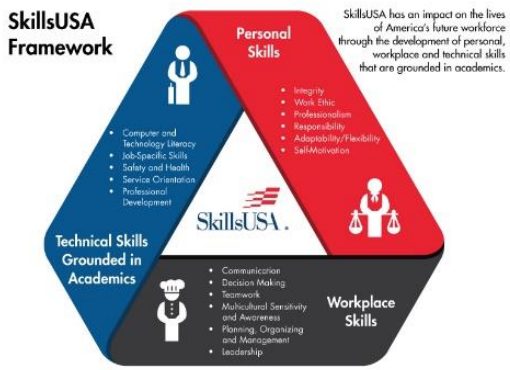
PRINCIPLES OF ENGINEERING & TECHNOLOGY

PURPOSE

To evaluate each contestant's understanding of basic technical concepts/principles of the applied sciences and their ability to demonstrate and explain the concept/principle in action and application.



ELIGIBILITY

For a CTPD to have a contestant, that CTPD must have an approved Principles of Technology program in place. Open to all active members of SkillsUSA who are enrolled or have completed a course in Principles of Technology. One contestant from each school that has registered for this contest on the State Intent Form (open to postsecondary and secondary). This contest will go straight to State unless we have more than 20 registered on the Intent Form.

ORIENTATION

Orientation and Lunch will be at 10:00am. Contest will begin by 12:00pm

CLOTHING REQUIREMENTS

Official SkillsUSA dress or business attire.

Men	Official red blazer or jacket, black dress slacks, white dress shirt, plain black tie with no pattern or SkillsUSA black tie, black socks and black shoes.
Women	Official red blazer or jacket; black dress skirt (knee length) or slacks with businesslike white, collarless blouse or white blouse with small, plain collar that may not extend onto the lapels of the blazer; black sheer or skin-tone hose and black shoes.

Note: Contestants must wear their official contest clothing to the contest orientation meeting. Teams will be judged in official attire at the contestant briefing.

OBSERVER RULE

SPECIAL INFORMATION

Beginning 2020 ALL SkillsUSA Ohio State Championships Contests will require a short interview component. Students should be prepared with basic job interview skills.

Demonstrations with moving devises and/or chemicals of any nature require safety precautions. There will be a penalty for infractions of safety procedures during the demonstration. A serious infraction will result in the contestants being asked to discontinue the demonstration, at the discretion of the judges.

The judges will remain seated at the judging table and the contestants are to remain in the 8' x 12' space provided for their demonstration. If any part of the demonstration needs to be made visible to the judges from another angle or close up, it is the responsibility of the contestant to provide a means of viewing for the judges within the above limitations. The contestants will be provided a table; however, if the table does not need to be used, the floor area within the space provided may be used.

TOOLS PROVIDED BY CONTESTANTS

1. Three copies of discussion paper (3 per demonstration)
2. Equipment and materials to complete one demonstration
3. Any safety equipment that is necessary (safety glasses, apron, etc.)

SCOPE OF THE CONTEST

Knowledge of Performance

There is no written knowledge test for this contest. Instead, a paper will be prepared and presented in this contest.

Skill Performance

The second portion of the contest is a technical demonstration where the knowledge, underlying theories, and applications of the chosen principle(s) in action and application will be demonstrated.

Contest Guidelines

1. Present a technical demonstration of (a) chosen principle(s) of technology. Demonstrate the principle(s) in theory and/or application, and leave the judges with a clear comprehension of the subject unit or sub-unit from principles of technology.
2. Answer questions and discuss the application of the principle(s) with the judges.
3. Any technical concept may be demonstrated, provided it is related to physics, can be referenced to the course curriculum, and incorporates basic principles of applied physics. If any hazardous or caustic materials are used, contestants must bring the associated Material Safety Data Sheet(s) (MSDS) to the contestant meeting and present five copies along with the five copies of the discussion paper for committee review.
4. The recitation of curriculum experiments is not, in and unto itself, sufficient to meet the requirements of the contest. Thorough research and in-depth treatment of the subject matter will be required to comply with the requirements of the contest and to be competitive. Imagination and innovation will be expected by the judges.
5. Any visual aids (signs, charts, transparencies, slides, diagrams) are to be prepared by the contestants. Professionally prepared visual materials are not permitted. No sound device of any kind may be used to transmit or amplify audible words unless they are integral to the technical demonstration itself. No compressed air, gas or flammable liquid may be used.
6. The contestant will use his or her contestant number only and will not mention his or her school, city or state.
7. The Principles of Engineering contest is an individual performance event. However, others can assist to set up and/or tear down the demonstration. Only students can be used as models or props in the demonstration.
8. Discussion paper — The contestant will prepare and present to the contest chair five copies of a discussion paper in accordance with the following requirements.
   a. The discussion paper shall include subjects (such as background, history, development, explanation of the theory, applications, examples, methods of demonstration or benefits) to be addressed to the extent appropriate to present a clear explanation and demonstrate the contestant's understanding of the subject.
   b. The discussion paper must be typed, one-and-a-half- or double-spaced in 10- or 12-point type, must have 1-inch margins on all sides and must be four to eight pages long. Each page (except the cover) is to have a one-up page number at the bottom of the page. *The cover page will not be counted in the page count; however, all tables, graphs, pictures and illustrations will be counted.*
      A cover page is required and must include the following: "(current year) Principles of Engineering Contest," and title of the technical demonstration and blanks for date, time and contestant number in the upper right-hand corner. The contestant number shall be placed in the upper right-hand corner of each page before handing in the paper.
   c. The discussion paper shall conform to the following format:
      1) Title — short, descriptive title for the technical demonstration, centered near the top of the page.
      2) Introduction — a descriptive introduction to the technical demonstration principle(s) involved, objectives of the demonstration and reason(s) for the choice.
      3) Discussion — as a minimum, include a detailed discussion of the following subject areas:
         a) The history and background of the principle(s) involved
         b) A description of the principle(s)
            involved and an explanation of the scientific theories embodied in the principle(s)
         c) The technical demonstration to be given: how it will be conducted, what will be shown and how it relates to the subject matter
         d) Practical applications of the principle (or principles) involved, including past, present and/or future
         e) Provide examples of demonstrations of the principle(s) that are possible or in existence, but are not practical for the contest
         f) Cite the particular unit and/or sub-unit in Principles of Technology curriculum that is the basis for this technical demonstration
      4) Summary — present a concluding discussion of the principle(s) to be demonstrated, what the demonstration will have achieved, relevance to the practical world and any concluding remarks or conclusions.
   d. A bibliography shall be included with the discussion paper to properly credit reference sources. Footnotes are required in the text to credit specific references. All bibliography and footnote information shall be included at the end of the paper. Formatting is at the discretion of the contestant; however, complete credit and reference data is mandatory. Page numbers such as "B1" will be used for the bibliography and footnote section but will not be included in the page count.
9. Technical demonstration — The contestant shall prepare and present a technical demonstration to a panel of judges in accordance with the following requirements. The purpose of the technical demonstration is for the contestants to

demonstrate thorough knowledge and awareness of the history, underlying theories, descriptive knowledge and applications of the chosen principle(s) in action and application. Exhibition of the contestants' demonstrations to the general public will be required, but not scored.

10. Contestants will be allowed five minutes to set up the demonstration and five minutes to clear the demonstration room. Penalty: Five points will be deducted for each 30 seconds or fraction thereof over the five- minute setup or clearing times.
    Each presentation of the technical demonstration to the judges shall be at least 10 minutes in length and shall not exceed 15 minutes in length. Penalty: Five points will be deducted for each 30 seconds or fraction thereof under 10 minutes or over 15 minutes in length. The timekeeper will indicate elapsed time of the demonstration at the 10-, 13- and 15-minute points.
    Setup time will begin when the contestant indicates readiness to set up by handing to the lead judge a 3"x5" card containing the title of the technical demonstration and the contestant number. The demonstration time will begin when the contestant indicates readiness and will stop when the contestant indicates that the technical demonstration has ended. The tear-down time will be timed from the end of the question and answer period until the contestant indicates completion to the lead judge.
11. A question and answer period will be allowed at the conclusion of each demonstration to permit the contest judges to query the contestants and further evaluate the contestants' understanding of the demonstrated principle. Questions by the judges may cover any aspect of a contestant's chosen principle(s) as presented in the discussion paper or technical demonstration. **This question and answer period is not to exceed 10 minutes in length.**

Judging Criteria

See the Rubric for Principles of Engineering & Technology for detailed description of each category.

STANDARDS AND COMPETENCIES

Ohio Technical Competencies

1.1.1	Identify the knowledge, skills and abilities necessary to succeed in careers.
1.1.5	Develop strategies for self-promotion in the hiring process (e.g., filling out job applications, résumé writing, interviewing skills, portfolio development).
1.2.1	Extract relevant, valid information from materials and cite sources of information.
1.2.2	Deliver formal and informal presentations.
1.2.3	Identify and use verbal, nonverbal and active listening skills to communicate effectively.
1.2.5	Communicate information (e.g., directions, ideas, vision, workplace expectations) for an intended audience and purpose.
1.2.6	Use proper grammar and expression in all aspects of communication.
1.2.10	Use interpersonal skills to provide group leadership, promote collaboration and work in a team.
1.2.11	Write professional correspondence, documents, job applications and résumés.
1.2.12	Use technical writing skills to complete forms and create reports.
1.2.13	Identify stakeholders and solicit their opinions.
1.4.2	Select and use software applications to locate, record, analyze and present information (e.g., word processing, e-mail, spreadsheet, databases, presentation, Internet search engines).

Ohio Academic Standards

English Language Arts

Reading

Ohio Technical Competencies	ELA Standard	ELA Standard Description
1.2.1	RI.9-10.1	Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.
1.2.1	RI.11-12.1	Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.

Writing

Ohio Technical Competencies	ELA Standard	ELA Standard Description
1.1.5 1.2.5 1.2.11	W.9-10.4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)
1.4.2	W.9-10-6	Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
1.2.1	W.9-10.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.
1.1.5 1.2.5 1.2.11	W.11-12.4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)
1.4.2	W.11-12.6	Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.
1.1.1	W.11-12.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
1.2.1	W.11-12.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

Speaking and Listening

Ohio Technical Competencies	ELA Standard	ELA Standard Description
1.1.1 1.2.3 1.2.5 1.2.10	SL.9-10.1	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grades 9–10 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas. b. Work with peers to set rules for collegial discussions and decision- making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed. c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions. d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.
1.2.2	SL.9-10.4	Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

1.2.2 1.4.2	SL.9-10.5	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
1.2.2 1.2.5 1.2.6	SL.9-10.6	Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate. (See grades 9–10 Language standards 1 and 3 for specific expectations.)
1.1.1 1.2.3 1.2.5 1.2.10	SL.11-12.1	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grades 11–12 topics, texts, and issues*, building on others' ideas and expressing their own clearly and persuasively. a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas. b. Work with peers to promote civil, democratic discussions and decision making, set clear goals and deadlines, and establish individual roles as needed. c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives. d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task.
1.2.2	SL. 11-12.4	Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.
1.2.2 1.4.2	SL. 11-12.5	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
1.2.2 1.2.5 1.2.6	SL. 11-12.6	Adapt speech to a variety of contexts and tasks, demonstrating a command of formal English when indicated or appropriate. (See grades 11–12 Language standards 1 and 3 for specific expectations.)

Language

Ohio Technical Competencies	ELA Standard	ELA Standard Description
1.2.6	L.9-10.1	Demonstrate command of the conventions of standard English grammar and usage when writing or speaking. a. Use parallel structure.* b. Use various types of phrases (noun, verb, adjectival, adverbial, participial, prepositional, absolute) and clauses (independent, dependent; noun, relative, adverbial) to convey specific meanings and add variety and interest to writing or presentations.
1.2.6	L.9-10.2	Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing. a. Use a semicolon (and perhaps a conjunctive adverb) to link two or more closely related independent clauses. b. Use a colon to introduce a list or quotation. c. Spell correctly.
1.2.6	L.9-10.3	Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.

		a. Write work so that it conforms to the guidelines in a style manual (e.g., MLA Handbook, Turabian's *Manual for Writers*) appropriate for the discipline and writing type. b. Edit work so that it conforms to the guidelines in a style manual appropriate for the discipline and writing type.
1.2.6	L.11-12.1	Demonstrate command of the conventions of standard English grammar and usage when writing or speaking. a. Apply the understanding that usage is a matter of convention, can change over time, and is sometimes contested. b. Resolve issues of complex or contested usage, consulting references (e.g., Merriam-Webster's Dictionary of English Usage, Garner's Modern American Usage) as needed.
1.2.6	L.11-12.2	Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing. a. Observe hyphenation conventions. b. Spell correctly.
1.2.6	L.11-12.3	Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening. a. Vary syntax for effect, consulting references (e.g., Tufte's *Artful Sentences*) for guidance as needed. b. Apply an understanding of syntax to the study of complex texts when reading.

Writing Standards for Literacy in History/Social Studies, Science and Technical Subjects

Ohio Technical Competencies	ELA Standard	ELA Standard Description
1.2.12	WHST.9-10.4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
1.2.12	WHST.9-10.5	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
1.2.12	WHST.11-12.4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
1.2.12	WHST.11-12.5	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

Mathematics

Standard	Description
N.RN.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents.
N.Q.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. ★
N.Q.2	Define appropriate quantities for the purpose of descriptive modeling.★
N.Q.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.★
N.VM.6	Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.
A.SSE.1	Interpret expressions that represent a quantity in terms of its context. ★ a. Interpret parts of an expression, such as terms, factors, and coefficients. b. Interpret complicated expressions by viewing one or more of their parts as a single entity.

A.SSE.2	Use the structure of an expression to identify ways to rewrite it. *For example, to factor 3x(x − 5) + 2(x − 5), students should recognize that the "x − 5" is common to both expressions being added, so it simplifies to (3x + 2)(x − 5); or see x4 − y4 as (x2)2 − (y2)2, thus recognizing it as a difference of squares that can be factored as (x2 − y2)(x2 + y2).*
A.SSE.3	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.★ a. Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. c. Use the properties of exponents to transform expressions for exponential functions. *For example, 8^t can be written as 2^{3t}.*
A.APR.1	Understand that polynomials form a system analogous to the integers, namely, that they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. a. Focus on polynomial expressions that simplify to forms that are linear or quadratic. (A1, M2) b. Extend to polynomial expressions beyond those expressions that simplify to forms that are linear or quadratic. (A2, M3)
A.APR.3	Identify zeros of polynomials, when factoring is reasonable, and use the zeros to construct a rough graph of the function defined by the polynomial.
A.REI.1	Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
A.REI.3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
A.REI.4	Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in *x* into an equation of the form (*x* − *p*)2 = *q* that has the same solutions. b. Solve quadratic equations as appropriate to the initial form of the equation by inspection, e.g., for *x*2 = 49; taking square roots; completing the square; applying the quadratic formula; or utilizing the Zero-Product Property after factoring. c. (+) Derive the quadratic formula using the method of completing the square.
A.REI.10	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
F.IF.1	Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then *f(x)* denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation *y = f(x)*.
F.IF.4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include the following: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*★(A2, M3) a. Focus on linear and exponential functions. (M1) b. Focus on linear, quadratic, and exponential functions. (A1, M2)
F.IF.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*★ a. Focus on linear and exponential functions. (M1) b. Focus on linear, quadratic, and exponential functions. (A1, M2) c. Emphasize the selection of a type of function for a model based on behavior of data and context. (A2, M3)
F.IF.6	Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★ (A2, M3)

F.IF.7	Graph functions expressed symbolically and indicate key features of the graph, by hand in simple cases and using technology for more complicated cases. Include applications and how key features relate to characteristics of a situation, making selection of a particular type of function model appropriate.★ a. Graph linear functions and indicate intercepts. (A1, M1)
F.BF.1	Write a function that describes a relationship between two quantities.★ a. Determine an explicit expression, a recursive process, or steps for calculation from context. i. Focus on linear and exponential functions. (A1, M1) ii. Focus on situations that exhibit quadratic or exponential relationships. (A1, M2) b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.* (A2, M3) c. (+) Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.*
G.CO.2	Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not, e.g., translation versus horizontal stretch.
G.CO.3	Identify the symmetries of a figure, which are the rotations and reflections that carry it onto itself. a. Identify figures that have line symmetry; draw and use lines of symmetry to analyze properties of shapes. b. Identify figures that have rotational symmetry; determine the angle of rotation, and use rotational symmetry to analyze properties of shapes.
G.CO.5	Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using items such as graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.
G.CO.9	Prove and apply theorems about lines and angles. *Theorems include but are not restricted to the following: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.*
G.SRT.4	Prove and apply theorems about triangles. *Theorems include but are not restricted to the following: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.*
G.GMD.3	Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. ★
G.GMD.4	Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.
S.MD.3	Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. *For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.*★
S.MD.4	Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. *For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?*★
S.MD.5	Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.★ a. Find the expected payoff for a game of chance. For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant. b. Evaluate and compare strategies on the basis of expected values. *For example, compare a high-deductible versus a low- deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.*
S.MD.6	Use probabilities to make fair decisions, e.g., drawing by lots, using a random number generator.★
S.MD.7	Analyze decisions and strategies using probability concepts, e.g., product testing, medical testing, pulling a hockey goalie at the end of a game.★

Science

The Ohio Science Standards addressed are dependent on the project.

During grades 9 through 12, all students must use the following scientific processes with appropriate laboratory safety techniques to construct their knowledge and understanding in all science content areas:

Scientific Processes

- Identify questions and concepts that guide scientific investigations;
- Design and conduct scientific investigations;
- Use technology and mathematics to improve investigations and communications;
- Formulate and revise explanations and models using logic and evidence (critical thinking);
- Recognize and analyze explanations and models; and
- Communicate and support a scientific argument.