Tennessee CTE

STEM III: STEM in Context

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
Essential Components of STEM Research	3	Explore how research teams are formed in order to answer scientific questions or design solutions to engineering problems. Using a scholarly database such as the Education Resources Information Center (ERIC), or searching on the websites of universities and other research institutions, investigate a well-known team of scientists or engineers (for example, the most recent Nobel Prize-winning teams in the sciences) and report to the class on how they collaborated to produce new scientific knowledge or solve an engineering problem. 3
	4	Research the ethical requirements for conducting scientific research or testing a prototype that will involve the public. For example, investigate the process for obtaining Institutional Review Board (IRB) approval when proposing a biomedical or human behavioral research study. Describe the concept of risk-benefit analysis in the production of new scientific knowledge; detail the rights and responsibilities of researchers—and, if applicable, their subjects—as they relate to conducting research in STEM fields. 4
	5	Examine how scientists, engineers, and other STEM professionals obtain funding, seek sponsorship, and/or gain approval to conduct their research. Explore websites such as the National Science Foundation or the National Institutes of Health to identify common processes around submitting proposals for research studies and procuring the necessary funds. Explain specific terminology such as request for proposals (RFP), competitive grants versus formula grants, and seed funding. 5
Research & Project Definition	6	Survey and observe people in your school and/or community. Analyze the results to determine potential STEM problems that need investigating or solving. Use hese ideas to conduct research to determine and define a team project. Using upporting evidence from the research, write and present a STEM project proposal

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	defining the project's purpose and goals. Include an outline of how the team intends to follow the scientific inquiry or engineering design process. 6
Team Development	**7 Define the team norms, or the set of team values, that are understood and approved by all team members. The norms should include the team's mission and guidelines for how team members will treat each other. Create a team handbook and include the documented team norms.** 7
	8 As a team, determine the professional attributes that must be embodied by team members in order to successfully complete the proposed project. Collaboratively develop a professionalism rubric with performance indicators for each attribute agreed upon. Include the rubric in the team handbook. Attributes may include the following: 8 a Effective communication 8.A b Respect for fellow team members 8.B c Ethical use of intellectual property and other project resources (including ethical treatment of test subjects, if applicable) 8.C d Timely achievement of project deadlines and goals 8.D e Collaborative and equitable distribution of work among all team members 8.E
	9 Identify the strengths and weaknesses of team members and organize the results into a graphic representation. Use the graphic representation to define the roles of each team member and create an organizational chart for the team handbook. For example, the strengths and weaknesses document will help identify the leader of the project team. 9
	10 Research Tuckman's stage model for team development (i.e., forming, storming, norming, performing, and adjourning). Prior to starting the STEM project, understand and explain each stage. After completing the project, write a brief evaluation of the team's growth at each stage. 10
Communication	**11 Develop a process for official team communication. Define and document format guidelines for various modes of communication such as written, verbal, and email. For example, distinguish between communication appropriate to use with a team member versus communication appropriate to use with a supervisor (teacher). Document the communication guidelines in the team handbook.** 11
	12 Practice effective verbal, nonverbal, written, and electronic communication skills for working with team members while demonstrating the ability to: listen attentively, speak courteously and respectfully, discuss each member's ideas, resolve conflict, and reach a consensus for team progress. 12
	13 Research various decision-making methods for teams, such as consensus, majority, minority, averaging, and expert. Practice using these various methods when team disagreements arise, determine which are most effective for the project team, and explain the reasoning. 13

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Project Management

14 **Perform an Internet search, interview local professionals, or consult industry journals to identify common principles of successful project management. Based on templates retrieved online or approved by the instructor, estimate a detailed project plan for the course-long project. The project plan should include at minimum the following: a schedule or Gantt chart outlining deliverables, complete with job assignments based on team member strengths and weaknesses; a tracker for progress toward goals; a time management component to log hours worked for each team member; and supporting diagrams, datasheets, and flowcharts illustrating essential stages in the process.** 14

15 **Based on the project proposal and project plan, identify projected costs and estimate a hypothetical budget. The projected costs may include but are not limited to materials, labor, equipment, and travel. Create a method to track the actual costs. For example, spreadsheets can be used to analyze and track project expenses.** 15

Project Completion and Presentation

16 **Apply all steps of the scientific inquiry or the engineering design process (depending on the nature of the project) to successfully generate a hypothesis or prototype, collect the relevant data, perform the necessary tests, interpret the results, make modifications to models or prototypes, and communicate results over the course of the project's duration. Produce a technical report documenting the findings of the project and justifying the team's final conclusions based on evidence obtained.** 16

17 **As a team, design a presentation to communicate the results of the project to both a technical and a non-technical audience. The presentation should be delivered orally but supported by relevant graphic illustrations, such as diagrams and models of project findings, and/or physical artifacts that represent the outcome of the project (i.e., a robotic prototype or a 3-D model). Prepare the presentation in a format that could be submitted to a competition such as a local Maker Faire or CTSO competitive event.** 17

Evaluation of Project Outcome

18 **Using tools that were developed during the course (i.e., professionalism rubric, project plan, organizational chart, team development evaluation), write a reflection paper to evaluate the project team's performance. Present the STEM project and team evaluation to the class. The paper should address, but is not limited to the following:** 18

- a Did the team accomplish the project goal? 18.A
- b How well did the team (collectively and individually) meet the performance indicators? 18.B
- c How did the team develop throughout the duration of the project? 18.C
- d How well did the team resolve disagreements? 18.D
- e Was the team leadership effective? 18.E
- f Was the project completed within budget? 18.F