

CARLISLE AREA SCHOOL DISTRICT

Carlisle, PA 17013

FOUNDATIONS OF TECHNOLOGY

GRADES 9-12

Date of Board Approval: June 19, 2014

CARLISLE AREA SCHOOL DISTRICT

PLANNED INSTRUCTION COVER PAGE

TITLE OF COURSE: Foundations of Technology

SUBJECT: EMD

GRADE LEVEL: 9-12

COURSE LENGTH: 1 year

DURATION: 50 minutes

FREQUENCY: 4/wk

PREREQUISITES: None

CREDIT: 1credit

LEVEL: N/A

Course Description/Objectives:

Foundations of Technology is an introductory level course intended for students who have an interest in manufacturing activities using tools, materials and equipment. Students engineer, manufacture and design a number of practical items using wood, metal, plastic composites and other materials. Course competencies include learning how to safely use various woodworking and metalworking tools and equipment including lathes, welders and saws. Science and math concepts are used in solving technological problems in a project based environment.

Text:

Curriculum Writing Committee: Matt Freeman and Najee Ferguson with assistance from Sean Allewelt

COURSE TIME LINE

Unit 1: Introduction to Technology

- History of Technology
- Types of Technology
- Technological Advances

6 days

Unit 2: Measurement

- Standard Measurement
- Metric Measurement
- Measurement Tools

6 days

Unit 3: Technical Sketching

- Design
- Proportions
- Geometric Shapes
- Line Types

12 days

Unit 4: Blueprint Reading

- Dimensions of an Object
- Views of an Object

5 days

Unit 5: Computer Aided Drafting, Design, and Manufacturing

- Page Layout
- Drawing Commands
- Dimensioning
- Types of Drawings
- 3 D Manufacturing

25 days

Unit 6: Lab Safety and Procedures

- Elements of Safety 10 days
- Emergency Drills and Procedures
- Material Safety Data Sheets
- Machine and Tool Safety

Unit 7: Woodworking Machines, Tools and Processes

- Tool Identification and Usage 25 days
- Machine Identification and Usage
- Types of Lumber and Finishes
- Mechanical Fasteners, Adhesives and Joints

Unit 8: Metal Working Machines, Tools and Processes

- Tool Identification and Usage 30 days
- Machine Identification Usage
- Mechanical Fasteners
- Adhesion vs. Cohesion
- Machining
- Metallurgy
- Pattern Development

Unit 9: Mass Production

- Jigs 25 days
- Fixtures
- Quality Assurance
- Group Dynamics

TOTAL: 144 days

KNOW, UNDERSTAND, DO

COURSE: Foundations of Technology

TIME FRAME: 6 days

UNIT # 1: Introduction to Technology (Essential)

GRADE: 9-12

STANDARDS:	
Pennsylvania Academic Standards for Science and Technology and Engineering Education –Grades 9-12:	
3.4.10.A1	<ul style="list-style-type: none"> • Illustrate how profit and an economic market often drive the development of technologies.
3.4.10.A3	<ul style="list-style-type: none"> • Examine how technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function.
3.4.12.A1	<ul style="list-style-type: none"> • Compare and contrast the rate of technological development over time.
3.4.12.A3	<ul style="list-style-type: none"> • Demonstrate how technological progress promotes the advancement of science, technology, engineering and mathematics (STEM).
3.4.10.B1	<ul style="list-style-type: none"> • Compare and contrast how the use of technology involves weighing the trade-offs between positive and negative effects.
3.4.10.B4	<ul style="list-style-type: none"> • Recognize that technological development has been evolutionary, the result of a series of refinements to a basic invention.
3.4.12.B1	<ul style="list-style-type: none"> • Analyze ethical, social, economic and cultural considerations as related to the development, selection and use of technologies
Pennsylvania Common Core Standards for Science and Technical Subjects-Grades 9-12:	
CC.3.6.9-10.C	<ul style="list-style-type: none"> • Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose and audience.
CC.3.6.9-10.H	<ul style="list-style-type: none"> • Draw evidence from informational texts to support analysis, reflection, and research.
CC.3.5.9-10.B	<ul style="list-style-type: none"> • Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

KNOW, UNDERSTAND, DO

COURSE: Foundations of Technology

TIME FRAME: 6 days

UNIT # 1: Introduction to Technology (Essential)

GRADE: 9-12

UNDERSTANDINGS

The many different types of technology have a clearly documented history, affect everyone and change over time.

COMMON ASSESSMENTS/CULMINATING ACTIVITY

Research presentation- technology related career/job.

KNOW

- Define technology.
- Identify the significance of the Industrial Revolution.
- List the five workable areas of technology.
- List historically important eras in human technology development.
- Identify inventions from various eras of human development.
- List the positive and negative impacts of various technological developments.
- Identify the effects technology can impose on a society or culture.

DO

- Propose an original technological invention.
- Create a technology timeline.
- Trace the history of a significant technological breakthrough.
- Compare and contrast science and technology.
- Predict the future of a specific technological invention.
- Investigate career opportunities in Science, Technology, Engineering and Math including present and future employment projects.

KNOW, UNDERSTAND, DO

COURSE: Foundations of Technology

TIME FRAME: 6 days

UNIT # 2: Measurement (Essential)

GRADE: 9-12

STANDARDS:	
Pennsylvania Academic Standards for Science and Technology and Engineering Education-Grades 9-12:	
3.4.12.A2	• Describe how management is the process of planning, organizing, and controlling work.
3.4.10.C1	• Apply the components of the technological design process.
3.4.12.C3	• Apply the concept that many technological problems require a multi-disciplinary approach.
Pennsylvania Common Core Standards for Mathematics-High School:	
CC.2.1.HS.F.5	• Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
CC.2.1.HS.F.2	• Apply properties of rational and irrational numbers to solve real world or mathematical problems.
CC.2.1.HS.F.3	• Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs and data displays.
CC.2.1.HS.F.6	• Extend the knowledge of arithmetic operations and apply to complex numbers.
CC.2.1.HS.F.4	• Use units as a way to understand problems and to guide the solution of multi-step problems.

KNOW, UNDERSTAND, DO

COURSE: Foundations of Technology

TIME FRAME: 6 days

UNIT # 2: Measurement (Essential)

GRADE: 9-12

UNDERSTANDINGS

Accurate measurements are essentials when working with materials. Students must know how to read, evaluate, convert and transfer measurements to complete engineering, manufacturing and design projects.

COMMON ASSESSMENTS/CULMINATING ACTIVITY

N/A

KNOW

- Define: standard measurement, inches, fractions, decimals, conversion, metric, millimeters, centimeters, meters, ruler, tape measure, micrometer, architect's scale, calipers, and dial.
- Identify the elements of standard measurement.
- Identify the elements of metric measurement.
- Identify basic measurement tools.
- List the mathematical equations essential to measurement.

DO

- Convert fractions to decimals and decimals to fractions.
- Convert standard measurement to metric measurement; convert metric measurement to standard measurement.
- Convert metric units.
- Demonstrate how to read and interpret a scale,
- Demonstrate how to read and interpret a caliper.
- Demonstrate how to read and interpret a micrometer.
- Demonstrate how to read and interpret metric and standard rulers.
- Demonstrate how to divide fractions and mixed numbers.
- Demonstrate how to read and interpret a dial.

KNOW, UNDERSTAND, DO

COURSE: Foundations of Technology

TIME FRAME: 12 days

UNIT # 3: Technical Sketching (Essential)

GRADE: 9-12

STANDARDS:	
Pennsylvania Academic Standards for Science and Technology and Engineering Education-Grades 9-12:	
3.4.10.C1	<ul style="list-style-type: none">• Apply the components of the technological design process.
3.4.10.C3	<ul style="list-style-type: none">• Illustrate the concept that not all problems are technological and not every problem can be solved using technology.
3.4.12.C3	<ul style="list-style-type: none">• Apply the concept that many technological problems require a multi-disciplinary approach.
Pennsylvania Common Core Standards for Science and Technical Subjects-Grades 9-12:	
CC.3.5.9-10.D	<ul style="list-style-type: none">• Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
CC.3.5.9-10.C	<ul style="list-style-type: none">• Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CC.3.5.9-10.G	<ul style="list-style-type: none">• Translate quantitative or technical information expressed in words in a text into visual form (e.g. table or chart) and translate information expressed visually or mathematically (e.g. in an equation) into words.
CC.3.6.9-10.C	<ul style="list-style-type: none">• Produce clear and coherent writing in which the development, organization and style are appropriate to task, purpose and audience.
CC.3.6.9-10.H	<ul style="list-style-type: none">• Draw evidence from informational texts to support analysis, reflection, and research.

KNOW, UNDERSTAND, DO

COURSE: Foundations of Technology

TIME FRAME: 12 days

UNIT # 3: Technical Sketching (Essential)

GRADE: 9-12

UNDERSTANDINGS

Planning and problem solving are essential aspects of engineering, manufacturing and design. Shape description, scale and perspective all determine proportions. The design process is essential to technological development.

COMMON ASSESSMENTS/CULMINATING ACTIVITY

Technical sketch analysis project

KNOW

- List the sequence of steps of various problem-solving techniques.
- List the seven steps of the design process: problem statement, design brief, brainstorm, modeling, feedback, test, and analyze.
- Define: sketching, prototype, and feedback loop.
- List the geometric elements used in technical sketching: circle, rectangle, triangle, pentagon, hexagon, and octagon.
- Define how proportion, perspective and shape impact design.
- List the line types used in technical sketching: object lines, hidden lines, dimension lines, and center lines.
- Identify basic technical sketching tools used by engineers and designers: rulers, scale, pencils, drafting table.

DO

- Apply problem-solving techniques to solve a series of scenarios.
- Use the seven steps of the design process to develop an idea for a technological device.
- Draw a sketch to scale.
- Sketch multiple views of an object.

KNOW, UNDERSTAND, DO

COURSE: Foundations of Technology

TIME FRAME: 5 days

UNIT # 4: Blueprint Reading (Compact)

GRADE: 9-12

STANDARDS:	
Pennsylvania Academic Standards for Science and Technology and Engineering Education-Grades 9-12:	
3.4.12.C1	<ul style="list-style-type: none"> Apply the concept that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
3.4.12.C3	<ul style="list-style-type: none"> Apply the concept that many technological problems require a multi-disciplinary approach.
3.4.10.C1	<ul style="list-style-type: none"> Apply the components of the technological design process.
Pennsylvania Common Core Standards for Mathematics-High School:	
CC.2.1.HS.F.4	<ul style="list-style-type: none"> Use units as a way to understand problems and to guide the solution of multi-step problems.
CC.2.1.HS.F.3	<ul style="list-style-type: none"> Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs and data displays.
CC.2.1.HS.F.5	<ul style="list-style-type: none"> Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
Pennsylvania Common Core Standards for Science and Technical Subjects-Grades 9-12:	
CC.3.5.9-10.D	<ul style="list-style-type: none"> Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
CC.3.5.9-10.C	<ul style="list-style-type: none"> Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CC.3.5.9-10.G	<ul style="list-style-type: none"> Translate quantitative or technical information expressed in words in a text into visual form (e.g. table or chart) and translate information expressed visually or mathematically (e.g. in an equation) into words.

KNOW, UNDERSTAND, DO

COURSE: Foundations of Technology

TIME FRAME: 5 days

UNIT # 4: Blueprint Reading (Compact)

GRADE: 9-12

UNDERSTANDINGS

Blueprints provide visual directions for engineers. It is essential to interpret blueprints correctly to achieve accuracy in engineering, manufacturing and design. Blueprints help technologists resolve design flaws before the model or prototype is developed.

COMMON ASSESSMENTS/CULMINATING ACTIVITY

N/A

KNOW

- Define: dimensions.
- List the different views of an object: front, top, bottom, right, and left.
- List the seven views of a blueprint: front, top, bottom, side auxiliary, section, and pictorial.
- Describe how a scale rule is used to covert measurements.

DO

- Use a scale rule to interpret dimensions on a blueprint.
- Create a model from a set of blueprints.
- Demonstrate how to covert measurements with a scale rule.

KNOW, UNDERSTAND, DO

COURSE: Foundations of Technology

TIME FRAME: 25 days

UNIT # 5: Computer Aided Drafting, Design, and Manufacturing (Essential)

GRADE: 9-12

STANDARDS:	
Pennsylvania Academic Standards for Science and Technology and Engineering Education-Grades 9-12:	
3.4.10.C1	<ul style="list-style-type: none"> Apply the components of the technological design process.
3.4.10.C2	<ul style="list-style-type: none"> Analyze a prototype and/or create a working model to test a design concept by making actual observations and necessary adjustments.
3.4.10.D1	<ul style="list-style-type: none"> Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product.
3.4.12.A2	<ul style="list-style-type: none"> Describe how management is the process of planning, organizing, and controlling work.
3.4.12.C2	<ul style="list-style-type: none"> Apply the concept that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
3.4.12.C3	<ul style="list-style-type: none"> Apply the concept that many technological problems require a multi-disciplinary approach.
Pennsylvania Common Core Standards for Science and Technical Subjects-Grades 9-12:	
CC.3.5.9-10.D	<ul style="list-style-type: none"> Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
CC.3.5.9-10.C	<ul style="list-style-type: none"> Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CC.3.5.9-10.G	<ul style="list-style-type: none"> Translate quantitative or technical information expressed in words in a text into visual form (e.g. table or chart) and translate information expressed visually or mathematically (e.g. in an equation) into words.

KNOW, UNDERSTAND, DO

COURSE: Foundations of Technology

TIME FRAME: 25 days

UNIT # 5: Computer Aided Drafting, Design, and Manufacturing (Essential)

GRADE: 9-12

UNDERSTANDINGS

Technologists use drafting tools, computerized programs and 3D technologies to plan, organize and control their work. These designs are controlled by the individual's creativity, resourcefulness and ability to think abstractly and concretely about their ideas.

COMMON ASSESSMENTS/CULMINATING ACTIVITY

3D manufactured prototype project using CADD software with drawings from appropriate layers.

KNOW

- Identify the tools of mechanical drawing and design.
- Identify the tools of computer aided drawing and design.
- Identify orthographic projections, isometric, oblique, section, auxiliary, perspective and pictorial views.
- Identify common lines and their line weights: object, hidden, center, construction, dimension, and border.
- Identify essential geometric shapes and their influence on design: rectangle, pentagon, triangle, octagon, circle, and polygon.
- List the steps of organizing a CADD drawing with appropriate layers.
- Recognize command lines in computerized design software programs.
- Recognize the influence of 3D technologies in drafting & design.

DO

- Sketch a prototype design.
- Create a scale drawing of an object using mechanical drafting/drawing tools.
- Create a scale drawing of an object using CADD software.
- Test and refine a prototype design using simulation software.
- Create an orthographic drawing from an isometric drawing.
- Create an isometric drawing from an orthographic drawing.
- Create a solid model from an object.
- Create an orthographic view from a solid model.
- Set up a CADD drawing with appropriate layers.
- Demonstrate how to use 3D technologies to manufacture a prototype.

KNOW, UNDERSTAND, DO

COURSE: Foundations of Technology

TIME FRAME: 10 days

UNIT # 6: Lab Safety and Procedures (Essential)

GRADE: 9-12

STANDARDS:	
Pennsylvania Academic Standards for Science and Technology and Engineering Education-Grades 9-12:	
3.4.10.D3	<ul style="list-style-type: none"> • Synthesize data, analyze trends, and draw conclusions regarding the effect of technology on the individual, society and the environment.
3.4.10.E7	<ul style="list-style-type: none"> • Evaluate structure design as related to function, considering such factors as style, convenience, safety and efficiency.
3.4.12.B2	<ul style="list-style-type: none"> • Illustrate how, with the aid of technology, various aspects of the environment can be monitored to provide information for decision making.
Pennsylvania Academic Standards for Health, Safety, and Physical Education-Grades 9-12:	
10.3.9.A	<ul style="list-style-type: none"> • Analyze the role of individual responsibility for safe practices and injury prevention in the home, school and community.
10.3.9.D	<ul style="list-style-type: none"> • Analyze the role of individual responsibility for safety during organized group activities.
Pennsylvania Common Core Standards for Science and Technical Subjects-Grades 9-12:	
CC.3.5.9-10.C	<ul style="list-style-type: none"> • Follow precisely a complex multistep procedure when carrying our experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CC.3.6.9-10.C	<ul style="list-style-type: none"> • Produce clear and coherent writing in which the development, organization and style are appropriate to task, purpose and audience.
CC.3.6.9-10.H	<ul style="list-style-type: none"> • Draw evidence from informational texts to support analysis, reflection, and research.

KNOW, UNDERSTAND, DO

COURSE: Foundations of Technology

TIME FRAME: 10 days

UNIT # 6: Lab Safety and Procedures (Essential)

GRADE: 9-12

UNDERSTANDINGS

Lab safety procedures must be followed in operating equipment efficiently and accurately. Safety is the first step in the procedures for using all equipment.

COMMON ASSESSMENTS/CULMINATING ACTIVITY

Create a lab safety poster.

KNOW

- Identify the steps of an emergency procedure.
- Identify the purpose for an emergency procedure.
- Identify the function of an emergency stop.
- List the steps for using hand tools safely.
- List the steps for using equipment and machines safely.
- Describe the information found on material safety data sheets.
- Distinguish between appropriate devices used for ear and eye protection.

DO

- Analyze material safety data sheets for essential information.
- Demonstrate proper use of various hand tools.
- Demonstrate effective use of various pieces of equipment: welder, lathe, table saw, band saw, etc.
- Demonstrate the proper way to wear eye protection.
- Demonstrate the proper way to wear ear protection.
- Master a safety task list with 100% accuracy.

KNOW, UNDERSTAND, DO

COURSE: Foundations of Technology

TIME FRAME: 25 days

UNIT # 7: Woodworking Machines, Tools and Processes (Important)

GRADE: 9-12

STANDARDS:	
Pennsylvania Academic Standards for Science and Technology and Engineering Education-Grades 9-12:	
3.4.10.C1	<ul style="list-style-type: none"> • Apply the components of the technological design process.
3.4.10.D1	<ul style="list-style-type: none"> • Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of a final product.
3.4.10.D2	<ul style="list-style-type: none"> • Diagnose a malfunctioning system and use tools, materials and knowledge to repair it.
3.4.12.D2	<ul style="list-style-type: none"> • Verify that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
3.4.10.E7	<ul style="list-style-type: none"> • Evaluate structure design as related to function, considering such factors as style, convenience, safety, and efficiency.
Pennsylvania Common Core Standards for Mathematics-High School:	
CC.2.1.HS.F.4	<ul style="list-style-type: none"> • Use units as a way to understand problems and to guide the solution of multi-step problems.
CC.2.1.HS.F.5	<ul style="list-style-type: none"> • Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
CC.2.1.HS.F.2	<ul style="list-style-type: none"> • Apply properties of rational and irrational numbers to solve real world or mathematical problems.
Pennsylvania Common Core Standards for Science and Technical Subjects-Grades 9-12:	
CC.3.5.9-10.C	<ul style="list-style-type: none"> • Follow precisely a complex multistep procedure when carrying our experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CC.3.5.9-10.D	<ul style="list-style-type: none"> • Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical contest relevant to grades 9-10 texts and topics.

KNOW, UNDERSTAND, DO

COURSE: Foundations of Technology

TIME FRAME: 25 days

UNIT # 7: Woodworking Machines, Tools and Processes (Important)

GRADE: 9-12

UNDERSTANDINGS

Proper and safe use of woodworking tools and machines to engineer, manufacture and design an original project made from wood materials. Use appropriate woodworking processes to achieve a desirable result.

COMMON ASSESSMENTS/CULMINATING ACTIVITY

Woodworking project: Student's choice demonstrating the engineering, manufacturing and design process.

KNOW

- Identify wood working hand tools and their uses.
- Identify wood working machines and their uses.
- Identify types of lumber. List the pros and cons of each.
- Identify mechanical fasteners: screws, nuts, bolts, and nails.
- Identify the six types of joints: butt, lap, miter, mortis, tenon, dado and rabbet.
- Identify various abrasives: emery cloth, rasp, file and sand paper.
- Identify various wood finishes: oil based, polyurethane and shellac.
- Identify various types of paint: interior, exterior, latex, oil based.
- Identify various adhesives: glue, epoxy and contact-cement.

DO

- Demonstrate the concept of square.
- Engineer, manufacture and design a jewelry box.
- Construct prototypes of wood joints.
- Sand and finish a scoop.
- Prepare a surface for adhesives.
- Demonstrate proper use of wood working tools.
- Demonstrate proper use of wood working equipment.
- Demonstrate proper technique for installing mechanical fasteners.

KNOW, UNDERSTAND, DO

COURSE: Foundations of Technology

TIME FRAME: 30 days

UNIT # 8: Metalworking Machines, Tools and Processes (Important)

GRADE: 9-12

STANDARDS:	
Pennsylvania Academic Standards for Science and Technology and Engineering Education-Grades 9-12:	
3.4.10.C1	<ul style="list-style-type: none"> • Apply the components of the technological design process.
3.4.10.D1	<ul style="list-style-type: none"> • Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of a final product.
3.4.10.D2	<ul style="list-style-type: none"> • Diagnose a malfunctioning system and use tools, materials and knowledge to repair it.
3.4.12.D2	<ul style="list-style-type: none"> • Verify that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
3.4.10.E7	<ul style="list-style-type: none"> • Evaluate structure design as related to function, considering such factors as style, convenience, safety, and efficiency.
Pennsylvania Common Core Standards for Mathematics-High School:	
CC.2.1.HS.F.4	<ul style="list-style-type: none"> • Use units as a way to understand problems and to guide the solution of multi-step problems.
CC.2.1.HS.F.5	<ul style="list-style-type: none"> • Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
CC.2.1.HS.F.2	<ul style="list-style-type: none"> • Apply properties of rational and irrational numbers to solve real world or mathematical problems.
Pennsylvania Common Core Standards for Science and Technical Subjects-Grades 9-12:	
CC.3.5.9-10.C	<ul style="list-style-type: none"> • Follow precisely a complex multistep procedure when carrying our experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CC.3.5.9-10.D	<ul style="list-style-type: none"> • Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical contest relevant to grades 9-10 texts and topics.

KNOW, UNDERSTAND, DO

COURSE: Foundations of Technology

TIME FRAME: 30 days

UNIT # 8: Metalworking Machines, Tools and Processes (Important)

GRADE: 9-12

UNDERSTANDINGS

Proper and safe use of metalworking tools and machines to engineer, manufacture and design an original project made from different metals. Use appropriate metalworking processes to achieve a desirable result.

COMMON ASSESSMENTS/CULMINATING ACTIVITY

Metalworking project: Student's choice demonstrating the engineering, manufacturing and design process.

KNOW

- Identify metalworking hand tools and their uses.
- Identify metalworking machines and their uses.
- Identify types of metal (metallurgy) and the pros and cons of each.
- Identify the reasons for using a pattern when designing with metal.
- Identify mechanical fasteners: rivet, sheet metal screws, nuts, bolts.
- Identify adhesives and cohesive: solder, weld, electrode, and flux.
- Describe the machining process: mill, cutting speed, lath, cutting tool, high-speed steel, and carbide.
- Distinguish between the different methods of welding.

DO

- Demonstrate the concept of square.
- Engineer, manufacture and design a metal scoop.
- Demonstrate proper welding techniques.
- Prepare a metal surface for adhesives.
- Demonstrate proper use of metalworking tools.
- Demonstrate proper use of metalworking equipment.
- Calculate the cutting speed for steel and aluminum.
- Mill a slot.
- Demonstrate proper technique for installing mechanical fasteners.
- Demonstrate proper soldering technique.

KNOW, UNDERSTAND, DO

COURSE: Foundations of Technology

TIME FRAME: 25 days

UNIT # 9: Mass Production (Important)

GRADE: 9-12

STANDARDS:	
Pennsylvania Academic Standards for Science and Technology and Engineering Education-Grades 9-12:	
3.4.12.E6	<ul style="list-style-type: none"> • Compare and contrast the importance of science, technology, engineering and math (STEM) as it pertains to the manufactured world.
3.4.12.A2	<ul style="list-style-type: none"> • Describe how management is the process of planning, organizing, and controlling work.
3.4.10.C2	<ul style="list-style-type: none"> • Analyze a prototype and/or create a working model to test a design concept by making actual observations and necessary adjustments.
3.4.10.E6	<ul style="list-style-type: none"> • Illustrate how manufacturing systems may be classified into types such as customized production, batch production, and continuous production.
3.4.10.C1	<ul style="list-style-type: none"> • Apply the components of the technological design process.
3.4.10.D1	<ul style="list-style-type: none"> • Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of a final product.
Pennsylvania Common Core Standards for Science and Technical Subjects-Grades 9-12:	
CC.3.5.9-10.C	<ul style="list-style-type: none"> • Follow precisely a complex multistep procedure when carrying our experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CC.3.5.9-10.D	<ul style="list-style-type: none"> • Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical contest relevant to grades 9-10 texts and topics.
Pennsylvania Common Core Standards for Mathematics-High School:	
CC.2.1.HS.F.4	<ul style="list-style-type: none"> • Use units as a way to understand problems and to guide the solution of multi-step problems.
CC.2.1.HS.F.5	<ul style="list-style-type: none"> • Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

KNOW, UNDERSTAND, DO

COURSE: Foundations of Technology

TIME FRAME: 25 days

UNIT # 9: Mass Production (Important)

GRADE: 9-12

UNDERSTANDINGS

Mass production is an essential aspect of a global economy. Without mass production, goods would not be as readily available. An essential task of every engineer is to develop new methods for the efficient mass production of the goods consumers use while maintaining quality assurance standards.

COMMON ASSESSMENTS/CULMINATING ACTIVITY

Mass produced project: Students' choice.

KNOW

- Describe the types of mass production: customized, continuous, batch.
- Identify jigs and fixtures.
- Describe how jigs and fixtures ensure accuracy.
- Describe the need for quality assurance in mass production.
- Identify how flow charts maximize productivity.
- List the sequence of steps of various problem-solving techniques.
- List the seven steps of the design process: problem statement, design brief, brainstorm, modeling, feedback, test, and analyze.
- Identify team member roles in mass production activities.

DO

- Create a flowchart for a manufacturing project.
- Design and build a jig.
- Design and build a fixture.
- Apply the seven steps of the design process to the manufacturing of a gumball machine.

ASSESSMENT

The teacher will use a variety of assessment techniques selected from, but not limited to, the following list:

- 1) Objective tests/quizzes
- 2) Essay tests
- 3) Take-home / in-class essays
- 4) Research papers
- 5) Projects
- 6) Demonstrations
- 7) Oral presentations:
 - Reports
- 8) Various writing assignments:
 - Project proposals
 - Short essays
- 9) Posters/Pictures
- 10) Charts/Graphs analysis
- 11) Homework
- 12) Class discussion
- 13) Teacher/Student conferences

Although each individual assessment will have its own grading value, common guidelines include, but are not limited to:

- Accurate information
- Logical development
- Proper format
- Clear presentation
- Focused argument/theme
- Neatness/Organization

Teacher and student-made rubrics will be developed at the discretion of the individual instructor.

Adaptations/Modifications for Students with I.E.P.s

Adaptations or modifications to this planned course will allow exceptional students to earn credits toward graduation or develop skills necessary to make a transition from the school environment to community life and employment. The I.E.P. team has determined that modifications to this planned course will meet the student's I.E.P. needs.

Adaptations/Modifications may include but are not limited to:

INSTRUCTION CONTENT

- Modification of instructional content and/or instructional approaches
- Modification or deletion of some of the essential elements

SETTING

- Preferential seating

METHODS

- Additional clarification of content
- Occasional need for one to one instruction
- Minor adjustments or pacing according to the student's rate of mastery
- Written work is difficult, use verbal/oral approaches
- Modifications of assignments/testing
- Reasonable extensions of time for task/project completion
- Assignment sheet/notebook
- Modified/adjusted mastery rates
- Modified/adjusted grading criteria
- Retesting opportunities

MATERIALS

- Supplemental texts and materials
- Large print materials for visually impaired students
- Outlines and/or study sheets
- Carbonless notebook paper
- Manipulative learning materials
- Alternatives to writing (tape recorder/calculator)