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CTSO Course Alignments: STEM Explorers

Below you will find standards for the STEM Explorers course aligned with competitive events from appropriate career and technical student organizations (CTSOs). Knowing the aligned events for your organization will allow you to have additional tools for teaching course standards, as well as increase student engagement and preparation in your CTSO activities. The final column recommends potential tools from other CTSO organizations. Even if your students are not participating in these organizations, available rubrics, tools, and materials can also add to the instructional resources at your disposal for best teaching your content.

Important to note: While the aligned activities below can be important tools in teaching course standards, it is important to note that events may not cover a standard in its entirety and should not be the sole instructional strategy used to address a standard.

	STANDARD	ALIGNED TSA COMPETITIVE EVENTS/PROGRAMS	OTHER POTENTIAL CTSO TOOLS & RESOURCES
1	Drawing on multiple sources (such as the Internet, textbooks, videos, and journals), investigate historical figures and milestones in science, technology, engineering, and mathematics. Create a report over a selected STEM figure or milestone. Explain how this figure or milestone had a lasting influence on at least two of the four STEM fields. (TN Reading 9; TN Writing 2, 4)	• **TSA**: Essays on Technology	
2	Drawing on multiple sources (such as the internet, textbooks, videos, and journals), research technologies that have benefited society. Create a presentation illustrating society's role in the creation of a chosen technology. Discuss the societal needs that led to the creation of this technology, as well as the benefits resulting from it. Provide examples to support the claim that this technology has been beneficial to society. Relate the specific areas of science, technology, engineering, and math that contributed to the development of this technology. (TN Reading 7; TN Writing 1, 4)	• **TSA**: Essays on Technology	• **FBLA:** Business Presentation
3	Explain how asking scientific questions can help to define an engineering problem to be solved. Choose a specific question(s) and problem that a scientist or engineer would encounter, then develop a model to illustrate the problem. Provide textual evidence from science and engineering books and websites to justify why the model illustrates the problem. (TN Reading 2; TN Writing 1, 4, 9)		

4	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. (TN Reading 3, 4)	• **TSA**: Electrical Applications	• **FFA:** Agricultural Mechanics and Technology • **SkillsUSA**: Occupational Health and Safety
5	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. (TN Reading 3, 4)		• **FFA:** Agricultural Mechanics and Technology • **SkillsUSA**: Occupational Health and Safety
6	Investigate the following six STEM-intensive career clusters: Manufacturing; STEM; Health Sciences; Information Technology; Architecture and Construction; Agriculture, Food and Natural Resources; and Transportation, Distribution and Logistics. Identify companies and organizations in the state, region, and the school's local community related to each of these clusters. Create an informative poster or presentation that identifies companies in each cluster, the products they produce, and the services they offer. (TN Reading 7; TN Writing 2, 4, 7)	• **TSA**: Career Prep, STEM Animation, Prepared Speech	• **FBLA:** Job Interview • **FCCLA**: Job Interview, Career Investigation, Entrepreneurship, Interpersonal Communications • **HOSA**: Health Career Display, Prepared Speaking • **SkillsUSA**: Job Interview, Employment Application Process, Entrepreneurship
7	Research various occupations in each of the six STEM-intensive career clusters: Manufacturing; STEM; Health Sciences; Information Technology; Architecture and Construction; Agriculture, Food and Natural Resources; and Transportation, Distribution and Logistics. Compose an informative table or chart highlighting at least one occupation in each cluster, to include the following: work activities typically performed; tools and technology used; nature of the work environment; and the knowledge and skills needed for success. (TN Reading 7; TN Writing 2, 4)	• **TSA**: Career Prep, STEM Animation, Prepared Speech	• **FBLA:** Job Interview • **FCCLA**: Job Interview, Career Investigation, Entrepreneurship, Interpersonal Communications • **HOSA**: Health Career Display • **SkillsUSA**: Job Interview, Employment Application Process, Entrepreneurship
8	Investigate the field of manufacturing and manufacturing processes. Drawing on technical texts and exemplar designs retrieved from manufacturing websites, design and create a model of a manufacturing process. Demonstrate how the model would be used by a manufacturer to conduct a specific manufacturing process. Write a persuasive essay that argues for the quality and efficiency of the model and the process it simulates/demonstrates. Then, evaluate the model and discuss how it and/or the process can be improved. (TN Reading 7, 9; TN Writing 1, 4, 9)	• **TSA**: Agricultural and Biotechnology Design, Construction Challenge, Essays on Technology, Go Green Manufacturing, Inventions and Innovations, Medical Technology Issues	• **HOSA**: Researched Persuasive Speaking

9	Research engineering and scientific texts to understand the engineering design and scientific inquiry processes. Design and create a product that meets specific constraints and criteria using an engineering process that includes the following: identifying the problem; identifying criteria and specifying constraints; brainstorming for possible solutions; researching and generating ideas; exploring alternative solutions; selecting an approach; writing a design proposal, developing a model or prototype; testing and evaluating; refining and improving; creating or making a product; and communicating results. Evaluate and report whether the solution met the original criteria and constraints, as well as what improvements could be made to the solution, including a summary of data. For example, students design and build a paper airplane that will stay aloft for the longest time. Students record their plane design before building and testing it. Students build and test their plane three times, recording the time aloft in each test. Students make a modification to their plane design. Students should be encouraged to only modify a single variable. Students build and test their modified plane three times as with their original plane. This process may be repeated multiple times. Students should create and present a report of the design, test results, results and conclusions. Teachers may wish to have students use their phones to take pictures of their plane designs and test results. (TN Reading 3; TN Writing 1, 4)	• **TSA**: Dragster, Essays on Technology, Flight, Go Green Manufacturing, Inventions and Innovations, Structural Model	
10	Research areas of the health sciences field. Collect, graph, and analyze personal health or forensic-related information. Write a brief explanation that categorizes the data collected and then describes the significance of the data. *For example, students may collect personal health-related information, such as heart rate (resting, vs. standing vs. active), their BMI, flexibility, or their lung capacity, and compare these against government recommendations. Alternatively, students may collect and analyze forensic information, such as hair or fingerprint samples. Students may then analyze and classify the samples. In either of these examples, the class or individuals' data should be graphed using bar or box-and-whisker graphs.* (TN Reading 3, TN Writing 2, 4;TN Math 6.EE, 6.SP)	• **TSA**: Agriculture and Biotechnology Design, Essays on Technology, Medical Technology Issues	• **HOSA**: Health Lifestyle, Forensic Medicine • **SkillsUSA**: Crime Scene Investigation
11	Research the field of information technology (IT) and define a problem that could be solved by an IT professional. Create a presentation that defines the problem and presents a possible solution including some form of information technology. Create a model (could be 3-D, a diagram, website, etc.) to illustrate the problem, the solution, or both. Include an informative evaluation of the model that explains the features and limitations of the model. *For example, students design a webpage that educates the community about an issue, concept, or program. The webpage may include audio, video, graphics, and text. After completing the webpage, have students check the size of the webpage, calculate download time under various download speeds, and determine changes that could be made to improve download time.* (TN Reading 3, 7; TN Writing 2, 4)	• **TSA** : Essays on Technology, STEM Animation, Video Game Design, Website Design	• **FBLA:** Help Desk, Cyber Security, Computer Problem Solving • **FCCLA**: Advocacy

12	Research a well-known building, such as the Empire State Building. Incorporate information obtained from the research to inform an original design for a structure meant to serve a specific purpose. Create a scaled drawing of the design as well as a 3-D model, attending to appropriate dimensions and scale. Provide evidence supporting why the design will work to meet the specific purpose. *For example, students design and build a model of a bridge that spans a specific space. Present the size of the bridge across a life-sized ravine and specify the material from which the students may build their model (i.e., balsa wood, bass wood, tooth picks, or soda straws). Test the load capacity of the bridge.* (TN Reading 3, 7; TN Writing 1, 4; TN Math 6.RP)	• **TSA**: Essays on Technology, Structural Model	• **FBLA:** 3-D Animation
13	Research a problem related to agriculture, food, and natural resources that could be solved using science, engineering, technology, and/or math. Design and conduct an experiment with a single independent variable that models the selected problem. Collect and analyze the data from the experiment. Create a report on the experiment that includes: a. Introduction explaining the principle tested and the methodology used in the test b. Data in graphs and/or tables c. Explanation of the data analysis d. Findings and conclusion from the experiment, as well as a justification to support the conclusion *For example, students design a water filtration experiment. The students test the ability of various materials, such as activated charcoal, a coffee filter, rocks, dirt, or a combination of materials, to clean water via a filtration process. Students should measure the volume, mass, and density; judge color; measure spectroscopy; and/or test the pH of water samples before and after filtration.* (TN Reading 3, 7; TN Writing 1, 2, 4; TN Math 6.SP)	• **TSA**: Agriculture and Biotechnology Design, Energy Sources, Essays on Technology, Geospatial Technology, Water Infrastructure	• **DECA:** Business Operations Research Events • **FFA:** Agriscience Fair
14	Research a problem relating to transportation, distribution, and logistics that could be solved using science, engineering, technology, and/or math. Design a model of a transportation technology based on specific criteria and constraints. Test the model's performance. Modify single aspects of the model's design and retest the model. Graph and analyze data from the test. Write an explanation based on the data analysis describing how the model could be further modified to optimize the design. Include any reasons why the test may have produced data that does not reflect the actual impact of the change in the test variable. For example, have students design and build a water bottle rocket. Divide the class into groups and have the various groups each test a different variable such as ballast, nose cone design, fin size, fin shape, water-to-air mixture, and bottle size. After each group presents their findings, assign the students to construct a rocket that will reach the maximum altitude. (TN Reading 3, 7; TN Writing 1, 4; TN Math 6.RP, 6.SP)	• **TSA**: Dragster, Essays on Technology, Flight, Jr. Solar Sprint	

ALL	**CAN BE USED WITH ALL/MOST STANDARDS**	• **TSA**: Problem Solving, Technical Design	• **FCCLA**: Illustrated Talk, Career Investigation, Chapter in Review Display, Chapter in Review Portfolio, • **SkillsUSA**: Career Pathways Showcase, Job Skills Demonstration A, Job Skills Demonstration O, Prepared Speech, Extemporaneous Speaking, Chapter Display, Principles Engineering Technology, Engineering Technology/Design