Medical Laboratory Technology II

8378 36 weeks

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Course Description

Suggested Grade Level: 12
Prerequisites: 8377

Students will 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 hematology, clinical chemistry, clinical microbiology, immunohematology, and immunology/serology. Competency includes performing the technique correctly, understanding the theory of the procedures, and interpreting the results. Weekly laboratory activities will stress actual student performance of the routine tests normally seen in the clinical setting.

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.

8378	Tasks/Competencies
Applying the Principles of Hemostasis/Coagulation	
⊕	Describe basic human anatomy and physiology in relation to hemostasis/coagulation.
⊕	Interpret common abbreviations related to hemostasis/coagulation.
⊕	Interpret basic medical laboratory terminology related to hemostasis/coagulation.
⊕	Explain the concepts of hemostasis/coagulation.
⊕	Explain the use of prothrombin time (PT) and activated partial thromboplastin time (APTT) testing.
⊕	Explain the importance of point-of-care testing.
⊕	Correlate abnormal hemostasis/coagulation laboratory results with disease processes.
Understanding the Basics of Immunology/Serology	
⊕	Describe basic human anatomy and physiology in relation to immunology/serology.
⊕	Interpret common abbreviations used in immunology/serology.
⊕	Interpret basic medical laboratory terminology related to immunology/serology.
⊕	Explain the host immune response to foreign substances.
⊕	Describe common serological tests.
⊕	Perform an enzyme immunoassay.
⊕	Correlate abnormal immunological/serological laboratory results with disease processes.
Performing Basic Microbiology Skills	
⊕	Describe basic human anatomy and physiology in relation to microbiology.
⊕	Interpret common abbreviations used in microbiology.
⊕	Interpret basic medical laboratory terminology related to microbiology.
⊕	Explain the importance of collection requirements for the various specimens used in microbiological studies.
⊕	Perform microscopy and Gram stain preparation.
⊕	Identify classifications of microorganisms based on cell wall structure.
⊕	Explain the concept of a pure and/or isolative culture.
⊕	Perform inoculation of patient specimen.
⊕	Perform isolation or subculture of microbes.
⊕	Explain the basic concepts of antibiotics and their classes.
⊕	Explain the concept of antibiotic susceptibility testing.
⊕	Describe basic identification techniques used to differentiate bacteria.

8378	Tasks/Competencies
⊕	Explain the causes and significance of methicillin-resistant Staphylococcus aureus (MRSA) and other antibiotic-resistant organisms.
⊕	Explain the basic characteristics of the most common yeast/fungi encountered in the clinical lab.
Understanding the Basics of Immunohematology/Transfusion Services	
⊕	Describe basic human anatomy and physiology in relation to immunohematology/transfusion.
⊕	Interpret common abbreviations used in immunohematology/transfusion services.
⊕	Interpret basic medical laboratory terminology related to immunohematology/transfusion services.
⊕	Explain how each blood group is identified.
⊕	Perform or simulate an antigen and antibody reaction in transfusion medicine.
⊕	Explain the various red blood cell components and derivatives used for transfusion.
⊕	Explain compatibility testing of blood.
⊕	Explain legal and medical ramifications of potential errors in immunohematology and transfusion services, as well as potential consequences.
Understanding the Basics of Molecular Diagnostics	
⊕	Describe basic human anatomy and physiology in relation to molecular diagnostics.
⊕	Interpret common abbreviations used in molecular diagnostics.
⊕	Interpret basic medical laboratory terminology related to molecular diagnostics.
⊕	Explain the advantages, disadvantages, and uses of molecular diagnostics.
⊕	Explain polymerase chain reaction (PCR) testing.
⊕	Perform PCR testing.
Exploring Professional Choices	
⊕	Explain the importance of a professional demeanor on the part of all healthcare professionals.
⊕	Demonstrate the importance of confidentiality in the medical laboratory technology field.
⊕	Describe employment-related tests and background checks in the medical laboratory technology field.
⊕	Research career paths in medical laboratory technology, to include the levels of education and job opportunities applicable within each pathway.
⊕	Describe credentialing in the medical laboratory technology profession.
⊕	Explain the importance of professional development for medical laboratory technology professionals.
⊕	Prepare and present a research project on a topic or question related to medical laboratory technology.
Describing the Opioid Crisis	
⊕	Describe the history and current state of the opioid crisis in the United States.
⊕	Describe the history and current state of the opioid crisis in Virginia.
⊕	Define the pharmacological components and common uses of opioids.
Examining the Key Factors of Drug Addiction	
⊕	Examine the science of addiction.
⊕	Explain prevention and early intervention strategies.

8378	Tasks/Competencies
⊕	Identify addiction and its behavioral elements, as defined by the Diagnostic and Statistical Manual of Mental Disorders (DSM-5).
⊕	Describe the treatment models of addiction therapy.
⊕	Describe the medication management antidote used to prevent fatal opioid overdoses.
Understanding Pain Management Protocols	
⊕	Explain the science of physiological and mental pain.
⊕	Describe the diagnostic tools used in developing pain management plans.
⊕	Describe pain treatment options available to various populations of patients.
⊕	Describe the effects of opioid dependency on the human body systems.
⊕	Explain the mechanism and physical effects of opioids on the human body.
⊕	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.
⊕	Describe the withdrawal and tapering side effects of opioid use.
⊕	Describe storage and disposal options for opioids.
⊕	Explain community resources for education about opioid use.
Working with Patients and Caregivers	
⊕	Describe key communication topics involving opioids for patients.
⊕	Describe communication topics for caregivers and family members.

Legend: ⊕Essential ○Non-essential ⊖Omitted

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 do blood tests help diagnose certain conditions or diseases?
- How does blood travel through the body?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Teamwork Events

- HOSA Bowl

Task Number 40

Interpret common abbreviations related to hemostasis/coagulation.

Definition

Interpretation should include abbreviations and acronyms associated with medical testing (e.g., CBC for complete blood count, BMP for basic metabolic panel, CMP for comprehensive metabolic panel, C&S for culture and sensitivity, U/A or UA for urinalysis).

Process/Skill Questions

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

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

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).

Process/Skill Questions

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

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Teamwork Events

- HOSA Bowl

Task Number 42

Explain the concepts of hemostasis/coagulation.

Definition

Explanation should include the

- role of platelets
- five major steps of the mechanism of coagulation
- intrinsic pathway
- extrinsic pathway
- role of the coagulation factors.

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?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Teamwork Events

- Health Education
- HOSA Bowl

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?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Teamwork Events

- Health Education

Task Number 44

Explain the importance of point-of-care testing.

Definition

Explanation should include that point-of-care testing

- uses minute amounts of blood

- can be performed for immediate (i.e., stat) results without sending the patient to a laboratory setting
- uses coagulation instruments.

Process/Skill Questions

- Why is it important to have the ability to run coagulation studies at the patient's bedside?
- Why is it often important to get immediate results on a patient?
- What other factors besides rapid turnaround go into the decision-making process when choosing point of care testing?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Task Number 45

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).

Process/Skill Questions

- Which factor is lacking in hemophilia?
- What constitutes the process of fibrinolysis?
- What is the significance of coagulation in acute cardiac syndrome (ACS)?
- What would an abnormal bleeding time suggest?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology
- Knowledge Test: Pathophysiology

Health Professions Events

- Biomedical Laboratory Science

Understanding the Basics of Immunology/Serology

Task Number 46

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
- Structure and function of the lymphatic system

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?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Teamwork Events

- HOSA Bowl

Task Number 47

Interpret common abbreviations used in immunology/serology.

Definition

Interpretation should include abbreviations and acronyms associated with medical testing (e.g., CBC for complete blood count, BMP for basic metabolic panel, CMP for comprehensive metabolic panel, C&S for culture and sensitivity, U/A or UA for urinalysis).

Process/Skill Questions

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

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Task Number 48

Interpret basic medical laboratory terminology related to immunology/serology.

Definition

Interpretation should include terminology such as

- humoral 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)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Teamwork Events

- HOSA Bowl

Task Number 49

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
- function of adaptive immunity
- comparison of the cellular and humoral components of adaptive immunity
- three immunologically functional groups of leukocytes

- five steps and general activities in phagocytosis
- types of lymphocytes and the function of each type
- definitions of *antigen* and *antibody*
- characteristics of antigens
- characteristics of antibodies
- five classes of antibodies.

Process/Skill Questions

- What are the five classes of antibodies?
- How does a lymphocyte function?
- What is adaptive or acquired immunity?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Teamwork Events

- Health Education
- HOSA Bowl

Task Number 50

Describe common serological tests.

Definition

Description should include

- characteristics of agglutination
- explanation of the mechanism of particle agglutination
- identification and comparison of the principles of
  - latex agglutination
  - coagglutination
  - liposome mediated agglutination

    - direct bacterial agglutination
    - hemagglutination
- identification and comparison of immunofluorescent assays
- identification and comparison of various enzyme immunoassays
- applications of
    - polymerase chain reaction (PCR)
    - Southern blot
    - Northern blot
    - Western blot
    - DNA chip technology
- comparison of two phases of testing for antibody levels
- definition of *antibody titer*
- explanation of the procedure for the serial dilution of serum
- explanation of the principles of immunologic tests for pregnancy.

Process/Skill Questions

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

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Task Number 51

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?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Task Number 52

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 (RAST) test measure? How does a RAST test work? How are RAST test results useful in patient diagnosis?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling

- Medical Terminology
- Knowledge Test: Pathophysiology

Health Professions Events

- Biomedical Laboratory Science

Performing Basic Microbiology Skills

Task Number 53

Describe basic human anatomy and physiology in relation to microbiology.

Definition

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

- Structures and functions of the cell
- Structures and functions of tissues, membranes, and glands
- Structure and function of the integumentary system
- Structure and function of the skeletal system
- Structure and function of the muscular system
- Structure and functions of blood
- Structure and functions of the heart
- Structures and functions of blood vessels and blood circulation
- Structure and function of the lymphatic system
- Structure and function of the respiratory system
- Structure and function of the gastrointestinal system
- Structure and function of the endocrine system
- Structure and function of the reproductive system
- Structure and function of the nervous system
- Structure and function of the 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?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Teamwork Events

- HOSA Bowl

Task Number 54

Interpret common abbreviations used in microbiology.

Definition

Interpretation should include abbreviations and acronyms associated with medical testing (e.g., CBC for complete blood count, BMP for basic metabolic panel, CMP for comprehensive metabolic panel, C&S for culture and sensitivity, U/A or UA for urinalysis).

Process/Skill Questions

- What stain is performed when identifying AFB?
- What is the difference between MIC and MBC?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Task Number 55

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.

Process/Skill Questions

- What is a facultative anaerobe?
- What is gamma hemolysis?
- What is beta hemolysis?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Teamwork Events

- HOSA Bowl

Task Number 56

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.

Process/Skill Questions

- Which numbered tube is used for a CSF culture and susceptibility?
- How long can it take for blood culture results?
- What is the appropriate specimen type for a urine culture?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Task Number 57

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.

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?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Task Number 58

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)

Health Science Events

- Medical Spelling
- Medical Terminology

Teamwork Events

- HOSA Bowl

Task Number 59

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)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Task Number 60

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 media 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.

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?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Task Number 61

Perform isolation or subculture of microbes.

Definition

Performance should include the proper technique to ensure pure culture.

Process/Skill Questions

- Should the inoculating loop be flamed between quadrants? Why, or why not?
- How many colonies are chosen when subculturing?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Task Number 62

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)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Teamwork Events

- HOSA Bowl

Task Number 63

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]).

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?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Task Number 64

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).

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)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Task Number 65

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
- 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)?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology
- Knowledge Test: Pathophysiology

Health Professions Events

- Biomedical Laboratory Science

Teamwork Events

- Health Education
- HOSA Bowl

Task Number 66

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

Definition

Explanation 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?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling

- Medical Terminology

Teamwork Events

- Health Education
- HOSA Bowl

Understanding the Basics of Immunohematology/Transfusion Services

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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:

- Structure and functions of blood
- Structures and functions of blood vessels and blood circulation
- Structure and function of the lymphatic 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?
- What is the lymphatic system? What roles does it play in healthy body function?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Teamwork Events

- HOSA Bowl

Task Number 68

Interpret common abbreviations used in immunohematology/transfusion services.

Definition

Interpretation should include abbreviations and acronyms associated with medical testing (e.g., CBC for complete blood count, BMP for basic metabolic panel, CMP for comprehensive metabolic panel, C&S for culture and sensitivity, U/A or UA for urinalysis).

Process/Skill Questions

- What is RBC?
- What is Ig?
- What is the Rh factor?
- What are the four blood types?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

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.

Process/Skill Questions

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

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Teamwork Events

- HOSA Bowl

Task Number 70

Explain how each blood group is identified.

Definition

Explanation should include identification through automation, tubes, and slides of the basic blood groups

- A
- B
- AB
- O
- Rh

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

Process/Skill Questions

- How are the basic blood groups different from each other?
- 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)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Teamwork Events

- Health Education
- HOSA Bowl

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)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Teamwork Events

- HOSA Bowl

Task Number 72

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

Definition

Explanation should include

- packed red blood cells
- platelets
- plasma
- leukocyte-reduced red blood cells (LRBC).

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?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Teamwork Events

- HOSA Bowl

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?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling

- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Task Number 74

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

Definition

Explanation should 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 should 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?

Common Career Technical Core

HL5

Analyze the legal and ethical responsibilities, limitations and implications of actions within the healthcare workplace

HL6

Evaluate accepted ethical practices with respect to cultural, social and ethnic differences within the healthcare workplace.

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology
- Knowledge Test: Medical Law and Ethics

Health Professions Events

- Biomedical Laboratory Science

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 the cell.

Process/Skill Questions

- How is a protein formed?
- What is the difference between the process of translation and transcription?
- Can central nervous system cells regenerate after being damaged? Why is this important?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Teamwork Events

- HOSA Bowl

Task Number 76

Interpret common abbreviations used in molecular diagnostics.

Definition

Interpretation should include abbreviations and acronyms associated with medical testing (e.g., CBC for complete blood count, BMP for basic metabolic panel, CMP for comprehensive metabolic panel, C&S for culture and sensitivity, U/A or UA for urinalysis).

Process/Skill Questions

- What is RNA?
- What is PCR?
- What is DNA?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Task Number 77

Interpret basic medical laboratory terminology related to molecular diagnostics.

Definition

Interpretation should include terminology such as

- restriction enzymes
- microarray
- probe amplification
- plasmids
- telomeres.

Process/Skill Questions

- What gel composition can be used in PCR?
- What processes are used to analyze STIs?
- Does a positive molecular test always indicate an active infection? Why, or why not?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

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 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)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Task Number 79

Explain polymerase chain reaction (PCR) testing.

Definition

Explanation should include the concepts that PCR testing is a relatively quick procedure for analyzing deoxyribonucleic acid (DNA) without the need for cloning and that it is commonly used for diagnosing genetic diseases.

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?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

Task Number 80

Perform PCR testing.

Definition

Performance should include

- reagent preparation
- equipment preparation
- proper loading of the gel
- proper use of the PCR thermocycler.

Process/Skill Questions

- At what temperature does denaturization occur?
- What buffer is used in PCR testing?
- What is the principle of a thermocycler?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Health Professions Events

- Biomedical Laboratory Science

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?

Common Career Technical Core

HL5

Analyze the legal and ethical responsibilities, limitations and implications of actions within the healthcare workplace

HL6

Evaluate accepted ethical practices with respect to cultural, social and ethnic differences within the healthcare workplace.

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology
- Knowledge Test: Medical Law and Ethics
- Knowledge Test: Transcultural Health Care

Health Professions Events

- Biomedical Laboratory Science

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?

Common Career Technical Core

HL5
Analyze the legal and ethical responsibilities, limitations and implications of actions within the healthcare workplace
HL6
Evaluate accepted ethical practices with respect to cultural, social and ethnic differences within the healthcare workplace.

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology
- Knowledge Test: Medical Law and Ethics

Health Professions Events

- Biomedical Laboratory Science

Task Number 83

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

Definition

Description of employment-related tests and background checks in the medical technology field should include the types of tests and checks (e.g., certification tests, drug tests, background checks, laboratory competency tests) 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?
- Can potential biomedical employees legally be screened for past and/or present medical conditions? Why, or why not?
- How are healthcare patients protected by pre-employment tests for professional competency? By pre-employment background checks for barrier crimes?

HOSA Competitive Events (High School)

Health Professions Events

- Biomedical Laboratory Science

Leadership Events

- Interviewing Skills
- Job-Seeking Skills

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)
- government agency
- forensic laboratory
- education
- consulting services
- information technology (IT) field.

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 television affected the level of interest in medical technology careers?

Common Career Technical Core

HL1
Determine academic subject matter, in addition to high school graduation requirements, necessary for pursuing a health science career.

HOSA Competitive Events (High School)

Health Professions Events

- Biomedical Laboratory Science

Leadership Events

- Medical Photography

Teamwork Events

- Health Career Display

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)
- Nurse Practitioner 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?

Common Career Technical Core

HL1
Determine academic subject matter, in addition to high school graduation requirements, necessary for pursuing a health science career.

HOSA Competitive Events (High School)

Health Professions Events

- Biomedical Laboratory Science

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?

Common Career Technical Core

HL1
Determine academic subject matter, in addition to high school graduation requirements, necessary for pursuing a health science career.

HOSA Competitive Events (High School)

Health Professions Events

- Biomedical Laboratory Science

Task Number 87

Prepare and present a research project on a topic or question related to medical laboratory technology.

Definition

Project should meet the following minimum criteria:

- Project should be research-based.
- Focus and content of the project should be determined and/or approved by the teacher.
- Format of the project should include an electronic presentation or other visual enhancement.

- Project research and delivery should adhere to pertinent Standards of Learning for Virginia.

Process/Skill Questions

- What sources are available for research on topics or questions related to medical laboratory technology?
- What resources specifically address the chosen topic or question?
- What conclusions can be drawn from your research?
- How can your research methods and results be most effectively presented to others?
- How has the project enlightened or changed your thinking toward the subject?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Teamwork Events

- Medical Innovation

Describing the Opioid Crisis

Task Number 88

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 89

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 addiction?
- 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 90

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

- Medical Spelling
- Medical Terminology
- Knowledge Test: Pharmacology

Health Professions Events

- Clinical Nursing

Examining the Key Factors of Drug Addiction

Task Number 91

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 92

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
- Prescription Opioids: Even When Prescribed by a Doctor (video), Centers for Disease Control and Prevention (CDC)

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 93

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 94

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 95

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?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology
- Knowledge Test: Pharmacology

Understanding Pain Management Protocols

Task Number 96

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 97

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 98

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 99

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 100

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 101

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 102

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

- Clinical Nursing

Task Number 103

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*?

HOSA Competitive Events (High School)

Health Science Events

- Knowledge Test: Pharmacology

Health Professions Events

- Clinical Nursing

Task Number 104

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 105

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 106

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

Describe basic human anatomy and physiology in relation to hemostasis/coagulation.	English: 12.5
Interpret common abbreviations related to hemostasis/coagulation.	
Interpret basic medical laboratory terminology related to hemostasis/coagulation.	English: 12.3
Explain the concepts of hemostasis/coagulation.	English: 12.5
Explain the use of prothrombin time (PT) and activated partial thromboplastin time (APTT) testing.	English: 12.5
Explain the importance of point-of-care testing.	English: 12.5
Correlate abnormal hemostasis/coagulation laboratory results with disease processes.	
Describe basic human anatomy and physiology in relation to immunology/serology.	English: 12.5 Science: BIO.4
Interpret common abbreviations used in immunology/serology.	
Interpret basic medical laboratory terminology related to immunology/serology.	English: 12.5
Explain the host immune response to foreign substances.	English: 12.3, 12.5
Describe common serological tests.	English: 12.3, 12.5
Perform an enzyme immunoassay.	Science: BIO.1, BIO.2
Correlate abnormal immunological/serological laboratory results with disease processes.	History and Social Science: GOVT.1
Describe basic human anatomy and physiology in relation to microbiology.	English: 12.5

Interpret common abbreviations used in microbiology.	
Interpret basic medical laboratory terminology related to microbiology.	English: 12.5
Explain the importance of collection requirements for the various specimens used in microbiological studies.	English: 12.5
Perform microscopy and Gram stain preparation.	Science: BIO.1
Identify classifications of microorganisms based on cell wall structure.	English: 12.5 Science: BIO.3
Explain the concept of a pure and/or isolative culture.	English: 12.5
Perform inoculation of patient specimen.	
Perform isolation or subculture of microbes.	
Explain the basic concepts of antibiotics and their classes.	English: 12.5
Explain the concept of antibiotic susceptibility testing.	English: 12.5
Describe basic identification techniques used to differentiate bacteria.	English: 12.5
Explain the causes and significance of methicillin-resistant Staphylococcus aureus (MRSA) and other antibiotic-resistant organisms.	English: 12.5 Science: BIO.5
Explain the basic characteristics of the most common yeast/fungi encountered in the clinical lab.	English: 12.5 Science: BIO.4
Describe basic human anatomy and physiology in relation to immunohematology/transfusion.	
Interpret common abbreviations used in immunohematology/transfusion services.	
Interpret basic medical laboratory terminology related to immunohematology/transfusion services.	English: 12.5
Explain how each blood group is identified.	English: 12.5 Science: BIO.4
Perform or simulate an antigen and antibody reaction in transfusion medicine.	Science: BIO.4
Explain the various red blood cell components and derivatives used for transfusion.	English: 12.5
Explain compatibility testing of blood.	English: 12.5
Explain legal and medical ramifications of potential errors in immunohematology and transfusion services, as well as potential consequences.	English: 12.5
Describe basic human anatomy and physiology in relation to molecular diagnostics.	English: 12.5
Interpret common abbreviations used in molecular diagnostics.	
Interpret basic medical laboratory terminology related to molecular diagnostics.	English: 12.5
Explain the advantages, disadvantages, and uses of molecular diagnostics.	English: 12.5

	History and Social Science: GOVT.1
Explain polymerase chain reaction (PCR) testing.	English: 12.5 Science: BIO.5
Perform PCR testing.	Science: BIO.5
Explain the importance of a professional demeanor on the part of all healthcare professionals.	English: 12.5
Demonstrate the importance of confidentiality in the medical laboratory technology field.	History and Social Science: GOVT.3
Describe employment-related tests and background checks in the medical laboratory technology field.	English: 12.5 History and Social Science: GOVT.3
Research career paths in medical laboratory technology, to include the levels of education and job opportunities applicable within each pathway.	English: 12.5, 12.8 History and Social Science: GOVT.1
Describe credentialing in the medical laboratory technology profession.	English: 12.5
Explain the importance of professional development for medical laboratory technology professionals.	English: 12.5 History and Social Science: GOVT.1
Prepare and present a research project on a topic or question related to medical laboratory technology.	English: 12.1, 12.5, 12.6, 12.7, 12.8
Describe the history and current state of the opioid crisis in the United States.	English: 12.5
Describe the history and current state of the opioid crisis in Virginia.	English: 12.5, 12.8
Define the pharmacological components and common uses of opioids.	English: 12.3, 12.8
Examine the science of addiction.	English: 12.5
Explain prevention and early intervention strategies.	English: 12.5, 12.8
Identify addiction and its behavioral elements, as defined by the Diagnostic and Statistical Manual of Mental Disorders (DSM-5).	English: 12.5
Describe the treatment models of addiction therapy.	English: 12.5
Describe the medication management antidote used to prevent fatal opioid overdoses.	English: 12.5, 12.8
Explain the science of physiological and mental pain.	English: 12.3, 12.5
Describe the diagnostic tools used in developing pain management plans.	English: 12.5
Describe pain treatment options available to various populations of patients.	English: 12.5, 12.8
Describe the effects of opioid dependency on the human body systems.	English: 12.5
Explain the mechanism and physical effects of opioids on the human body.	English: 12.5

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.	English: 12.5
Describe the withdrawal and tapering side effects of opioid use.	English: 12.5
Describe storage and disposal options for opioids.	English: 12.5, 12.8
Explain community resources for education about opioid use.	English: 12.5
Describe key communication topics involving opioids for patients.	English: 12.5
Describe communication topics for caregivers and family members.	English: 12.5

Teaching Resources

Textbooks

Ehrlich, Ann, and Carol L. Schroeder. *Medical Terminology for Health Professions*. Clifton Park, NY: Delmar, 2005.

Estridge, Barbara H., and Anna P. Reynolds. *Basic Clinical Laboratory Techniques*. Clifton Park, NY: Delmar Thomson Learning, 2008.

Holmes, Deborah E. *Quick Reference for Health Care Providers*. Clifton Park, NY: Thomson Delmar Learning, 2005.

Marshall, Jacquelyn R. *The Clinical Laboratory Assistant/Phlebotomist*. Orange, CA: Career Publishing Inc., 2000.

Rizzo, Donald C. *Fundamentals of Anatomy and Physiology*. Clifton Park, NY: Thomson Delmar Learning, 2006.

Simmers, Louise. *Health Science Career Exploration*. Clifton Park, NY: Thomson Delmar Learning, 2004.

Simmers, Louise. *Diversified Health Occupations, 6th Edition.* Clifton Park, NY: Thomson Delmar Learning, 2004.

Simmers, Louise. *Teacher's Resource Kit to Accompany Diversified Health Occupations, 6th Edition.* Clifton Park, NY: Thomson Delmar Learning, 2004.

Other Textbooks

Garza, Diana and Kathleen Becan-McBride. *Phlebotomy Handbook Blood Collection Essentials, 7th Edition.* Upper Saddle River, NJ: Pearson Prentice Hall, 2005.

Turgeon, Mary Louise. *Linne & Ringsruds Clinical Laboratory Science, 5th Edition.* St. Louis, MO: Mosby, 2007.

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. Naloxone Fact Sheet (PDF).

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

Office of National Drug Control Policy, White House. Fentanyl: Safety Recommendations for First Responders (PDF).

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.*

- Biotechnology Foundations in Agricultural and Environmental Science (8085/36 weeks)
- Biotechnology Foundations in Health and Medical Sciences (8344/36 weeks)
- Biotechnology Foundations in Technology Education (8468/36 weeks)
- Medical Laboratory Technology I (8377/36 weeks)

Career Cluster: Health Science	
Pathway	**Occupations**
Biotechnology Research and Development	**Research Assistant**
Diagnostics Services	**Cardiovascular Technologist** **Medical, Clinical Laboratory Technician** **Phlebotomist** **Radiologic Technologist, Radiographer**
Health Informatics	**Epidemiologist** **Medical Assistant**
Therapeutic Services	**Pharmacy Technician**

Career Cluster: Science, Technology, Engineering and Mathematics	
Pathway	**Occupations**
Science and Mathematics	**Bioinformatics Technician**