not readily produced by the market;
b. describing government’s establishment and maintenance of the rules and institutions in which markets operate, including the establishment and enforcement of property rights, contracts, consumer rights, labor-management relations, environmental protection, and competition in the marketplace;
c. investigating and describing the types and purposes of taxation that are used by local, state, and federal governments to pay for services provided by the government;
d. analyzing how Congress can use fiscal policy to stabilize the economy;
e. describing the effects of the Federal Reserve’s monetary policy on price stability, employment, and the economy; and
f. evaluating the trade-offs in government decisions.

**VUS.3**
The student will apply social science skills to understand early European colonization by

a. evaluating the economic characteristics of the colonies;
b. analyzing how social and political factors impacted the culture of the colonies; and
c. explaining the impact of the development of indentured servitude and slavery in the colonies.

VUS.6

The student will apply social science skills to understand major events in Virginia and United States history during the first half of the nineteenth century by

a. explaining territorial expansion and its impact on the American Indians;
b. describing the political results of territorial expansion;
c. assessing the political and economic changes that occurred during this period, with emphasis on James Madison and the War of 1812;
d. analyzing the social and cultural changes during the period, with emphasis on “the age of the common man” (Jacksonian Era);
e. evaluating the cultural, economic, and political issues that divided the nation, including tariffs, slavery, the abolitionist and women’s suffrage movements, and the role of the states in the Union.;
f. explaining how Manifest Destiny and President James K. Polk’s policies impacted the nation; and
g. evaluating and explaining the multiple causes and compromises leading to the Civil War, including the role of the institution of slavery.

VUS.13

The student will apply social science skills to understand the social, political, and cultural movements and changes in the United States during the second half of the twentieth century by

a. explaining the factors that led to United States expansion;
b. evaluating and explaining the impact of the Brown v. Board of Education decision, the roles of Thurgood Marshall and Oliver W. Hill, Sr., and how Virginia responded to the decision;
c. explaining how the National Association for the Advancement of Colored People (NAACP), the 1963 March on Washington, the Civil Rights Act of 1964, the Voting Rights Act of 1965, and the Americans with Disabilities Act (ADA) had an impact on all Americans;
d. analyzing changes in immigration policy and the impact of increased immigration;
e. evaluating and explaining the foreign and domestic policies pursued by the American government after the Cold War;
f. explaining how scientific and technological advances altered American lives; and
g. evaluating and explaining the changes that occurred in American culture.

VUS.14

The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

a. assessing the development of and changes in domestic policies, with emphasis on the impact of the role the United States Supreme Court played in defining a constitutional right to privacy, affirming equal rights, and upholding the rule of law;
b. evaluating and explaining the changes in foreign policies and the role of the United States in a world confronted by international terrorism, with emphasis on the American response to 9/11 (September 11, 2001);
c. evaluating the evolving and changing role of government, including its role in the American economy; and
d. explaining scientific and technological changes and evaluating their impact on American culture

WHII.13

The student will apply social science skills to understand of the political, economic, social, and cultural aspects of independence movements and development efforts by

a. describing the struggles for self-rule, including Gandhi’s leadership in India and the development of India’s democracy;
b. describing Africa’s independence movements, including Jomo Kenyatta’s leadership of Kenya and Nelson Mandela’s role in South Africa; and
c. describing the end of the mandate system and the creation of states in the Middle East, including the roles of Golda Meir and Gamal Abdel Nasser.

WHII.14

The student will apply social science skills to understand the global changes during the early twenty-first century by

a. identifying contemporary political issues, with emphasis on migrations of refugees and others, ethnic/religious conflicts, and the impact of technology, including the role of social media and chemical and biological technologies;
b. assessing the link between economic and political freedom;
c. describing economic interdependence, including the rise of multinational corporations, international organizations, and trade agreements; and
d. analyzing the increasing impact of terrorism.

10.5

The student will read, interpret, analyze, and evaluate nonfiction texts.

a. Analyze text features and organizational patterns to evaluate the meaning of texts.
b. Recognize an author’s intended audience and purpose for writing.
c. Skim materials to develop an overview and locate information.
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h. Recognize and analyze use of ambiguity, contradiction, paradox, irony, sarcasm, overstatement, and understatement in text.
i. Generate and respond logically to literal, inferential, evaluative, synthesizing, and critical thinking questions about the text(s).

12.5

The student will read, interpret, analyze, and evaluate a variety of nonfiction texts.

a. Use critical thinking to generate and respond logically to literal, inferential, and evaluative questions about the text(s).
b. Identify and synthesize resources to make decisions, complete tasks, and solve specific problems.
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ITEEA National Standards

14. Medical Technologies

6. The Role of Society in the Development and Use of Technology

Task Number 053

Explain the applications of genetics in pharmacology.

Definition

Explanation should include major contributions of genetics to pharmacology, as well as the effect of pharmacology on biomedicine.

Process/Skill Questions

- What are designer drugs?
• How does a drug affect a patient and treatment?
• What are the positive and negative effects of genetic applications in pharmacology on a patient?

Related Standards of Learning

Science

BIO.5
The student will investigate and understand common mechanisms of inheritance and protein synthesis. Key concepts include

a. cell growth and division;
b. gamete formation;
c. cell specialization;
d. prediction of inheritance of traits based on the Mendelian laws of heredity;
e. historical development of the structural model of DNA;
f. genetic variation;
g. the structure, function, and replication of nucleic acids;
h. events involved in the construction of proteins;
i. use, limitations, and misuse of genetic information; and
j. exploration of the impact of DNA technologies.

English

10.5
The student will read, interpret, analyze, and evaluate nonfiction texts.

a. Analyze text features and organizational patterns to evaluate the meaning of texts.
b. Recognize an author’s intended audience and purpose for writing.
c. Skim materials to develop an overview and locate information.
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understatement in text.
e. Analyze false premises claims, counterclaims, and other evidence in persuasive writing.

ITEEA National Standards

3. The Relationships Among Technologies and the Connections Between Technology and
Other Fields

Task Number 054

Describe the effects of biotechnology on preventive healthcare.

Definition

Description should include examples of biotechnology-related ethical, legal, and social issues in preventive
healthcare, as well as new advances in the preventive healthcare field.

Process/Skill Questions

- How has the Human Genome Project (HGP) impacted immunology?
- What percentage of the human genome actually codes for functioning genes?
- How have society and governmental influences affected preventive healthcare?
- What are basic preventive healthcare processes, and what is their relation to biomedicine?

Related Standards of Learning

History and Social Science
GOVT.9

The student will apply social science skills to understand the process by which public policy is made by

a. defining public policy and determining how to differentiate public and private action;
b. examining different perspectives on the role of government;
c. describing how the national government influences the public agenda and shapes public policy by examining examples such as the Equal Rights Amendment, the Americans with Disabilities Act (ADA), and Section 9524 of the Elementary and Secondary Education Act (ESEA) of 1965;
d. describing how the state and local governments influence the public agenda and shape public policy;
e. investigating and evaluating the process by which policy is implemented by the bureaucracy at each level;
f. analyzing how the incentives of individuals, interest groups, and the media influence public policy; and
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GOVT.15

The student will apply social science skills to understand the role of government in the Virginia and United States economies by

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b. describing government’s establishment and maintenance of the rules and institutions in which markets operate, including the establishment and enforcement of property rights, contracts, consumer rights, labor-management relations, environmental protection, and competition in the marketplace;
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d. analyzing how Congress can use fiscal policy to stabilize the economy;
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VUS.13

The student will apply social science skills to understand the social, political, and cultural movements and changes in the United States during the second half of the twentieth century by

a. explaining the factors that led to United States expansion;
b. evaluating and explaining the impact of the Brown v. Board of Education decision, the roles of Thurgood Marshall and Oliver W. Hill, Sr., and how Virginia responded to the decision;
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The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

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The student will apply social science skills to understand of the political, economic, social, and cultural aspects of independence movements and development efforts by

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WHII.14

The student will apply social science skills to understand the global changes during the early twenty-first century by

a. identifying contemporary political issues, with emphasis on migrations of refugees and others, ethnic/religious conflicts, and the impact of technology, including the role of social media and chemical and biological technologies;
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ITEEA National Standards
13. Assess the Impact of Products and Systems

4. The Cultural, Social, Economic, and Political Effects of Technology

5. The Effects of Technology on the Environment

**TSA Competitive Events**

**Digital Video Production**
Investigating Forensics

Task Number 055

Define forensic science.

Definition

Definition should explain that forensic science is science that is used in the court system. Biotechnological aspects include DNA testing, paternity testing, serology testing, and special applications in wildlife/species determination.

Process/Skill Questions

- What is the purpose of forensic science?
- What are the processes involved with identifying a person through DNA analysis?
- When did the forensic use of DNA analysis first begin? How has it evolved over the years?
- What is serology testing? How has it evolved over the years?
- What role does DNA testing play in the determination of new species and wildlife forensics?
- What resources offer information about forensic science in the criminal, medical, and biological fields?
- What techniques are used in forensic DNA analysis to amplify the DNA and improve the outcome of the analysis?

Related Standards of Learning

History and Social Science

VUS.14

The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

a. assessing the development of and changes in domestic policies, with emphasis on the impact of the role the United States Supreme Court played in defining a constitutional right to privacy, affirming equal rights, and upholding the rule of law;
b. evaluating and explaining the changes in foreign policies and the role of the United States in a world confronted by international terrorism, with emphasis on the American response to 9/11 (September 11, 2001);
c. evaluating the evolving and changing role of government, including its role in the American economy; and
d. explaining scientific and technological changes and evaluating their impact on American culture

WG.17

The student will apply social science skills to analyze the impact of globalization by
a. identifying factors, including comparative advantage, that influence the distribution of economic activities and trade;
b. describing ways that economic and social interactions change over time; and
c. mapping, describing, and evaluating economic unions.

WHII.14

The student will apply social science skills to understand the global changes during the early twenty-first century by

a. identifying contemporary political issues, with emphasis on migrations of refugees and others, ethnic/religious conflicts, and the impact of technology, including the role of social media and chemical and biological technologies;
b. assessing the link between economic and political freedom;
c. describing economic interdependence, including the rise of multinational corporations, international organizations, and trade agreements; and
d. analyzing the increasing impact of terrorism.

Science

BIO.5

The student will investigate and understand common mechanisms of inheritance and protein synthesis. Key concepts include

a. cell growth and division;
b. gamete formation;
c. cell specialization;
d. prediction of inheritance of traits based on the Mendelian laws of heredity;
e. historical development of the structural model of DNA;
f. genetic variation;
g. the structure, function, and replication of nucleic acids;
h. events involved in the construction of proteins;
i. use, limitations, and misuse of genetic information; and
j. exploration of the impact of DNA technologies.

English

10.3

The student will apply knowledge of word origins, derivations, and figurative language to extend vocabulary development in authentic texts.

a. Use structural analysis of roots, affixes, synonyms, and antonyms, to understand complex words.
b. Use context, structure, and connotations to determine meanings of words and phrases.
c. Discriminate between connotative and denotative meanings and interpret the connotation.
d. Explain the meaning of common idioms.
e. Explain the meaning of literary and classical allusions and figurative language in text.
f. Extend general and cross-curricular vocabulary through speaking, listening, reading, and writing.

10.5

The student will read, interpret, analyze, and evaluate nonfiction texts.
a. Analyze text features and organizational patterns to evaluate the meaning of texts.  
b. Recognize an author’s intended audience and purpose for writing.  
c. Skim materials to develop an overview and locate information.  
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g. Analyze and synthesize information in order to solve problems, answer questions, and generate new knowledge.  
h. Analyze ideas within and between selections providing textual evidence.  
i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.  
j. Use reading strategies throughout the reading process to monitor comprehension.

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g. Analyze false premises, claims, counterclaims, and other evidence in persuasive writing.  
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d. Explain the meaning of common idioms, and literary and classical allusions in text.
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The student will read, interpret, analyze, and evaluate a variety of nonfiction texts.

a. Use critical thinking to generate and respond logically to literal, inferential, and evaluative questions about the text(s).
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ITEEA National Standards

1. The Characteristics and Scope of Technology

14. Medical Technologies

15. Agricultural and Related Biotechnologies

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

TSA Competitive Events

Biotechnology Design

Technology Bowl (Written and Oral)

Task Number 056

Describe situations in which medical forensics can be used.

Definition
Description should include situations such as determining paternity, cause of death, effects of earlier treatments of diseases, and efficacy of drugs.

**Process/Skill Questions**

- What are the types and purposes of paternity tests for humans and animals?
- What are some of the tests used to determine cause of death?
- How can biological forensic evidence be collected and protected?
- How can the study of DNA analysis affect future treatments of disease?
- How has the use of commercially available kits for ethnic DNA analysis affected the study of DNA in society?
- What are the ethical dilemmas involved with the ever-growing DNA databases?

**Related Standards of Learning**

**English**

10.5

The student will read, interpret, analyze, and evaluate nonfiction texts.

   a. Analyze text features and organizational patterns to evaluate the meaning of texts.
   b. Recognize an author’s intended audience and purpose for writing.
   c. Skim materials to develop an overview and locate information.
   d. Compare and contrast informational texts for intent and content.
   e. Interpret and use data and information in maps, charts, graphs, timelines, tables, and diagrams.
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   g. Analyze false premises, claims, counterclaims, and other evidence in persuasive writing.
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e. Analyze false premises claims, counterclaims, and other evidence in persuasive writing.

**ITEEA National Standards**

14. Medical Technologies

**Task Number 057**

**Describe situations in which forensic science can be used in criminal investigations.**

**Definition**

Description may include gathering and preserving evidence related to a criminal act. Situations may include those involving ballistics, terrorist acts, presence of suspect materials (e.g., anthrax), drowning, entomology, plant material used as evidence, accident scenes, forensic nursing (e.g., sexual assault/rape kits), and other cases involving law enforcement officers or medical examiners.

**Process/Skill Questions**

- What types of evidence may be collected from a crime scene?
- How does the type of crime determine the evidence gathered?
- What steps are involved in gathering and preserving evidence from a crime scene?
- What evidence suggests a criminal vs. an accidental act?
- What skills are important to have as a team member (whether law enforcement, medical professionals, scientists, government agencies, or media) in criminal forensics?
- How does television's portrayal of forensic science influence society's perception of the field?

**Related Standards of Learning**

**English**
10.5
The student will read, interpret, analyze, and evaluate nonfiction texts.

a. Analyze text features and organizational patterns to evaluate the meaning of texts.
b. Recognize an author’s intended audience and purpose for writing.
c. Skim materials to develop an overview and locate information.
d. Compare and contrast informational texts for intent and content.
e. Interpret and use data and information in maps, charts, graphs, timelines, tables, and diagrams.
f. Draw conclusions and make inferences on explicit and implied information using textual support as evidence.
g. Analyze and synthesize information in order to solve problems, answer questions, and generate new knowledge.
h. Analyze ideas within and between selections providing textual evidence.
i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.
j. Use reading strategies throughout the reading process to monitor comprehension.

11.5
The student will read, interpret, analyze, and evaluate a variety of nonfiction texts including employment documents and technical writing.

a. Apply information from texts to clarify understanding of concepts.
b. Read and correctly interpret an application for employment, workplace documents, or an application for college admission.
c. Analyze technical writing for clarity.
d. Paraphrase and synthesize ideas within and between texts.
e. Draw conclusions and make inferences on explicit and implied information using textual support.
f. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.
g. Analyze false premises, claims, counterclaims, and other evidence in persuasive writing.
h. Recognize and analyze use of ambiguity, contradiction, paradox, irony, sarcasm, overstatement, and understatement in text.
i. Generate and respond logically to literal, inferential, evaluative, synthesizing, and critical thinking questions about the text(s).

12.5
The student will read, interpret, analyze, and evaluate a variety of nonfiction texts.

a. Use critical thinking to generate and respond logically to literal, inferential, and evaluative questions about the text(s).
b. Identify and synthesize resources to make decisions, complete tasks, and solve specific problems.
c. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.
d. Recognize and analyze use of ambiguity, contradiction, paradox, irony, overstatement, and understatement in text.
e. Analyze false premises claims, counterclaims, and other evidence in persuasive writing.
**14. Medical Technologies**

**Task Number 058**

**Describe situations in which biological forensic science can be used.**

**Definition**

Description should include a definition of *biological forensic science*. Situations may include those involving any living organisms (e.g., disruptions in plant and animal life cycles, endangered species, extinct species, plant and animal mutations, and animal habitat degradation).

**Process/Skill Questions**

- How would one describe the interrelationship of criminal, medical, and biological forensic sciences?
- What basic skills are needed to collect evidence for biological forensics? Why is each skill important?
- How and where is biological forensic evidence processed?
- In what recent events have biological forensics been used? What effect did they have?

**Related Standards of Learning**

**English**

10.5

The student will read, interpret, analyze, and evaluate nonfiction texts.

a. Analyze text features and organizational patterns to evaluate the meaning of texts.
b. Recognize an author’s intended audience and purpose for writing.
c. Skim materials to develop an overview and locate information.
d. Compare and contrast informational texts for intent and content.
e. Interpret and use data and information in maps, charts, graphs, timelines, tables, and diagrams.
f. Draw conclusions and make inferences on explicit and implied information using textual support as evidence.
g. Analyze and synthesize information in order to solve problems, answer questions, and generate new knowledge.
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i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.
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application for college admission.

c. Analyze technical writing for clarity.

d. Paraphrase and synthesize ideas within and between texts.

e. Draw conclusions and make inferences on explicit and implied information using textual support.

f. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.

g. Analyze false premises, claims, counterclaims, and other evidence in persuasive writing.

h. Recognize and analyze use of ambiguity, contradiction, paradox, irony, sarcasm, overstatement, and understatement in text.

i. Generate and respond logically to literal, inferential, evaluative, synthesizing, and critical thinking questions about the text(s).

12.5

The student will read, interpret, analyze, and evaluate a variety of nonfiction texts.

a. Use critical thinking to generate and respond logically to literal, inferential, and evaluative questions about the text(s).

b. Identify and synthesize resources to make decisions, complete tasks, and solve specific problems.

c. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.

d. Recognize and analyze use of ambiguity, contradiction, paradox, irony, overstatement, and understatement in text.

e. Analyze false premises claims, counterclaims, and other evidence in persuasive writing.

ITEEA National Standards

14. Medical Technologies

15. Agricultural and Related Biotechnologies

Task Number 059

Demonstrate the basic instrumentation used in DNA analysis for forensic purposes.

Definition

Demonstration should include

- DNA extraction from living tissue
- pipetting technique
- gel electrophoresis.

Process/Skill Questions
- What are the primary types of instruments and equipment used in forensic science?
- What purpose do the instruments serve?
- What safety practices are important when using the instruments of forensic science?

Related Standards of Learning

**English**

10.5
The student will read, interpret, analyze, and evaluate nonfiction texts.

a. Analyze text features and organizational patterns to evaluate the meaning of texts.
b. Recognize an author’s intended audience and purpose for writing.
c. Skim materials to develop an overview and locate information.
d. Compare and contrast informational texts for intent and content.
e. Interpret and use data and information in maps, charts, graphs, timelines, tables, and diagrams.
f. Draw conclusions and make inferences on explicit and implied information using textual support as evidence.
g. Analyze and synthesize information in order to solve problems, answer questions, and generate new knowledge.
h. Analyze ideas within and between selections providing textual evidence.
i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.
j. Use reading strategies throughout the reading process to monitor comprehension.

11.5
The student will read, interpret, analyze, and evaluate a variety of nonfiction texts including employment documents and technical writing.

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b. Read and correctly interpret an application for employment, workplace documents, or an application for college admission.
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g. Analyze false premises, claims, counterclaims, and other evidence in persuasive writing.
h. Recognize and analyze use of ambiguity, contradiction, paradox, irony, sarcasm, overstatement, and understatement in text.
i. Generate and respond logically to literal, inferential, evaluative, synthesizing, and critical thinking questions about the text(s).

12.5
The student will read, interpret, analyze, and evaluate a variety of nonfiction texts.

a. Use critical thinking to generate and respond logically to literal, inferential, and evaluative questions about the text(s).
b. Identify and synthesize resources to make decisions, complete tasks, and solve specific problems.
c. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.
d. Recognize and analyze use of ambiguity, contradiction, paradox, irony, overstatement, and understatement in text.
e. Analyze false premises claims, counterclaims, and other evidence in persuasive writing.

ITEEA National Standards

12. Use and Maintain Technological Products and Systems

2. The Core Concepts of Technology

TSA Competitive Events

Engineering Design
Understanding Biomedical Engineering

Task Number 060

Define bioengineering.

Definition

Definition should explain that bioengineering is the design and manipulation of materials and organisms to create new products for medical, agricultural, and engineering applications.

Process/Skill Questions

- What are some examples of bioengineered products in the fields of medicine, agriculture, and engineering?
- What are the steps in the engineering design process?
- What are some of the ethical and legal issues associated with bioengineering?

Related Standards of Learning

History and Social Science

VUS.14

The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

a. assessing the development of and changes in domestic policies, with emphasis on the impact of the role the United States Supreme Court played in defining a constitutional right to privacy, affirming equal rights, and upholding the rule of law;
b. evaluating and explaining the changes in foreign policies and the role of the United States in a world confronted by international terrorism, with emphasis on the American response to 9/11 (September 11, 2001);
c. evaluating the evolving and changing role of government, including its role in the American economy; and
d. explaining scientific and technological changes and evaluating their impact on American culture

WG.17

The student will apply social science skills to analyze the impact of globalization by

a. identifying factors, including comparative advantage, that influence the distribution of economic activities and trade;
b. describing ways that economic and social interactions change over time; and
c. mapping, describing, and evaluating economic unions.
WHII.14

The student will apply social science skills to understand the global changes during the early twenty-first century by

a. identifying contemporary political issues, with emphasis on migrations of refugees and others, ethnic/religious conflicts, and the impact of technology, including the role of social media and chemical and biological technologies;
b. assessing the link between economic and political freedom;
c. describing economic interdependence, including the rise of multinational corporations, international organizations, and trade agreements; and
d. analyzing the increasing impact of terrorism.

10.3

The student will apply knowledge of word origins, derivations, and figurative language to extend vocabulary development in authentic texts.

a. Use structural analysis of roots, affixes, synonyms, and antonyms, to understand complex words.
b. Use context, structure, and connotations to determine meanings of words and phrases.
c. Discriminate between connotative and denotative meanings and interpret the connotation.
d. Explain the meaning of common idioms.
e. Explain the meaning of literary and classical allusions and figurative language in text.
f. Extend general and cross-curricular vocabulary through speaking, listening, reading, and writing.

10.5

The student will read, interpret, analyze, and evaluate nonfiction texts.

a. Analyze text features and organizational patterns to evaluate the meaning of texts.
b. Recognize an author’s intended audience and purpose for writing.
c. Skim materials to develop an overview and locate information.
d. Compare and contrast informational texts for intent and content.
e. Interpret and use data and information in maps, charts, graphs, timelines, tables, and diagrams.
f. Draw conclusions and make inferences on explicit and implied information using textual support as evidence.
g. Analyze and synthesize information in order to solve problems, answer questions, and generate new knowledge.
h. Analyze ideas within and between selections providing textual evidence.
i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.
j. Use reading strategies throughout the reading process to monitor comprehension.

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The student will apply knowledge of word origins, derivations, and figurative language to extend vocabulary development in authentic texts.

a. Use structural analysis of roots, affixes, synonyms, and antonyms to understand complex words.
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i. Generate and respond logically to literal, inferential, evaluative, synthesizing, and critical thinking questions about the text(s).

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a. Use structural analysis of roots, affixes, synonyms, and antonyms, to understand complex words.
b. Use context, structure, and connotations to determine meanings of words and phrases.
c. Discriminate between connotative and denotative meanings and interpret the connotation.
d. Explain the meaning of common idioms, and literary and classical allusions in text.
e. Extend general and cross-curricular vocabulary through speaking, listening, reading, and writing.

12.5
The student will read, interpret, analyze, and evaluate a variety of nonfiction texts.

a. Use critical thinking to generate and respond logically to literal, inferential, and evaluative questions about the text(s).
b. Identify and synthesize resources to make decisions, complete tasks, and solve specific problems.
c. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.
d. Recognize and analyze use of ambiguity, contradiction, paradox, irony, overstated, and understatement in text.
e. Analyze false premises claims, counterclaims, and other evidence in persuasive writing.

ITEEA National Standards
Task Number 061

Identify uses of nanobiotechnology.

Definition

Identification should include nanobiotechnology applications in medicine, agriculture, and engineering.

Process/Skill Questions

- What is the history of nanobiotechnology?
- How do patients benefit from tools fabricated by nanobiotechnology? How do farmers benefit? Engineers? The American consumer?

Related Standards of Learning

**History and Social Science**

VUS.14

The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

a. assessing the development of and changes in domestic policies, with emphasis on the impact of the role the United States Supreme Court played in defining a constitutional right to
privacy, affirming equal rights, and upholding the rule of law;
b. evaluating and explaining the changes in foreign policies and the role of the United States in a world confronted by international terrorism, with emphasis on the American response to 9/11 (September 11, 2001);
c. evaluating the evolving and changing role of government, including its role in the American economy; and
d. explaining scientific and technological changes and evaluating their impact on American culture

WG.17

The student will apply social science skills to analyze the impact of globalization by

a. identifying factors, including comparative advantage, that influence the distribution of economic activities and trade;
b. describing ways that economic and social interactions change over time; and
c. mapping, describing, and evaluating economic unions.

WHII.14

The student will apply social science skills to understand the global changes during the early twenty-first century by

a. identifying contemporary political issues, with emphasis on migrations of refugees and others, ethnic/religious conflicts, and the impact of technology, including the role of social media and chemical and biological technologies;
b. assessing the link between economic and political freedom;
c. describing economic interdependence, including the rise of multinational corporations, international organizations, and trade agreements; and
d. analyzing the increasing impact of terrorism.

10.5

The student will read, interpret, analyze, and evaluate nonfiction texts.

a. Analyze text features and organizational patterns to evaluate the meaning of texts.
b. Recognize an author’s intended audience and purpose for writing.
c. Skim materials to develop an overview and locate information.
d. Compare and contrast informational texts for intent and content.
e. Interpret and use data and information in maps, charts, graphs, timelines, tables, and diagrams.
f. Draw conclusions and make inferences on explicit and implied information using textual support as evidence.
g. Analyze and synthesize information in order to solve problems, answer questions, and generate new knowledge.
h. Analyze ideas within and between selections providing textual evidence.
i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.
j. Use reading strategies throughout the reading process to monitor comprehension.

11.5

The student will read, interpret, analyze, and evaluate a variety of nonfiction texts including
employment documents and technical writing.

a. Apply information from texts to clarify understanding of concepts.
b. Read and correctly interpret an application for employment, workplace documents, or an
   application for college admission.
c. Analyze technical writing for clarity.
d. Paraphrase and synthesize ideas within and between texts.
e. Draw conclusions and make inferences on explicit and implied information using textual
   support.
f. Analyze multiple texts addressing the same topic to determine how authors reach similar or
   different conclusions.
g. Analyze false premises, claims, counterclaims, and other evidence in persuasive writing.
h. Recognize and analyze use of ambiguity, contradiction, paradox, irony, sarcasm,
   overstatement, and understatement in text.
i. Generate and respond logically to literal, inferential, evaluative, synthesizing, and critical
   thinking questions about the text(s).

12.5

The student will read, interpret, analyze, and evaluate a variety of nonfiction texts.

a. Use critical thinking to generate and respond logically to literal, inferential, and evaluative
   questions about the text(s).
b. Identify and synthesize resources to make decisions, complete tasks, and solve specific
   problems.
c. Analyze multiple texts addressing the same topic to determine how authors reach similar or
   different conclusions.
d. Recognize and analyze use of ambiguity, contradiction, paradox, irony, overstatement, and
   understatement in text.
e. Analyze false premises claims, counterclaims, and other evidence in persuasive writing.

ITEEA National Standards

6. The Role of Society in the Development and Use of Technology

TSA Competitive Events

Biotechnology Design

Task Number 062

Identify examples of biowarfare.

Definition
Identification should include

- the history of biowarfare
- applications of biowarfare
- circumstances surrounding the use of biowarfare
- the use of personal protective equipment (PPE).

**Process/Skill Questions**

- What is the historical development of biowarfare?
- Why and how is PPE used in biowarfare?
- What international laws govern biowarfare?
- Why is a knowledge of biotechnology important for military leaders? For other military personnel? For civilians?

**Related Standards of Learning**

**History and Social Science**

**GOVT.9**

The student will apply social science skills to understand the process by which public policy is made by

a. defining public policy and determining how to differentiate public and private action;
b. examining different perspectives on the role of government;
c. describing how the national government influences the public agenda and shapes public policy by examining examples such as the Equal Rights Amendment, the Americans with Disabilities Act (ADA), and Section 9524 of the Elementary and Secondary Education Act (ESEA) of 1965;
d. describing how the state and local governments influence the public agenda and shape public policy;
e. investigating and evaluating the process by which policy is implemented by the bureaucracy at each level;
f. analyzing how the incentives of individuals, interest groups, and the media influence public policy; and
g. devising a course of action to address local and/or state issues.

**GOVT.15**

The student will apply social science skills to understand the role of government in the Virginia and United States economies by

a. describing the provision of government goods and services that are not readily produced by the market;
b. describing government’s establishment and maintenance of the rules and institutions in which markets operate, including the establishment and enforcement of property rights, contracts, consumer rights, labor-management relations, environmental protection, and competition in the marketplace;
c. investigating and describing the types and purposes of taxation that are used by local, state, and federal governments to pay for services provided by the government;
d. analyzing how Congress can use fiscal policy to stabilize the economy;
e. describing the effects of the Federal Reserve’s monetary policy on price stability, employment, and the economy; and
f. evaluating the trade-offs in government decisions.

VUS.13

The student will apply social science skills to understand the social, political, and cultural movements and changes in the United States during the second half of the twentieth century by

a. explaining the factors that led to United States expansion;
b. evaluating and explaining the impact of the Brown v. Board of Education decision, the roles of Thurgood Marshall and Oliver W. Hill, Sr., and how Virginia responded to the decision;
c. explaining how the National Association for the Advancement of Colored People (NAACP), the 1963 March on Washington, the Civil Rights Act of 1964, the Voting Rights Act of 1965, and the Americans with Disabilities Act (ADA) had an impact on all Americans;
d. analyzing changes in immigration policy and the impact of increased immigration;
e. evaluating and explaining the foreign and domestic policies pursued by the American government after the Cold War;
f. explaining how scientific and technological advances altered American lives; and
g. evaluating and explaining the changes that occurred in American culture.

VUS.14

The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

a. assessing the development of and changes in domestic policies, with emphasis on the impact of the role the United States Supreme Court played in defining a constitutional right to privacy, affirming equal rights, and upholding the rule of law;
b. evaluating and explaining the changes in foreign policies and the role of the United States in a world confronted by international terrorism, with emphasis on the American response to 9/11 (September 11, 2001);
c. evaluating the evolving and changing role of government, including its role in the American economy; and
d. explaining scientific and technological changes and evaluating their impact on American culture

WHII.12

The student will apply social science skills to understand the conflicts during the second half of the twentieth century by

a. explaining the causes of the Cold War, including the competition between the American and Soviet economic and political systems and the causes of the collapse of communism in the Soviet Union and Eastern Europe;
b. describing the major leaders and events of the Cold War, including the location of major conflicts;
c. describing conflicts and revolutionary movements in Asia and their major leaders, including Mao Tse-tung (Zedong), Chiang Kai-shek, Deng Xiaoping, and Ho Chi Minh; and
d. examining the political and economic shifts that led to the end of the Cold War, with emphasis on Margaret Thatcher, Mikhail Gorbachev, and Ronald Reagan.
WHII.13

The student will apply social science skills to understand of the political, economic, social, and cultural aspects of independence movements and development efforts by

a. describing the struggles for self-rule, including Gandhi’s leadership in India and the development of India’s democracy;
b. describing Africa’s independence movements, including Jomo Kenyatta’s leadership of Kenya and Nelson Mandela’s role in South Africa; and
c. describing the end of the mandate system and the creation of states in the Middle East, including the roles of Golda Meir and Gamal Abdel Nasser.

WHII.14

The student will apply social science skills to understand the global changes during the early twenty-first century by

a. identifying contemporary political issues, with emphasis on migrations of refugees and others, ethnic/religious conflicts, and the impact of technology, including the role of social media and chemical and biological technologies;
b. assessing the link between economic and political freedom;
c. describing economic interdependence, including the rise of multinational corporations, international organizations, and trade agreements; and
d. analyzing the increasing impact of terrorism.

ITEEA National Standards

6. The Role of Society in the Development and Use of Technology

TSA Competitive Events

Technology Bowl (Written and Oral)

Task Number 063

Design and produce a biomechanism.

Definition

Design and production should include a portfolio (e.g., research, possible solutions, experimentation) and a model of a biomechanism.

Process/Skill Questions
What types of human problems can biomechanisms solve?
How can biomechanisms be designed and produced?
How does society benefit from the development of biomechanisms?

Related Standards of Learning

**History and Social Science**

**VUS.14**

The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

- assessing the development of and changes in domestic policies, with emphasis on the impact of the role the United States Supreme Court played in defining a constitutional right to privacy, affirming equal rights, and upholding the rule of law;
- evaluating and explaining the changes in foreign policies and the role of the United States in a world confronted by international terrorism, with emphasis on the American response to 9/11 (September 11, 2001);
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- explaining scientific and technological changes and evaluating their impact on American culture

**WG.17**

The student will apply social science skills to analyze the impact of globalization by

- identifying factors, including comparative advantage, that influence the distribution of economic activities and trade;
- describing ways that economic and social interactions change over time; and
- mapping, describing, and evaluating economic unions.

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- assessing the link between economic and political freedom;
- describing economic interdependence, including the rise of multinational corporations, international organizations, and trade agreements; and
- analyzing the increasing impact of terrorism.

**Science**

**BIO.1**

The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

- observations of living organisms are recorded in the lab and in the field;
b. hypotheses are formulated based on direct observations and information from scientific literature;
c. variables are defined and investigations are designed to test hypotheses;
d. graphing and arithmetic calculations are used as tools in data analysis;
e. conclusions are formed based on recorded quantitative and qualitative data;
f. sources of error inherent in experimental design are identified and discussed;
g. validity of data is determined;
h. chemicals and equipment are used in a safe manner;
i. appropriate technology including computers, graphing calculators, and probeware is used for gathering and analyzing data, communicating results, modeling concepts, and simulating experimental conditions;
j. research utilizes scientific literature;
k. differentiation is made among a scientific hypothesis, theory, and law;
l. alternative scientific explanations and models are recognized and analyzed; and
m. current applications of biological concepts are used.

### 10.1

The student will make planned multimodal, interactive presentations collaboratively and individually.

a. Make strategic use of multimodal tools.
b. Credit information sources.
c. Demonstrate the ability to work effectively with diverse teams including setting rules and goals for group work such as coming to informal consensus, taking votes on key issues, and presenting alternate views.
d. Assume responsibility for specific group tasks.
e. Include all group members and value individual contributions made by each group member.
f. Use a variety of strategies to listen actively and speak using appropriate discussion rules with awareness of verbal and nonverbal cues.
g. Respond thoughtfully and tactfully to diverse perspectives, summarizing points of agreement and disagreement.
h. Choose vocabulary, language, and tone appropriate to the topic, audience, and purpose.
i. Access, critically evaluate, and use information accurately to solve problems.
j. Use reflection to evaluate one’s own role and the group process in small-group activities.
k. Evaluate a speaker’s point of view, reasoning, use of evidence, rhetoric, and identify any faulty reasoning.

### 10.5

The student will read, interpret, analyze, and evaluate nonfiction texts.

a. Analyze text features and organizational patterns to evaluate the meaning of texts.
b. Recognize an author’s intended audience and purpose for writing.
c. Skim materials to develop an overview and locate information.
d. Compare and contrast informational texts for intent and content.
e. Interpret and use data and information in maps, charts, graphs, timelines, tables, and diagrams.
f. Draw conclusions and make inferences on explicit and implied information using textual support as evidence.
g. Analyze and synthesize information in order to solve problems, answer questions, and generate new knowledge.
h. Analyze ideas within and between selections providing textual evidence.

i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.

j. Use reading strategies throughout the reading process to monitor comprehension.

10.8

The student will find, evaluate, and select credible resources to create a research product.

a. Verify the accuracy, validity, and usefulness of information.

b. Analyze information gathered from diverse sources by identifying misconceptions, main and supporting ideas, conflicting information, and point of view or bias.

c. Evaluate and select evidence from a variety of sources to introduce counter claims and to support claims.

d. Cite sources for both quoted and paraphrased ideas using a standard method of documentation, such as that of the Modern Language Association (MLA) or the American Psychological Association (APA).

e. Define the meaning and consequences of plagiarism and follow ethical and legal guidelines for gathering and using information.

f. Demonstrate ethical use of the Internet.

11.1

The student will make planned informative and persuasive multimodal, interactive presentations collaboratively and individually.

a. Select and effectively use multimodal tools to design and develop presentation content.

b. Credit information sources.

c. Demonstrate the ability to work collaboratively with diverse teams.

d. Respond thoughtfully and tactfully to diverse perspectives, summarizing points of agreement and disagreement.

e. Use a variety of strategies to listen actively and speak using appropriate discussion rules with awareness of verbal and nonverbal cues.

f. Anticipate and address alternative or opposing perspectives and counterclaims.

g. Evaluate the various techniques used to construct arguments in multimodal presentations.

h. Use vocabulary appropriate to the topic, audience, and purpose.

i. Evaluate effectiveness of multimodal presentations.

11.5

The student will read, interpret, analyze, and evaluate a variety of nonfiction texts including employment documents and technical writing.

a. Apply information from texts to clarify understanding of concepts.

b. Read and correctly interpret an application for employment, workplace documents, or an application for college admission.

c. Analyze technical writing for clarity.

d. Paraphrase and synthesize ideas within and between texts.

e. Draw conclusions and make inferences on explicit and implied information using textual support.

f. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.

g. Analyze false premises, claims, counterclaims, and other evidence in persuasive writing.

h. Recognize and analyze use of ambiguity, contradiction, paradox, irony, sarcasm, overstatement, and understatement in text.
i. Generate and respond logically to literal, inferential, evaluative, synthesizing, and critical thinking questions about the text(s).

11.8

The student will analyze, evaluate, synthesize, and organize information from a variety of credible resources to produce a research product.

b. Make sense of information gathered from diverse sources by identifying misconceptions, main and supporting ideas, conflicting information, point of view or bias.
c. Synthesize relevant information from primary and secondary sources and present it in a logical sequence.
d. Cite sources for both quoted and paraphrased ideas using a standard method of documentation, such as that of the Modern Language Association (MLA) or the American Psychological Association (APA).
e. Define the meaning and consequences of plagiarism and follow ethical and legal guidelines for gathering and using information.
f. Demonstrate ethical use of the Internet.

12.1

The student will make planned persuasive/argumentative, multimodal, interactive presentations collaboratively and individually.

a. Select and effectively use multimodal tools to design and develop presentation content.
b. Credit information sources.
c. Demonstrate the ability to work collaboratively with diverse teams.
d. Anticipate and address alternative or opposing perspectives and counterclaims.
e. Evaluate the various techniques used to construct arguments in multimodal presentations.
f. Use a variety of strategies to listen actively and speak using appropriate discussion rules with awareness of verbal and nonverbal cues.
g. Critique effectiveness of multimodal presentations.

12.5

The student will read, interpret, analyze, and evaluate a variety of nonfiction texts.

a. Use critical thinking to generate and respond logically to literal, inferential, and evaluative questions about the text(s).
b. Identify and synthesize resources to make decisions, complete tasks, and solve specific problems.
c. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.
d. Recognize and analyze use of ambiguity, contradiction, paradox, irony, overstatement, and understatement in text.
e. Analyze false premises claims, counterclaims, and other evidence in persuasive writing.

12.8

The student will analyze, evaluate, synthesize, and organize information from a variety of credible resources to produce a research product.

a. Frame, analyze, and synthesize information to solve problems, answer questions, and generate new knowledge.
b. Analyze information gathered from diverse sources by identifying misconceptions, main and
supporting ideas, conflicting information, point of view, or bias.
c. Critically evaluate the accuracy, quality, and validity of the information.
d. Cite sources for both quoted and paraphrased ideas using a standard method of
documentation, such as that of the Modern Language Association (MLA) or the American
Psychological Association (APA).
e. Define the meaning and consequences of plagiarism and follow ethical and legal guidelines
for gathering and using information.
f. Demonstrate ethical use of the Internet.

**ITEEA National Standards**

11. Apply the Design Processes

12. Use and Maintain Technological Products and Systems

**TSA Competitive Events**

- Biotechnology Design
- Engineering Design
Examining Social Aspects and Ethics of Biotechnology

Task Number 064

Define bioethics.

Definition

Definition should include the standard description of ethics and the relationship of biotechnology to ethics.

Process/Skill Questions

- Why does the study of biotechnology require the study of ethics?
- What are prominent ethical issues raised by biotechnology?

Related Standards of Learning

History and Social Science

VUS.14

The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

a. assessing the development of and changes in domestic policies, with emphasis on the impact of the role the United States Supreme Court played in defining a constitutional right to privacy, affirming equal rights, and upholding the rule of law;
b. evaluating and explaining the changes in foreign policies and the role of the United States in a world confronted by international terrorism, with emphasis on the American response to 9/11 (September 11, 2001);
c. evaluating the evolving and changing role of government, including its role in the American economy; and
d. explaining scientific and technological changes and evaluating their impact on American culture

WG.17

The student will apply social science skills to analyze the impact of globalization by

a. identifying factors, including comparative advantage, that influence the distribution of economic activities and trade;
b. describing ways that economic and social interactions change over time; and
c. mapping, describing, and evaluating economic unions.

WHII.14
The student will apply social science skills to understand the global changes during the early twenty-first century by

a. identifying contemporary political issues, with emphasis on migrations of refugees and others, ethnic/religious conflicts, and the impact of technology, including the role of social media and chemical and biological technologies;
b. assessing the link between economic and political freedom;
c. describing economic interdependence, including the rise of multinational corporations, international organizations, and trade agreements; and
d. analyzing the increasing impact of terrorism.

10.3
The student will apply knowledge of word origins, derivations, and figurative language to extend vocabulary development in authentic texts.

a. Use structural analysis of roots, affixes, synonyms, and antonyms, to understand complex words.
b. Use context, structure, and connotations to determine meanings of words and phrases.
c. Discriminate between connotative and denotative meanings and interpret the connotation.
d. Explain the meaning of common idioms.
e. Explain the meaning of literary and classical allusions and figurative language in text.
f. Extend general and cross-curricular vocabulary through speaking, listening, reading, and writing.

11.3
The student will apply knowledge of word origins, derivations, and figurative language to extend vocabulary development in authentic texts.

a. Use structural analysis of roots, affixes, synonyms, and antonyms to understand complex words.
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e. Explain the meaning of literary and classical allusions and figurative language in text.
f. Extend general and cross-curricular vocabulary through speaking, listening, reading, and writing.

12.3
The student will apply knowledge of word origins, derivations, and figurative language to extend vocabulary development in authentic texts.

a. Use structural analysis of roots, affixes, synonyms, and antonyms, to understand complex words.
b. Use context, structure, and connotations to determine meanings of words and phrases.
c. Discriminate between connotative and denotative meanings and interpret the connotation.
d. Explain the meaning of common idioms, and literary and classical allusions in text.
e. Extend general and cross-curricular vocabulary through speaking, listening, reading, and writing.
TSA Competitive Events

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**Task Number 065**

**Assess implications of biotechnology, including gene therapy, patenting of living tissue, and cloning.**

**Definition**

Assessment should include

- historical effects (e.g., animal husbandry, seed modification)
- current effects (e.g., gene therapy, patenting of living tissue, cloning)
- positive and negative effects.

**Process/Skill Questions**

- How has society benefited from biotechnology?
- How has biotechnology been affected by society?
- What is gene therapy meant to do?
- What is cloning?
- How and why are patents given to living tissue products and gene products?

**Related Standards of Learning**

**GOVT.1**

The student will demonstrate skills for historical thinking, geographical analysis, economic decision
making, and responsible citizenship by

a. planning inquiries by synthesizing information from diverse primary and secondary sources;
b. analyzing how political and economic trends influence public policy, using demographic information and other data sources;
c. comparing and contrasting historical, cultural, economic, and political perspectives;
d. evaluating critically the quality, accuracy, and validity of information to determine misconceptions, fact and opinion, and bias;
e. constructing informed, analytic arguments using evidence from multiple sources to introduce and support substantive and significant claims;
f. explaining how cause-and-effect relationships impact political and economic events;
g. taking knowledgeable, constructive action, individually and collaboratively, to address school, community, local, state, national, and global issues;
h. using a decision-making model to analyze the costs and benefits of a specific choice, considering incentives and possible consequences;
i. applying civic virtues and democratic principles to make collaborative decisions; and
j. communicating conclusions orally and in writing to a wide range of audiences, using evidence from multiple sources and citing specific sources.

GOVT.9

The student will apply social science skills to understand the process by which public policy is made by

a. defining public policy and determining how to differentiate public and private action;
b. examining different perspectives on the role of government;
c. describing how the national government influences the public agenda and shapes public policy by examining examples such as the Equal Rights Amendment, the Americans with Disabilities Act (ADA), and Section 9524 of the Elementary and Secondary Education Act (ESEA) of 1965;
d. describing how the state and local governments influence the public agenda and shape public policy;
e. investigating and evaluating the process by which policy is implemented by the bureaucracy at each level;
f. analyzing how the incentives of individuals, interest groups, and the media influence public policy; and
g. devising a course of action to address local and/or state issues.

GOVT.15

The student will apply social science skills to understand the role of government in the Virginia and United States economies by

a. describing the provision of government goods and services that are not readily produced by the market;
b. describing government’s establishment and maintenance of the rules and institutions in which markets operate, including the establishment and enforcement of property rights, contracts, consumer rights, labor-management relations, environmental protection, and competition in the marketplace;
c. investigating and describing the types and purposes of taxation that are used by local, state, and federal governments to pay for services provided by the government;
d. analyzing how Congress can use fiscal policy to stabilize the economy;
e. describing the effects of the Federal Reserve’s monetary policy on price stability, employment, and the economy; and
f. evaluating the trade-offs in government decisions.

**VUS.13**

The student will apply social science skills to understand the social, political, and cultural movements and changes in the United States during the second half of the twentieth century by

a. explaining the factors that led to United States expansion;
b. evaluating and explaining the impact of the *Brown v. Board of Education* decision, the roles of Thurgood Marshall and Oliver W. Hill, Sr., and how Virginia responded to the decision;
c. explaining how the National Association for the Advancement of Colored People (NAACP), the 1963 March on Washington, the Civil Rights Act of 1964, the Voting Rights Act of 1965, and the Americans with Disabilities Act (ADA) had an impact on all Americans;
d. analyzing changes in immigration policy and the impact of increased immigration;
e. evaluating and explaining the foreign and domestic policies pursued by the American government after the Cold War;
f. explaining how scientific and technological advances altered American lives; and
g. evaluating and explaining the changes that occurred in American culture.

**VUS.14**

The student will apply social science skills to understand political and social conditions in the United States during the early twenty-first century by

a. assessing the development of and changes in domestic policies, with emphasis on the impact of the role the United States Supreme Court played in defining a constitutional right to privacy, affirming equal rights, and upholding the rule of law;
b. evaluating and explaining the changes in foreign policies and the role of the United States in a world confronted by international terrorism, with emphasis on the American response to 9/11 (September 11, 2001);
c. evaluating the evolving and changing role of government, including its role in the American economy; and
d. explaining scientific and technological changes and evaluating their impact on American culture.

**WHII.12**

The student will apply social science skills to understand the conflicts during the second half of the twentieth century by

a. explaining the causes of the Cold War, including the competition between the American and Soviet economic and political systems and the causes of the collapse of communism in the Soviet Union and Eastern Europe;
b. describing the major leaders and events of the Cold War, including the location of major conflicts;
c. describing conflicts and revolutionary movements in Asia and their major leaders, including Mao Tse-tung (Zedong), Chiang Kai-shek, Deng Xiaoping, and Ho Chi Minh; and
d. examining the political and economic shifts that led to the end of the Cold War, with emphasis on Margaret Thatcher, Mikhail Gorbachev, and Ronald Reagan.

**WHII.13**

The student will apply social science skills to understand the conflicts during the second half of the twentieth century by
The student will apply social science skills to understand the political, economic, social, and cultural aspects of independence movements and development efforts by

a. describing the struggles for self-rule, including Gandhi’s leadership in India and the development of India’s democracy;
b. describing Africa’s independence movements, including Jomo Kenyatta’s leadership of Kenya and Nelson Mandela’s role in South Africa; and
c. describing the end of the mandate system and the creation of states in the Middle East, including the roles of Golda Meir and Gamal Abdel Nasser.

WHII.14

The student will apply social science skills to understand the global changes during the early twenty-first century by

a. identifying contemporary political issues, with emphasis on migrations of refugees and others, ethnic/religious conflicts, and the impact of technology, including the role of social media and chemical and biological technologies;
b. assessing the link between economic and political freedom;
c. describing economic interdependence, including the rise of multinational corporations, international organizations, and trade agreements; and
d. analyzing the increasing impact of terrorism.

Science

BIO.5

The student will investigate and understand common mechanisms of inheritance and protein synthesis. Key concepts include

a. cell growth and division;
b. gamete formation;
c. cell specialization;
d. prediction of inheritance of traits based on the Mendelian laws of heredity;
e. historical development of the structural model of DNA;
f. genetic variation;
g. the structure, function, and replication of nucleic acids;
h. events involved in the construction of proteins;
i. use, limitations, and misuse of genetic information; and
j. exploration of the impact of DNA technologies.

ITEEA National Standards

13. Assess the Impact of Products and Systems

TSA Competitive Events

Biotechnology Design
Task Number 066

Differentiate among ethical principles that reflect social, religious, economic, and political perspectives.

Definition

Differentiation should be made among ethical principles reflected in social, religious, economic, and political segments of society.

Process/Skill Questions

- How are ethics different from laws?
- Why are the different principles of ethics essential?
- Why are there differences in ethical principles from one person or group to another?
- Whose ethics should guide biotechnology? Why?

Related Standards of Learning

History and Social Science

GOVT.1

The student will demonstrate skills for historical thinking, geographical analysis, economic decision making, and responsible citizenship by

a. planning inquiries by synthesizing information from diverse primary and secondary sources;
b. analyzing how political and economic trends influence public policy, using demographic information and other data sources;
c. comparing and contrasting historical, cultural, economic, and political perspectives;
d. evaluating critically the quality, accuracy, and validity of information to determine misconceptions, fact and opinion, and bias;
e. constructing informed, analytic arguments using evidence from multiple sources to introduce and support substantive and significant claims;
f. explaining how cause-and-effect relationships impact political and economic events;
g. taking knowledgeable, constructive action, individually and collaboratively, to address school, community, local, state, national, and global issues;
h. using a decision-making model to analyze the costs and benefits of a specific choice, considering incentives and possible consequences;
i. applying civic virtues and democratic principles to make collaborative decisions; and
j. communicating conclusions orally and in writing to a wide range of audiences, using evidence from multiple sources and citing specific sources.

GOVT.3

The student will apply social science skills to understand the concepts of democracy by

a. recognizing the fundamental worth and dignity of the individual;
b. recognizing the equality of all citizens under the law;
c. recognizing what defines a citizen and how noncitizens can become citizens;
d. recognizing majority rule and minority rights;
e. recognizing the necessity of compromise; and  
f. recognizing the freedom of the individual.

GOVT.9

The student will apply social science skills to understand the process by which public policy is made by

a. defining public policy and determining how to differentiate public and private action;  
b. examining different perspectives on the role of government;  
c. describing how the national government influences the public agenda and shapes public policy by examining examples such as the Equal Rights Amendment, the Americans with Disabilities Act (ADA), and Section 9524 of the Elementary and Secondary Education Act (ESEA) of 1965;  
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GOVT.15

The student will apply social science skills to understand the role of government in the Virginia and United States economies by

a. describing the provision of government goods and services that are not readily produced by the market;  
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c. investigating and describing the types and purposes of taxation that are used by local, state, and federal governments to pay for services provided by the government;  
d. analyzing how Congress can use fiscal policy to stabilize the economy;  
e. describing the effects of the Federal Reserve’s monetary policy on price stability, employment, and the economy; and  
f. evaluating the trade-offs in government decisions.

GOVT.16

The student will apply social science skills to understand that in a democratic republic, thoughtful and effective participation in civic life is characterized by

a. exercising personal character traits such as trustworthiness, responsibility, and honesty;  
b. obeying the law and paying taxes;  
c. serving as a juror;  
d. participating in the political process and voting in local, state, and national elections;
e. performing public service;
f. keeping informed about current issues;
g. respecting differing opinions and the rights of others;
h. practicing personal and fiscal responsibility;
i. demonstrating the knowledge, skills, and attitudes that foster the responsible and respectful use of digital media; and
j. practicing patriotism.

10.5
The student will read, interpret, analyze, and evaluate nonfiction texts.

a. Analyze text features and organizational patterns to evaluate the meaning of texts.
b. Recognize an author’s intended audience and purpose for writing.
c. Skim materials to develop an overview and locate information.
d. Compare and contrast informational texts for intent and content.
e. Interpret and use data and information in maps, charts, graphs, timelines, tables, and diagrams.
f. Draw conclusions and make inferences on explicit and implied information using textual support as evidence.
g. Analyze and synthesize information in order to solve problems, answer questions, and generate new knowledge.
h. Analyze ideas within and between selections providing textual evidence.
i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.
j. Use reading strategies throughout the reading process to monitor comprehension.

11.5
The student will read, interpret, analyze, and evaluate a variety of nonfiction texts including employment documents and technical writing.

a. Apply information from texts to clarify understanding of concepts.
b. Read and correctly interpret an application for employment, workplace documents, or an application for college admission.
c. Analyze technical writing for clarity.
d. Paraphrase and synthesize ideas within and between texts.
e. Draw conclusions and make inferences on explicit and implied information using textual support.
f. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.
g. Analyze false premises, claims, counterclaims, and other evidence in persuasive writing.
h. Recognize and analyze use of ambiguity, contradiction, paradox, irony, sarcasm, overstatement, and understatement in text.
i. Generate and respond logically to literal, inferential, evaluative, synthesizing, and critical thinking questions about the text(s).

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d. Recognize and analyze use of ambiguity, contradiction, paradox, irony, overstatement, and understatement in text.
e. Analyze false premises claims, counterclaims, and other evidence in persuasive writing.

ITEEA National Standards

4. The Cultural, Social, Economic, and Political Effects of Technology

TSA Competitive Events

Essays on Technology

Task Number 067

Identify regulations that affect biotechnology.

Definition

Identification should include

- legislation and safety guidelines
- ways that private and government organizations and business and industry influence the regulation of biotechnology.

Process/Skill Questions

- What are some of the regulatory agencies/organizations that affect biotechnology? How do they affect it?
- What do these regulatory agencies/organizations stand to benefit from regulating biotechnology?
- What are the advantages and disadvantages of biotechnology regulations from the consumer's perspective?

Related Standards of Learning

History and Social Science

GOVT.9

The student will apply social science skills to understand the process by which public policy is made by
a. defining public policy and determining how to differentiate public and private action;
b. examining different perspectives on the role of government;
c. describing how the national government influences the public agenda and shapes public policy by examining examples such as the Equal Rights Amendment, the Americans with Disabilities Act (ADA), and Section 9524 of the Elementary and Secondary Education Act (ESEA) of 1965;
d. describing how the state and local governments influence the public agenda and shape public policy;
e. investigating and evaluating the process by which policy is implemented by the bureaucracy at each level;
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g. devising a course of action to address local and/or state issues.

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The student will read, interpret, analyze, and evaluate nonfiction texts.

a. Analyze text features and organizational patterns to evaluate the meaning of texts.
b. Recognize an author’s intended audience and purpose for writing.
c. Skim materials to develop an overview and locate information.
d. Compare and contrast informational texts for intent and content.
e. Interpret and use data and information in maps, charts, graphs, timelines, tables, and diagrams.
f. Draw conclusions and make inferences on explicit and implied information using textual support as evidence.
g. Analyze and synthesize information in order to solve problems, answer questions, and generate new knowledge.
h. Analyze ideas within and between selections providing textual evidence.
i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.
j. Use reading strategies throughout the reading process to monitor comprehension.

11.5
The student will read, interpret, analyze, and evaluate a variety of nonfiction texts including employment documents and technical writing.

a. Apply information from texts to clarify understanding of concepts.
b. Read and correctly interpret an application for employment, workplace documents, or an application for college admission.
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g. Analyze false premises, claims, counterclaims, and other evidence in persuasive writing.
h. Recognize and analyze use of ambiguity, contradiction, paradox, irony, sarcasm, overstatement, and understatement in text.
i. Generate and respond logically to literal, inferential, evaluative, synthesizing, and critical thinking questions about the text(s).
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a. Use critical thinking to generate and respond logically to literal, inferential, and evaluative questions about the text(s).
b. Identify and synthesize resources to make decisions, complete tasks, and solve specific problems.
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e. Analyze false premises claims, counterclaims, and other evidence in persuasive writing.

**ITEEA National Standards**

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**TSA Competitive Events**

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| 012 | Analyze how organic macromolecules are manipulated and detected, using biotechnological tools. | English: 10.5, 11.5, 12.5  
Science: BIO.1 |
| 013 | Explain the function of carbohydrates and lipids. | English: 10.5, 11.5, 12.5  
Science: BIO.2 |
| 014 | Differentiate among the types of proteins found in organisms. | English: 10.5, 11.5, 12.5 |
| 015 | Explain the basic principles of protein utilization in organisms. | English: 10.5, 11.5, 12.5  
Science: BIO.5 |
| 016 | Explain the advantages of protein utilization in organisms. | English: 10.5, 11.5, 12.5  
Mathematics: AFDA.1, AFDA.3, AII.7, AII.9, PS.8*, PS.11*  
Science: BIO.4, BIO.7, BIO.8 |
| 017 | Illustrate the function or use of an enzyme, using a prototype or model. | Science: BIO.2 |
History and Social Science: VUS.14, WG.17, WHII.14  
Science: BIO.5 |
| 019 | Develop a timeline of genetic engineering milestones. | English: 10.5, 10.8, 11.5, 11.8, 12.5, 12.8  
History and Social Science: GOVT.9, GOVT.15, VUS.3, VUS.6, VUS.13, VUS.14, WHI.1, WHI.2, WHI.3, WHI.4, WHI.5, WHI.8, WHI.9, WHI.11, WHI.12, WHI.13, WHII.1, WHII.2, WHII.5, WHII.6, WHII.7, WHII.13, WHII.14  
Science: BIO.1, BIO.5 |
| 020 | Model deoxyribonucleic acid (DNA). | History and Social Science: WHII.4  
Science: BIO.5 |
| 021 | Assess the importance of the genetic information contained in DNA. | English: 10.5, 11.5, 12.5  
History and Social Science: VUS.14, WG.17, WHII.14  
Science: BIO.5 |
| 022 | Describe the function of DNA, ribonucleic acid (RNA), and protein in living cells. | History and Social Science: WHII.4  
Science: BIO.5 |
| 023 | Demonstrate how the structure of DNA influences its function, analysis, and manipulation. | History and Social Science: WHII.4  
Science: BIO.5 |
| 024 | Demonstrate how manipulation of nucleic acids through genetic engineering alters the function of proteins and subsequent cellular processes. | Science: BIO.1, BIO.5 |
| 025 | Explain how genetic engineering is used in plants, animals, and medicine. | English: 10.5, 11.5, 12.5  
History and Social Science: VUS.14, WG.17, WHII.14 |
| 026 | Explain the importance of genetic mapping. | English: 10.5, 11.5, 12.5  
History and Social Science: VUS.14, WG.17, WHII.14  
Science: BIO.5 |
| 027 | Analyze social implications of genetic engineering. | English: 10.5, 11.5, 12.5  
History and Social Science: GOVT.9, GOVT.15, VUS.3, VUS.6, VUS.13, VUS.14, WHII.13, WHII.14 |
| 028 | Assess the social implication of environmental quality management. | English: 10.5, 11.5, 12.5  
History and Social Science: GOVT.9, GOVT.15, VUS.13, VUS.14, WG.14, WG.15, WG.17, WHII.13, WHII.14 |
| 029 | Investigate biotreatment systems. | English: 10.5, 10.8, 11.5, 11.8, 12.5, 12.8  
History and Social Science: VUS.14, WG.17, WHII.14 |
| 030 | Examine the potential benefits of biological controls in plant and animal systems. | English: 10.5, 11.5, 12.5 |
| 031 | Design a bioremediation system. | English: 10.1, 10.5, 10.6, 10.7, 11.1, 11.5, 11.6, 11.7, 12.1, 12.5, 12.6, 12.7  
History and Social Science: VUS.14, WG.17, WHII.14  
Science: BIO.1 |
| 032 | Plan a biorestoration system. | English: 10.1, 10.5, 10.6, 10.7, 11.1, 11.5, 11.6, 11.7, 12.1, 12.5, 12.6, 12.7  
History and Social Science: VUS.14, WG.17, WHII.14  
Science: BIO.1 |
| 033 | Demonstrate the use of biotechnology to restore or remediate contaminated environments. | History and Social Science: VUS.14, WG.17, WHII.14 |
| 034 | Demonstrate various procedures used with tissue cultures. |  |
| 035 | Analyze social implications of biotechnology in agriculture. | English: 10.5, 11.5, 12.5  
History and Social Science: GOVT.9, GOVT.15, VUS.13, VUS.14, WG.14, WG.15, WG.17, WHII.13, WHII.14 |
| 036 | Identify microbial applications in agriculture. | English: 10.5, 11.5, 12.5  
Science: BIO.3, BIO.7 |
| 037 | Summarize the role of biotechnology in crop modification. | English: 10.5, 11.5, 12.5  
History and Social Science: VUS.14, WG.17, WHII.14  
Science: BIO.5, BIO.7 |
| 038 | Identify factors that jeopardize food safety. | English: 10.5, 11.5, 12.5 |
| 039 | Examine advances of biotechnology in food science. | History and Social Science: WHI.3, WHI.12 |
| 040 | Define *bioprocessing*. | English: 10.3, 11.3, 12.3  
History and Social Science: VUS.14, WG.17, WHII.14 |
| 041 | Describe the process of fermentation. | English: 10.5, 11.5, 12.5  
History and Social Science: WHI.3, WHI.4  
Science: BIO.2 |
| 042 | Prepare a product generated from bioprocessing. | History and Social Science: VUS.14, WG.17, WHII.14 |
| 043 | Describe genetic engineering applications used in bioprocessing. | English: 10.5, 11.5, 12.5  
History and Social Science: VUS.14, WG.17, WHII.14  
Science: BIO.5 |
| 044 | Demonstrate the application of microbes in bioprocessing. | |
| 045 | Describe the social and environmental effects of bioprocessing. | English: 10.5, 11.5, 12.5  
History and Social Science: GOVT.9, GOVT.15, VUS.13, VUS.14, WG.14, WG.15, WG.17, WHII.13, WHII.14 |
| 046 | Perform separation and purification techniques. | Science: CH.1 |
| 047 | Illustrate the design of bioprocessing systems. | |
| 048 | Identify the influence of biotechnology on medicine. | English: 10.5, 11.5, 12.5  
History and Social Science: GOVT.9, GOVT.15, VUS.13, VUS.14, WHII.13, WHII.14 |
| 049 | Describe the ethical, legal, and social implications of biomedicine. | English: 10.5, 11.5, 12.5  
History and Social Science: GOVT.9, GOVT.15, VUS.13, VUS.14, WHII.13, WHII.14 |
| 050 | Explain vaccine (i.e., immunology) research and development. | English: 10.5, 11.5, 12.5  
History and Social Science: VUS.8, VUS.13, VUS.14, WG.17, WHII.8, WHII.14  
Science: BIO.3 |
| 051 | Describe the effects of molecular research on society. | English: 10.5, 11.5, 12.5  
History and Social Science: GOVT.9, GOVT.15, |
<table>
<thead>
<tr>
<th>Task</th>
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<tr>
<td>052</td>
<td>Identify emerging healthcare technologies.</td>
<td>English: 10.5, 11.5, 12.5</td>
<td>Science: BIO.5</td>
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<tr>
<td>053</td>
<td>Explain the applications of genetics in pharmacology.</td>
<td>English: 10.5, 11.5, 12.5</td>
<td>Science: BIO.5</td>
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<tr>
<td>054</td>
<td>Describe the effects of biotechnology on preventive healthcare.</td>
<td>English: 10.5, 11.5, 12.5</td>
<td>History and Social Science: GOVT.9, GOVT.15, VUS.3, VUS.6, VUS.13, VUS.14, WHII.13, WHII.14</td>
</tr>
<tr>
<td>055</td>
<td>Define forensic science.</td>
<td>English: 10.3, 10.5, 11.3, 11.5, 12.3, 12.5</td>
<td>History and Social Science: VUS.14, WG.17, WHII.14</td>
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<tr>
<td>056</td>
<td>Describe situations in which medical forensics can be used.</td>
<td>English: 10.5, 11.5, 12.5</td>
<td>Science: BIO.5</td>
</tr>
<tr>
<td>057</td>
<td>Describe situations in which forensic science can be used in criminal investigations.</td>
<td>English: 10.5, 11.5, 12.5</td>
<td></td>
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<tr>
<td>058</td>
<td>Describe situations in which biological forensic science can be used.</td>
<td>English: 10.5, 11.5, 12.5</td>
<td></td>
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<tr>
<td>059</td>
<td>Demonstrate the basic instrumentation used in DNA analysis for forensic purposes.</td>
<td>English: 10.5, 11.5, 12.5</td>
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<tr>
<td>060</td>
<td>Define bioengineering.</td>
<td>English: 10.3, 10.5, 11.3, 11.5, 12.3, 12.5</td>
<td>History and Social Science: VUS.14, WG.17, WHII.14</td>
</tr>
<tr>
<td>061</td>
<td>Identify uses of nanobiotechnology.</td>
<td>English: 10.5, 11.5, 12.5</td>
<td>History and Social Science: VUS.14, WG.17, WHII.14</td>
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<tr>
<td>062</td>
<td>Identify examples of biowarfare.</td>
<td>History and Social Science: GOVT.9, GOVT.15, VUS.13, VUS.14, WHII.12, WHII.13, WHII.14</td>
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<tr>
<td>063</td>
<td>Design and produce a biomechanism.</td>
<td>English: 10.1, 10.5, 10.8, 11.1, 11.5, 11.8, 12.1, 12.5, 12.8</td>
<td>History and Social Science: VUS.14, WG.17, WHII.14</td>
</tr>
<tr>
<td>064</td>
<td>Define bioethics.</td>
<td>English: 10.3, 11.3, 12.3</td>
<td>History and Social Science: VUS.14, WG.17, WHII.14</td>
</tr>
</tbody>
</table>
| 065 | Assess implications of biotechnology, including gene therapy, patenting of living tissue, and cloning. | History and Social Science: GOVT.1, GOVT.9, GOVT.15, VUS.13, VUS.14, WHII.12, WHII.13, WHII.14  
Science: BIO.5 |
| 066 | Differentiate among ethical principles that reflect social, religious, economic, and political perspectives. | English: 10.5, 11.5, 12.5  
History and Social Science: GOVT.1, GOVT.3, GOVT.9, GOVT.15, GOVT.16 |
| 067 | Identify regulations that affect biotechnology. | English: 10.5, 11.5, 12.5  
History and Social Science: GOVT.9 |
Entrepreneurship Infusion Units may be used to help students achieve additional, focused competencies and enhance the validated tasks/competencies related to identifying and starting a new business venture. Because the unit is a complement to certain designated courses and is not mandatory, all tasks/competencies are marked “optional.”