

# Biomedical Technician

**8347 36 weeks**

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# Acknowledgments

The following educators contributed to the development of components of this instructional framework:

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Ann Craddock, Virginia HOSA Specialist, Charlottesville  
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## Course Description

**Suggested Grade Level:** 11 or 12

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

*Recommended prerequisite(s): Biotechnology Foundations 8344 (36 weeks)*

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# 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.

8347	Tasks/Competencies	
Exploring Foundations in Biomedical Technology		
	(+)	Explain the evolving role of biotechnology in medicine.
	(+)	Explain the scientific method.
	(+)	Maintain records and documentation.
	(+)	Demonstrate technical writing.
	(+)	Explain the importance of communication skills in biomedical technology.
	(+)	Perform a literature review.
	(+)	Follow instructions.
	(+)	Describe state/local/industry/professional regulations.
	(+)	Follow state/local/industry/professional regulations.
	(+)	Follow time-management practices.
Maintaining Safe Environment		
	(+)	Follow protocol and safety procedures/guidelines.
	(+)	Demonstrate use of Safety Data Sheets (SDS).
	(+)	Identify first aid supplies, personnel, and emergency protection areas.
	(+)	Identify common laboratory hazards and standard precautions.
	(+)	Demonstrate procedures for handling and disposing of infectious and/or hazardous materials.
	(+)	Use personal protective equipment according to regulatory agencies' specifications.

+	Maintain safety equipment, clean work area, and clean laboratory supply storage area.	
Maintaining Quality Assurance		
+	Explain the concepts of quality assurance and quality control.	
+	Perform validation testing.	
+	Validate all results against known standards.	
+	Explain the concept of product-testing specifications.	
Performing Basic Laboratory Skills		
+	Practice aseptic techniques.	
+	Perform mathematical calculations and conversions.	
+	Explain the concepts of sample and sampling technique.	
+	Explain the process for making stock reagents and solutions.	
+	Make stock reagents and solutions.	
+	Monitor, adjust, and maintain physical properties of a solution/reagent.	
+	Sterilize reagents and equipment.	
+	Make and dispense culture media.	
+	Conduct and maintain inventory of laboratory supplies.	
+	Install equipment.	
+	Perform routine equipment maintenance.	
+	Use basic weighing and measuring techniques.	
+	Use the scientific method when performing research.	
+	Perform basic separation techniques.	
+	Perform statistical analysis of data.	
Performing Basic Microbiology Skills		
+	Perform microscopy and vital stain preparation.	

+	Identify basic structures of microorganisms and cells.	
+	Quantify microorganisms and cells.	
+	Explain the concept of a pure culture.	
+	Isolate and store pure cultures.	
+	Explain the concept of fermentation.	
+	Perform fermentation.	
+	Explain the concept of harvesting cells.	
+	Identify hosts and life cycles of microorganisms.	
Performing Cell Culture Techniques		
+	Perform bioassays.	
+	Explain isolation of cell lines.	
+	Propagate plant and/or animal tissue.	
Performing Molecular Biology Techniques		
+	Perform nucleic acid sequencing procedures.	
+	Explain specific nucleic acid sequences.	
+	Explain the role of DNA testing in forensic science and genetics.	
+	Isolate nucleic acids.	
+	Perform restriction digests.	
+	Perform gel electrophoresis.	
+	Label nucleic acids.	
+	Use a sequence database.	
Applying Chemical Techniques for Biological Analysis		
+	Explain basic cloning techniques.	
+	Explain the concept of proteins.	

<input checked="" type="radio"/>	Explain specific proteins and toxins.	
<input checked="" type="radio"/>	Perform protein detection and separation techniques.	
<input checked="" type="radio"/>	Describe advanced protein detection and separation techniques.	
Exploring Professional Choices		
<input checked="" type="radio"/>	Examine professional ethical standards for biomedical technology.	
<input checked="" type="radio"/>	Explain the importance of confidentiality in the biomedical technology field.	
<input checked="" type="radio"/>	Describe tests for employability in the biomedical technology field.	
<input checked="" type="radio"/>	Explore career pathways in biomedical technology.	
<input checked="" type="radio"/>	Prepare an oral report for presentation.	

Legend:  Essential  Non-essential  Omitted

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# Curriculum Framework

## Exploring Foundations in Biomedical Technology

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### Task Number 39

#### Explain the evolving role of biotechnology in medicine.

##### Definition

The explanation of biotechnology's evolving role in medicine should include the following:

- The meaning of *biotechnology*
- A history and timeline of biotechnological developments and major contributors in the field
- Examples of current applications of biotechnology in the field of medicine
- Trends in biotechnology in the field of medicine

##### Process/Skill Questions

- How does biotechnology differ from other forms of technology?
- How has biotechnology influenced various fields of medicine in recent years?
- How have biotechnological advancements in various fields of medicine impacted the quality of human life in recent years?

#### HOSA Competitive Events (High School)

##### Health Science Events

- Medical Spelling
- Medical Terminology

##### Health Professions Events

- Biomedical Laboratory Science

##### Teamwork Events



- HOSA Bowl

### **Recognition**

- Health Care Issues Exam
- 

## **Task Number 40**

### **Explain the scientific method.**

#### **Definition**

The explanation of the scientific method includes the process, the steps, and the purpose.

#### **Process/Skill Questions**

- What are the steps in the scientific method process?
- Why must the steps of the scientific method be followed in a specific order?
- What is the purpose of using the scientific method?

### **HOSA Competitive Events (High School)**

#### **Health Professions Events**

- Biomedical Laboratory Science

#### **Teamwork Events**

- HOSA Bowl
- 

## **Task Number 41**

### **Maintain records and documentation.**

#### **Definition**

Maintenance of records and documentation includes the following:

- Keeping accurate, complete, and appropriately formatted records, as evidenced in student data log

- Assuring that files, bench notes, and other collected data are organized at all times
- Maintaining both manual and electronic files, including computer databases

### **Process/Skill Questions**

- Why is it important to keep accurate and standardized records in the field of medicine?
- What data comprises medical record keeping?
- What are the possible effects of lack of documentation in the field of medicine?
- What resources and tools are available to manage medical information?
- What data is maintained through medical record keeping?

### **HOSA Competitive Events (High School)**

#### **Health Science Events**

- Medical Spelling
- Medical Terminology

#### **Health Professions Events**

- Biomedical Laboratory Science

## **Task Number 42**

### **Demonstrate technical writing.**

#### **Definition**

Technical writing should include

- developing summaries based on bench notes, factual documentation, and observations
- preparing a written report of factual information gathered through the scientific method and using appropriate vocabulary
- following instructor specifications and the Virginia Standards of Learning.

### **Process/Skill Questions**

- Why are technical writing skills important in the medical workplace?
- What resources are available to locate information for writing a technical report?

### **HOSA Competitive Events (High School)**

#### **Health Science Events**

- Medical Spelling
- Medical Terminology

#### **Health Professions Events**

- Biomedical Laboratory Science
  - Clinical Specialty
- 

## **Task Number 43**

### **Explain the importance of communication skills in biomedical technology.**

#### **Definition**

The explanation of communication skills in biomedical technology must emphasize the following:

- The need for effective oral and written communication with laboratory personnel, other health care professionals, and, if required, patients and the public
- The importance of ensuring accuracy and reliability of results
- The importance of keeping information confidential
- The importance of presenting information in an orderly and efficient manner
- The need for professionalism, including professional conduct and interpersonal skills with laboratory personnel, other health care professionals, and, if required, patients and the public

#### **Process/Skill Questions**

- What is effective communication?
- Why are professional attitude and behavior important when communicating with others?
- What roles do effective communication skills play in customer service?
- What are some potential consequences of not communicating effectively in the medical workplace?

### **HOSA Competitive Events (High School)**

#### **Health Science Events**

- Medical Spelling
- Medical Terminology

## Health Professions Events

- Biomedical Laboratory Science
- 

### **Task Number 44**

#### **Perform a literature review.**

##### **Definition**

Performing a literature review consists of reading, analyzing, and documenting research sources, as follows:

- Locating literature pertaining to a specified topic
- Assessing information for accuracy
- Differentiating between objective and subjective sources
- Completing an accurate record of sources used (e.g., scientific magazines and journals, web resources, interviews with scientists or researchers, material provided by laboratories or businesses, and on-site visits), according to teacher-approved specifications and proper citation format

##### **Process/Skill Questions**

- How does one locate information on a specific medical-related topic?
- What tools are important/useful in performing a literature review in the field of medicine?
- What precautions must be taken when performing a literature review?
- Why is a literature review important to medical research?

#### **HOSA Competitive Events (High School)**

##### **Health Science Events**

- Medical Spelling
  - Medical Terminology
- 

### **Task Number 45**

#### **Follow instructions.**

## Definition

Following instructions includes ensuring accuracy and quality of laboratory and other workplace performance by

- listening to oral instructions
- reading instructions
- asking questions for clarification and understanding
- adhering to written and oral instructions
- verifying accuracy and completeness of adherence to instructions.

## Process/Skill Questions

- Why must instructions be followed in the order given?
- What are the consequences of not following instructions in the medical field?

## HOSA Competitive Events (High School)

### Health Professions Events

- Biomedical Laboratory Science
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## Task Number 46

### Describe state/local/industry/professional regulations.

#### Definition

A description includes the following:

- The meaning of the term *regulations*
- The importance of regulations
- The roles of regulatory government agencies that impact the biomedical field, such as [U.S. Department of Transportation](#) (DOT), [U.S. Department of Health and Human Services](#) (HHS), [Occupational Safety and Health Administration](#) (OSHA), [U.S. Department of Agriculture](#) (USDA), [U.S. Food and Drug Administration](#) (FDA), [U.S. Environmental Protection Agency](#) (EPA), [Virginia Department of Health](#) (VDH), Center for Disease Control and Prevention (CDC), and others.
- The purpose of [Clinical Laboratory Improvement Amendments](#) (CLIA)
- Major regulated areas, such as packaging, handling, and shipping of biological materials
- The purpose of each regulatory organization

#### Process/Skill Questions

- Why do government regulations exist?
- What resources are available for locating information on government agencies and their respective regulations?
- Why are government regulations in place for regulating the packaging, handling, and shipping of biological materials? What other government regulations may pertain to biomedical laboratories?

## **HOSA Competitive Events (High School)**

### **Health Science Events**

- Medical Spelling
- Medical Terminology

### **Health Professions Events**

- Biomedical Laboratory Science

## **Task Number 47**

### **Follow state/local/industry/professional regulations.**

#### **Definition**

Following state, local, industry, and professional regulations includes

- understanding and applying government regulations as they relate to the transportation (packaging, handling, and shipping) of biological materials
- maintaining compliance records as specified by local, state, and federal regulations.

#### **Process/Skill Questions**

- What penalties may be incurred if government regulations are not followed? If industry regulations are not followed?
- If government regulations are not properly followed, what can be the impact on employees in the health care field? On patients?
- How can biomedical laboratories and other medical facilities ensure proper adherence to government and industry regulations?

## **HOSA Competitive Events (High School)**

### **Health Science Events**

- Medical Spelling
- Medical Terminology

#### **Health Professions Events**

- Biomedical Laboratory Science
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## **Task Number 48**

### **Follow time-management practices.**

#### **Definition**

Following time-management practices includes exhibiting the behaviors listed below and explaining the importance of each behavior in the biomedical workplace:

- Arriving at work on time
- Prioritizing tasks
- Setting goals and deadlines
- Meeting deadlines
- Multitasking
- Making effective use of time

#### **Process/Skill Questions**

- What is meant by multitasking? Why is multitasking important in the biotechnology field?
- What are some examples of deadlines that a biomedical technician may face? Why is it important to meet such deadlines?
- Why is it important to be on time for work? What can be the results if a person is habitually late for work?
- How can an employee learn to make more effective use of his or her time at work?

### **HOSA Competitive Events (High School)**

#### **Health Professions Events**

- Biomedical Laboratory Science
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# Maintaining Safe Environment

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## Task Number 49

### Follow protocol and safety procedures/guidelines.

#### Definition

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

- Protocols are detailed plans for carrying out a specific process.
- Standard operating procedures are step-by-step instructions for conducting tests/experiments or for performing other practices using prescribed methods or techniques.

#### Process/Skill Questions

- How do protocols differ from standard operating procedures?
- Why do certain industry or government protocols exist in the biomedical laboratory setting?
- What dangers may exist if a biomedical technician does not follow standard operating procedures or protocols?

### HOSA Competitive Events (High School)

#### Health Science Events

- Medical Spelling
- Medical Terminology

#### Health Professions Events

- Biomedical Laboratory Science

#### Emergency Preparedness Events

- CPR/First Aid
- 
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## **Task Number 50**

### **Demonstrate use of safety data sheets (SDS).**

#### **Definition**

Demonstration should include

- explaining the nature and purpose of SDS
- explaining the various sections of SDS
- demonstrating the use of SDS.

#### **Process/Skill Questions**

- What is SDS?
- Why are SDS important?
- What are the various sections of SDS?
- Where are SDS found?

### **HOSA Competitive Events (High School)**

#### **Health Science Events**

- Medical Spelling
- Medical Terminology

#### **Health Professions Events**

- Biomedical Laboratory Science

#### **Teamwork Events**

- HOSA Bowl

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## **Task Number 51**

### **Identify first aid supplies, personnel, and emergency protection areas.**

#### **Definition**

Identification of first aid supplies, personnel, and emergency protection areas includes the following:

- Identifying emergency situations requiring first aid, such as cuts, burns, electrical shock, and other injury from biological and chemical spills or inhalation of chemicals
- Identifying equipment and supplies required to handle simple emergency situations, such as those listed above
- Identifying the location of equipment and supplies to respond to emergencies
- Being prepared to participate in an emergency response
- Activating an appropriate emergency response plan/team, including use of SDS
- Knowing one's individual role in the emergency response plan/team
- Identifying eye wash stations, showers, hoods, Personal Protective Equipment (PPE), and SDS

### **Process/Skill Questions**

- How does one locate information on safety and first aid procedures in the work area?
- Why must biomedical technicians be familiar with first aid procedures?
- What are emergency protection areas? Why are they important in biomedical laboratory settings?

### **HOSA Competitive Events (High School)**

#### **Health Science Events**

- Medical Spelling
- Medical Terminology

#### **Health Professions Events**

- Biomedical Laboratory Science

#### **Emergency Preparedness Events**

- CPR/First Aid
- Life Support Skills

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## **Task Number 52**

**Identify common laboratory hazards and standard precautions.**

## **Definition**

Identification of common laboratory hazards includes commentary on the hazardous properties (e.g., corrosiveness, flammability) and safe use of the following:

- 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 biomedical technician reduce the risk of common laboratory hazards?
- What workplace hazards are particularly associated with biotechnology?
- Why is following standard operating procedures and approved laboratory methods essential to the prevention of injury from laboratory hazards?
- How can standard precautions prevent disease transmission?
- How do standard precautions differ from other safety measures followed in the laboratory?

## **HOSA Competitive Events (High School)**

### **Health Science Events**

- Medical Spelling
- Medical Terminology

### **Health Professions Events**

- Biomedical Laboratory Science

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## **Task Number 53**

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

## **Definition**

Demonstration consists of explaining and demonstrating procedures for handling and disposing of infectious and/or hazardous materials, including explanation of the following and their importance to a safe environment:

- Chain of infection
- PPE
- Aseptic technique
- Clean-up procedures
- Disposal of waste materials
- Sterile technique (including the concept of "chemically clean")

### **Process/Skill Questions**

- How can the chain of infection be broken?
- What are appropriate cleanup procedures for hazardous materials?
- Why are aseptic rules important to the field of biomedical technology?
- What are the specific rules and procedures involved in asepsis?
- What is the chain of infection? Why is it important to understand it?
- What are the rules for handling, cleaning up, and disposing of infectious and/or hazardous materials?
- What is the difference between the concept of "chemically clean" (disinfected) and the concept of "biologically clean" (sterile)?

### **HOSA Competitive Events (High School)**

#### **Health Science Events**

- Medical Spelling
- Medical Terminology

#### **Health Professions Events**

- Biomedical Laboratory Science

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## **Task Number 54**

**Use personal protective equipment (PPE) according to regulatory agencies' specifications.**

### **Definition**

Using PPE includes a demonstration of the appropriate use, removal, and disposal of the following:

- Gloves
- Lab coats/aprons
- Glasses/goggles/face shields
- Masks
- Other essential PPE

### **Process/Skill Questions**

- What is the importance of wearing PPE?
- How can wearing appropriate PPE reduce the risk of contamination or injury?
- How does one determine which PPE are appropriate in a given situation?
- What penalties might an employee face if PPE are not worn or are used inappropriately? Why?
- How do PPE or devices protect the laboratory worker? How do they protect the experiment?

### **HOSA Competitive Events (High School)**

#### **Health Science Events**

- Medical Spelling
- Medical Terminology

#### **Health Professions Events**

- Biomedical Laboratory Science

#### **Teamwork Events**

- HOSA Bowl

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## **Task Number 55**

**Maintain safety equipment, clean work area, and clean laboratory supply storage area.**

### **Definition**

Maintaining safety equipment, cleaning work area, and cleaning laboratory supply and storage areas includes the following:

- 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 make-up, 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 work environment

### **Process/Skill Questions**

- Why is it important to keep the laboratory equipment clean?
- Why is it important to keep the laboratory equipment in good repair and condition?
- Why are safety and cleanliness so essential in a laboratory environment?
- What procedures should be in place for reporting equipment problems?

### **HOSA Competitive Events (High School)**

#### **Health Science Events**

- Medical Spelling
- Medical Terminology

#### **Health Professions Events**

- Biomedical Laboratory Science

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# **Maintaining Quality Assurance**

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## **Task Number 56**

**Explain the concepts of quality assurance and quality control.**

## Definition

Explaining the concepts of quality assurance and quality control includes the following:

- Defining the terms *quality assurance* and *quality control*
- Differentiating between quality assurance and quality control
- Identifying the components of quality assurance
  - Equipment (maintenance and repair)
  - Facility (safe and clean work environment)
  - Personnel (initial and ongoing training)
  - Supplies (receipt inspection, labeling, inventory, testing, and validation)
  - Documents and records (standard operating procedures; documentation of test results through the use of logbooks, equipment logs, and other forms of documentation)
  - Quality control (verification of equipment operation and test results)

## Process/Skill Questions

- How does quality assurance affect your daily life?
- Why is quality assurance critical in the biomedical technology field?
- How are quality assurance and quality control different? How do they complement each other?

## HOSA Competitive Events (High School)

### Health Professions Events

- Biomedical Laboratory Science

### Teamwork Events

- HOSA Bowl

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## Task Number 57

### Perform validation testing.

#### Definition

Performance of validation testing consists of an ongoing demonstration of specific laboratory skills (e.g., identifying relevant laboratory equipment and describing or demonstrating how and when to use it).

## Process/Skill Questions

- What is validation testing?
- What is the difference between external and internal validation?
- Why must biomedical technicians use external validation?
- What are the steps in validation testing?
- What is the importance of performing ongoing validation testing?
- What are the potential effects of not performing validation testing?

## HOSA Competitive Events (High School)

### Health Science Events

- Medical Spelling
- Medical Terminology

### Health Professions Events

- Biomedical Laboratory Science
- 

## Task Number 58

### Validate all results against known standards.

#### Definition

Validation includes routine test procedures (e.g., by obtaining a known freeze-dried bacterium from a commercial vendor, adding sterile water, following with plating technique, incubating, staining, and proceeding with biochemical identification). Known standards may include those set by the National Institute of Standards and Technology (NIST), industry, and/or the company.

## Process/Skill Questions

- Why is it important to validate results against known standards?
- What government and industry validation standards are widely used in the biomedical field? Why do these standards exist ?
- How does validation testing relate to the final product?

## HOSA Competitive Events (High School)

### Health Science Events

- Medical Spelling



- Medical Terminology

**Health Professions Events**

- Biomedical Laboratory Science
- 

## **Task Number 59**

### **Explain the concept of product-testing specifications.**

#### **Definition**

Explaining the concept of required product-testing specifications includes the following:

- Product and reagents testing
- Standard operating procedures
- Verification of expiration dates
- Maintenance of proper storage conditions
- Adherence to limitations
- Other factors

#### **Process/Skill Questions**

- What precautions must be taken when using reagents?
- How does one locate information on specific reagents?
- How does adherence to product-testing specifications affect final testing results?

### **HOSA Competitive Events (High School)**

**Health Professions Events**

- Biomedical Laboratory Science
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## **Performing Basic Laboratory Skills**

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## Task Number 60

### Practice aseptic techniques.

#### Definition

Practicing aseptic techniques includes demonstration of the following:

- Aseptic hand washing
- Disinfection of workstation
- Disposal of waste materials
- Use of good laboratory practices (GLP) in all biomedical laboratory work

#### Process/Skill Questions

- What does *aseptic* mean?
- What agents or solutions are typically used in aseptic techniques?
- What PPE are necessary when practicing aseptic techniques?
- What is good laboratory practice?
- Why is the performance of aseptic techniques important in the biomedical laboratory?
- What precautions must be taken before conducting a procedure?
- What aseptic steps does one take to prepare the workstation for a procedure?

### HOSA Competitive Events (High School)

#### Health Science Events

- Medical Spelling
- Medical Terminology

#### Health Professions Events

- Biomedical Laboratory Science

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## Task Number 61

### Perform mathematical calculations and conversions.

#### Definition

Performance of mathematical calculations and conversions should include the following:

- Number concepts (integers, rational numbers, decimals, percentages, and 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 (e.g., interpolation, extrapolation)
- Scientific notation, significant digits, and rules of rounding
- 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 biomedical 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 biomedical laboratories?
- In what circumstances might a biomedical technician need to perform mathematical operations using spreadsheet software? Database software?
- What could be the potential impact on a test or experiment if a biomedical technician does not have strong mathematical skills?

### **HOSA Competitive Events (High School)**

#### **Health Science Events**

- Medical Spelling
- Medical Terminology
- Medical Math

#### **Health Professions Events**

- Biomedical Laboratory Science

## **Task Number 62**

### **Explain the concepts of sample and sampling technique.**

#### **Definition**

Explanation should include sample size, sample location, aseptic collection techniques, proper identification/labeling, and storage.

## **Process/Skill Questions**

- How is sample location determined?
- How is sample size determined for relevant results?
- What are possible consequences of improper identification? Of inadequate sampling?
- What safety precautions must be followed during sampling?
- What resources would a biomedical technician use to determine adequate sample size?
- What effects could improper sample storage have on test results?

## **HOSA Competitive Events (High School)**

### **Health Science Events**

- Medical Spelling
- Medical Terminology

### **Health Professions Events**

- Biomedical Laboratory Science
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## **Task Number 63**

### **Explain the process for making stock reagents and solutions.**

#### **Definition**

Explanation should include the steps involved in the process for making stock reagents and solutions, to include weighing and measuring, as well as the importance of accuracy and precision throughout the process. Explanation should also cover dilution techniques and the purpose for reagents.

#### **Process/Skill Questions**

- How would a biomedical technician mix a working solution from a 10X concentrated solution? What is this solution used for?
- 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?

## **HOSA Competitive Events (High School)**

### **Health Science Events**

- Medical Spelling
- Medical Terminology
- Medical Math

#### **Health Professions Events**

- Biomedical Laboratory Science
- 

## **Task Number 64**

### **Make stock reagents and solutions.**

#### **Definition**

Making stock reagents and solutions should include using proper measurements, conversions, and record keeping and labeling.

#### **Process/Skill Questions**

- Why is it important to include a mix date on solutions and reagents?
- What could be the result of improper measurements when making stock reagents and solutions?
- What type of record keeping is used when making reagents and solutions? Why is record keeping important when making reagents and solutions?
- What clean-up procedures should be followed after making stock reagents and solutions?

### **HOSA Competitive Events (High School)**

#### **Health Science Events**

- Medical Spelling
- Medical Terminology
- Medical Math

#### **Health Professions Events**

- Biomedical Laboratory Science
- 

## **Task Number 65**

# **Monitor, adjust, and maintain physical properties of a solution/reagent.**

## **Definition**

Monitoring, adjusting, and maintaining the physical properties of a solution and/or reagent includes the parameters of pH, temperature, specific gravity, light exposure, and expiration, along with other labeling requirements.

## **Process/Skill Questions**

- Will the physical parameters of a solution or reagent remain constant with storage? Why, or why not?
- How could changes in the physical properties of a solution affect research results?
- Where would the biomedical technician obtain information on proper storage conditions for a reagent or solution?
- Should a reagent be used after the expiration date? Why, or why not?
- How would the biomedical technician monitor and adjust parameters for a specific solution or reagent?

## **HOSA Competitive Events (High School)**

### **Health Science Events**

- Medical Spelling
- Medical Terminology
- Medical Math

### **Health Professions Events**

- Biomedical Laboratory Science
- 

## **Task Number 66**

# **Sterilize reagents and equipment.**

## **Definition**

Sterilization of reagents and equipment includes using an autoclave, flame, and/or chemical disinfection to maintain sterile conditions. It should also include strict adherence to manufacturers' instructions for all devices.

## Process/Skill Questions

- Why is it important for a biomedical technician to clean his or her work area?
- Which sterilization methods should be used for specific materials?
- How would the biomedical technician determine which method to use?
- What are the steps for the various sterilization methods?
- What safety measures must be taken with various sterilization techniques? Why?

## HOSA Competitive Events (High School)

### Health Science Events

- Medical Spelling
- Medical Terminology

### Health Professions Events

- Biomedical Laboratory Science

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## Task Number 67

### Make and dispense culture media.

#### Definition

Performance includes using aseptic technique and proper measurements while following manufacturer's instructions to mix and dispense culture media (e.g., agars, broths, gel slides).

## Process/Skill Questions

- Why is it important to follow aseptic technique when mixing media?
- How should a culture be incubated for proper growth?
- What could happen if the media were not accurately measured during preparation?
- What are proper storage parameters for common media? Why?

## HOSA Competitive Events (High School)

### Health Science Events

- Medical Spelling
- Medical Terminology

### Health Professions Events

- Biomedical Laboratory Science
- 

## **Task Number 68**

### **Conduct and maintain inventory of laboratory supplies.**

#### **Definition**

Conducting and maintaining laboratory supplies includes

- inspecting regularly
- labeling correctly
- ensuring adequate supplies
- ensuring appropriate storage conditions
- testing
- validating.

#### **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?

#### **HOSA Competitive Events (High School)**

##### **Health Science Events**

- Medical Spelling
- Medical Terminology

##### **Health Professions Events**

- Biomedical Laboratory Science
- 

## **Task Number 69**

### **Install equipment.**



## Definition

Equipment installation includes setting up and validating biomedical equipment according to manufacturers' instructions.

## Process/Skill Questions

- What types of basic electrical/electronic knowledge are useful when installing various types of laboratory equipment?
- What other basic knowledge of physics is useful when installing biomedical equipment?
- What safety precautions are necessary when installing biomedical equipment?
- What resources would a biomedical technician use to set up and validate equipment?
- What does it mean to *validate* equipment? Why is it important?

## HOSA Competitive Events (High School)

### Health Professions Events

- Biomedical Laboratory Science
  - Clinical Specialty
- 

## Task Number 70

### Perform routine equipment maintenance.

#### Definition

Routine equipment maintenance includes the following:

- Explaining the basic operating principles of the most common equipment used in biomedical laboratory work
- Performing manufacturers' recommended maintenance procedures on biomedical laboratory equipment
- Updating existing equipment as needed
- Reporting the need for repair or replacement of faulty equipment
- Demonstrating adherence to required safety precautions

#### Process/Skill Questions

- Why is maintenance important in the operation of biomedical laboratory equipment?
- How could test results be affected by lack of maintenance?
- What resources would an individual use to perform routine equipment maintenance?
- What safety precautions must be taken when performing routine equipment maintenance?

## **HOSA Competitive Events (High School)**

### **Health Professions Events**

- Biomedical Laboratory Science
  - Clinical Specialty
- 

## **Task Number 71**

### **Use basic weighing and measuring techniques.**

#### **Definition**

Basic weighing and measuring in a laboratory includes the following:

- Using appropriate equipment (e.g., scales, balances, graduated cylinders, pipettes) to accurately measure materials
- Explaining the concepts of molarity and molality and solution concentration
- Using tables or formulas to convert between metric and U.S. Customary measuring systems

#### **Process/Skill Questions**

- How does one measure a small amount of a powdered material?
- Why is it important to measure accurately when mixing solutions?
- Why should a laboratory worker record his/her measurements and label mixtures?
- What could happen if part of a laboratory worker's measurements were in the U.S. Customary system and part of them were metric? Why is it important for measurements to be consistent?

## **HOSA Competitive Events (High School)**

### **Health Science Events**

- Medical Spelling
- Medical Terminology
- Medical Math

### **Health Professions Events**

- Biomedical Laboratory Science
-

## **Task Number 72**

### **Use the scientific method when performing research.**

#### **Definition**

Use of the scientific method when performing research should include the following:

- Stating the problem
- Formulating a hypothesis
- Designing the research methodology
- Conducting the experiment
- Collecting and analyzing the data
- Drawing conclusions and determining implications
- Validating the data and conclusions
- Presenting conclusions in report or 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)**

#### **Health Science Events**

- Medical Spelling
- Medical Terminology
- Medical Math

#### **Health Professions Events**

- Biomedical Laboratory Science

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## **Task Number 73**

### **Perform basic separation techniques.**

#### **Definition**

Performing basic separation techniques involves using a centrifuge and/or filtration to separate materials or cellular components.

### **Process/Skill Questions**

- What safety precautions must be followed while using the centrifuge?
- How does the centrifuge separate materials?
- How does a centrifuge differ from a filtration system in separating materials?
- What are some examples of materials or components that can be separated mechanically (with a centrifuge and/or filtration)? Why might they need to be separated?

### **HOSA Competitive Events (High School)**

#### **Health Science Events**

- Medical Spelling
- Medical Terminology

#### **Health Professions Events**

- Biomedical Laboratory Science

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## **Task Number 74**

### **Perform statistical analysis of data.**

#### **Definition**

Performing statistical analysis of data should include the following:

- Using mean, median, mode, standard deviation, and variance to analyze data sets and describe patterns and departures from patterns
- Presenting data in graphical display (e.g., dot plot, histogram)

#### **Process/Skill Questions**

- What are the definitions of *mean*, *median*, *mode*, *standard deviation*, and *variance*? How might the calculation of these provide useful data in a biomedical laboratory analysis?
- 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 biomedical laboratory data?

- Can information from statistical analysis produce incorrect conclusions? Why, or why not?

## **HOSA Competitive Events (High School)**

### **Health Science Events**

- Medical Spelling
- Medical Terminology
- Medical Math

### **Health Professions Events**

- Biomedical Laboratory Science

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# **Performing Basic Microbiology Skills**

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## **Task Number 75**

### **Perform microscopy and vital stain preparation.**

#### **Definition**

Performance of microscopy and vital stain preparation includes the following:

- Preparing slides
- Demonstrating correct staining techniques
- Using appropriate magnification
- Identifying specimens

#### **Process/Skill Questions**

- What are the steps of slide preparation and staining?
- What magnification needs to be used for identification?
- Why are microscopy and vital stain preparation so important in laboratory testing?

## **HOSA Competitive Events (High School)**

### **Health Science Events**

- Medical Spelling
- Medical Terminology

### **Health Professions Events**

- Biomedical Laboratory Science
- 

## **Task Number 76**

### **Identify basic structures of microorganisms and cells.**

#### **Definition**

Identifying basic structures of microorganisms and cells (e.g., bacteria, fungi, parasites, viruses, red cells, white cells, platelets, epithelial cells, bone cells) involves distinguishing and labeling microorganism and cell components, including organelles and structures.

#### **Process/Skill Questions**

- For given microorganism and cell structures, what is the function of each structure?
- What are some of the applications of identifying basic microorganism and cell structures? (e.g., industrial, medical, forensic)

### **HOSA Competitive Events (High School)**

#### **Health Science Events**

- Medical Spelling
- Medical Terminology

#### **Health Professions Events**

- Biomedical Laboratory Science
- 

## **Task Number 77**

### **Quantify microorganisms and cells.**

## **Definition**

Quantification of microorganisms and cells consists of dilution, filtering, plating, and counting (including knowledge and use of counting rules).

## **Process/Skill Questions**

- What is the purpose of quantification?
- What is the process of quantification?
- Why must the steps be performed in a certain order?
- What counting rules are used in quantification?

## **HOSA Competitive Events (High School)**

### **Health Science Events**

- Medical Spelling
- Medical Terminology

### **Health Professions Events**

- Biomedical Laboratory Science
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## **Task Number 78**

### **Explain the concept of a pure culture.**

#### **Definition**

Explanation should include the concept that a pure 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 of obtaining a pure culture?
- Why must one use a pure 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 79**

### **Isolate and store pure cultures.**

#### **Definition**

Isolation and storage of pure cultures includes the use of sterile techniques to obtain one colony for growth.

#### **Process/Skill Questions**

- What is a sterile technique?
- What is the medium used to grow a pure culture? Why is this medium used?
- What temperature needs to be used when growing a pure culture? Why?
- How do cryogenic techniques maintain the integrity of cultures?

### **HOSA Competitive Events (High School)**

#### **Health Science Events**

- Medical Spelling
- Medical Terminology

#### **Health Professions Events**

- Biomedical Laboratory Science
- 

## **Task Number 80**

### **Explain the concept of fermentation.**

#### **Definition**



Explanation of fermentation should include the steps of the fermentation process, incorporating the following concepts about the process:

- It involves release of energy from an organic compound.
- It does not require oxygen (i.e., is anaerobic).
- It concludes with an electron transfer to an organic compound (i.e., one of the products used or formed during the fermentation process).

### **Process/Skill Questions**

- What are some applications of fermentation?
- What temperature, media, and carbohydrate source must be used for fermentation?

### **HOSA Competitive Events (High School)**

#### **Health Science Events**

- Medical Spelling
- Medical Terminology

#### **Health Professions Events**

- Biomedical Laboratory Science

#### **Teamwork Events**

- HOSA Bowl

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## **Task Number 81**

### **Perform fermentation.**

#### **Definition**

Performance should include implementing the steps in the fermentation process and explaining each step as it is carried out.

#### **Process/Skill Questions**

- In performing a given fermentation demonstration, what microorganism is being used? What is the resulting byproduct? What gas is produced?
- What safety precautions are necessary when performing fermentation?

## HOSA Competitive Events (High School)

### Health Professions Events

- Clinical Specialty
- 

## Task Number 82

### Explain the concept of harvesting cells.

#### Definition

Explanation should include commentary on the concept of cell harvesting, as well as uses of harvesting cells, such as cell culture, DNA extraction, abnormal protein identification, *in vitro* fertilization, and cloning.

#### Process/Skill Questions

- What are various ways of harvesting cells?
- What are the pros and cons of cloning and *in vitro* fertilization?
- How are cell cultures maintained?

## HOSA Competitive Events (High School)

### Health Science Events

- Medical Spelling
- Medical Terminology

### Health Professions Events

- Biomedical Laboratory Science

### Teamwork Events

- HOSA Bowl
- 

## Task Number 83

### Identify hosts and life cycles of microorganisms.

## Definition

Identification should include hosts and life cycles of bacteria, protozoa, rickettsiae, viruses, and fungi. Using a microscope or a photograph, student should describe the reproduction of the microorganisms.

## Process/Skill Questions

- What are the characteristics of the identified microorganisms?
- What do the microorganisms have in common?
- How are the microorganisms different from one another?
- How can the life cycle of microorganisms be interrupted to reduce disease?

## HOSA Competitive Events (High School)

### Health Science Events

- Medical Spelling
- Medical Terminology

### Health Professions Events

- Biomedical Laboratory Science

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# Performing Cell Culture Techniques

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## Task Number 84

### Perform bioassays.

#### Definition

Performance should include an explanation of the term *bioassay* and demonstration of a simple bioassay, such as the effect of an antiseptic or disinfectant on a culture.

#### Process/Skill Questions

- In a bioassay to determine the effect of an antiseptic or disinfectant on a culture, what is the effect of the disinfectant or antiseptic on the microbial growth? What is the mechanism of the disinfectant or antiseptic on the structure of the microorganism?
- What are some medical and industrial uses of bioassays?
- What equipment can be used to perform bioassays?

## **HOSA Competitive Events (High School)**

### **Health Science Events**

- Medical Spelling
- Medical Terminology

### **Health Professions Events**

- Clinical Specialty

## **Task Number 85**

### **Explain isolation of cell lines.**

#### **Definition**

Explanation should include the process of harvesting, isolating, and growing pure cell lines.

#### **Process/Skill Questions**

- What are some medical and industrial uses of a cell culture?
- What is the effect of contaminated cell culture lines?
- Why are there restrictions on the use of specific cell lines? What cell lines can be funded federally?

## **HOSA Competitive Events (High School)**

### **Health Science Events**

- Medical Spelling
- Medical Terminology

### **Health Professions Events**

- Biomedical Laboratory Science

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## **Task Number 86**

### **Propagate plant and/or animal tissue.**

#### **Definition**

Propagation of plant and/or animal tissue includes growing plant or animal tissues (using, for example, purchased kits). It also includes a description of the process of propagation and student-recorded observations of growth.

#### **Process/Skill Questions**

- What are some medical and industrial uses of a plant or animal tissue culture?
- What are the difficulties of growing plant and animal tissue cultures?
- What laboratory conditions are necessary for successfully growing tissue cultures?

#### **HOSA Competitive Events (High School)**

##### **Health Science Events**

- Medical Spelling
- Medical Terminology

##### **Health Professions Events**

- Clinical Specialty
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## **Performing Molecular Biology Techniques**

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### **Task Number 87**

#### **Perform nucleic acid sequencing procedures.**

##### **Definition**

Performing nucleic acid sequencing procedures includes an explanation that DNA sequencing is the laboratory procedure for determining the order of the nucleotides in a strand of DNA. The demonstration consists of the most commonly used technique of chain termination sequencing, including DNA synthesis, gel electrophoresis, and DNA detection.

### **Process/Skill Questions**

- What is the purpose of DNA sequencing? How is the resulting information used?
- How does the science of genetics pertain to inherited traits?
- How is a recessive trait demonstrated in an individual?
- Why is it important to analyze DNA molecular differences?

### **HOSA Competitive Events (High School)**

#### **Health Science Events**

- Medical Spelling
- Medical Terminology

#### **Health Professions Events**

- Biomedical Laboratory Science
  - Clinical Specialty
- 

## **Task Number 88**

### **Explain specific nucleic acid sequences.**

#### **Definition**

Explanation of specific nucleic acid sequences should include “start” and “stop” codons, as well as the process of RNA transcription and translation.

#### **Process/Skill Questions**

- What happens if there is an error in the transcription of a nucleic acid sequence?
- Besides transcription errors, are there any other sources of error when working with nucleic acid sequences?
- What are some examples of human diseases that occur from such errors? Are there any built-in mechanisms to repair errors and thus prevent disease?

### **HOSA Competitive Events (High School)**

### **Health Science Events**

- Medical Spelling
- Medical Terminology

### **Health Professions Events**

- Biomedical Laboratory Science
- 

## **Task Number 89**

### **Explain the role of DNA testing in forensic science and genetics.**

#### **Definition**

Explanation of the role of DNA testing in forensic science and genetics should include the following:

- Criminal and/or victim identification
- Disease or condition predisposition, including identification of inherited genetic disease
- Tissue and/or organ transplant compatibility
- Paternity testing

#### **Process/Skill Questions**

- What is the process of DNA fingerprinting?
- What are the ethical implications of DNA fingerprinting (e.g., regarding its use in genetic testing of newborns, insurance or job discrimination, or patenting of rare genes)?
- What roles do recessive and dominant genes play in common genetic disorders?

### **HOSA Competitive Events (High School)**

#### **Health Science Events**

- Medical Spelling
- Medical Terminology

#### **Health Professions Events**

- Biomedical Laboratory Science

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## **Task Number 90**

### **Isolate nucleic acids.**

#### **Definition**

Isolating nucleic acids consists of extracting DNA from a cell or tissue sample by separating the DNA from the rest of the organic material so that the isolated DNA can be viewed with a microscope. The isolation procedures will depend on the type of organic material from which the DNA is being extracted.

#### **Process/Skill Questions**

- What are the basic steps of DNA isolation? What equipment and materials may be used to isolate DNA?
- How might the process of DNA isolation differ depending on the type of organic matter upon which it is performed?

### **HOSA Competitive Events (High School)**

#### **Health Science Events**

- Medical Spelling
- Medical Terminology

#### **Health Professions Events**

- Biomedical Laboratory Science
- 

## **Task Number 91**

### **Perform restriction digests.**

#### **Definition**

Performing restriction digests consists of the following process:

- Adding enzyme to DNA to slice the gene sequence at a specific point
- Timing the procedure
- Washing off the reagent



- Analyzing the end result

### **Process/Skill Questions**

- How is the specific point of the gene sequence determined for a certain trait?
- Why does the laboratory technician need to use an enzyme to slice a small portion of the DNA?
- What are the steps involved in the process of restriction digests?
- What is the application of performing restriction digests?

### **HOSA Competitive Events (High School)**

#### **Health Science Events**

- Medical Spelling
- Medical Terminology

#### **Health Professions Events**

- Biomedical Laboratory Science
- Clinical Specialty

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## **Task Number 92**

### **Perform gel electrophoresis.**

#### **Definition**

Performing gel electrophoresis should include setting up equipment, applying DNA fragments, timing the procedure, staining the completed results, and interpreting the results.

#### **Process/Skill Questions**

- What are the applications for DNA electrophoresis?
- How does the electric current separate the fragments?
- What does each band represent?

### **HOSA Competitive Events (High School)**

#### **Health Science Events**

- Medical Spelling
- Medical Terminology

### **Health Professions Events**

- Biomedical Laboratory Science
- 

## **Task Number 93**

### **Label nucleic acids.**

#### **Definition**

Labeling nucleic acids includes identification of the sequencing of nucleotides.

#### **Process/Skill Questions**

- What is the Human Genome Project? When was the project completed?
- When was DNA discovered and by whom? Why was this such an important discovery?
- What are the possible combinations of nitrogenous bases?
- How is this information used in science and industry?

### **HOSA Competitive Events (High School)**

#### **Health Science Events**

- Medical Spelling
- Medical Terminology

#### **Health Professions Events**

- Biomedical Laboratory Science
- 

## **Task Number 94**

### **Use a sequence database.**

#### **Definition**

Using a sequence database includes consulting several Internet databases (or purchased software) and comparing the results.

#### **Process/Skill Questions**

- Why is it important to use databases when comparing DNA?
- Is there more to be learned about the nucleotides and genetic diseases than we already know? Why, or why not? What is the next step?
- If you have a specific genetic mutation, does it automatically mean you will acquire a disease? Why, or why not?

## **HOSA Competitive Events (High School)**

### **Health Science Events**

- Medical Spelling
- Medical Terminology

### **Health Professions Events**

- Biomedical Laboratory Science

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# **Applying Chemical Techniques for Biological Analysis**

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## **Task Number 95**

### **Explain basic cloning techniques.**

#### **Definition**

Explanation includes the steps to create an exact replica of the original organism, including removing the nucleus from the oocyte and replacing it with the DNA from the organism to be cloned.

#### **Process/Skill Questions**

- What are the benefits of cloning animals? How could cloned animals be used in pharmaceuticals?
- What are the steps involved in nuclear transfer?
- What are the ethical concerns involved in cloning animals? Plants?

- What are the current U.S. laws concerning human cloning? How do U.S. laws about human cloning compare with those of other countries?

## **HOSA Competitive Events (High School)**

### **Health Science Events**

- Medical Spelling
- Medical Terminology

### **Health Professions Events**

- Biomedical Laboratory Science

### **Teamwork Events**

- HOSA Bowl
- 

## **Task Number 96**

### **Explain the concept of proteins.**

#### **Definition**

Explanation of the concept of proteins includes the following:

- The steps to make a protein, including messenger RNA, transfer RNA, and ribosomal RNA and DNA expression
- The levels of protein structures
- The relationship between the structure and functions of proteins
- Ways proteins are used in the field of biomedical technology
- Functional classes of proteins

#### **Process/Skill Questions**

- Why are proteins necessary to a cell?
- What are the implications of an abnormal protein (e.g., cystic fibrosis, sickle cell anemia, thalassemia, muscular dystrophy)?
- What is the role of enzymes?

## **HOSA Competitive Events (High School)**

### **Health Science Events**

- Medical Spelling
- Medical Terminology

#### **Health Professions Events**

- Biomedical Laboratory Science

#### **Teamwork Events**

- HOSA Bowl
- 

## **Task Number 97**

### **Explain specific proteins and toxins.**

#### **Definition**

Explanation includes a description of a variety of specific proteins and toxins (e.g., botulism, botox, tetanus, mycotoxins, ricin, prions), along with their effects on the body and their medical applications.

#### **Process/Skill Questions**

- What are some of the effects of specific toxins on the body?
- What are prions? When were they discovered? What promise do they hold in medical research?
- What are some common medical applications for toxins?
- What antitoxins are available? In what situations might they be used?

### **HOSA Competitive Events (High School)**

#### **Health Science Events**

- Medical Spelling
- Medical Terminology

#### **Health Professions Events**

- Biomedical Laboratory Science

#### **Teamwork Events**

- HOSA Bowl

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## Task Number 98

### Perform protein detection and separation techniques.

#### Definition

Performing protein detection and separation techniques includes giving a definition of *protein* and a description of its role in a cell, demonstrating steps in detection and separation (including gel electrophoresis), and explaining why the process of protein detection and separation is important in the biomedical field.

#### Process/Skill Questions

- In protein detection and separation, what does each band represent?
- What are the applications for protein electrophoresis?
- How does one identify the protein from gel electrophoresis?

### HOSA Competitive Events (High School)

#### Health Science Events

- Medical Spelling
- Medical Terminology

#### Health Professions Events

- Biomedical Laboratory Science

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## Task Number 99

### Describe advanced protein detection and separation techniques.

#### Definition

Description consists of commentary on advanced techniques (e.g., gas chromatography, liquid chromatography, mass spectrometry) and the basic process involved in each.

#### Process/Skill Questions

- What happens if the essential proteins are not consumed?
- What are examples of how the body uses proteins for normal function?
- What is protein engineering? How can it be used to improve life?
- What are the medical implications of abnormal proteins?

## **HOSA Competitive Events (High School)**

### **Health Science Events**

- Medical Spelling
- Medical Terminology

### **Health Professions Events**

- Biomedical Laboratory Science

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# **Exploring Professional Choices**

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## **Task Number 100**

### **Examine professional ethical standards for biomedical technology.**

#### **Definition**

Examination of professional ethical standards includes analysis of the position of the profession on current bioethics issues (e.g., stem cell research, cloning, patents, privacy, social issues, biopiracy, artificial devices, artificial intelligence, and genetic/protein engineering).

#### **Process/Skill Questions**

- What is the definition of *ethics*?
- Why is a discussion of ethical issues surrounding a technique or technology necessary?
- What are benefits and drawbacks of selected current and emerging bioethical procedures? What are the U.S. government regulations and global regulations regarding these procedures?
- How is public opinion shaping current policy?

- Why are politics and biotechnology so closely entwined?
- What effects might biotechnology have on future generations?

## **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 101**

### **Explain the importance of confidentiality in the biomedical technology field.**

#### **Definition**

Explanation should include the concepts of privacy, job and health insurance discrimination, and confidential business information, as related to the field of biomedical technology. Explanation should also include privacy issues related to the use of electronic devices (e.g., phones, cameras) and social media.

#### **Process/Skill Questions**

- How could a person's genetic information be misused?
- How could a business be harmed by leaked genetic information?
- How could an individual lose a job or health insurance based on genetic information?
- What legal rights do U.S. citizens have regarding confidentiality of their genetic information?
- Does the Health Insurance Portability and Accountability Act of 1996 (HIPAA) apply toward the biomedical technology field?

## **HOSA Competitive Events (High School)**

### **Health Science Events**

- Knowledge Test: Medical Law and Ethics



### **Health Professions Events**

- Biomedical Laboratory Science

### **Teamwork Events**

- Biomedical Debate

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## **Task Number 102**

### **Describe tests for employability in the biomedical technology field.**

#### **Definition**

Description of employability tests in the biomedical technology field should include both the types of tests (e.g., laboratory tests, fingerprinting, FBI investigations, and other types of security clearance screening) and the purposes (e.g., for detecting drug abuse, criminal background, and other undesirable behavior).

#### **Process/Skill Questions**

- How is drug testing used to screen potential and current employees?
- May potential biomedical employees legally be screened for past and/or present medical conditions? Why, or why not?
- Does an individual have any privacy right protection in regard to drug testing, criminal background checks, and other employment screening techniques? Why, or why not?
- How can an individual's social media history affect his or her chances for employment?
- How might tattoos and piercings limit one's employment opportunities? How can an individual with tattoos and/or piercings make himself/herself more presentable to a prospective employer?

#### **HOSA Competitive Events (High School)**

### **Health Professions Events**

- Biomedical Laboratory Science

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## **Task Number 103**

# Explore career pathways in biomedical technology.

## Definition

Exploration of biomedical technology career pathways should include educational requirements, career benefits and drawbacks, employment outlook, salary, and job descriptions.

Many websites offer career exploration resources, including

- the Virginia Department of Education's [Career Planning Guide](#)
- the U.S. Bureau of Labor Statistics [Occupational Outlook Handbook](#).

## Process/Skill Questions

- What colleges or universities offer programs in biomedical technology in Virginia? Elsewhere?
- What classes should a student take in high school to prepare for a career in biomedical technology?
- How have initiatives, such as the Homeland Security Act of 2002, affected job opportunities in biomedical technology?
- How has television affected job opportunities in biomedical technology?

## HOSA Competitive Events (High School)

### Health Professions Events

- Biomedical Laboratory Science

### Teamwork Events

- Health Career Display

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## Task Number 104

### Prepare an oral report for presentation.

#### Definition

Report should be research-based, its focus should be determined and/or approved by the teacher, and its format should include an electronic presentation or other visual enhancement.

#### Process/Skill Questions

- What information sources are available for research on your topic?
- What conclusions can you draw from your research?
- Has your project changed your thinking or attitude toward your subject?

## HOSA Competitive Events (High School)

### Teamwork Events

- Public Service Announcement

## SOL Correlation by Task

39	Explain the evolving role of biotechnology in medicine.	English: 11.5, 12.5  Science: BIO.4, BIO.5h, BIO.5i, BIO.5j
40	Explain the scientific method.	English: 11.5, 12.5  History and Social Science: WHII.4  Mathematics: G.1, PS.1*  Science: BIO.1, CH.1, ES.2, PH.1
41	Maintain records and documentation.	Mathematics: COM.1, PS.1*
42	Demonstrate technical writing.	English: 11.6, 11.7, 12.6, 12.7  History and Social Science: WHII.4  Science: BIO.1, CH.1, PH.1
43	Explain the importance of communication skills in biomedical technology.	English: 11.5, 12.5  History and Social Science: GOVT.16
44	Perform a literature review.	English: 11.5, 11.8, 12.5, 12.8  History and Social Science: VUS.1  Science: BIO.1j
45	Follow instructions.	English: 11.1, 11.5, 11.6, 11.7, 12.6, 12.7

		Science: BIO.1, CH.1
46	Describe state/local/industry/professional regulations.	English: 11.5, 11.8, 12.5, 12.8  History and Social Science: GOVT.8, GOVT.9
47	Follow state/local/industry/professional regulations.	English: 11.5, 11.8, 12.5, 12.8  History and Social Science: GOVT.8, GOVT.9
48	Follow time-management practices.	History and Social Science: GOVT.16
49	Follow protocol and safety procedures/guidelines.	English: 11.5, 12.5  History and Social Science: GOVT.8, GOVT.9  Science: BIO.1, CH.1, PH.1
50	Demonstrate use of Safety Data Sheets (SDS).	English: 11.5, 12.5  History and Social Science: GOVT.8, GOVT.9  Science: CH.1b
51	Identify first aid supplies, personnel, and emergency protection areas.	History and Social Science: GOVT.16  Science: CH.1, CH.1c
52	Identify common laboratory hazards and standard precautions.	Science: CH.1, CH.1a, CH.1b, CH.1c
53	Demonstrate procedures for handling and disposing of infectious and/or hazardous materials.	Science: CH.1b
54	Use personal protective equipment according to regulatory agencies' specifications.	English: 11.5, 12.5  Science: CH.1, CH.1a, CH.1b
55	Maintain safety equipment, clean work area, and clean laboratory supply storage area.	English: 11.5, 12.5  History and Social Science: GOVT.16  Science: CH.1, CH.1b
56	Explain the concepts of quality assurance and quality control.	English: 11.3, 11.5, 12.3, 12.5  History and Social Science: GOVT.8  Science: CH.1, PH.1

57	Perform validation testing.	Science: BIO.1, CH.1, PH.1
58	Validate all results against known standards.	English: 11.5, 12.5  Science: BIO.1, BIO.1g
59	Explain the concept of product-testing specifications.	
60	Practice aseptic techniques.	
61	Perform mathematical calculations and conversions.	Mathematics: A.1, A.4, A.9, AFDA.3, AFDA.7, AII.9, COM.1, PS.2*, PS.3*, PS.4*  Science: BIO.1d, BIO.1i, CH.1f, CH.1g, CH.1h, PH.2
62	Explain the concepts of sample and sampling technique.	English: 11.5, 12.5  Mathematics: PS.8*  Science: BIO.1, CH.1
63	Explain the process for making stock reagents and solutions.	English: 11.5, 12.5
64	Make stock reagents and solutions.	Mathematics: A.1, A.4  Science: CH.1
65	Monitor, adjust, and maintain physical properties of a solution/reagent.	Science: CH.4c, CH.4d
66	Sterilize reagents and equipment.	English: 11.5, 12.5
67	Make and dispense culture media.	English: 11.5, 12.5  Mathematics: A.1, A.4
68	Conduct and maintain inventory of laboratory supplies.	Science: BIO.1, CH.1
69	Install equipment.	English: 11.5, 12.5
70	Perform routine equipment maintenance.	English: 11.5, 12.5
71	Use basic weighing and measuring techniques.	Mathematics: A.1, A.4  Science: CH.1, CH.4c, PH.1
72	Use the scientific method when performing research.	English: 11.5, 11.8, 12.5, 12.8  Mathematics: G.1  Science: BIO.1, CH.1, ES.1
73	Perform basic separation techniques.	
74	Perform statistical analysis of data.	Mathematics: PS.1*, PS.17, PS.19, PS.2*, PS.4*  Science: BIO.1, CH.1, PH.1

75	Perform microscopy and vital stain preparation.	Science: BIO.1
76	Identify basic structures of microorganisms and cells.	Science: BIO.3, BIO.4c
77	Quantify microorganisms and cells.	
78	Explain the concept of a pure culture.	English: 11.5, 12.5
79	Isolate and store pure cultures.	
80	Explain the concept of fermentation.	English: 11.5, 12.5 Science: BIO.4
81	Perform fermentation.	
82	Explain the concept of harvesting cells.	English: 11.5, 12.5
83	Identify hosts and life cycles of microorganisms.	Science: BIO.4
84	Perform bioassays.	
85	Explain isolation of cell lines.	English: 11.5, 12.5
86	Propagate plant and/or animal tissue.	
87	Perform nucleic acid sequencing procedures.	Mathematics: AII.5, COM.13 Science: BIO.5
88	Explain specific nucleic acid sequences.	English: 11.5, 12.5 Science: BIO.5
89	Explain the role of DNA testing in forensic science and genetics.	English: 11.5, 11.8, 12.5, 12.8 Science: BIO.5
90	Isolate nucleic acids.	
91	Perform restriction digests.	
92	Perform gel electrophoresis.	Science: BIO.5
93	Label nucleic acids.	Science: BIO.5
94	Use a sequence database.	Mathematics: COM.1
95	Explain basic cloning techniques.	English: 11.5, 12.5 Science: BIO.5
96	Explain the concept of proteins.	English: 11.5, 12.5 Science: BIO.5
97	Explain specific proteins and toxins.	
98	Perform protein detection and separation techniques.	English: 11.3, 11.5, 12.3, 12.5 Science: BIO.5, BIO.2b
99	Describe advanced protein detection and separation techniques.	English: 11.5, 12.5
100	Examine professional ethical standards for biomedical technology.	English: 11.5, 12.5 History and Social Science: WHI.1

		Science: BIO.5
101	Explain the importance of confidentiality in the biomedical technology field.	English: 11.5, 12.5
102	Describe tests for employability in the biomedical technology field.	English: 11.5, 12.5
103	Explore career pathways in biomedical technology.	English: 11.5, 11.8, 12.5, 12.8
104	Prepare an oral report for presentation.	English: 11.1, 11.8, 12.1, 12.8

## Teacher Resources

The resources below may be helpful to Biomedical Technician teachers and their students.

- *Bioresearch Monitoring Good Laboratory Practices*. U.S. Food and Drug Administration.  
<https://www.fda.gov/iceci/enforcementactions/bioresearchmonitoring/ucm133789.htm>.
- *The Biotechniques Virtual Laboratory*. Genetic Science Learning Center. University of Utah. <http://learn.genetics.utah.edu/content/labs/>. Contains multimedia teaching resources on Tour of the Basics, Gel Electrophoresis, DNA Extraction, and DNA Microarray.
- *Career Center: Biotechnology*. Access Excellence. The National Health Museum Resource Center. <http://www.accessexcellence.org/RC/CC>. Contains information about careers in clinical laboratory science and biotechnology.
- *Cellular Metabolism and Fermentation*. Estrella Mountain Community College, Avondale, AZ.  
<https://www2.estrellamountain.edu/faculty/farabee/biobk/BioBookGlyc.html>. Provides an explanation and diagrams of the fermentation process.
- *Cloning in Focus*. Learn.Genetics. Genetic Science Learning Center. University of Utah. <http://learn.genetics.utah.edu/content/cloning/>. Includes "Click and Clone," an online multimedia simulation in which the site visitor uses somatic cell nuclear transfer to clone Mimi, a brown female mouse.
- *Cracking the Code of Life*. The Public Broadcasting Service. NOVA.  
<http://www.pbs.org/wgbh/nova/genome/>. Companion Web site for the NOVA program on genetics. Contains lots of classroom resources.
- *Diving into the Gene Pool*. Exploratorium, San Francisco, CA.  
[http://www.exploratorium.edu/genepool/genepool\\_home.html](http://www.exploratorium.edu/genepool/genepool_home.html). An online exhibition exploring genetics and the Human Genome Project from a variety of perspectives.
- *DNA from the Beginning*. <http://www.dnafb.org/dnafb/>. An animated primer on the basics of DNA, genes, and heredity.
- *DNA Interactive*. <http://www.dnai.org/index.htm>. DNA and genome-related teaching guides and lesson builders, personalized Web pages, My DNA, student activities, and more.
- *DNA Learning Center*. <http://www.dnalc.org/>. Includes an interactive DNA timeline.
- *Ethical, Legal, and Social Issues*. Human Genome Project Information.  
[http://www.ornl.gov/sci/techresources/Human\\_Genome/elsi/elsi.shtml](http://www.ornl.gov/sci/techresources/Human_Genome/elsi/elsi.shtml).

- *General Laboratory Procedures, Equipment Use, and Safety Considerations*. University of Maryland Baltimore County. <http://www.research.umbc.edu/~jwolf/method2.htm#Sterile%20technique>.
- *Genetics in Context*. Electronic Scholarly Publishing. <http://www.esp.org/timeline/>. A dual timeline, with scientific events (especially those relevant to classical genetics) presented against those of general historical and cultural interest.
- *Genetics Education Partnership*. <http://gep.wustl.edu/>. Teacher instructional guides, curricula, classroom activities, and suggested outreach activities on genetics.
- *Genome News Network*. The Center for the Advancement of Genomics. <http://www.genomenewsnetwork.org/index.php>. Original articles and links.
- *Glossary of Agricultural Biotechnology Terms*. Agriculture: Biotechnology. U.S. Department of Agriculture. <https://www.usda.gov/topics/biotechnology/biotechnology-glossary>. An agriculture-oriented glossary, but includes many generic terms of use to biomedical technicians.
- *Good Laboratory Practice*. U.S. Food and Drug Administration. <https://www.fda.gov/aboutfda/centersoffices/officeofmedicalproductsandtobacco/cder/ucm090275.htm>. The FDA's official site for "Good Laboratory Practice" in the United States.
- *Human Genome Resources*. National Center for Biotechnology Information (NCBI) of the National Library of Medicine (NLM). <http://www.ncbi.nlm.nih.gov/genome/guide/human/>. A comprehensive, one-stop genomic information center.
- *Infection Prevention*. Engender Health. <http://www.engenderhealth.org/IP/index.html>. A site designed to help healthcare students and practitioners improve infection prevention practices.
- *National Human Genome Research Institute*. <http://www.genome.gov>. Provides many links of interest to Biomedical Technology teachers:
  - ---. *All about the Human Genome Project*. <http://www.genome.gov/10001772>. Focuses on the international effort to map the human genome.
  - ---. *Fact Sheets*. <http://www.genome.gov/10000202>. Genetic concepts, research, and more.
  - ---. *Genetic Education Modules for Teachers*. <http://www.genome.gov/10005911>. Teaching tools to help students understand genetics and genomics.
  - ---. *Online Genetics Education Resources*. <http://www.genome.gov/10000464>. Links to genetics information.
  - ---. *Speaking about Genetics*. <http://www.genome.gov/12011706>. Teacher and speaker resources; information on scheduling an NHGRI speaker.
  - ---. *Talking Glossary of Genetic Terms*. <https://www.genome.gov/glossary/>. A multimedia glossary with downloadable illustrations.
- *Office of Genomics and Disease Prevention of the Centers for Disease Control and Prevention (CDC)*. <http://www.cdc.gov/genomics/default.htm>. Provides information about human genetic discoveries and how they can be used to improve health and prevent disease.
- *Recombinant DNA Labs: Basic Tools for the Molecular Biologist*. Sciences Education Foundation. <http://www.sci-ed-ga.org/modules/dna/index.html>.



- *U.S. Surgeon General's Family History Initiative.*  
<https://www.hhs.gov/programs/prevention-and-wellness/family-health-history/index.html>.

## **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

- College and Work Readiness Assessment (CWRA+)
- National Career Readiness Certificate Assessment
- 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)
- Health Assisting Careers (8331/36 weeks)
- Medical Laboratory Technology I (8377/36 weeks)

Career Cluster: Health Science	
Pathway	Occupations
Biotechnology Research and Development	Biochemist Cell Biologist Medical, Clinical Laboratory Technician Research Assistant
Diagnostics Services	Cardiovascular Technologist Computer Tomography (CT) Technologist Medical, Clinical Laboratory Technologist Nuclear Medicine Technologist Radiologic Technologist, Radiographer
Health Informatics	Bioinformatics Technician Epidemiologist
Support Services	Environmental Sampling and Analysis Technician Medical, Clinical Laboratory Technologist
Therapeutic Services	Audiologist Exercise Physiologist Physician Surgical Technologist