Tennessee CTE

BioSTEM II

Safety	1	Accurately read and interpret safety rules, including but not limited to rules published by the National Science Teachers Association (NSTA), rules pertaining to electrical safety, Occupational Safety and Health Administration (OSHA) guidelines, and state and national code requirements. Be able to distinguish between the rules and explain why certain rules apply. 1
	2	Identify and explain the intended use of safety equipment available in the classroom. For example, demonstrate how to properly inspect, use, and maintain safe operating procedures with tools and equipment. Incorporate safety procedures and complete safety test with 100 percent accuracy. 2
The Roles of Scientists	3	Determine the scientist's role in explaining why phenomena occur in the natural world, justified by historical and current science knowledge. Research a known scientist and present in an informative paper, oral presentation, or other format his/her contributions to scientific knowledge in the fields of food, environmental, biomedical, research, and forensic science. Include an outline of how the scientific inquiry process was used in his/her work. 3
DNA Basics	4	Explain how DNA serves as a template for self-replication and encoding of biological information using an original visual DNA model. Define the terms DNA replication, DNA transcription, and translation of mRNA. Recount the processes involved in each and describe the negative outcomes if there is an interference in the process. Using domainspecific terminology, develop a scientific explanation to support the claim that the structures and mechanisms of DNA and RNA are the primary sources of heritable information. 4
	5	Construct a visual artifact, annotated with written explanations, detailing how DNA in chromosomes is transmitted to the next generation via mitosis or meiosis. Note qualitative and quantitative traits, mutations, transposable genetic elements, and regulation of gene expressions. 5
	6	Research and explain Mendel's model of inheritance. Using this model, trace the pattern of appearance within a family for a heritable disease that is on the recessive allele and one that is on the dominant allele. Develop an argumentative essay regarding how a certain biotechnology could genetically modify a gene to prevent this disorder, citing information from textbooks and/or professional journals and websites. 6

	7 In an argumentative essay, state claims and counterclaims about how DNA structure and function may be exploited using modern genetic engineering methods to produce specific genetic constructs, such as selecting, excising, ligating, and cloning of genetic material. Ensure the documentation is written in domain-specific medical terminology. 7
	8 Distinguish between a number of strategies used to isolate or clone a gene, such as activation tagging, map-based gene cloning, plasmid cloning vectors, viral vectors, and shuttle vectors. Present an overview of these strategies in a visual format. 8
Questioning and Defining Problems	9 Engage in scientific inquiry by brainstorming to create questions to understand how a certain phenomenon in the natural world works, to understand why a phenomenon occurs, or to determine the validity of a theory. 9
	10 Research various sources (e.g., articles, end-uses, textbooks) and identify one or more questions that will guide a scientific investigation of the various functions of DNA in food, environmental, biomedical, research, or forensic science. For example, questions should be relevant, testable, and based on current scientific knowledge. 10
	11 Develop an original proposal as would a food, environmental, biomedical, research, or forensic scientist that will guide the scientific inquiry and follow responsible ethical practices. For example, the proposal should outline the reason for the research interest, hypothesis, methodology, data analysis, importance of study, and deliverables. 11
Planning and Investigating	12 Make a hypothesis that explains a scientific question about DNA and its relationship to food, environmental, biomedical, research, or forensic science. Plan and conduct a simple investigation and record observations (e.g., data) in a manner easily retrievable by others. 12
	13 Identify the independent variables and dependent variables in an investigation. Demonstrate the effects of a changing independent variable on a dependent variable, and observe and record results. 13
Data Analysis and Interpretation	14 Use mathematics to represent and solve scientific questions. For example, simple limit cases can be used to determine if a model is realistic. 14
	15 Evaluate data and identify any limitations of data analysis. Using this information, determine whether to make scientific claims from data or revise an investigation and collect more data. 15
	16 Compare and contrast the data results from multiple iterations of a scientific investigation. For example, consider how well each explanation is supported by evidence, prior research, and scientific knowledge. 16

Problem Solutions and Scientific Explanations	**17**	**Develop an explanation to a scientific question that is logically consistent, peer reviewed, and justified by DNA analysis and scientific knowledge.** 17
Communicating Solutions and Explanations	**18**	**Develop a technical report to communicate and defend a scientific explanation and justify its merit and validity with scientific information. Consider the ethical implications of the findings. The report can include tables, diagrams, graphs, procedures, and methodology. For example, conduct a BioSTEM forum, present scientific research, and provide evidence to support arguments for or against scientific solutions.** 18