# Medical Laboratory Technology II

8378/36 weeks

## Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acknowledgments</td>
<td>1</td>
</tr>
<tr>
<td>Course Description</td>
<td>2</td>
</tr>
<tr>
<td>Task Essentials Table</td>
<td>2</td>
</tr>
<tr>
<td>Curriculum Framework</td>
<td>4</td>
</tr>
<tr>
<td>Applying the Principles of Hemostasis/Coagulation</td>
<td>4</td>
</tr>
<tr>
<td>Understanding the Basics of Immunology/Serology</td>
<td>7</td>
</tr>
<tr>
<td>Performing Basic Microbiology Skills</td>
<td>10</td>
</tr>
<tr>
<td>Understanding the Basics of Immunohematology/Transfusion Services</td>
<td>16</td>
</tr>
<tr>
<td>Understanding the Basics of Molecular Diagnostics</td>
<td>20</td>
</tr>
<tr>
<td>Exploring Professional Choices</td>
<td>23</td>
</tr>
<tr>
<td>Describing the Opioid Crisis</td>
<td>26</td>
</tr>
<tr>
<td>Examining the Key Factors of Drug Addiction</td>
<td>29</td>
</tr>
<tr>
<td>Understanding Pain Management Protocols</td>
<td>32</td>
</tr>
<tr>
<td>Working with Patients and Caregivers</td>
<td>38</td>
</tr>
<tr>
<td>SOL Correlation by Task</td>
<td>39</td>
</tr>
<tr>
<td>Teaching Resources</td>
<td>42</td>
</tr>
<tr>
<td>Entrepreneurship Infusion Units</td>
<td>43</td>
</tr>
<tr>
<td>Opioid Abuse Prevention Education</td>
<td>43</td>
</tr>
<tr>
<td>Appendix: Credentials, Course Sequences, and Career Cluster Information</td>
<td>45</td>
</tr>
</tbody>
</table>

## Acknowledgments

The components of this instructional framework were developed by the following curriculum development panelists:

- Gayle Melberg, Program Head – Medical Laboratory Technology, Reynolds Community College, Richmond
- Maria Torres Pillot, Program Director, MLT, PBT, and MLA Programs, Northern Virginia Community College, Springfield
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- Salle Sappington, Instructor, Monroe Technology Center, Loudoun County Public Schools
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Correlations to the Virginia Standards of Learning were reviewed and updated by the following:
Course Description

Suggested Grade Level: 12

Prerequisite: Medical Laboratory Technology I (8377)

In this hands-on course, students perform tests normally seen in the clinical setting as they build on the foundational knowledge and skills obtained in Medical Laboratory Technology I. The students will use the basic principles necessary to perform competently in the areas of clinical microbiology, immunohematology, and immunology/serology, coagulation/hemostasis, and molecular diagnostics. Competency includes performing the technique correctly, understanding the theory of the procedures, and interpreting the results.

NOTE: This course has specific state laws and regulations from a governing medical board or agency. Please contact the Virginia Department of Education, Office of Career and Technical Education prior to implementing this course. All inquiries may be sent to cte@doe.virginia.gov.

Task Essentials Table

- 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>8378</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>39</td>
<td>⊕  Describe basic human anatomy and physiology in relation to hemostasis/coagulation.</td>
</tr>
<tr>
<td>40</td>
<td>⊕  Interpret common abbreviations related to hemostasis/coagulation.</td>
</tr>
<tr>
<td>41</td>
<td>⊕  Interpret basic medical laboratory terminology related to hemostasis/coagulation.</td>
</tr>
<tr>
<td>42</td>
<td>⊕  Explain the concepts of hemostasis/coagulation and fibrinolysis.</td>
</tr>
<tr>
<td>Task</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
</tr>
<tr>
<td>43</td>
<td>Explain the use of prothrombin time (PT) and activated partial thromboplastin time (APTT) testing.</td>
</tr>
<tr>
<td>44</td>
<td>Correlate abnormal hemostasis/coagulation laboratory results with disease processes.</td>
</tr>
</tbody>
</table>

**Understanding the Basics of Immunology/Serology**

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>Describe basic human anatomy and physiology in relation to immunologyserology.</td>
</tr>
<tr>
<td>46</td>
<td>Interpret common abbreviations used in immunologyserology.</td>
</tr>
<tr>
<td>47</td>
<td>Interpret basic medical laboratory terminology related to immunologyserology.</td>
</tr>
<tr>
<td>48</td>
<td>Explain the host immune response to foreign substances.</td>
</tr>
<tr>
<td>49</td>
<td>Describe common immunological tests.</td>
</tr>
<tr>
<td>50</td>
<td>Perform an enzyme immunoassay.</td>
</tr>
<tr>
<td>51</td>
<td>Correlate abnormal immunologicalserological laboratory results with disease processes.</td>
</tr>
</tbody>
</table>

**Performing Basic Microbiology Skills**

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>52</td>
<td>Describe basic human anatomy and physiology in relation to microbiology.</td>
</tr>
<tr>
<td>53</td>
<td>Interpret common abbreviations used in microbiology.</td>
</tr>
<tr>
<td>54</td>
<td>Interpret basic medical laboratory terminology related to microbiology.</td>
</tr>
<tr>
<td>55</td>
<td>Explain the importance of collection requirements for the various specimens used in microbiological studies.</td>
</tr>
<tr>
<td>56</td>
<td>Perform microscopy and Gram stain preparation.</td>
</tr>
<tr>
<td>57</td>
<td>Identify classifications of microorganisms based on cell wall structure.</td>
</tr>
<tr>
<td>58</td>
<td>Explain the concept of a pure and/or isolative culture.</td>
</tr>
<tr>
<td>59</td>
<td>Perform inoculation of patient specimen.</td>
</tr>
<tr>
<td>60</td>
<td>Perform isolation or subculture of microbes.</td>
</tr>
<tr>
<td>61</td>
<td>Explain the basic concepts of antibiotics and their classes.</td>
</tr>
<tr>
<td>62</td>
<td>Explain the concept of antibiotic susceptibility testing.</td>
</tr>
<tr>
<td>63</td>
<td>Describe basic identification techniques used to differentiate bacteria.</td>
</tr>
<tr>
<td>64</td>
<td>Explain the causes and significance of methicillin-resistant Staphylococcus aureus (MRSA) and other antibiotic-resistant organisms.</td>
</tr>
<tr>
<td>65</td>
<td>Explain the basic characteristics of the most common yeastfungi encountered in the clinical lab.</td>
</tr>
<tr>
<td>66</td>
<td>Explain the basic characteristics of the most common parasites encountered in the clinical lab.</td>
</tr>
</tbody>
</table>

**Understanding the Basics of Immunohematology/Transfusion Services**

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>67</td>
<td>Describe basic human anatomy and physiology in relation to immunohematologytransfusion.</td>
</tr>
<tr>
<td>68</td>
<td>Interpret common abbreviations used in immunohematologytransfusion services.</td>
</tr>
<tr>
<td>69</td>
<td>Interpret basic medical laboratory terminology related to immunohematologytransfusion services.</td>
</tr>
<tr>
<td>70</td>
<td>Explain how each blood group is identified.</td>
</tr>
<tr>
<td>71</td>
<td>Perform or simulate an antigen and antibody reaction in transfusion medicine.</td>
</tr>
<tr>
<td>72</td>
<td>Explain the various red blood cell components and derivatives used for transfusion.</td>
</tr>
<tr>
<td>73</td>
<td>Explain compatibility testing of blood.</td>
</tr>
<tr>
<td>74</td>
<td>Explain legal and medical ramifications of potential errors in immunohematology and transfusion services, as well as potential consequences.</td>
</tr>
</tbody>
</table>

**Understanding the Basics of Molecular Diagnostics**

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>75</td>
<td>Describe basic human anatomy and physiology in relation to molecular diagnostics.</td>
</tr>
<tr>
<td>76</td>
<td>Interpret common abbreviations used in molecular diagnostics.</td>
</tr>
<tr>
<td>77</td>
<td>Interpret basic medical laboratory terminology related to molecular diagnostics.</td>
</tr>
<tr>
<td>78</td>
<td>Explain the advantages, disadvantages, and uses of molecular diagnostics.</td>
</tr>
<tr>
<td>79</td>
<td>Perform polymerase chain reaction (PCR) testing.</td>
</tr>
<tr>
<td>80</td>
<td>Research innovations in genetic manipulation (e.g., CRISPR).</td>
</tr>
</tbody>
</table>

**Exploring Professional Choices**

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>81</td>
<td>Explain the importance of a professional demeanor on the part of all healthcare professionals.</td>
</tr>
</tbody>
</table>
Curriculum Framework

Applying the Principles of Hemostasis/Coagulation

Task Number 39

Describe basic human anatomy and physiology in relation to hemostasis/coagulation.

Definition
Description should include the following basic anatomical structures and body cavities:

- Structure and functions of blood
- Structure and functions of the heart
- Structures and functions of blood vessels and blood circulation
Process/Skill Questions

- What are the purposes of red blood cells? White blood cells? Platelets?
- How does blood travel through the body?

HOSA Competitive Events (High School)

HOSA Bowl (HB)

Biomedical Laboratory Science (BT)

Task Number 40

Interpret common abbreviations related to hemostasis/coagulation.

Definition
Interpretation should include abbreviations and acronyms associated with medical testing (e.g., DIC for disseminated intravascular coagulation).

Process/Skill Questions

- What is a PT?
- What is a PTT?
- Why is INR part of coagulation studies?

Task Number 41

Interpret basic medical laboratory terminology related to hemostasis/coagulation.

Definition
Interpretation should include terminology such as

- adhesion
- fibrinogen
- prothrombin
- plasminogen
- ionized calcium
- hemorrhage
- petechiae
- anticoagulant (e.g., Coumadin)
- clotting or thrombosis.

Process/Skill Questions

- Which clotting factor is absent in hemophilia?
- What is the function of plasmin?

HOSA Competitive Events (High School)

Medical Terminology (MT)

Biomedical Laboratory Science (BT)
Task Number 42

Explain the concepts of hemostasis/coagulation and fibrinolysis.

Definition
Explanation should include

- the three phases of hemostasis
- fibrinolysis
- the role of platelets
- the five major steps of the mechanism of coagulation
- intrinsic pathway
- extrinsic pathway
- common pathway
- the role of the coagulation factors
- factor deficiencies
- vascular fragility.

Process/Skill Questions

- Why are platelets considered primary in the coagulation process?
- How does a breach in the integrity of the vein trigger the coagulation process?
- How does fibrinogen turn into fibrin?
- What is fibrinolysis and why is it important?

HOSA Competitive Events (High School)

Biomedical Laboratory Science (BT)

Task Number 43

Explain the use of prothrombin time (PT) and activated partial thromboplastin time (APTT) testing.

Definition
Explanation should include the uses of prothrombin time, activated partial thromboplastin time, and international normalized ratio (INR) testing for monitoring anticoagulation (e.g., warfarin and heparin) therapy.

Process/Skill Questions

- What is the difference between intrinsic and extrinsic pathways?
- What are the two main drug therapies for coagulation disorders?
- Which pathway is monitored by PT testing? APTT testing?

Task Number 44

Correlate abnormal hemostasis/coagulation laboratory results with disease processes.
**Definition**
Correlation should include linking abnormal coagulation results with disease processes (e.g., hemophilia, deep vein thrombosis, DIC).

**Process/Skill Questions**

- Which factor is lacking in the two forms of hemophilia (A and B)?
- What diseases are correlated with abnormal fibrinolysis?
- What is the significance of coagulation in acute cardiac syndrome (ACS)?

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### Understanding the Basics of Immunology/Serology

**Task Number 45**

**Describe basic human anatomy and physiology in relation to immunology/serology.**

**Definition**
Description should include the following basic anatomical structures and body cavities:

- Structures and functions of blood vessels and blood circulation
- Structures and function of the lymphatic system
  - primary lymphoid tissues (i.e., bone marrow, thymus)
  - secondary lymphoid tissues (i.e., spleen, lymph nodules, MALT).

**Process/Skill Questions**

- What is the lymphatic system? What roles does it play in healthy body function?
- What is immunity? What is the relationship between immunity and the lymphatic system?
- Why is immunity a critical concept in health care?

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**HOSA Competitive Events (High School)**

Biomedical Laboratory Science (BT)

**Task Number 46**

**Interpret common abbreviations used in immunology/serology.**

**Definition**
Interpretation should include abbreviations and acronyms associated with medical testing.

**Process/Skill Questions**

- What is the difference between an IFA and DFA?
- What is IgE?
- What is an ELISA?
- What is an agglutination test?
Task Number 47

Interpret basic medical laboratory terminology related to immunology/serology.

Definition
Interpretation should include terminology such as

- adaptive immunity
- innate immunity
- cell-mediated immunity
- agglutination
- cytokine
- polyclonal antibodies.

Process/Skill Questions

- How do IgM and IgG differ?
- What is a Western blot analysis?

HOSA Competitive Events (High School)

Medical Terminology (MT)
Biomedical Laboratory Science (BT)

Task Number 48

Explain the host immune response to foreign substances.

Definition
Explanation should include

- first line of defense against infection
  - components and general function of natural immunity (e.g., skin, mucus membranes, secretions)
- second line of defense
  - granulocytes/phagocytes
  - five steps and general activities in phagocytosis
  - inflammation
  - comparison of the cellular and humoral components of innate immunity (acute phase reactants, C-reactive protein [CRP])
- third line of defense (adaptive response)
  - function of adaptive immunity
  - types of lymphocytes and the function of each type
  - definitions and characteristics of antigen and antibody
  - five classes of antibodies.

Process/Skill Questions

- How does a lymphocyte function?
- What is adaptive or acquired immunity?
- What characteristic in neutrophils demonstrates that they have performed phagocytosis?
HOSA Competitive Events (High School)

Biomedical Laboratory Science (BT)

**Task Number 49**

**Describe common immunological tests.**

**Definition**

Description may include

- agglutination (detection of antigens/antibodies)
  - latex agglutination
  - hemagglutination
- immunoassays (detection of antigens/antibodies)
  - sensitivity
  - competitive vs. noncompetitive
  - homogenous vs. heterogenous
  - applications (e.g., EIA enzyme immunoassay)
- definition of *antibody titer*
- explanation of the procedure for the serial dilution of serum
- explanation of the principles of immunologic tests for pregnancy
- molecular test (detection of nucleic acids)
  - polymerase chain reaction (PCR).

**Process/Skill Questions**

- What is an enzyme immunoassay?
- What is an antibody titer (e.g., Hepatitis B, MMR)?

**Task Number 50**

**Perform an enzyme immunoassay.**

**Definition**

Performance should include

- reagent preparation
- equipment preparation
- completion of testing sequence.

**Process/Skill Questions**

- What is the purpose of the chromogen or substrate?
- What is the purpose of the wash step?
- What is a false positive result?
- What is the purpose of using positive and negative controls?

**Task Number 51**

**Correlate abnormal immunological/serological laboratory results with disease processes.**
Definition
Correlation should include linking abnormal immunology/serology laboratory results with
disease processes (e.g., HIV, scleroderma, allergies).

Process/Skill Questions

- What does a positive rapid plasma regain (RPR) test mean? What further testing should be performed? Why?
- What does a positive screening test for HIV indicate? What further testing should be performed? Why?
- What does a radioallergosorbent test (RAST) measure? How does a RAST work? How are RAST results useful in patient diagnosis?
- What is the difference between screening and confirmatory tests, and how are they used?

Performing Basic Microbiology Skills

Task Number 52
Describe basic human anatomy and physiology in relation to microbiology.

Definition
Description should include the following basic anatomical structures and body cavities and their functions:

- Cell
- Tissues, membranes, and glands
- Integumentary system
- Skeletal system
- Muscular system
- Blood
- Heart
- Blood vessels and blood circulation
- Lymphatic system
- Respiratory system
- Gastrointestinal system
- Endocrine system
- Reproductive system
- Nervous system
- Urinary system

Process/Skill Questions

- What major organs are contained in each body cavity? Why is this information important to medical laboratory professionals?
- How does joint fluid aid human movement?
- What is the importance of the human papillomavirus (HPV) vaccine?
- What is meningitis? What test is used to diagnose it?
- Why is kidney function essential for healthy production of urine? Why is this information useful to medical laboratory professionals?
- What is normal flora?
Task Number 53

Interpret common abbreviations used in microbiology.

Definition
Interpretation should include abbreviations and acronyms associated with medical testing.

Process/Skill Questions
- What stain is performed when identifying AFB?
- What is the difference between MIC and MBC?

Task Number 54

Interpret basic medical laboratory terminology related to microbiology.

Definition
Interpretation should include terminology such as
- normal flora
- opportunistic pathogen
- bacteria
- gram positive
- gram negative
- pathogen
- zone of inhibition
- parasites
- fungi.

Process/Skill Questions
- What is a facultative anaerobe?
- What is gamma hemolysis?
- What is beta hemolysis?

Task Number 55

Explain the importance of collection requirements for the various specimens used in microbiological studies.
Definition
Explanation should include

- throat swabs
- blood cultures
- CSF specimens
- urine cultures
- stool specimens.

Process/Skill Questions

- Which numbered tube is used for a CSF culture and susceptibility?
- How long can it take for blood culture results?
- What safety protocols are necessary when collecting and processing the various microbiological specimens?
- What is the appropriate specimen type for a urine culture?

HOSA Competitive Events (High School)
Biomedical Laboratory Science (BT)

Task Number 56
Perform microscopy and Gram stain preparation.

Definition
Performance should include

- preparation of a Gram stain using crystal violet, Gram's iodine, decolorizer, and safranin
- examination of a Gram-stained smear for gram-positive and gram-negative organisms
- explanation of the observed morphology.

Process/Skill Questions

- Why is immersion oil used when examining a smear for bacteria?
- What is the importance of using the correct order of reagents when performing a Gram stain?
- How do gram-positive organisms appear on a Gram stain?
- How do the gram-negative organisms appear on a Gram stain?
- How does one differentiate between primary stain vs. counterstain?

HOSA Competitive Events (High School)
Biomedical Laboratory Science (BT)

Task Number 57
Identify classifications of microorganisms based on cell wall structure.

Definition
Identification should include

- the cell wall structure of gram-positive bacteria
- the cell wall structure of gram-negative bacteria
- the gram stain reaction and morphology of Staphylococcus and Streptococcus, gram-positive cocci vs. E. coli, and gram-negative rods.

**Process/Skill Questions**

- What are the differences in the cell wall of a gram-positive vs. a gram-negative bacteria?
- Why would a Gram stain be ineffective in staining a virus?
- Why is the Gram stain such a rapid and cost-effective means for early diagnosis of bacterial infections?
- How can the Gram stain reaction and morphology be used to differentiate Staphylococcus and E. coli?

**HOSA Competitive Events (High School)**

**Biomedical Laboratory Science (BT)**

**Task Number 58**

**Explain the concept of a pure and/or isolative culture.**

**Definition**  
Explanation should include the concept that a pure and/or isolative culture contains a single kind of microorganism, without contaminants. It should also include commentary on the importance of purity in laboratory cultures.

**Process/Skill Questions**

- What is the purpose of a pure culture?
- What is the process for obtaining a pure and/or isolative culture?
- Why must one use a pure and/or isolative culture in biomedical laboratory work?

**HOSA Competitive Events (High School)**

**Biomedical Laboratory Science (BT)**

**Task Number 59**

**Perform inoculation of patient specimen.**

**Definition**  
Performance should include plating on media that enables differentiation between gram-negative and gram-positive organisms. It should also include an explanation of the media types, examples of each, and their purposes:

- CNA (colistin naladixic acid) agar isolates gram-positive bacteria.
- EMB (eosin methylene blue) agar isolates gram-negative bacteria.
- MacConkey agar isolates gram-negative bacteria.
- Selective vs. differential media

**Process/Skill Questions**

- How does CNA agar isolate gram-positive bacteria?
- Which media would be useful in isolating E. coli? What components of the agar make this possible?
- What is the difference between nutritive, enrichment, selective, and differential media?
Task Number 60

Perform isolation or subculture of microbes.

Definition
Performance should include the proper technique to ensure pure culture.

Process/Skill Questions
- How many colonies are chosen when subculturing?

Task Number 61

Explain the basic concepts of antibiotics and their classes.

Definition
Explanation should include:
- aminoglycosides
- cephalosporins
- penicillin
- quinolones
- macrocyclic (e.g., fidaxomicin).

Process/Skill Questions
- What classes of antibiotics are used to treat gram-positive infections?
- What is beta lactamase?

HOSA Competitive Events (High School)
Biomedical Laboratory Science (BT)

Task Number 62

Explain the concept of antibiotic susceptibility testing.

Definition
Explanation should include the concept and importance of antibiotic susceptibility testing by means of a common procedure such as measuring each antibiotic disc's zone of inhibition (e.g., Kirby-Bauer disc diffusion method, finding each antibiotic's minimum inhibitory concentration [MIC]). Explanation may include performing a susceptibility test.

Process/Skill Questions
- What is the importance of using a McFarland standard as a reference when performing Kirby-Bauer disc diffusion?
- Which "broth dilution" method uses serial dilutions?
- How is the MIC of an antibiotic determined?
- How is automated susceptibility testing performed?

Task Number 63
Describe basic identification techniques used to differentiate bacteria.

**Definition**
Description should include basic techniques used to differentiate bacteria, such as the techniques of

- Gram stain morphology (differentiates between gram-positive cocci and gram-negative rods)
- catalase (differentiates between Staphylococcus and Streptococcus)
- coagulase (differentiates between Staphylococcus aureus and other species of Staphylococcus)
- indole (differentiates between E. coli and other gram-negative organisms).

Description may include performing rapid identification tests.

**Process/Skill Questions**

- How could Gram stain morphology be useful in diagnosing an infection with Staphylococcus vs. E. coli?
- How is the catalase test useful in differentiating between Staphylococcus and Streptococcus?
- Which gram-positive cocci is catalase- and coagulase-positive? Why is this important to know?
- What is the significance of a positive indole when identifying E. coli vs. other gram-negative rods?

**HOSA Competitive Events (High School)**

Biomedical Laboratory Science (BT)

**Task Number 64**

**Explain the causes and significance of methicillin-resistant Staphylococcus aureus (MRSA) and other antibiotic-resistant organisms.**

**Definition**
Explanation should include

- the reasons antibiotic resistance develops in organisms such as MRSA
- examples of hospital-acquired infections
- the dangers of antibiotic-resistant organisms
- the relationship between antibiotic-resistant organisms and infection-control measures and procedures.

**Process/Skill Questions**

- How does treatment of viral infections contribute to antibiotic resistance? What other factors can contribute?
- Why is so much media attention focused on MRSA?
- What can be done to reduce the spread of antibiotic-resistant organisms?
- What are other examples of Multiple Drug Resistant Organisms (MDRO)?
Task Number 65

Explain the basic characteristics of the most common yeast/fungi encountered in the clinical lab.

Definition
Explaination should include

- Candida species
- ringworm
- athlete's foot
- thrush.

Process/Skill Questions

- What is the most common media used to isolate yeast?
- What is the purpose of an India ink test?
- What is the purpose of a KOH preparation?

Task Number 66

Explain the basic characteristics of the most common parasites encountered in the clinical lab.

Definition
Explaination should include

- pinworm
- malaria
- giardia
- naeglaria.

Process/Skill Questions

- What would be the specimen type for malaria tests?
- How does one perform a pinworm prep?

Understanding the Basics of Immunohematology/Transfusion Services

Task Number 67
Describe basic human anatomy and physiology in relation to immunohematology/transfusion.

Definition
Description should include the following basic anatomical structures and body cavities and their functions:

- Blood
- Blood vessels and blood circulation
- Immune system

Process/Skill Questions

- What are the purposes of red blood cells? White blood cells? Platelets?
- How do blood tests help diagnose certain conditions or diseases?
- How does blood travel through the body?
- What component of a red cell helps maintain blood oxygen level?
- What is immunity? What is the relationship between immunity and the lymphatic system?
- Why is immunity a critical concept in health care?

HOSA Competitive Events (High School)

HOSA Bowl (HB)

Biomedical Laboratory Science (BT)

Task Number 68

Interpret common abbreviations used in immunohematology/transfusion services.

Definition
Interpretation should include abbreviations and acronyms associated with blood unit processing and release of blood components (e.g., IAT for indirect antiglobulin test, DAT for direct antiglobulin test).

Process/Skill Questions

- What is RBC?
- What is Ig?
- What is the Rh factor?
- What are the four blood types?
- What is a T&S?
- What is CPDA1?

Task Number 69

Interpret basic medical laboratory terminology related to immunohematology/transfusion services.

Definition
Interpretation should include terminology such as
• apheresis
• allele
• histocompatibility testing
• human leukocyte antigen
• antibody screen
• antibody panel.

Process/Skill Questions

• What is the role of complement?
• What is a heterozygous genotype?
• What is a heterozygous phenotype?

HOSA Competitive Events (High School)

Medical Terminology (MT)

Biomedical Laboratory Science (BT)

Task Number 70

Explain how each blood group is identified.

Definition
Explanation should include identification through automation, tubes, and slides of the basic ABO blood groups (A, B, AB, and O) and the two Rh blood types (negative and positive).

Explanation should also include an understanding of universal donor and recipient and ABO phenotypes and genotypes.

Process/Skill Questions

• How are the basic ABO blood groups different from each other?
• What is the Rh type?
• What is the difference between the ABO and Rh blood group?
• What role can genetics play in ABO blood group frequencies?
• What is the procedure involved with each of the various blood-group identification methods? When might each be used? Why?
• How do antigens and antibodies determine the different blood groups?

HOSA Competitive Events (High School)

Biomedical Laboratory Science (BT)

Task Number 71

Perform or simulate an antigen and antibody reaction in transfusion medicine.

Definition
Performance or simulation should include

• ABO typing
• Rh typing.
Process/Skill Questions

- What is the significance of Rh negative?
- What is the significance of Rh positive?
- What influences the Rh positive?

HOSA Competitive Events (High School)

Biomedical Laboratory Science (BT)

Task Number 72

Explain the various red blood cell components and derivatives used for transfusion.

Definition

Explanation should include

- packed red blood cells
- platelets (including plateletpheresis)
- plasma (including plasmapheresis)
- leukocyte-reduced red blood cells (LRBC)
- washed blood cells
- radiated cells.

Process/Skill Questions

- What is the shelf life for packed red blood cells?
- What is the shelf life for platelets?
- What are the benefits of transfusing LRBC?
- What is the difference between random donor platelets and plateletpheresis collections?

HOSA Competitive Events (High School)

Biomedical Laboratory Science (BT)

Task Number 73

Explain compatibility testing of blood.

Definition

Explanation should include ABO and Rh typing and screening for unexpected antibodies and cross-matching.

Process/Skill Questions

- Why is it important for immunohematology or transfusion service to verify the blood type of each donor?
- What is meant by compatibility of blood types? Which blood types are compatible with other blood types?
- Are any blood types incompatible with all other types? Why is this important?
- How does the issue of compatibility affect the relative amount of blood in each type that is typically sought and stored by immunohematology or transfusion service?
- What is the effect if the patient is transfused with an incompatible unit?
Task Number 74

Explain legal and medical ramifications of potential errors in immunohematology and transfusion services, as well as potential consequences.

Definition
Explanation may include potential errors, such as

- misidentification of a patient or specimen
- failure to get a patient's informed consent for blood drawing or transfusion
- failure to inform a patient of potential risks from a procedure.

Explanation may also include potential consequences, such as

- tort liability
- infection of a patient
- injury or scarring of a patient
- hemorrhaging of a patient
- toxicity or death of a patient resulting from an incompatible cross-match.

Process/Skill Questions

- Why is it essential to get a patient's informed consent prior to blood drawing or transfusion?
- How can an incompatible cross-match result in toxicity? In death?
- How can incompatible cross-matches be prevented?
- What procedure(s) should be followed if an incompatible cross-match is suspected?
- In blood drawing or transfusion, how can the healthcare team reduce the chances of patient infection? Scarring? Hemorrhaging?

Understanding the Basics of Molecular Diagnostics

Task Number 75

Describe basic human anatomy and physiology in relation to molecular diagnostics.

Definition
Description should include

- the structure and functions of deoxyribonucleic acid (DNA)
• nucleotides
• transcription/translation
• function of proteins.

Process/Skill Questions

• How is a protein formed?
• What is the difference between the process of translation and transcription?

HOSA Competitive Events (High School)

Biomedical Laboratory Science (BT)

Task Number 76

Interpret common abbreviations used in molecular diagnostics.

Definition
Interpretation should include abbreviations and acronyms associated with medical testing.

Process/Skill Questions

• What is RNA?
• What is PCR?
• What is DNA?

Task Number 77

Interpret basic medical laboratory terminology related to molecular diagnostics.

Definition
Interpretation may include terminology such as

• restriction enzymes
• microarray
• probe amplification
• plasmids
• chromosomes
• telomeres.

Process/Skill Questions

• What gel composition can be used in PCR?
• What processes are used to analyze STIs?

HOSA Competitive Events (High School)

Medical Terminology (MT)

Biomedical Laboratory Science (BT)

Task Number 78
Explain the advantages, disadvantages, and uses of molecular diagnostics.

Definition
Explanation may include the following concepts:

- Advantages of molecular diagnostics such as
  - the ability to detect diseases that are difficult to identify by traditional methodology
  - rapid diagnoses
  - more sensitive test methodology
  - requirement of a minute sample (especially important in tuberculosis, hepatitis, chlamydia, gonorrhea, and certain other cases)
  - use in paternity and forensic testing.

- Disadvantages of molecular diagnostics such as
  - relatively high cost
  - higher level of technician training than is needed for traditional diagnostics.

Process/Skill Questions

- How has molecular diagnostic testing become important in the diagnosis of leukemia?
- What is meant by a genetic fingerprint? What is the relationship between the "genetic fingerprint" and molecular diagnosis?
- Why is rapid diagnosis through molecular testing important?

HOSA Competitive Events (High School)

Biomedical Laboratory Science (BT)

Task Number 79

Perform polymerase chain reaction (PCR) testing.

Definition
Performance should include

- explaining that PCR testing is a relatively quick procedure for analyzing DNA without the need for cloning and that it is commonly used for diagnosing genetic diseases
- following the steps for PCR testing
  - reagent preparation
  - equipment preparation
  - proper loading of the gel
  - proper use of the PCR thermocycler.

Process/Skill Questions

- What is a nucleotide? What is the role of nucleotides in PCR testing?
- Why are amino acid sequences important in PCR?
- How can a DNA segment be replicated?
- What was the purpose of the Human Genome Project?
- At what temperature does denaturization occur?
- What buffer is used in PCR testing?
- What is the principle of a thermocycler?
Task Number 80

Research innovations in genetic manipulation (e.g., CRISPR).

Definition
Research may include performing or simulating genetic manipulation.

Process/Skill Questions

- What are the potential uses for genetic manipulation?
- Who developed CRISPR?
- What are some ethical implications of genetic manipulation?

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Exploring Professional Choices

Task Number 81

Explain the importance of a professional demeanor on the part of all healthcare professionals.

Definition
Explanation should include the following concepts:

- A professional demeanor is characterized by actively listening to the patient and family and addressing their questions and concerns; ensuring that the patient and family understand procedures, risks, and potential results of laboratory testing; tending to the physical needs of the patient with gentleness, confidence, and respect; maintaining a calm, courteous, and professional manner; and treating each patient as an individual, respecting his or her personality, culture, age, and condition.
- A professional demeanor is essential for establishing patient trust, communicating essential information to the patient and family, and maintaining professional integrity.
- A professional demeanor is essential for understanding ethical practice with respect to cultural, social, and ethnic diversity as it applies to healthcare delivery.

Process/Skill Questions

- What are some examples of professional demeanor?
- How can a healthcare professional's establishment of patient trust positively affect patient care outcomes?
- What role can active listening play in establishing and maintaining successful communication with a patient? With the patient's family? What other techniques can help contribute to successful communication with a patient and his or her family?
- What is professional integrity? Why is it important to the healthcare professional? To the patient? To the healthcare organization?
- How can a professional demeanor reduce personal job stress?
- How do professional organizations provide guidance on expectations for professional behavior?

HOSA Competitive Events (High School)

Medical Law and Ethics (MLE)
Task Number 82

Demonstrate the importance of confidentiality in the medical laboratory technology field.

Definition
Demonstration should include

- the concept of personal privacy
- the importance of understanding and preventing job, health insurance, and social discrimination
- the significance of the Health Insurance Portability and Accountability Act (HIPAA), as related to the field of medical laboratory technology.

Demonstration can be achieved by

- role-playing
- situation analysis
- case studies.

Process/Skill Questions

- How could knowledge of a person's genetic information be misused to affect his or her employment? Health insurance eligibility?
- What legal rights do U.S. citizens have regarding confidentiality of their genetic information? Of their healthcare records in general?
- How does HIPAA affect medical laboratory technology personnel and patient records?

HOSA Competitive Events (High School)

Medical Law and Ethics (MLE)

Task Number 83

Describe employment-related tests and background checks in the medical laboratory technology field.

Definition
Description should include the types of tests and checks (e.g., certification tests, drug tests, background checks, laboratory competency tests, immunization requirements) and their purposes (e.g., validation of professional competence, detection of substance abuse, scrutiny of background for barrier crimes and other undesirable behavior). It should also describe the concept of barrier crimes and the reasons barrier-crime checks are required by law in the healthcare field.

Process/Skill Questions

- How is drug testing used to screen potential and current employees? Why are drug tests administered to potential medical laboratory personnel?
- How are healthcare patients protected by pre-employment tests for professional competency? By pre-employment background checks for barrier crimes?

Task Number 84
Research career paths in medical laboratory technology, to include the levels of education and job opportunities applicable within each pathway.

Definition
Researching should include consulting authoritative, current sources to determine educational requirements, career benefits and drawbacks, employment outlooks, salaries, and job descriptions. Research should include opportunities for qualified job seekers at all levels of educational preparation, including

- non-degreed phlebotomist/clinical laboratory assistant
- AAS-degreed certified medical laboratory technician/clinical laboratory technician
- BS-degreed medical laboratory scientist/clinical laboratory scientist
- BS-degreed pre-medicine graduate
- MS-degreed clinical laboratory scientist
- PhD-degreed professional in science-specific discipline.

Job opportunities for career paths should represent a wide range of laboratory settings, such as

- hospital
- reference laboratory
- industry
- physician office
- acute care facility
- health maintenance organization (HMO)
- public health
- forensic laboratory
- education
- consulting services
- computer science and biomedical engineering
- research.

Process/Skill Questions

- What colleges and universities offer programs in medical technology in Virginia? In nearby states?
- Which postsecondary programs are considered among the strongest in the United States?
- What classes should a student take in high school to prepare for a career in medical technology?
- How have national initiatives (e.g., Homeland Security legislation, Human Genome Project) affected job opportunities in medical technology?
- How has mass media affected the level of interest in medical technology careers?

HOSA Competitive Events (High School)

Health Career Display (HCD)

Biomedical Laboratory Science (BT)

Task Number 85

Describe credentialing in the medical laboratory technology profession.
Definition
Description should include credentialing associated with the following organizations:

- American Medical Technologists (AMT)
- American Society for Clinical Pathology (ASCP)
- National Healthcareer Association (NHA)
- National Center for Competency Testing (NCCT)
- National Phlebotomy Association (NPA)

Process/Skill Questions

- What nationally recognized credentialing is available for medical laboratory technology personnel at various educational levels?
- What is the relationship between credentialing and scope of practice?
- How can the attainment of national credentials affect employment opportunities? Career goals?

HOSA Competitive Events (High School)

Biomedical Laboratory Science (BT)

Task Number 86

Explain the importance of professional development for medical laboratory technology professionals.

Definition
Explanation should include the importance of continually updating one's professional knowledge and skills regarding new procedures and technologies for the purposes of

- maintaining continuing education units required by credentialing bodies
- succeeding in career advancement
- achieving personal satisfaction and increased self-esteem
- providing optimal patient care.

Process/Skill Questions

- What are continuing education units? How can they help medical laboratory technology employees?
- How can medical laboratory technology professionals keep current on new procedures and technologies in their field?
- What role does continuing education play in patient care?
- What is the PACE system of continuing education in medical laboratory professions?

HOSA Competitive Events (High School)

Biomedical Laboratory Science (BT)

Describing the Opioid Crisis

Task Number 87
Describe the history and current state of the opioid crisis in the United States.

Definition

Description should include

- the relationship between opioid prescribing and illicit opioid use to overall opioid overdose deaths
- the prevalence of co-occurring mental health disorders
- the shift in attitudes in the 1990s toward pain management and use of opioids, including the role of pharmaceutical marketing
- the stigma associated with addiction and the changing view of addiction from a moral failing to a chronic, relapsing disease
- statistics, trends, and demographics surrounding the crisis
- population health and other public health aspects of the crisis, including its effects on family and neonates, as well as overall health costs.

Process/Skill Questions

- How are opioids created?
- Can opioids be safely prescribed to patients taking psychotropic drugs?
- How does society stereotype individuals with a history of drug addiction?
- What are the current trends that have contributed to the nationwide opioid crisis?
- How has the opioid epidemic affected emergency rooms and the first responder system?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Teamwork Events

- Creative Problem Solving
- Public Service Announcement

Task Number 88

Describe the history and current state of the opioid crisis in Virginia.

Definition

Description should include

- the relationship between opioid prescribing and illicit opioid use to overall opioid overdose deaths
- the prevalence of co-occurring mental health disorders
- the shift in attitudes in the 1990s toward pain management and use of opioids, including the role of pharmaceutical marketing
- the stigma associated with addiction and the changing view of addiction from a moral failing to a chronic, relapsing disease
- statistics, trends, and demographics surrounding the crisis
- population health and other public health aspects of the crisis, including its effects on family and neonates, as well as overall health costs
the Virginia Department of Health’s Declaration of a Public Health Emergency on November 21, 2016
proposed legislation to address the crisis in Virginia (i.e., House Bill 2161 and Senate Bill 1179, which require the secretary of health and human resources to convene a workgroup to establish educational guidelines for training healthcare providers in the safe prescribing and appropriate use of opioids)
the development of curricula and educational standards regarding opioid addiction.

Resource: The Opioid Crisis Among Virginia Medicaid Beneficiaries

Process/Skill Questions

What agencies participated in the governor’s task meeting on the opioid crisis?
What educational organizations will be tasked with providing opioid training to their students?
What is the benefit of educating future medical professionals about opioid training?
What is the current attitude in society about opioid use and addiction?
How is the local community affected by the opioid epidemic?

HOSA Competitive Events (High School)

Health Science Events
- Medical Spelling
- Medical Terminology

Teamwork Events
- Creative Problem Solving
- Public Service Announcement

Task Number 89

Define the pharmacological components and common uses of opioids.

Definition

Definition should include
- plant-based opioids (e.g., opium from poppy seeds)
- names of legal and illegal opioids
- heroin
- names of the most common opioids
- fentanyl
- medical diagnoses and injuries associated with opioid prescriptions
- commonly used terms.

Resource: Prescription Pain Medications, National Institute on Drug Abuse for Teens

Process/Skill Questions

For what illnesses are opioids commonly prescribed?
What is the current medical protocol when opioids are prescribed?

HOSA Competitive Events (High School)

Health Science Events
Examining the Key Factors of Drug Addiction

Task Number 90

Examine the science of addiction.

Definition

Examination should include

- biopsychosocial aspects of addiction
- the role of endorphins and dopamine
- the role of religious beliefs
- behavioral aspects of addiction
- life cycle of addiction
- misuse of opioids.

Process/Skill Questions

- How will understanding the physiological absorption of opioids in the body provide a holistic assessment?
- What spiritual characteristics might be observed in the science of addiction?
- What are some genetic explanations for some family members being more prone to addiction?

Task Number 91

Explain prevention and early intervention strategies.

Definition

Explanation should include

- risk and protective factors in opioid addiction
- specific populations at risk of addiction
- motivational interviewing and other communication strategies
- naloxone co-prescribing
- roles of family and social institutions in prevention and early intervention.

Resources:

- Prevention Tip Card, Office of the Attorney General of Virginia
Process/Skill Questions

- What are the physiological characteristics of opioid addiction?
- What demographic is most affected by the opioid epidemic? What are some explanations for this?
- How can provision of naloxone and training in its use be sustained financially?
- What obligations do families and society as a whole have in preventing and providing early intervention related to drug addiction?

Task Number 92

Identify addiction and its behavioral elements, as defined by the Diagnostic and Statistical Manual of Mental Disorders (DSM-5).

Definition

Identification should include

- DSM-5 Criteria for Substance Use Disorders
- American Society of Addiction Medicine (ASAM) Criteria (i.e., The Six Dimensions of Multidimensional Assessment)
- CONTINUUM, The ASAM Criteria Decision Engine
- clinical and behavioral aspects of addiction
- practice-appropriate screening tools, including co-morbidity screening.

Process/Skill Questions

- What are DSM-5 and ASAM and what information do they provide to healthcare professionals?
- What are clinical and behavioral elements of addiction that should be recognized by healthcare professionals?
- Who is responsible for providing the necessary screening tools and training?

HOSA Competitive Events (High School)

Health Science Events

- Knowledge Test: Behavioral Health
- Knowledge Test: Medical Law and Ethics

Health Professions Events

- Clinical Nursing

Task Number 93

Describe the treatment models of addiction therapy.

Definition
Description should include

- a recognition that addiction is a chronic disease
- evidence-based treatment models for addiction in general and opioid addiction in particular
- medication-assisted treatment
- the continuum of care in opioid addiction treatment
- how and when to make a referral for treatment
- the roles in an interdisciplinary addiction team
- the role of peers in the treatment of addiction
- the difference between a drug culture and recovery culture
- the management of patients in recovery, including factors contributing to relapse.

Process/Skill Questions

- How many treatment models exist for addiction therapy? Why is one model better than the other?
- What are the advantages of evidence-based treatments and models?
- What medication-assisted treatment programs are available? Who provides them?

HOSA Competitive Events (High School)

Health Science Events
  - Knowledge Test: Behavioral Health
  - Knowledge Test: Medical Law and Ethics

Health Professions Events
  - Clinical Nursing

Task Number 94

Describe the medication management antidote used to prevent fatal opioid overdoses.

Definition

Description should include

- availability and use of naloxone
- naloxone training (e.g., REVIVE!)
- naloxone training agencies
- monitoring of concurrent prescriptions.

Resources:

- Frequently Asked Questions about Naloxone, Virginia Department of Health
- How to prepare naloxone for administration, Virginia Department of Behavioral Health and Developmental Services

Process/Skill Questions

- What is naloxone?
- How much does naloxone cost with health insurance? How much does naloxone cost without health insurance?
- Who should receive naloxone training?
Understanding Pain Management Protocols

Task Number 95

Explain the science of physiological and mental pain.

Definition

Explanation should include:

- definition of pain from the International Association for the Study of Pain (IASP)
- neurobiological basis of pain
- biopsychosocial model of pain
- types of pain (e.g., neuropathic)
- acute, sub-acute, and chronic pain, including pain generation
- spinal and brain modulation, behavioral adaptation and maladaptation, and the continuum from acute to chronic disabling pain
- the underlying science of pain relief.

Process/Skill Questions

- What is the IASP definition of pain?
- How can a medical professional get a patient to describe physiological pain?
- What assessment tools can be used to help patients describe physiological pain? How do tools differ for describing mental pain?
- How are pain and levels of pain categorized?

HOSA Competitive Events (High School)

Health Science Events

- Knowledge Test: Nutrition
- Knowledge Test: Transcultural Health Care

Teamwork Events

- Community Awareness
- Creative Problem Solving
- HOSA Bowl

Task Number 96

Describe the diagnostic tools used in developing pain management plans.
Definition

Description should include

- pain-related health history and examination
- understanding the role of family in supporting individuals in need of pain management
- practice-appropriate screening tools that include aspects such as mood and function
- the use and limitations of pain scales
- differential diagnosis of pain and its placement on the pain continuum.

Resource: Promoting Safer and More Effective Pain Management, CDC

Process/Skill Questions

- What are the Wong-Baker, LEGO, and Hospice assessment tools?
- How do pain assessment tools vary across the life span?
- When completing an assessment, is pain considered subjective or objective?

HOSA Competitive Events (High School)

Health Science Events

- Knowledge Test: Nutrition
- Knowledge Test: Transcultural Health Care

Teamwork Events

- Community Awareness
- Creative Problem Solving
- HOSA Bowl

Task Number 97

Describe pain treatment options available to various populations of patients.

Definition

Description should include

- special populations in pain management, such as palliative/end-of-life care patients, patients with cancer, pediatric patients, and geriatric populations
- non-pharmacologic treatment of pain, including active care and self-care, evidence- and non-evidence-based approaches, and multimodal pain management
- non-opioid pharmacologic management of pain
- the challenges in discussing the psychological aspects of pain and the role of the central nervous system
- adverse drug event prevention for all pain medications
- the roles in an interdisciplinary pain management team
- the significance of issues such as anxiety, depression, and sleep deprivation in pain management
- the placebo effect
- goals and expectations in the treatment of pain, based on diagnosis and pain continuum
- when to make a pain referral and to whom.

Resources:

- CDC Fact Sheet for Prescribing Opioids for Chronic Pain
• CDC Guidelines for Prescribing Opioids for Chronic Pain

Process/Skill Questions

• What pain management resources are available for special populations?
• What are alternative forms of pain management?
• What role does the mind play in pain management?

HOSA Competitive Events (High School)

Health Science Events

○ Knowledge Test: Nutrition
○ Knowledge Test: Transcultural Health Care

Teamwork Events

○ Community Awareness
○ Creative Problem Solving
○ HOSA Bowl

Task Number 98

Describe the effects of opioid dependency on the human body systems.

Definition

Description should include the short- and long-term effects of opioids on the following:

• Nervous system
• Respiratory system
• Circulatory system
• Digestive system
• Skeletal system

Resource: Drugs and Your Body, Scholastic

Process/Skill Questions

• How does the misuse of opioids affect nutrition and weight loss?
• How might opioid misuse be evident in a person’s vital signs?
• How do opioids affect the brain as the control center for homeostasis?

HOSA Competitive Events (High School)

Health Science Events

○ Medical Spelling
○ Medical Terminology

Teamwork Events

○ HOSA Bowl
Task Number 99

Explain the mechanism and physical effects of opioids on the human body.

Definition

Explanation should include the following:

- Mechanism of action and metabolism of opioids
- Development of tolerance, dependence, and addiction
- Health consequences of drug misuse
  - HIV, hepatitis, and other infectious diseases
  - Cancer
  - Cardiovascular effects
  - Respiratory effects
  - Gastrointestinal effects
  - Musculoskeletal effects
  - Kidney damage
  - Liver damage
  - Neurological effects
  - Hormonal effects
  - Prenatal effects
  - Other health effects
  - Mental health effects
  - Death
- Withdrawal
  - Causes
  - Timeframe (i.e., peaks of withdrawal symptoms)
  - Physical signs (e.g., nausea, diarrhea, vomiting, cold flashes)

Process/Skill Questions

- What are the short- and long-term effects of withdrawal dependence symptoms?
- How long can the human body function while exhibiting the symptoms of withdrawal?
- What are other medical conditions that may arise because of the symptoms of physical dependence?

HOSA Competitive Events (High School)

  Health Science Events
  - Medical Spelling
  - Medical Terminology

  Teamwork Events
  - HOSA Bowl

Task Number 100

Explain the use of opioids in practice settings, the role of opioids in pain management, and risk factors associated with the use of the medication.

Definition
Explanation should include

- appropriate use of different opioids in various practice settings
- the interactions, risks, and intolerance of prescription opioids
- the role and effectiveness of opioids in acute, sub-acute, and chronic pain
- a reassessment of opioid use based on stage of pain
- contemporary treatment guidelines, best practices, health policies, and government regulations related to opioid use
- use of opioids in pain management of patients with substance abuse disorders, in recovery, and in palliative/end-of-life care.

Process/Skill Questions

- When should risk factors regarding opioids be reviewed with the patient?
- What are the options when treating patients with a history of substance abuse?
- What government regulations and policies are in place to improve the safe administration of opioids?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology
- Knowledge Test: Pharmacology

Teamwork Events

- Creative Problem Solving
- HOSA Bowl

Task Number 101

Describe the withdrawal and tapering side effects of opioid use.

Definition

Description should include

- characteristics of acute and protracted withdrawal from opioid dependence or addiction
- tapering
- pain contracts or agreements.

Process/Skill Questions

- What are the stages of withdrawal in opioid abuse transition?
- What medications might be needed in the withdrawal stage?
- What information should be included in the pain management contract?

HOSA Competitive Events (High School)

Health Science Events

- Knowledge Test: Pharmacology

Health Professions Events
Task Number 102

Describe storage and disposal options for opioids.

Definition

Description should include

- medicine take-back options (e.g., National Drug Take Back Day)
- disposal in the household trash and flushing certain potentially dangerous medicines down the toilet.

Resources:

- Disposal of Unused Medicines: What You Should Know, Food and Drug Administration (FDA)
- Prescription Drug Abuse and Tips for Proper Disposal, Office of the Attorney General of Virginia

Process/Skill Questions

- How should medications be stored in the house?
- What is National Prescription Drug Take Back Initiative?
- What is the black box?

Task Number 103

Explain community resources for education about opioid use.

Definition

Explanation should include key components of and resources for patient education in the use of opioids, including

- risks
- benefits
- side effects
- tolerance
- signs of sedation or overdose
- naloxone, including its storage and disposal.

Process/Skill Questions
What resources for opioid education are available locally, statewide, and nationally?
Where should the patient first be informed about the resources available?
How does social media aid in patient education on opioid addiction?

HOSA Competitive Events (High School)

Health Science Events

○ Knowledge Test: Pharmacology

Health Professions Events

○ Clinical Nursing

Working with Patients and Caregivers

Task Number 104

Describe key communication topics involving opioids for patients.

Definition

Description should include

- benefits and risks of opioids
- opioid risk screening (i.e., taking a social, medical, and financial history)
- risk mitigation (e.g., naloxone, safe storage, pain contracts)
- medication tapers and/or discontinuation of therapy.

Process/Skill Questions

- What are the benefits of using opioids in medicine?
- What is the relationship between demographics and risk of opioid addiction?
- How does culture influence risk factors in opioid abuse?

HOSA Competitive Events (High School)

Health Science Events

○ Medical Spelling
○ Medical Terminology

Health Professions Events

○ Clinical Nursing

Task Number 105

Describe communication topics for caregivers and family members.
Definition

Description should include

- basic knowledge about opioids
- signs of addiction
- treatment options for addiction
- naloxone training for caregivers
- legal issues related to misuse.

Process/Skill Questions

- What rights do caregivers have in regard to medical information of the abuser?
- What legal steps might the caregiver or family have to take for treatment?
- Where can the caregiver or family members receive naloxone training? Are children of opioid abusers eligible for training?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Clinical Nursing

SOL Correlation by Task

<table>
<thead>
<tr>
<th>Task</th>
<th>SOL Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Applying the Principles of Hemostasis/Coagulation</strong></td>
<td></td>
</tr>
</tbody>
</table>
| 39   | Describe basic human anatomy and physiology in relation to hemostasis/coagulation. | English: 12.5  
|      |  | History: WHII 4  
|      |  | Science: BIO.4 |
| 40   | Interpret common abbreviations related to hemostasis/coagulation. | English: 12.5 |
| 41   | Interpret basic medical laboratory terminology related to hemostasis/coagulation. | English: 12.5 |
| 42   | Explain the concepts of hemostasis/coagulation and fibrinolysis. | English: 12.5 |
| 43   | Explain the use of prothrombin time (PT) and activated partial thromboplastin time (APTT) testing. | English: 12.5 |
| 44   | Correlate abnormal hemostasis/coagulation laboratory results with disease processes. | English: 12.5 |
| **Understanding the Basics of Immunology/Serology** |
| 45   | Describe basic human anatomy and physiology in relation to immunology/serology. | English: 12.5  
|      |  | History: WHII 4  
<p>|      |  | Science: BIO.4 |
| 46   | Interpret common abbreviations used in immunology/serology. | English: 12.5 |
| 47   | Interpret basic medical laboratory terminology related to immunology/serology. | English: 12.5 |
| 48   | Explain the host immune response to foreign substances. | English: 12.5 |
| 49   | Describe common immunological tests. | English: 12.5 |
| 50   | Perform an enzyme immunoassay. |  |
| 51   | Correlate abnormal immunological/serological laboratory results with disease processes. | English: 12.5 |</p>
<table>
<thead>
<tr>
<th>Task</th>
<th>SOL Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Performing Basic Microbiology Skills</strong></td>
<td></td>
</tr>
</tbody>
</table>
| 52 | Describe basic human anatomy and physiology in relation to microbiology. | English: 12.5  
Science: BIO.4, BIO.3 |
| 53 | Interpret common abbreviations used in microbiology. | English: 12.5 |
| 54 | Interpret basic medical laboratory terminology related to microbiology. | English: 12.5 |
| 55 | Explain the importance of collection requirements for the various specimens used in microbiological studies. | English: 12.5 |
| 56 | Perform microscopy and Gram stain preparation. | English: 12.5 |
| 57 | Identify classifications of microorganisms based on cell wall structure. | English: 12.5  
History: WHII 4 |
| 58 | Explain the concept of a pure and/or isolative culture. | English: 12.5 |
| 59 | Perform inoculation of patient specimen. | English: 12.5 |
| 60 | Perform isolation or subculture of microbes. | English: 12.5 |
| 61 | Explain the basic concepts of antibiotics and their classes. | English: 12.5 |
| 62 | Explain the concept of antibiotic susceptibility testing. | English: 12.5 |
| 63 | Describe basic identification techniques used to differentiate bacteria. | English: 12.5  
History: WHII 4 |
| 64 | Explain the causes and significance of methicillin-resistant Staphylococcus aureus (MRSA) and other antibiotic-resistant organisms. | English: 12.5  
Science: BIO.4 |
| 65 | Explain the basic characteristics of the most common yeast/fungi encountered in the clinical lab. | English: 12.5 |
| 66 | Explain the basic characteristics of the most common parasites encountered in the clinical lab. | English: 12.5 |
| **Understanding the Basics of Immunohematology/Transfusion Services** | |
| 67 | Describe basic human anatomy and physiology in relation to immunohematology/transfusion. | English: 12.5  
History: WHII 4 |
| 68 | Interpret common abbreviations used in immunohematology/transfusion services. | English: 12.5  
Science: BIO.4 |
| 69 | Interpret basic medical laboratory terminology related to immunohematology/transfusion services. | English: 12.5 |
| 70 | Explain how each blood group is identified. | English: 12.5  
History: WHII 4 |
| 71 | Perform or simulate an antigen and antibody reaction in transfusion medicine. | English: 12.5  
History: WHII 4 |
| 72 | Explain the various red blood cell components and derivatives used for transfusion. | English: 12.5  
History: WHII 4 |
| 73 | Explain compatibility testing of blood. | English: 12.5 |
| 74 | Explain legal and medical ramifications of potential errors in immunohematology and transfusion services, as well as potential consequences. | English: 12.5  
History: Govt 7, 8, 9, 15, 16 |
| **Understanding the Basics of Molecular Diagnostics** | |
| 75 | Describe basic human anatomy and physiology in relation to molecular diagnostics. | English: 12.5  
History: WHII 4 |
<table>
<thead>
<tr>
<th>Task</th>
<th>SOL Correlations</th>
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<tbody>
<tr>
<td>76 Interpret common abbreviations used in molecular diagnostics.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>77 Interpret basic medical laboratory terminology related to</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>molecular diagnostics.</td>
<td></td>
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<tr>
<td>78 Explain the advantages, disadvantages, and uses of molecular</td>
<td>English: 12.5</td>
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<tr>
<td>diagnostics.</td>
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<tr>
<td>79 Perform polymerase chain reaction (PCR) testing.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>80 Research innovations in genetic manipulation (e.g., CRISPR).</td>
<td>English: 12.5, 12.8</td>
</tr>
<tr>
<td><strong>Exploring Professional Choices</strong></td>
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<tr>
<td>81 Explain the importance of a professional demeanor on the part of</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>all healthcare professionals.</td>
<td>History: Govt 16</td>
</tr>
<tr>
<td>82 Demonstrate the importance of confidentiality in the medical</td>
<td>History: Govt 7, 8, 9, 15, 16</td>
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<tr>
<td>laboratory technology field.</td>
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<tr>
<td>83 Describe employment-related tests and background checks in the</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>medical laboratory technology field.</td>
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</tr>
<tr>
<td>84 Research career paths in medical laboratory technology, to include</td>
<td>English: 12.5, 12.8</td>
</tr>
<tr>
<td>the levels of education and job opportunities applicable within each</td>
<td>History: Govt 16</td>
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<tr>
<td>pathway.</td>
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<tr>
<td>85 Describe credentialing in the medical laboratory technology</td>
<td>English: 12.5</td>
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<tr>
<td>profession.</td>
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<td>86 Explain the importance of professional development for medical</td>
<td>English: 12.5</td>
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<td>laboratory technology professionals.</td>
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<tr>
<td><strong>Describing the Opioid Crisis</strong></td>
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<tr>
<td>87 Describe the history and current state of the opioid crisis in the</td>
<td>English: 12.5</td>
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<tr>
<td>United States.</td>
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<tr>
<td>88 Describe the history and current state of the opioid crisis in</td>
<td>English: 12.5, 12.8</td>
</tr>
<tr>
<td>Virginia.</td>
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<tr>
<td>89 Define the pharmacological components and common uses of</td>
<td>English: 12.3, 12.8</td>
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<tr>
<td>opioids.</td>
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<tr>
<td><strong>Examining Key Factors of Drug Addiction</strong></td>
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<tr>
<td>90 Examine the science of addiction.</td>
<td>English: 12.5</td>
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<tr>
<td>91 Explain prevention and early intervention strategies.</td>
<td>English: 12.5, 12.8</td>
</tr>
<tr>
<td>92 Identify addiction and its behavioral elements, as defined by the</td>
<td>English: 12.5</td>
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<tr>
<td>Diagnostic and Statistical Manual of Mental Disorders (DSM-5).</td>
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<tr>
<td>93 Describe the treatment models of addiction therapy.</td>
<td>English: 12.5</td>
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<td>94 Describe the medication management antidote used to prevent</td>
<td>English: 12.3, 12.8</td>
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<td>fatal opioid overdoses.</td>
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<tr>
<td><strong>Understanding Pain Management Protocols</strong></td>
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<tr>
<td>95 Explain the science of physiological and mental pain.</td>
<td>English: 12.3, 12.5</td>
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<td>96 Describe the diagnostic tools used in developing pain management</td>
<td>English: 12.5</td>
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<td>plans.</td>
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<td>97 Describe pain treatment options available to various populations</td>
<td>English: 12.5, 12.8</td>
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<tr>
<td>of patients.</td>
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<td>98 Describe the effects of opioid dependency on the human body</td>
<td>English: 12.5</td>
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<td>systems.</td>
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<td>99 Explain the mechanism and physical effects of opioids on the</td>
<td>English: 12.5</td>
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<td>human body.</td>
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<td>100 Explain the use of opioids in practice settings, the role of</td>
<td>English: 12.5</td>
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<tr>
<td>opioids in pain management, and risk factors associated with the</td>
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<td>use of the medication.</td>
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<td>101 Describe the withdrawal and tapering side effects of opioid use.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>102 Describe storage and disposal options for opioids.</td>
<td>English: 12.5, 12.8</td>
</tr>
<tr>
<td>103 Explain community resources for education about opioid use.</td>
<td>English: 12.5</td>
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<tr>
<td><strong>Working with Patients and Caregivers</strong></td>
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<tr>
<td>104 Describe key communication topics involving opioids for patients.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>105 Describe communication topics for caregivers and family members.</td>
<td>English: 12.5</td>
</tr>
</tbody>
</table>
Teaching Resources

Textbooks


Other Textbooks


Web Resources

American Academy of Family Physicians. *CLIA Waived and PPM Tests Defined*. This site explains Clinical Laboratory Improvement Amendment (CLIA) waived tests and Provider Performed Microscopy (PPM).

American Medical Technologists. This is the official site of the AMT, a professional organization for medical laboratory professionals.

American Society for Clinical Pathology. This is the official site of the ASCP, a professional organization for medical laboratory professionals.

Centers for Disease Control and Prevention (CDC). This CDC site offers links to information on health and safety topics, data and statistics, publications, CDC Health protection goals, and other topics. It also provides resources for Good Laboratory Practices for Waived Testing.

Clinical and Laboratory Standards Institute (CLSI). This site provides links to news, standards, activities, recent publications, and other resources related to CLSI and the medical laboratory technology field.

Dolan DNA Learning Center. Gene Almanac. *Biology Animation Library*. This site provides illustrations and descriptions of a number of biology animations that relate to medical and biomedical laboratory technology, including a polymerase chain reaction animation.
National Accrediting Agency for Clinical Laboratory Sciences. This is the official site of the NAACLS, a professional organization for medical laboratory professionals.

National Fire Protection Association (NFPA). This NFPA site offers quick links to resources such as NFPA codes and standards, facts sheets and safety tips, and news highlights that are sometimes pertinent to the medical laboratory setting.

National Institutes of Health. LifeWorks. This NIH site presents a career interview with a practicing medical and clinical laboratory technician.

National Institutes of Health. Medline Plus. This National Library of Medicine site provides links to health topics, an online illustrated encyclopedia, an online dictionary, and other resources relevant to medical laboratory technologists.

National Institutes of Health. Diagnostic Tests. This National Library of Medicine site presents information on test preparation for patients; laboratory testing procedures, purposes, results, and risks; and other resources related to diagnostic tests.

Occupational Safety and Health Administration. Safety and Health Topics. This OSHA page provides the links to various safety and health topics, as well as the latest on hazards and controls in the hospital setting, including laboratories, as well as information on bloodborne pathogens and Methicillin-resistant Staphylococcus aureus (MRSA).

U.S. Department of Health and Human Services. Health Information Privacy. This site helps consumers and covered entities to understand the administration of and protections provided by the Health Insurance Portability and Accountability Act (HIPAA).

U.S. Food and Drug Administration. Bioresearch Monitoring: Good Laboratory Practice. This site provides references and guidance for Good Laboratory Practice (GLP).

University of Michigan. Department of Natural Science. Science Learning Center. Online Modules. These modules offer instructional aids related to a variety of biology and chemistry topics that relate to medical laboratory technology.

Virginia Career VIEW. This career resource provides current U.S., Virginia, and local occupational and career-planning data for those exploring the field of medical and clinical medical technology.

Entrepreneurship Infusion Units

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.”

Opioid Abuse Prevention Education

This Opioid Abuse Prevention document includes resources for opioid abuse prevention education from kindergarten to 12th grade.

Other Opioid Resources


Virginia Department of Behavioral Health and Developmental Services. Revive! Opioid Overdose and Naloxone Education for Virginia (website).

National Institute on Drug Abuse, National Institutes of Health. Easy to Read Drug Facts: Alcohol (website; PDF available)

National Institute on Drug Abuse, National Institutes of Health. Easy to Read Drug Facts: Bath Salts (website; PDF available)

National Institute on Drug Abuse, National Institutes of Health. Easy to Read Drug Facts: Cocaine (website; PDF available)

National Institute on Drug Abuse, National Institutes of Health. Easy to Read Drug Facts: E-Cigarette (website; PDF available)

National Institute on Drug Abuse, National Institutes of Health. Easy to Read Drug Facts: Heroin (website; PDF available)

National Institute on Drug Abuse, National Institutes of Health. Easy to Read Drug Facts: Marijuana (website; PDF available)

National Institute on Drug Abuse, National Institutes of Health. Easy to Read Drug Facts: MDMA (website; PDF available)

National Institute on Drug Abuse, National Institutes of Health. Easy to Read Drug Facts: Meth (website; PDF available)

National Institute on Drug Abuse, National Institutes of Health. Easy to Read Drug Facts: Pain Medicine (website; PDF available)

National Institute on Drug Abuse, National Institutes of Health. Easy to Read Drug Facts: Spice (K2) (website; PDF available)

National Institute on Drug Abuse, National Institutes of Health. Easy to Read Drug Facts: Tobacco and Nicotine (website; PDF available)

National Institute on Drug Abuse, National Institutes of Health. Easy to Read Drug Facts: Other Drugs People Use and Misuse (website; PDF available)
Appendix: Credentials, Course Sequences, and Career Cluster Information

Industry Credentials: Only apply to 36-week courses

- Certified Phlebotomy Technician (CPT) Examination (AAH)
- Certified Phlebotomy Technician (CPT) Examination (NHA)
- College and Work Readiness Assessment (CWRA+)
- National Career Readiness Certificate Assessment
- National Certified Phlebotomy Technician (NCPT) Examination
- Nationally Registered Certified Phlebotomy Technician (NRCPT) Examination
- Phlebotomy Technician Certification (PTC) Examination
- Workplace Readiness Skills for the Commonwealth Examination

Concentration sequences: A combination of this course and those below, equivalent to two 36-week courses, is a concentration sequence. Students wishing to complete a specialization may take additional courses based on their career pathways. A program completer is a student who has met the requirements for a CTE concentration sequence and all other requirements for high school graduation or an approved alternative education program.

- Medical Laboratory Technology I (8377/36 weeks)

Career Cluster: Health Science

<table>
<thead>
<tr>
<th>Pathway</th>
<th>Occupations</th>
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<tbody>
<tr>
<td>Biotechnology</td>
<td></td>
</tr>
<tr>
<td>Research and Development</td>
<td>Research Assistant</td>
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<tr>
<td>Diagnostics Services</td>
<td>Cardiovascular Technologist</td>
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<td></td>
<td>Medical, Clinical Laboratory Technician</td>
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<td></td>
<td>Phlebotomist</td>
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<td></td>
<td>Radiologic Technologist, Radiographer</td>
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<tr>
<td>Health Informatics</td>
<td>Epidemiologist</td>
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<td></td>
<td>Medical Assistant</td>
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<tr>
<td>Therapeutic Services</td>
<td>Pharmacy Technician</td>
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</tbody>
</table>

Career Cluster: Science, Technology, Engineering and Mathematics

<table>
<thead>
<tr>
<th>Pathway</th>
<th>Occupations</th>
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</thead>
<tbody>
<tr>
<td>Science and Mathematics</td>
<td>Bioinformatics Technician</td>
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</table>