

Curriculum for BACE 2019

KNOWLEDGE EXAM SUBJECT CATEGORIES

1.0 BIOCHEMISTRY/CHEMISTRY

- 1.1 Compare and contrast types of chemical bonds
- 1.2 Understand the chemistry of molecules and macromolecules
- 1.3 Differentiate between homogeneous and heterogeneous mixtures
- 1.4 Discuss the differences between aerobic and anaerobic respiration
- 1.5 Demonstrate knowledge of enzymes and reaction rates
- 1.6 Describe DNA structure and function
- 1.7 Describe transcription
- 1.8 Describe protein structure and function
- 1.9 Describe translation and gene expression

2.0 BIOLOGICAL SYSTEMS

- 2.1 Explain cell theory
- 2.2 Understand the general physiology of cells
- 2.3 Explain the interaction between cells, and between cells and their environment
- 2.4 Describe cell division (meiosis and mitosis)
- 2.5 Discuss cell staining, and distinguish between Gram positive/negative cells
- 2.6 Demonstrate an understanding of the immune system
- 2.7 Understand the genetics of model organisms
- 2.8 Describe the “central dogma of molecular biology”

3.0 GENERAL TOPICS IN BIOTECHNOLOGY

- 3.1 Describe historical applications of biotechnology
- 3.2 Discuss current techniques used in biotechnology, and their applications
- 3.3 Illustrate examples of the benefits to society of biotechnological advances
- 3.4 Discuss ethics and bioethics in the workplace and society
- 3.5 Describe careers in the biotechnology field
- 3.6 Outline the development and the regulatory approval process of biopharmaceuticals
- 3.7 Outline the manufacturing process of biopharmaceuticals
- 3.8 Demonstrate knowledge of regulatory agencies governing the manufacture and distribution of biotechnology-derived products
- 3.9 Outline the role of various departments in a company, including Research and Development, Quality Assurance, Quality Control, and Manufacturing
- 3.10 Understand the purpose of Good Laboratory Practices (GLPs) in product testing
- 3.11 Understand the purpose of Good Clinical Practices (GCPs) in clinical trials
- 3.12 Understand the purpose of current Good Manufacturing Practices (cGMPs)
- 3.13 Discuss the role and identify types of documents used in cGMP compliant industries
- 3.14 Describe Environmental Monitoring in a controlled space
- 3.15 Describe appropriate workplace behaviors
- 3.16 Identify proper workplace safety behaviors

4.0 LABORATORY SKILLS/APPLICATIONS

- 4.1 Describe the process of culturing microorganisms and tissues using aseptic technique
- 4.2 Discuss the differences between sterilization, decontamination, and disinfection
- 4.3 Describe the proper use of microscopes
- 4.4 Understand the principle by which a pH meter works

- 4.5 Discuss methods of chromosomal and plasmid DNA isolation, purification, and quantification
- 4.6 Contrast agarose gel electrophoresis and polyacrylamide gel electrophoresis (PAGE)
- 4.7 Understand how restriction enzymes are used
- 4.8 Describe recombinant DNA and cloning techniques
- 4.9 Discuss the transformation or transfection of model organisms
- 4.10 Describe the mechanism of Polymerase Chain Reaction (PCR)
- 4.11 Discuss protein expression in model organisms
- 4.12 Discuss methods of molecule/protein isolation, purification, and quantification
- 4.13 Understand Western blotting, ELISA, and other immunoassays
- 4.14 Explain the principles of spectrophotometry
- 4.15 Demonstrate knowledge of laboratory equipment calibration and validation
- 4.16 Use scientific notation correctly
- 4.17 Use significant digits correctly
- 4.18 Use decimals correctly

5.0 RESEARCH & SCIENTIFIC METHOD

- 5.1 Discuss good experimental design, including the proper use of controls
- 5.2 Explain the scientific method
- 5.3 Analyze and interpret data, including the use of statistical analysis
- 5.4 Explain how to maintain a laboratory notebook
- 5.5 Discuss various ways of communicating scientific research, including peer-reviewed journals, and presenting posters or talks at meetings

PRACTICAL EXAM SUBJECT CATEGORIES

6.0 APPLIED MATHEMATICS IN BIOTECHNOLOGY

- 6.1 Use scientific notation correctly
- 6.2 Use significant digits correctly
- 6.3 Use decimals correctly
- 6.4 Perform calculations for serial dilutions
- 6.5 Perform calculations using dilution ratios
- 6.6 Make conversions within the metric system, and use metric measurements
- 6.7 Solution preparation:
 - 6.7.1 Solve Volume/Volume (V/V) solution calculations
 - 6.7.2 Solve Weight/Volume (W/V) solution calculations
 - 6.7.3 Solve Molarity solution calculations
 - 6.7.4 Solve Dilution Factor calculations
- 6.8 Generate a graph using collected data:
 - 6.8.1 Apply Beer's Law
 - 6.8.2 Generate a standard curve
 - 6.8.3 Properly plot data
 - 6.8.4 Interpret data

7.0 BIOTECHNOLOGY SKILLS

- 7.1 Accurately measure liquids using micropipets and serological pipets
- 7.2 Accurately measure mass using electronic balances
- 7.3 Demonstrate proper aseptic/sterile technique
- 7.4 Demonstrate proper culturing of microorganisms
- 7.5 Demonstrate proper use of electrophoresis equipment

- 7.6 Properly measure and adjust the pH of a solution with a pH meter
- 7.7 Properly prepare solutions, buffers, and media
- 7.8 Properly perform a serial dilution
- 7.9 Describe the applications and proper use of a spectrophotometer
- 7.10 Describe the proper use of a centrifuge
- 7.11 Use 24-hour time correctly

8.0 LABORATORY EQUIPMENT

- 8.1 Identify laboratory glassware and equipment
- 8.2 Demonstrate proper and safe use of equipment (including, but not limited to):
 - 8.2.1 Fume hoods
 - 8.2.2 Biosafety cabinets
 - 8.2.3 Microscopes
 - 8.2.4 Electrophoresis equipment
 - 8.2.5 Spectrophotometers
 - 8.2.6 Micropipets & serological pipets
 - 8.2.7 Electronic balances
 - 8.2.8 pH meters
 - 8.2.9 Incubators
 - 8.2.10 Centrifuges
 - 8.2.11 Water baths
 - 8.2.12 Stirrers/shakers
 - 8.2.13 Vortexers
 - 8.2.14 Autoclaves

9.0 WORKPLACE SAFETY & BEHAVIOR

- 9.1 Identify Safety Symbols
- 9.2 Exercise proper laboratory safety protocols
- 9.3 Describe proper handling of biological and hazardous waste
- 9.4 Identify and properly use Personal Protective Equipment (PPE)
- 9.5 Derive information from Safety Data Sheets (SDS)
- 9.6 Follow practices associated with regulatory compliance
- 9.7 Demonstrate good documentation practices, including following Standard Operating Procedures (SOPs)
- 9.8 Properly label items including solutions, buffers, Petri plates, samples, and products
- 9.9 Identify acceptable work habits