Alabama CTE

Biotechnology II: High School

Foundational Standards

1. **Incorporate safety procedures in handling, operating, and maintaining tools and machinery; handling materials; utilizing personal protective equipment; maintaining a safe work area; and handling hazardous materials and forces.** F.1
2. **Demonstrate effective workplace and employability skills, including communication, awareness of diversity, positive work ethic, problem-solving, time management, and teamwork.** F.2
3. **Explore the range of careers available in the field and investigate their educational requirements and demonstrate job-seeking skills including resume-writing and interviewing.** F.3
4. **Advocate and practice safe, legal, responsible, and ethical use of information and technology tools specific to the industry pathway** F.4
5. **Participate in a Career and Technical Student Organization (CTSO) to increase knowledge and skills and to enhance leadership and teamwork.** F.5
6. **Demonstrate effective infection control techniques as defined by the Centers for Disease Control and Prevention (CDC) and The Joint Commission guidelines.** F.6

Career Opportunities

1. **Outline the role of various departments in a biotechnology company, including research and development, quality assurance, quality control, and manufacturing.** 1

Biotechnology Industry

2. **Identify and describe the roles of regulatory agencies governing the manufacture and distribution of biotechnology-derived products.** 2
   - a Outline the processes of developing, manufacturing, and obtaining regulatory approval of biopharmaceuticals. 2.A
3. **Research and implement safety and quality control standards specific to the biotechnology industry.** 3
   - a Explain the purpose of Good Laboratory Practice (GLP), Good Clinical Practice (GCP), and Current Good Manufacturing Practice (CGMP). 3.A
   - b Explain how environmental monitoring is carried out in a controlled space. 3.B
   - c Identify, analyze, and explain the roles of documentation utilized in CGMP-compliant industries. 3.C

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Technical Skills and Applications	**4 Demonstrate current techniques used in biotechnology labs.** 4 a Differentiate among sterilization, decontamination, and disinfection; describe equipment and procedures for each; and explain when each process should be employed. 4.A b Demonstrate and explain methods of molecule and protein isolation, purification, and quantification using polyacrylamide gel. 4.B c Research and discuss methods of DNA isolation, purification, and quantification. 4.C d Use models to illustrate the transformation and transfection of organisms. 4.D e Model or utilize clustered regularly interspaced short palindromic repeats (CRISPR) in the lab setting to introduce genetic information into a genome. 4.E f Perform immunoassay using serial dilution. 4.F g Describe common stains used in the laboratory and explain when each is preferred. 4.G
Biochemistry	**5 Analyze and explain vital intracellular processes.** 5 a Compare and contrast types of chemical bonds within cells. 5.A b Model the structures and explain the functions of molecules and macromolecules. 5.B c Compare and contrast aerobic and anaerobic respiration. 5.C d Use enzymes to modify reaction rates in the laboratory setting. 5.D **6 Model the structure and describe the functions of proteins in an organism.** 6
Biological Systems	**7 Map and explain the response of the immune system in the body, beginning with the identification of a foreign antigen.** 7
Applied Mathematics in Biotechnology	**8 Prepare laboratory solutions, buffers, and media, performing necessary calculations, including serial dilutions, dilution ratios, molarity, and dilution factor.** 8 a Calculate conversions within the metric system using scientific notation, significant digits, and decimals. 8.A b Calculate volume/volume (v/v) and weight/volume (w/v) of solutions. 8.B c Produce a graph by applying Beer's Law to generate a standard curve, plot data, and interpret results. 8.C d Calculate bacterial transformation efficiency. 8.D e Record time-sensitive laboratory data using the 24-hour clock. 8.E
Re Me	**emonstrate use of the scientific method to document and analyze the results of a aboratory procedure.** 9

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a Outline the characteristics of good experimental design, including the proper use of controls. 9.A

b Collect, record, analyze, and interpret data, including statistical analysis. 9.B

c Outline various ways of communicating scientific research, including peer-reviewed journals, exhibitions, laboratory notebooks, and live or online presentations. 9.C