

Medical Laboratory Technology I

8377 36 weeks

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Acknowledgments

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Course Description

Suggested Grade Level: 11 or 12

In Medical Laboratory Technology I, students gain foundational knowledge and skills appropriate for a variety of medical-related career paths in the field of medical technology. They are introduced to diagnostic and therapeutic laboratory procedures that support medical research and practice, and investigate safety, quality assurance, and ethical concerns associated with the field of medical technology.

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.

8377	Tasks/Competencies
Exploring Foundations in Medical Laboratory Technology	
+	Explain the evolving roles of laboratory technology in medicine.
+	Explain the importance of working within the scope of practice.
+	Demonstrate technical writing.
+	Explain the scientific method in context of course responsibilities.
+	Explain the importance of communication skills with other members of the healthcare team in medical laboratory technology.
+	Examine professional ethical standards for medical laboratory personnel.
+	Perform a best-practices literature review.
+	Describe government, industry, and professional regulatory bodies pertaining to medical laboratory technology.
+	Adhere to government, industry, and professional regulations pertaining to medical laboratory technology.
+	Explain the concept of determining reference ranges in medical laboratory testing.
+	Maintain laboratory records and documentation.
+	Follow facility policy and procedures in regard to specimen collection, processing, and analysis.
Maintaining a Safe Environment	
+	Explain the importance of and techniques for infection control and prevention.
+	Identify types of isolation.
+	Describe the role of the Occupational Safety and Health Administration (OSHA) and the National Fire Protection Association (NFPA) in laboratory safety standards.
+	Follow protocol and safety procedures.
+	Identify first-aid situations, supplies, personal protective measures, emergency protection areas, and actions of a first responder.
+	Identify common laboratory hazards.

8377	Tasks/Competencies
+	Demonstrate use of personal protective equipment (PPE).
+	Demonstrate use of safety data sheets (SDS).
+	Demonstrate procedures for handling and disposing of infectious and/or hazardous materials.
+	Maintain laboratory equipment, a clean work area, and a clean laboratory supply storage area.
Performing Basic Laboratory Skills	
+	Compare various forms and grades of water used in the laboratory.
+	Compare various grades of chemicals used in the laboratory, including their levels, qualities, and purposes.
+	Identify the parts of a compound microscope and explain their functions.
+	Practice aseptic techniques.
+	Perform mathematical calculations and conversions.
+	Demonstrate basic pipetting techniques.
+	Explain the process for making stock reagents and solutions.
+	Explain the importance of maintaining sterile reagents and equipment.
+	Maintain inventory of laboratory supplies.
+	Use basic weighing and measuring techniques.
+	Use the scientific method when performing research.
+	Identify routine equipment maintenance needs.
Maintaining Quality Assurance	
+	Explain the concepts of quality assurance and quality control as they relate to activities of the clinical laboratory.
+	Explain validation testing.
+	Perform statistical analysis of data.

8377	Tasks/Competencies
Understanding the Basics of Specimen Collection	
+	Describe basic human anatomy and physiology in relation to specimen collection.
+	Interpret common abbreviations used in phlebotomy.
+	Interpret basic medical laboratory terminology related to phlebotomy.
+	Explain the importance of accurate patient identification in specimen collection.
+	Demonstrate safe positioning of patients during venipuncture.
+	Demonstrate specimen collection procedures appropriate to the patient (e.g., ethnicity, age, medical status, culture).
+	Explain the order of the draw (for tubes).
+	Demonstrate blood collection, handling, and processing for venipuncture procedures.
Understanding the Basics of Urinalysis	
+	Interpret common abbreviations used in urinalysis.
+	Interpret basic medical laboratory terminology related to urinalysis.
+	Describe various collection methods.
+	Perform routine physical and chemical examination of urine.
+	Identify common microscopic constituents of sediment.
+	Interpret urinalysis test results.
Understanding the Basics of Hematology	
+	Explain the process of hematopoiesis.
+	Interpret common abbreviations used in hematology.
+	Interpret basic medical laboratory terminology related to hematology.
+	Explain the components of a complete blood count (CBC).
+	Explain point-of-care testing in relation to hematology.
+	Describe additional procedures in the hematology department.

8377	Tasks/Competencies
<input checked="" type="radio"/>	Explain peripheral blood-smear evaluation.
<input checked="" type="radio"/>	Perform a microhematocrit.
<input checked="" type="radio"/>	Interpret hematology test results.
Understanding the Basics of Body Chemistry	
<input checked="" type="radio"/>	Review basic human anatomy and physiology in relation to body chemistry.
<input checked="" type="radio"/>	Interpret common abbreviations used in body chemistry.
<input checked="" type="radio"/>	Interpret basic medical laboratory terminology related to body chemistry.
<input checked="" type="radio"/>	Identify natural chemical components of the human body.
<input checked="" type="radio"/>	Explain point-of-care testing in relation to body chemistry.
<input checked="" type="radio"/>	Explain the theory behind performing routine clinical chemistry procedures.
<input checked="" type="radio"/>	Interpret body chemistry test results.
<input checked="" type="radio"/>	Explain how chemistry instrumentation affects specimen testing.
<input checked="" type="radio"/>	Present an overview of instrumentation methodology.

Legend: Essential Non-essential Omitted

Curriculum Framework

Exploring Foundations in Medical Laboratory Technology

Task Number 39

Explain the evolving roles of laboratory technology in medicine.

Definition

Explanation may include

- important figures in the history of laboratory testing (e.g., Hippocrates, Antonie van Leeuwenhoek, James Watson, Francis Crick) and the contributions of each
- manual vs. automated methods of laboratory testing in recent medical laboratory practice
- the growing role of laboratory testing in diagnosis
- the increasing number of job opportunities
- the increasing usage of molecular diagnostics
- the departmentalization of a clinical laboratory
- the structures of a healthcare organization
- the various categories of personnel in the clinical laboratory
- the uses of various sites for laboratory testing (e.g., central laboratory, point of care, physician's office, reference laboratory)
- the cause and effect on healthcare system change based on the influence of technology, epidemiology, bio-ethics, socio-economics, and various forms of complementary (non-traditional) medicine.

Process/Skill Questions

- What roles did the early pioneers of science play in the development of laboratory technology? To what extent do the contributions of each pioneer still influence the medical laboratory technology field?
- How are manual and automated laboratory methods similar? How are they different? Is there a place for both methods in today's laboratory? Explain.
- How does the addition of molecular diagnostics contribute to the medical laboratory field?

Task Number 40

Explain the importance of working within the scope of practice.

Definition

Explanation should reflect an understanding of

- the concept of scope of practice

- the people and organizations that define scope of practice (e.g., accrediting agencies, employers)
- the legal and ethical ramifications of working outside one’s scope of practice
- the [Clinical Laboratory Improvement Amendments](#) (CLIA).

Process/Skill Questions

- How is *scope of practice* typically defined in laboratory activities?
- How can medical laboratory professionals determine their applicable scope of practice?
- What are the potential consequences to the patient and to the employee/employer when a medical laboratory professional works outside his or her scope of practice?

Common Career Technical Core

HL2

Explain the healthcare worker’s role within their department, their organization, and the overall healthcare system.

Task Number 41

Demonstrate technical writing.

Definition

Demonstration should include writing that is accurate, easily legible, succinct, and understandable, and that conforms to scientific or technical procedures in the medical environment. A template may be used.

Process/Skill Questions

- Why is important to use a template when writing laboratory procedures?
- Why is it important to follow proper citation formatting in journal/research articles?
- Why is effective documentation of instrument troubleshooting important in the medical laboratory?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Leadership Events

- Extemporaneous Writing
-

Task Number 42

Explain the scientific method in context of course responsibilities.

Definition

Explanation should include the steps of the scientific method:

- State the problem.
- Formulate a hypothesis.
- Design the research methodology.
- Conduct the experiment.
- Collect and analyze resulting data.
- Draw conclusions and implications.
- Validate the data and conclusions.
- Present conclusions in a report or in graphic form.

Process/Skill Questions

- How is the scientific method used by medical laboratory professionals?
- What is a controlled experiment? Why are controlled experiments essential to scientific research?
- Why is validation an essential step of the scientific method?

HOSA Competitive Events (High School)

Teamwork Events

- Health Education
 - HOSA Bowl
-

Task Number 43

Explain the importance of communication skills with other members of the healthcare team in medical laboratory technology.

Definition

Explanation should include the importance of and techniques for exchanging diagnostic and other information with the appropriate departments and other professionals by

- conveying information in a clear, accurate, concise, and timely manner
- applying active listening skills by using reflection, restatement, and clarification
- demonstrating courtesy to others
- using and interpreting verbal and nonverbal behaviors to enhance communication within scope of practice.

Process/Skill Questions

- What communication skills are the most important when a medical laboratory professional interacts with a patient? Why?
- How can communication barriers result in patient error?
- How can insufficient communication between coworkers result in laboratory error?
- Why is sensitivity to cultural diversity essential to good patient communication?
- What is the purpose of using universal abbreviations in the medical field?
- What are the possible drawbacks of using medical abbreviations when communicating with patients? Coworkers? Physicians?

Common Career Technical Core

HL-THR2

Communicate patient/client information among healthcare team members to facilitate a team approach to patient care.

Task Number 44

Examine professional ethical standards for medical laboratory personnel.

Definition

Examination should include an analysis of the profession's position on current medical ethical issues (e.g., stem-cell research, cloning, patient privacy, social issues, genetic/protein engineering).

Examination should also include analysis of the [Presidential Commission for the Study of Bioethical Issues](#).

Process/Skill Questions

- What similarities exist between U.S. government bioethical regulations and bioethical regulations in other countries? What differences exist?
- What role does the Health Insurance Portability and Accountability Act (HIPAA) play in protecting patient confidentiality?
- How is public opinion shaping current ethical policy for medical laboratory technology?
- What effects might current biotechnical research have on future generations?

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.

Task Number 45

Perform a best-practices literature review.

Definition

Performing a best-practices literature review should include

- analyzing government regulations that pertain to laboratory safety
- identifying legal ramifications of patient or specimen misidentification
- researching [Certification Commission for Health Information Technology](#) (CCHIT) pertaining to best practices.

Process/Skill Questions

- What is the importance of the publication date of sources?
- If a laboratory instrument manufacturer publishes an article on its product, what are possible issues regarding the validity of the information?
- How is it possible to determine the validity of a resource? Why are some online sites more reputable than others?

Common Career Technical Core

HL4

Evaluate the roles and responsibilities of individual members as part of the healthcare team and explain their role in promoting the delivery of quality health care.

Task Number 46

Describe government, industry, and professional regulatory bodies pertaining to medical laboratory technology.

Definition

Description should include the following sources of medical laboratory technology regulations:

- [Clinical Laboratory Improvement Amendments](#) (CLIA)
- [Occupational Safety and Health Administration](#) (OSHA)
- [Health Insurance Portability and Accountability Act](#) (HIPAA)
- [U.S. Food and Drug Administration](#) (FDA)
- [Clinical and Laboratory Standards Institute](#) (CLSI)
- [College of American Pathologists](#) (CAP)
- [National Fire Protection Association](#) (NFPA)
- [The Joint Commission](#) (TJC)
- [Centers for Medicare and Medicaid Services](#) (CMS)
- [Commission on Office Laboratory Accreditation](#) (COLA)

Description should also include a brief description of CLIA 88 regulations and the classifications of laboratory testing by complexity of the test (waived, moderately complex, highly complex, or provider-performed microscopy).

Process/Skill Questions

- What penalties can result from violating HIPAA? Why is confidentiality a serious issue in the medical field?
- What penalties can result from breaching OSHA safety standards? Why is workplace safety regulated in the medical field?
- Who determines the standard method for laboratory testing? Why are standard methods important in laboratory testing?
- What are the differences between waived and nonwaived tests?

Common Career Technical Core

HL5

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

Task Number 47

Adhere to government, industry, and professional regulations pertaining to medical laboratory technology.

Definition

Adherence should include abiding by relevant federal, state, local, industry, and professional regulations related to proficiency testing, competency assessment, and inspection standards.

Process/Skill Questions

- What is proficiency testing? Why is it useful for medical laboratories?
- How does a medical laboratory ensure the competence of its laboratory professionals?
- What happens if a facility fails to meet CLIA regulations during an inspection?
- What are analytical and non-analytical factors in quality assessment? Explain.

Common Career Technical Core

HL5

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

Task Number 48

Explain the concept of determining reference ranges in medical laboratory testing.

Definition

Explanation should include that

- reference ranges are determined by statistical calculations based on a large cross section of the population
- results outside the reference range suggest possible disease states
- reference ranges vary based on the methodology used.

Process/Skill Questions

- Why are reference range calculations important in disease diagnosis?

- How are reference ranges determined?
- Is it possible for a person to have a reference value on a laboratory test and still be ill? Why, or why not?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
 - Medical Terminology
-

Task Number 49

Maintain laboratory records and documentation.

Definition

Maintenance should be performed on records and documentation associated with blood-banking, microbiology, research, patient laboratory results, and other laboratory-related responsibilities.

Process/Skill Questions

- Why must medical records be organized? Why must they be kept current?
- Why is a medical record considered a legal document? Why is it important for medical laboratory professionals to understand the legal nature of medical records?
- If medical records are inaccurate, what are the potential ramifications for the patient? The employee? The employer?

Common Career Technical Core

HL-THR2

Communicate patient/client information among healthcare team members to facilitate a team approach to patient care.

HL-THR3

Utilize processes for assessing, monitoring and reporting patient's/clients' health status to the treatment team within protocol and scope of practice.

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Task Number 50

Follow facility policy and procedures in regard to specimen collection, processing, and analysis.

Definition

Following policy and procedures should include

- prioritizing tasks
- prioritizing patient specimens according to medical necessity.

Process/Skill Questions

- Why would a medical laboratory technician need to run a stat test prior to a routine test?
- How would a specimen be tracked from collection to processing?
- How can accuracy be maintained when multitasking is required?
- How can a technician's time-management skills affect his or her coworkers?

Common Career Technical Core

HL-THR2

Communicate patient/client information among healthcare team members to facilitate a team approach to patient care.

HL-THR3

Utilize processes for assessing, monitoring and reporting patient's/clients' health status to the treatment team within protocol and scope of practice.

HOSA Competitive Events (High School)

Teamwork Events

- Creative Problem Solving

Maintaining a Safe Environment

Task Number 51

Explain the importance of and techniques for infection control and prevention.

Definition

Explanation should include

- ways that infection is spread (e.g., droplet, direct contact, airborne, bloodborne)
- techniques to prevent the spread of infection (e.g., washing hands; keeping hands off face, eyes, ears, nose, and mouth; wearing gloves)
- protective technologies for infection control (e.g., cap piercing, safety devices on needles, disposable gowns).

Process/Skill Questions

- Why is infection control and prevention critical in the hospital setting?
- What are the components in the chain of infection? How can the cycle be broken?
- What personal protective equipment (PPE) is needed for performing blood tests? Why?
- How does standard PPE differ from high-risk PPE (e.g., as needed for the Ebola virus, tuberculosis)?
- What are biosafety levels 1-4?

Common Career Technical Core

HL3

Identify existing and potential hazards to clients, coworkers, visitors, and self in the healthcare workplace.

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Teamwork Events

- Health Education
- HOSA Bowl

Task Number 52

Identify types of isolation.

Definition

Identification should include the primary types of isolation and their purposes, which are

- isolation for infections spread by airborne transmission (e.g., chicken pox, measles, smallpox, tuberculosis)
- isolation for infections transmitted by direct contact or indirect contact (e.g., influenza, conjunctivitis)
- isolation for infections spread by droplet transmission through coughing, sneezing, or talking (e.g., respiratory infections).

Identification should also include the concept that isolation is sometimes needed for the patient and sometimes for the healthcare provider (i.e., reverse isolation).

Process/Skill Questions

- What are the consequences of not following the correct procedures for isolation?
- What are the consequences of not following the correct procedures for reverse isolation?
- Beyond routine PPE, what additional procedures must be followed with a patient in airborne isolation? In tuberculosis isolation (e.g., fit testing)?

Common Career Technical Core

HL3

Identify existing and potential hazards to clients, coworkers, visitors, and self in the healthcare workplace.

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Teamwork Events

- Health Education
- HOSA Bowl

Task Number 53

Describe the role of the Occupational Safety and Health Administration (OSHA) and the National Fire Protection Association (NFPA) in laboratory safety standards.

Definition

Description should include the job-safety regulations established by OSHA for workers and the fire-protection and chemical-exposure regulations established by NFPA.

Process/Skill Questions

- What does the NFPA diamond symbol indicate about a chemical?
- What does OSHA do to protect the safety of employees? The safety of visitors to a workplace site?
- If an OSHA inspector observes a laboratory technician testing blood without the use of gloves, what consequences may result?
- What are the components of the OSHA-mandated plans for chemical hygiene and occupational exposure to bloodborne pathogens?

Common Career Technical Core

HL5

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

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Teamwork Events

- Health Education
- HOSA Bowl

Task Number 54

Follow protocol and safety procedures.

Definition

Following protocol and safety procedures should include using methods or techniques in an industry-approved, safe manner and should reflect an understanding of the following concepts:

- OSHA laboratory-safety regulations
- NFPA chemical-exposure regulations
- Protocols are detailed plans for carrying out a specific process (e.g., assessment of patient's health status).
- Standard operating procedures (SOPs) are step-by-step instructions for conducting tests and experiments or for performing other practices, using prescribed methods or techniques

Process/Skill Questions

- How do protocols and SOPs differ?
- Why do certain industry or government protocols exist in the laboratory setting?
- What dangers may exist if a laboratory technician does not follow SOPs or protocols?

Common Career Technical Core

HL5

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

Task Number 55

Identify first-aid situations, supplies, personal protective measures, emergency protection areas, and actions of a first responder.

Definition

Identification should include

- emergency situations requiring first aid, such as cuts, burns, and other injuries from biological and chemical spills or inhalation of chemicals
- equipment and supplies required to handle simple emergency situations, such as those listed above
- eye-wash stations, showers, hoods, and equipment needed for personal protection
- appropriate initial action plan, including use of safety data sheets (SDS), for a team responding to a simple emergency situation.

Process/Skill Questions

- How does one locate information on safety and first-aid procedures?
- Why must medical laboratory professionals be familiar with first-aid procedures?
- What are emergency protection safety stations? Why are they important in laboratory settings?
- What are the types of fire extinguishers? How is each type used within the lab?

Common Career Technical Core

HL3

Identify existing and potential hazards to clients, coworkers, visitors, and self in the healthcare workplace.

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Teamwork Events

- Health Education
- HOSA Bowl

Emergency Preparedness Events

- Life Support Skills

Task Number 56

Identify common laboratory hazards.

Definition

Identification should include the hazardous properties (e.g., corrosiveness, flammability) and safe use of the following, according to SDS information, manufacturer cautions, laboratory SOPs, and OSHA regulations:

- Hazardous biological materials
- Hazardous chemical materials, such as acids, bases, and other reagents

- Other potential sources of danger in the workplace, such as electricity, heat, and glassware

Process/Skill Questions

- How does communication play a role in identifying and preventing injury from common laboratory hazards? How can a medical laboratory worker reduce the risk of common laboratory hazards?
- What workplace hazards are particularly associated with medical laboratories?
- Why is following SOPs and approved laboratory methods essential to the prevention of injury from laboratory hazards?

Common Career Technical Core

HL3

Identify existing and potential hazards to clients, coworkers, visitors, and self in the healthcare workplace.

Task Number 57

Demonstrate use of personal protective equipment (PPE).

Definition

Demonstration should include the appropriate application, use, removal, and disposal of the following:

- Gloves
- Lab coats/aprons/gowns
- Glasses/goggles/splash guards (shields)
- Masks
- Hood
- Other PPE used in medical laboratory settings

Process/Skill Questions

- What is the importance of wearing PPE?
- How can wearing appropriate PPE reduce the risk of contamination or injury?
- What penalties might an employee face if PPE is not worn or is used inappropriately? Why?
- How do PPE or protective devices protect the laboratory worker? How do they protect the experiment or test?

Task Number 58

Demonstrate use of safety data sheets (SDS).

Definition

Demonstration should include

- explaining the nature and purpose of an [SDS](#) (i.e., a manufacturer-prepared document that describes a product, identifies its potential hazards, and provides measures for preventing and responding to misuse and accidents involving the product)
- explaining the various sections of an SDS (i.e., product identification data, ingredients, and potential hazards; first-aid, firefighting, and accidental release measures; precautions for handling, storage, transport, and disposal; and other information related to safe use of the product and protection in the case of hazardous exposure)
- using an SDS in a given laboratory setting.

Process/Skill Questions

- What is a safety data sheet? Why are these sheets important?
- What are the required sections of any safety data sheet? How does each of these sections aid the user?
- Where are safety data sheets found? Why?

Task Number 59

Demonstrate procedures for handling and disposing of infectious and/or hazardous materials.

Definition

Demonstration should include explaining the chain of infection and PPE and following procedures for the following:

- Aseptic technique
- Cleanup
- Disposal of waste materials
- Receptacles for disposal (e.g., sharps containers, containers for biohazards vs. regular trash)

Process/Skill Questions

- Why are aseptic rules important to the field of medical laboratory technology?

- What are the specific rules and procedures involved in asepsis, as it relates to specimen collection?
- What are the rules for handling, cleaning up, and disposing of infectious and/or hazardous materials?

Common Career Technical Core

HL3

Identify existing and potential hazards to clients, coworkers, visitors, and self in the healthcare workplace.

Task Number 60

Maintain laboratory equipment, a clean work area, and a clean laboratory supply storage area.

Definition

Maintenance should include

- keeping the equipment clean, in good condition, and in good repair
- explaining proper sanitation and disinfection of work area and laboratory supplies
- adhering to laboratory prohibitions (e.g., no eating, no drinking, no applying makeup, no putting on contacts or lip balm, no gum chewing, no neglect of personal hygiene)
- attending to inventory control
- following industry guidelines and regulations
- identifying precautions to prevent contamination of apparatus, work surfaces, self, others, and other elements of the medical laboratory environment.

Process/Skill Questions

- Why is it important to keep the medical laboratory equipment clean?
- Why is it important to keep the medical laboratory equipment in good repair and condition?
- Why are safety and cleanliness essential in a medical laboratory environment?

Performing Basic Laboratory Skills

Task Number 61

Compare various forms and grades of water used in the laboratory.

Definition

Comparison should include the following types or grades of water:

- Deionized
- Distilled
- Sterile
- Type I
- Type II
- Type III

Process/Skill Questions

- What is the process used to prepare deionized water?
 - What tests use distilled water? Deionized water?
-

Task Number 62

Compare various grades of chemicals used in the laboratory, including their levels, qualities, and purposes.

Definition

Comparison should include

- analytical reagent grade
- chemically pure grade
- stock.

Process/Skill Questions

- Which procedures would use an analytical reagent vs. a chemically pure grade chemical?
- Why is it important to know the outdate of the reagent?
- When is it appropriate to substitute one grade of reagent for another? Explain.

Task Number 63

Identify the parts of a compound microscope and explain their functions.

Definition

Identification of parts should include

- aperture iris diaphragm
- body tube
- condenser
- eyepiece (ocular)
- nosepiece
- numerical aperture
- interpupillary distance.

Identification of functions should include

- field diaphragm
- high-power objective
- low-power objective
- oil-immersion objective.

Process/Skill Questions

- How is a diopter adjustment performed?
- What is the focal length?
- What is the interpupillary distance?
- What is the difference between magnification and resolution?
- What is meant by the term *parfocal* and how is it used in microscopy?
- What does the term *alignment* mean?
- How is a microscope aligned?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Teamwork Events

- HOSA Bowl

Task Number 64

Practice aseptic techniques.

Definition

Practicing aseptic techniques should include demonstration of

- aseptic hand washing
- cleaning, sterilizing, and disinfecting workstation
- protecting reagents and equipment from contamination
- disposing of waste materials
- making use of good laboratory practice (GLP) in all laboratory work.

Process/Skill Questions

- What is meant by good laboratory practice?
- Why is the practice of aseptic techniques important in the medical laboratory?
- What precautions must be taken while handling infectious microbiology specimens?
- What are the aseptic techniques used in collection of specimens?

Common Career Technical Core

HL3

Identify existing and potential hazards to clients, coworkers, visitors, and self in the healthcare workplace.

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Teamwork Events

- Health Education
- HOSA Bowl

Task Number 65

Perform mathematical calculations and conversions.

Definition

Performance should demonstrate knowledge of

- number concepts (e.g., integers; rational numbers; decimals, percentages, and their equivalent rational numbers)
- metric system and metric conversions (e.g., milliliters to microliters)
- ratios and proportions
- dilution concentration calculations (e.g., solution concentrations)
- graphing and interpretation of graphs and statistical data
- scientific notation
- data manipulation and presentation
- computer software applications (e.g., using data spreadsheets, graphing software)
- statistics (e.g., sampling, sample size, mean and mode, standard deviation, normal and bimodal, statistical significance).

Process/Skill Questions

- How might a medical laboratory technician use ratios and proportions in the laboratory? How might he or she use graphing? Statistics?
- Why is the metric system the system of choice in medical laboratories?
- In what circumstances might a medical laboratory technician need to perform mathematical operations, using spreadsheet software? Database software?
- What could be the potential impact on a test or experiment if a medical laboratory technician does not have strong mathematical skills?

HOSA Competitive Events (High School)

Health Science Events

- Medical Math
-

Task Number 66

Demonstrate basic pipetting techniques.

Definition

Demonstration should include basic pipetting techniques, using autodelivery, volumetric, and transfer pipettes.

The Virginia Department of Education mandates *no* oral pipetting in any laboratory or clinical setting.

Process/Skill Questions

- How is the principle of air displacement used in pipetting?
- How do air bubbles affect the accuracy of volume when pipetting?
- Why is selection of the appropriate pipette important in the delivery of fluid?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Teamwork Events

- Health Education
-

Task Number 67

Explain the process for making stock reagents and solutions.

Definition

Explanation should include the steps for weighing and measuring, as well as the importance of accuracy, precision, and record keeping in the process.

Explanation should incorporate the concepts of normality and molarity, as well as dilution techniques and the purpose of reagents.

Process/Skill Questions

- What could be the result of improper measurements when diluting calibration material?
- What dilution techniques are commonly used when mixing reagents and solutions?
- What is the procedure for weighing and measuring when making stock reagents and solutions?
- Why is it important to include a mix date on solutions and reagents?
- What type of record keeping is used when making reagents and solutions? Why is record keeping important when making reagents and solutions?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Teamwork Events

- Health Education
-

Task Number 68

Explain the importance of maintaining sterile reagents and equipment.

Definition

Explanation should include the importance of using an autoclave and/or chemical disinfection to maintain sterile conditions. It should also cite the need for strict adherence to manufacturers' instructions for all devices, as well as emphasize the importance of checking for contamination of reagents and/or equipment.

Process/Skill Questions

- Why is it important for a medical laboratory professional to clean his or her work area?
- Which sterilization methods should be used for agar preparation?
- What are the steps for the various sterilization methods?
- What safety measures must be taken with steam sterilization equipment? Why?

Task Number 69

Maintain inventory of laboratory supplies.

Definition

Maintaining inventory of laboratory supplies should include

- regularly inspecting and rotating inventory
- labeling inventory correctly
- ensuring adequate supplies
- ensuring appropriate storage conditions, testing, and validation
- conducting a complete inventory of supplies on a specified schedule (e.g., annually).

Process/Skill Questions

- What are the most common considerations when conducting an inventory of laboratory supplies? Why is each important?
 - What are the possible consequences of not maintaining adequate inventory of laboratory supplies?
 - What is the relationship between inventory control and quality control?
-

Task Number 70

Use basic weighing and measuring techniques.

Definition

Use of basic techniques should include

- selecting appropriate equipment (e.g., scales, balances, graduated cylinders, pipettes) to accurately determine weight and measurement of materials
- explaining the concepts of molarity and molality
- explaining the concept of solution concentration and its relationship to measurement
- consulting tables or using formulas to convert between metric and English measuring systems.

Process/Skill Questions

- How should one measure a small amount of a powdered material in a medical laboratory setting?
- Why is it important to measure accurately when mixing solutions?
- Why should a medical laboratory professional record his or her measurements and label mixtures?
- What could happen if some of a medical laboratory professional's measurements were in the English system and some of them were metric? Why is it important for measurements to be consistent?

HOSA Competitive Events (High School)

Health Science Events

- Medical Math
-

Task Number 71

Use the scientific method when performing research.

Definition

Use of the scientific method should include the following steps:

- State the problem.
- Formulate a hypothesis.
- Design the research methodology.
- Conduct the experiment.
- Collect and analyze the data.
- Draw conclusions and implications.
- Validate the data and conclusions.
- Present conclusions in a report or in graphic form.

Process/Skill Questions

- What is the difference between a hypothesis and a theory?
- Why is it important to use a standardized method of research?
- Why is it important to keep detailed notes when performing research?
- What are some common guidelines used in collecting data?
- What are common sources of error in scientific research?

HOSA Competitive Events (High School)

Leadership Events

- Researched Persuasive Speaking

Teamwork Events

- HOSA Bowl

Task Number 72

Identify routine equipment maintenance needs.

Definition

Identification should include

- explaining the basic operating principles of the most common equipment used in medical laboratory work
- following manufacturers' recommended cleaning and preventive maintenance procedures
- contacting manufacturer representative in the case of more complex maintenance
- updating existing equipment as needed
- reporting the need for repair or replacement of faulty equipment.

Process/Skill Questions

- Why is maintenance important in the operation of laboratory equipment?
 - How could test results be affected by improperly maintained equipment?
 - What resources would a medical laboratory technician use to perform routine equipment maintenance?
 - What safety precautions must be taken when performing routine equipment maintenance?
-

Maintaining Quality Assurance

Task Number 73

Explain the concepts of quality assurance and quality control as they relate to activities of the clinical laboratory.

Definition

Explanation should include the following:

- Discuss how local, state, and federal regulations require the implementation of quality-assessment programs.
- Discuss professional organizations' implementation of regulations.
- Identify the components of quality assurance through the use of control samples, quality-control ranges, and quality-control charts.
 - Verification of equipment operation
 - Verification of test results

Process/Skill Questions

- How does quality assurance affect daily life in the medical laboratory?
- Why is quality assurance critical in the medical laboratory technology field?

- How are quality assurance and quality control different? How do they complement each other?
- What is the importance of troubleshooting failed quality-control results before releasing final patient results?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Teamwork Events

- Health Education
- HOSA Bowl

Task Number 74

Explain validation testing.

Definition

Explanation should emphasize that validation testing consists of an ongoing demonstration of specific laboratory skills, such as

- identifying relevant laboratory equipment
- describing and demonstrating how and when to use the equipment.

As related to chemistry and hematology analyzers, validation testing should

- ensure the instrument is accurate and precise
- include establishing a normal reference range according to patient information
- include a linearity study against known standards
- include correlating instrument to instrument.

Process/Skill Questions

- What is the importance of performing ongoing validation testing?
- What are the potential effects if ongoing validation testing is not performed?
- What validation testing is required when changing from one instrument or kit to another in the laboratory?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Teamwork Events

- Health Education
-

Task Number 75

Perform statistical analysis of data.

Definition

Performing statistical analysis of data should include

- using mean, median, and/or mode to analyze data sets and describe patterns and departures from patterns
- presenting data in a graphical display (e.g., dot plot, histogram)
- demonstrating a basic understanding of trending, basic high and low values of controls, and Levey-Jennings quality-control charts.

Process/Skill Questions

- What is meant by the terms *mean*, *median*, and *mode*? How might the calculation of mean, median, and mode provide useful data in a medical laboratory analysis?
- What is standard deviation? In what types of situations might standard deviation provide useful biomedical laboratory data?
- What are some examples of conclusions that may be drawn from the statistical analysis of medical laboratory data?
- How can information from statistical analysis produce incorrect conclusions?

HOSA Competitive Events (High School)

Health Science Events

- Medical Math
-

Understanding the Basics of Specimen Collection

Task Number 76

Describe basic human anatomy and physiology in relation to specimen collection.

Definition

Description should include planes of the body and the structure and function of the following body systems:

- Circulatory
- Digestive
- Endocrine
- Gastrointestinal
- Integumentary
- Lymphatic
- Muscular
- Nervous
- Reproductive
- Respiratory
- Skeletal
- Urinary

Process/Skill Questions

- Why is it important for a medical laboratory professional to understand the planes of the body?
- Why is it often said that the integumentary system is the body's first line of defense? How does this concept relate to medical laboratory technology?
- What are the purposes of red blood cells? White blood cells? Platelets?
- How does the blood travel through the body?
- What component of a red cell helps maintain the blood-oxygen level?
- How do blood tests help diagnose certain conditions or diseases?
- 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 77

Interpret common abbreviations used in phlebotomy.

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 included in a BMP?
- What is EDTA?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
 - Medical Terminology
-

Task Number 78

Interpret basic medical laboratory terminology related to phlebotomy.

Definition

Interpretation should include terminology such as

- *hematoma*
- *lumen*
- *palpate*
- *cephalic vein*
- *lancet and capillary tube.*

Process/Skill Questions

- What is a tourniquet?
- What is venipuncture?
- What is a vacutainer?
- What is the venipuncture procedure for a patient with a mastectomy?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Teamwork Events

- HOSA Bowl

Task Number 79

Explain the importance of accurate patient identification in specimen collection.

Definition

Explanation should include the prevention of patient injuries or fatalities due to incorrect patient identification. It should also include the concept that most laboratory errors are the result of misidentification and that there are relevant medical and legal issues related to misidentification.

Process/Skill Questions

- What are the ramifications of incorrect patient identification?
- What forms of patient identification are acceptable in laboratory collection? Why?
- What steps can be taken to reduce patient identification errors?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
 - Medical Terminology
-

Task Number 80

Demonstrate safe positioning of patients during venipuncture.

Definition

Demonstration should include

- assessing patient status
- evaluating potential hazards to patient
- choosing and applying appropriate transport methods
- choosing and applying appropriate transfer methods
- modifying positioning to accommodate patient status
- practicing preventive measures for disease transmission during equipment use
- applying appropriate principles of body mechanics without injury to the patient or self
- focusing on the maintenance of patient well-being at all times
- using appropriate patient interaction skills during specimen collection.

Process/Skill Questions

- What injuries might a patient sustain in the event of syncope? How can such injuries be prevented?
- What is the effect on blood circulation if a patient's arm is elevated during collection? Why is this important in venipuncture?
- Why is the positioning of patients important during venipuncture?
- What communication techniques can be applied to reduce patient anxiety?

Common Career Technical Core

HL3

Identify existing and potential hazards to clients, coworkers, visitors, and self in the healthcare workplace.

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
 - Medical Terminology
-

Task Number 81

Demonstrate specimen collection procedures appropriate to the patient (e.g., ethnicity, age, medical status, culture).

Definition

Demonstration should include

- equipment preparation
- patient identification
- patient preparation
- venipuncture or capillary collection
- labeling
- determination of preanalytical variables
- adherence to standard precautions.

Process/Skill Questions

- Why do technicians have patients pump a fist during specimen collection?
- What effect would drawing above an intravenous line (IV) have on test results?
- How would warming the venipuncture site affect capillary blood flow?
- What are the results of improperly mixing blood specimens?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Teamwork Events

- Health Education
 - HOSA Bowl
-

Task Number 82

Explain the order of the draw (for tubes).

Definition

Explanation should address the risk of additive carryover and include the proper current sequence of tube collection. It should include the differences among collection methods (e.g., syringe vs. multiple sample vs. capillary collection), as well as the differences among capillary tubes (e.g., blue-top, red-top, purple-top or EDTA tube).

Process/Skill Questions

- Why is it important to fill the light-blue top first in coagulation testing?
- What potential erroneous results may be seen as a result of drawing an ethylenediaminetetraacetic acid (EDTA, or purple) tube prior to a red-top tube?
- Why is a lavender microtainer collected before all others in a capillary collection?

HOSA Competitive Events (High School)

Health Science Events

- Medical Terminology
-

Task Number 83

Demonstrate blood collection, handling, and processing for venipuncture procedures.

Definition

Demonstration should include the tube choice and venipuncture procedures for serum vs. plasma vs. whole blood, to include centrifuge operation and specimen aliquoting.

Process/Skill Questions

- Which tubes result in the formation of serum? Of plasma?
- What is the role of fibrinogen in the determination of serum or plasma?
- What is the significance of correctly labeling an aliquot?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Teamwork Events

- Health Education

Understanding the Basics of Urinalysis

Task Number 84

Interpret common abbreviations used in urinalysis.

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 included in a U/A or UA?
- What is GFR?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Task Number 85

Interpret basic medical laboratory terminology related to urinalysis.

Definition

Interpretation should include terminology such as

- *amorphous*
- *casts*
- *hematuria*
- *proteinuria*
- *urochrome*
- *refractometer.*

Process/Skill Questions

- What is the significance of ketones in the urine?
- What is the causative agent of bilirubinuria?
- What is most important during a 24-hour urine specimen collection?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Teamwork Events

- HOSA Bowl

Task Number 86

Describe various collection methods.

Definition

Description should include methods of collection such as

- supra-pubic
- mid-stream
- catheterized
- pediatric collection bags
- chain of custody.

Description should also include the importance of using a label preprinted with patient identification data and should identify the reason that labels must include date, time, source, and method of collection.

Process/Skill Questions

- What is the correct collection procedure for a mid-stream urine sample?
- Why would a medical laboratory professional not use a diaper in an infant urine collection?
- What is the importance of a catheterized specimen in determining a urinary tract infection?
- What is the significance of identifying the correct collection time when interpreting patient results?
- How should a medical laboratory technician handle a urine specimen that is unlabeled?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Teamwork Events

- Health Education
 - HOSA Bowl
-

Task Number 87

Perform routine physical and chemical examination of urine.

Definition

Performance should include the three main components:

- Chemical examination of urine, using dip sticks (i.e., reagent strips) to determine the presence of glucose, blood (i.e., red cells, white cells), protein, and other substances/parameters
- Physical examination of urine, to include color, turbidity, and other characteristics
- Microscopic examination of urine, to include casts, cells, crystals, and other constituents

Process/Skill Questions

- What is the significance of turbidity in a urine sample?
- What reaction on a test strip indicates the presence of leukocytes? Why is the presence of leukocytes significant?
- What changes occur in a urine sample that is left at room temperature? Why? How does this affect test validity?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Teamwork Events

- Health Education

Task Number 88

Identify common microscopic constituents of sediment.

Definition

Identification should include constituents such as

- white cells
- red cells
- casts
- bacteria
- yeast
- epithelial cells
- crystals.

Process/Skill Questions

- In what pH should calcium oxalate crystals be found? Why is this phenomenon important?
- What does the type of epithelial cell show about its origin in the urinary tract?
- What does the presence of casts indicate in a patient?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Teamwork Events

- Health Education
-

Task Number 89

Interpret urinalysis test results.

Definition

Interpretation should include linking abnormal laboratory results with disease processes (e.g., diabetes, infection, substance abuse).

Process/Skill Questions

- What does the presence of glucose in the urine indicate about a patient?
- What does the presence of neutrophils in the urine indicate about a patient?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
 - Medical Terminology
 - Knowledge Test: Pathophysiology
-

Understanding the Basics of Hematology

Task Number 90

Explain the process of hematopoiesis.

Definition

Explanation should include the formation of erythrocytes, leukocytes, and thrombocytes.

Process/Skill Questions

- What is the hematopoietic stem cell?
- What is a megakaryocyte?
- What is the precursor to a plasma cell?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Teamwork Events

- HOSA Bowl
-

Task Number 91

Interpret common abbreviations used in hematology.

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 are the components of a CBC? WBC? RBC?
- What is an ESR?
- What is a PMN?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
 - Medical Terminology
-

Task Number 92

Interpret basic medical laboratory terminology related to hematology.

Definition

Interpretation should include terminology such as

- *megakaryocyte*
- *thrombocyte*
- *hemopoiesis*
- *hemoglobin*
- *anemia*
- *erythrocyte.*

Process/Skill Questions

- What is a differential smear?
- What color granules are present in an eosinophil?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Teamwork Events

- HOSA Bowl
-

Task Number 93

Explain the components of a complete blood count (CBC).

Definition

Explanation should include the following components:

- Red blood cell (RBC) count

- White blood cell (WBC) count
- Platelets
- Hemoglobin
- Hematocrit
- Red cell indices (e.g., mean corpuscular hemoglobin [MCH], mean corpuscular volume [MCV], mean corpuscular hemoglobin concentration [MCHC], red blood cell distribution width [RDW])
- Anticoagulant used for a CBC

Process/Skill Questions

- What are the formed elements in human blood?
- What is being measured when a medical laboratory technician measures a hematocrit?
- How is oxygen carried from the lungs to the cells?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Teamwork Events

- Health Education

Task Number 94

Explain point-of-care testing in relation to hematology.

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 a hemoglobin meter
- uses an occult blood test.

Process/Skill Questions

- Why is it important to have the ability to run a hemoglobin level at the patient's bedside?

- Why is it often important to get immediate laboratory results on a patient?
- What is the benefit of using a transcutaneous bilirubin testing method?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
 - Medical Terminology
-

Task Number 95

Describe additional procedures in the hematology department.

Definition

Description should include the following hematology procedures:

- Erythrocyte sedimentation rate (ESR)
- Sickle cell screen
- Other bodily-fluid analysis (e.g., cerebrospinal fluid, joint, semen)
- Reticulocyte count

Process/Skill Questions

- What conditions may be consistent with an elevated ESR?
- What variant hemoglobin is associated with sickle cell disease?
- What are the differences between a peripheral blood count and a cerebrospinal blood (CSF) count?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
 - Medical Terminology
-

Task Number 96

Explain peripheral blood-smear evaluation.

Definition

Explanation should include the concept of normal ratios of white blood count (WBC) populations (including differential) and blood cell morphology. Explanation should also include identification and description of the morphologic alterations of size, shape, color, inclusions, and abnormal distribution patterns in erythrocytes.

Process/Skill Questions

- What cells in a WBC differential indicate bacterial infection?
- What WBC types are identified in a differential?
- What might cause nucleated blood cells to appear in a peripheral smear?
- What is anisocytosis?
- In what form of anemia would hypochromic, microcytic red blood cells be present?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
 - Medical Terminology
-

Task Number 97

Perform a microhematocrit.

Definition

Performance should include

- collection of proper specimen type
- centrifugation of specimen
- analysis of result obtained from graph reading device.

Process/Skill Questions

- What is the buffy coat layer?
- What does a low hematocrit indicate?
- What does a high hematocrit indicate?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
 - Medical Terminology
-

Task Number 98

Interpret hematology test results.

Definition

Interpretation should include linking abnormal hematology laboratory results (e.g., erythrocyte sedimentation rate [ESR]) with disease processes (e.g., leukemia, cat-scratch disease, inflammatory bowel disease).

Process/Skill Questions

- What are the most important blood characteristics in the septic patient?
- How can a reticulocyte count be linked to anemia?
- Why does a sickle cell cause anemia?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
 - Medical Terminology
 - Knowledge Test: Pathophysiology
-

Understanding the Basics of Body Chemistry

Task Number 99

Review basic human anatomy and physiology in relation to body chemistry.

Definition

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

- Structures and functions of tissues, membranes, and glands
- Structure and function of the integumentary system
- Structure and function of the skeletal 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

- How do blood tests help diagnose certain conditions or diseases?
- What are the roles of the liver in the gastrointestinal system? Why is this knowledge helpful to medical laboratory professionals?
- What are the hazards of high blood sugar? Of low blood sugar?
- What role(s) do hormones play in the reproductive system? Why is this information useful to medical laboratory professionals?
- 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 100

Interpret common abbreviations used in body chemistry.

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 are the components of a BMP?
- What does an elevated CK indicate?
- What does an elevated BUN indicate?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
 - Medical Terminology
-

Task Number 101

Interpret basic medical laboratory terminology related to body chemistry.

Definition

Interpretation should include terminology such as

- *electrolytes*
- *anion gap*
- *analyte*
- *lipids*
- *homeostasis*
- *gout*
- *spectrophotometer.*

Process/Skill Questions

- What is the importance of a K-level before surgery?
- What is the normal range of a blood glucose level?
- What genetic disorders can be diagnosed through protein electrophoresis?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

Teamwork Events

- HOSA Bowl
-

Task Number 102

Identify natural chemical components of the human body.

Definition

Identification should include the structure of a molecule, as well as chemical elements (e.g., sodium, potassium, hydrogen) and other basic chemical components (e.g., proteins, lipids, carbohydrates, nucleic acids) present in the body.

Process/Skill Questions

- Why is a balanced blood pH level important? How is blood pH level measured?
- Why is water important in the body?
- Why is electrolyte balance important in the body? How is it measured?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
 - Medical Terminology
-

Task Number 103

Explain point-of-care testing in relation to body chemistry.

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 a handheld glucose meter.

Process/Skill Questions

- Why is it important to have the ability to run a blood glucose level at the patient's bedside?
- Why is it often important to get immediate laboratory results on a patient?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
 - Medical Terminology
-

Task Number 104

Explain the theory behind performing routine clinical chemistry procedures.

Definition

Explanation should include the theory behind routine clinical chemistry procedures, such as tests for glucose, electrolytes, cholesterol, blood urea nitrogen (BUN), creatinine, and therapeutic drug monitoring (TDM).

Process/Skill Questions

- What is the difference between drug screening and therapeutic monitoring?
- What two tests are used to assess kidney function in the body?
- What is a normal blood glucose level? How does the medical laboratory professional test for blood glucose?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
 - Medical Terminology
-

Task Number 105

Interpret body chemistry test results.

Definition

Interpretation should include linking abnormal chemistry laboratory results with disease processes, such as diabetes, hepatitis, renal failure, and dyslipidemia (i.e., high cholesterol).

Process/Skill Questions

- What glucose results would indicate diabetes?
- What is the effect of an elevated potassium level on the heart?
- What level of creatinine would be considered diagnostic of renal impairment?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
 - Medical Terminology
 - Knowledge Test: Pathophysiology
-

Task Number 106

Explain how chemistry instrumentation affects specimen testing.

Definition

Explanation should include impacts such as

- decreased turnaround time
- increased cost-effectiveness
- improved reproducibility
- higher accuracy of results.

Process/Skill Questions

- Why has automation been adapted widely in the chemistry lab?
- How has automation helped improve laboratory test productivity?
- How has automation improved the chemistry lab regarding technician-to-technician variation?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
 - Medical Terminology
-

Task Number 107

Present an overview of instrumentation methodology.

Definition

Presentation should include the primary principles of instrumentation (e.g., photometry, ion-selective electrodes). It should also include an overview of methodology for instrumentation (e.g., spectrophotometry, chemiluminescence).

Process/Skill Questions

- How does Beer's law relate to testing done with a chemistry analyzer?
- Why has chemiluminescence replaced radioimmunoassay (RIA) as the favored immunochemistry testing methodology?
- How does an ion-selective electrode work?

HOSA Competitive Events (High School)

Health Science Events

- Medical Spelling
- Medical Terminology

SOL Correlation by Task

Explain the evolving roles of laboratory technology in medicine.	English: 11.5, 12.5
Explain the importance of working within the scope of practice.	English: 11.5, 12.5
Demonstrate technical writing.	English: 11.6, 11.7, 12.6, 12.7
Explain the scientific method in context of course responsibilities.	English: 11.5, 12.5
Explain the importance of communication skills with other members of the healthcare team in medical laboratory technology.	English: 11.5, 12.5
Examine professional ethical standards for medical laboratory personnel.	
Perform a best-practices literature review.	English: 11.5, 11.8, 12.5, 12.8
Describe government, industry, and professional regulatory bodies pertaining to medical laboratory technology.	English: 11.5, 11.8, 12.5, 12.8 History and Social Science: GOVT.1, GOVT.16
Adhere to government, industry, and professional regulations pertaining to medical laboratory technology.	History and Social Science: GOVT.1, GOVT.16
Explain the concept of determining reference ranges in medical laboratory testing.	English: 11.5, 12.5 Mathematics: AFDA.7, AII.11, PS.17, PS.2*, PS.16*
Maintain laboratory records and documentation.	
Follow facility policy and procedures in regard to specimen collection, processing, and analysis.	
Explain the importance of and techniques for infection control and prevention.	English: 11.5, 12.5
Identify types of isolation.	
Describe the role of the Occupational Safety and Health Administration (OSHA) and the National Fire Protection Association (NFPA) in laboratory safety standards.	English: 11.5, 11.8, 12.5, 12.8 History and Social Science: GOVT.16
Follow protocol and safety procedures.	Science: BIO.1, CH.1
Identify first-aid situations, supplies, personal protective measures, emergency protection areas, and actions of a first responder.	Science: BIO.1, CH.1
Identify common laboratory hazards.	Science: BIO.1, CH.1
Demonstrate use of personal protective equipment (PPE).	Science: BIO.1, CH.1

Demonstrate use of safety data sheets (SDS).	Science: BIO.1, CH.1
Demonstrate procedures for handling and disposing of infectious and/or hazardous materials.	Science: BIO.1, CH.1
Maintain laboratory equipment, a clean work area, and a clean laboratory supply storage area.	Science: BIO.1, CH.1
Compare various forms and grades of water used in the laboratory.	
Compare various grades of chemicals used in the laboratory, including their levels, qualities, and purposes.	Science: BIO.1, CH.1, CH.4
Identify the parts of a compound microscope and explain their functions.	
Practice aseptic techniques.	
Perform mathematical calculations and conversions.	Mathematics: A.4, A.7, A.9, AFDA.1, AFDA.3, AFDA.4, AFDA.7, AFDA.8, AII.3, AII.7, AII.9, AII.11, PS.2*, PS.3*, PS.4*, PS.8*, PS.10*
Demonstrate basic pipetting techniques.	Science: CH.1
Explain the process for making stock reagents and solutions.	English: 11.5, 12.5
Explain the importance of maintaining sterile reagents and equipment.	English: 11.5, 12.5
Maintain inventory of laboratory supplies.	
Use basic weighing and measuring techniques.	Science: CH.1, CH.3
Use the scientific method when performing research.	Science: BIO.1
Identify routine equipment maintenance needs.	
Explain the concepts of quality assurance and quality control as they relate to activities of the clinical laboratory.	English: 11.5, 11.8, 12.5, 12.8 Mathematics: PS.2*, PS.3*, PS.8*, PS.10*
Explain validation testing.	English: 11.5, 12.5 Mathematics: A.9, PS.5, PS.2*, PS.8*
Perform statistical analysis of data.	Mathematics: PS.1*, PS.2*, PS.4*
Describe basic human anatomy and physiology in relation to specimen collection.	English: 11.5, 12.5 Science: BIO.4
Interpret common abbreviations used in phlebotomy.	
Interpret basic medical laboratory terminology related to phlebotomy.	English: 11.3, 11.5, 12.3, 12.5
Explain the importance of accurate patient identification in specimen collection.	English: 11.5, 12.5

Demonstrate safe positioning of patients during venipuncture.	
Demonstrate specimen collection procedures appropriate to the patient (e.g., ethnicity, age, medical status, culture).	
Explain the order of the draw (for tubes).	English: 11.5, 12.5
Demonstrate blood collection, handling, and processing for venipuncture procedures.	
Interpret common abbreviations used in urinalysis.	
Interpret basic medical laboratory terminology related to urinalysis.	English: 11.3, 11.5, 12.3, 12.5
Describe various collection methods.	English: 11.5, 12.5
Perform routine physical and chemical examination of urine.	
Identify common microscopic constituents of sediment.	English: 11.5, 12.5 Science: BIO.1
Interpret urinalysis test results.	
Explain the process of hematopoiesis.	English: 11.5, 12.5
Interpret common abbreviations used in hematology.	
Interpret basic medical laboratory terminology related to hematology.	English: 11.3, 11.5, 12.3, 12.5
Explain the components of a complete blood count (CBC).	English: 11.3, 11.5, 12.3, 12.5
Explain point-of-care testing in relation to hematology.	English: 11.5, 12.5
Describe additional procedures in the hematology department.	
Explain peripheral blood-smear evaluation.	English: 11.5, 12.5
Perform a microhematocrit.	
Interpret hematology test results.	
Review basic human anatomy and physiology in relation to body chemistry.	English: 11.5, 12.5 Science: BIO.4
Interpret common abbreviations used in body chemistry.	
Interpret basic medical laboratory terminology related to body chemistry.	English: 11.3, 11.5, 12.3, 12.5
Identify natural chemical components of the human body.	
Explain point-of-care testing in relation to body chemistry.	English: 11.5, 12.5

Explain the theory behind performing routine clinical chemistry procedures.	
Interpret body chemistry test results.	
Explain how chemistry instrumentation affects specimen testing.	English: 11.5, 12.5
Present an overview of instrumentation methodology.	

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.”

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.*

- Biomedical Technician (8347/36 weeks)
- 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)
- Introduction to Health and Medical Sciences (8302/36 weeks)
- Introduction to Health and Medical Sciences (8301/18 weeks)
- Medical Laboratory Technology II (8378/36 weeks)
- Medical Terminology (8383/36 weeks)
- Medical Terminology (8384/18 weeks)

Career Cluster Name: Health Science	
Pathway Title	Occupation Title(s): Bolded occupations are currently associated.
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