DELAWARE VALLEY SCHOOL DISTRICT

PLANNED INSTRUCTION

A PLANNED COURSE FOR:

Technology Systems

Grade Level:9-12

Date of Board Approval: _____2016_____

DELAWARE VALLEY SCHOOL DISTRICT

Planned Instruction

Title of Planned Instruction: Technology Systems

Subject Area: Technology Education Grade(s): 9-12

Course Description: Student(s) will explore & complete activities involving technological systems, focusing on the areas of Transportation and Construction. Applying the ten steps of the Engineering Design Process, students will design & build working models of various modes of transportation. In construction technology, students design & build a scaled working model of a structure. Specific topics include: Mouse Trap Powered Vehicles, Crane Building, CO2 Airplanes and Solid Fuel Rocketry.

Time/Credit for the Course: 1 Semester (70 Hours) / ½ Credit

Curriculum Writing Committee: Eric Thiele

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Curriculum Map

1. **Marking Period One:**

Technology Systems Unit 1- Technological Systems (5 days), Technology Systems Unit 2- Mouse Trap Powered Vehicles (25 Days), Technology Systems Unit 3- Production Systems: Construction (5 Days), Technology Systems Unit 4- Model Crane Building (30 Days)

Marking Period One -Goals:

Technology Systems Unit 1:

- Student(s) will recognize that technological systems are designed to satisfy human needs & wants.
- Student(s) will identify that all systems have inputs, a process and outputs.
- Student(s) will demonstrate how the basic systems model can be used to analyze all kinds of systems.
- Student(s) will explain in a technological system, a technological process combines resources to provide an output in response to a command input.
- Student(s) will tell how feedback is used to make the actual result of a system come close as possible to the desired result.
- Student(s) will differentiate between desirable & undesirable outputs of a system.
- Student(s) will discuss how subsystems can be combined to produce more powerful system
- Student(s) will demonstrate safe operation of various power tools used for processing materials.
- Student(s) will demonstrate a mature attitude for their own safety as well as their classmates.

Technology Systems Unit 2:

- Student(s) will identify and utilize the Engineering/Design Model (ten steps) to design an MTPV.
- Student(s) will identify all the subsystems of an MTVP.
- Student(s) prepare a set of sketches and scaled drawing of their MTVP using appropriate drafting equipment.
- Students will apply the concepts of multi-view projection (orthographic projection) to their final/working drawing. Centering and dimensioning of their drawing will also be encouraged.
- Student(s) will examine the physical properties that act on vehicle i.e. friction, inertia, force, acceleration, momentum, center of mass, rotational inertia, potential energy, kinetic energy, mechanical advantage (MA).

- Student(s) will select appropriate materials for construction of their MTPV.
- Student(s) will practice safe operation of machines & hand tools for construction of their MTVP.
- Student(s) will test their vehicles; and collect & complete a data sheet based upon performance of the vehicle.
- Student(s) will calculate & solve miles per hour (MPH), feet per second (F/S), averages of distance traveled, time (sec) of their vehicles. Utilizing Microsoft Excel program student will enter data in tables and use formulas and functions to analyze data.
- Student(s) will analyze and interpret data from the performance of the vehicle and make modifications to their design (feedback).
- Student(s) will summarize activity by completing post-evaluation activity.

Technology Systems Unit 3:

- Student(s) will recognize that construction refers to producing a structure on a site.
- Student(s) will identify that a construction system combines resources to provide a structure as an output.
- Student(s) will explain the three subsystems within the construction system (designing, managing, and building).
- Student(s) will identify that construction sites must be chosen to fit in with the needs of people and the environment.
- Student(s) will determine that a foundation is built to support a structure.
- Student(s) will Identify the usable part of a structure is called the superstructure.
- Student(s) will know the various types of structures (bridges, buildings, dams, roads, towers, canals, and tunnels).

Technology Systems Unit 4:

- Student(s) will identify and utilize the Engineering/Design Model (ten steps) to design a model crane.
- Student(s) prepare a set of sketches and scaled drawing of their structure using appropriate drafting equipment.
- Student(s) will explore the roles of a Civil Engineer: drafting, surveying, soil science, mathematics, materials & processes, transportation, physics, and environmental issues.
- Student(s) will examine the physical properties that act on structure i.e. friction, equilibrium, elasticity, thrust line, stress & strain: compression, tension, shear, torsion, and bending.
- Student(s) will identify that all structures experience several types of force/load: dead, live, static, and dynamic.
- Student(s) will examine how geometric shapes effect structural design i.e. arches, and triangles.
- Student(s) will select appropriate materials for construction of their crane.
- Student(s) will practice safe operation of machines & hand tools for construction

of their crane.
• Student(s) will test their structures; and collect & complete a data sheet based upon performance of the structure.
• Student(s) will calculate & solve efficiency rating. Utilizing computers, student will enter data in tables and use formulas and
functions to analyze data.
• Student(s) will analyze and interpret data from the performance of their structure for future planning. (feedback).
• Student(s) will summarize activity by completing post-evaluation activity.

Understanding of:

The technological problem solving method
The systems model, including input, processes, output and feedback
Technology systems vocabulary
Lab safety
Machine Usage

2. **Marking Period Two:**

Most of the Crane Unit will take place during Marking Period 2 (25 Days). Technology Systems Unit 5- CO2 Powered Airplane (10 days), Technology Systems Unit 6- Solid Fuel Rocket (10 days)

Goals:

Technology Systems Unit 5:

- Student(s) will identify and utilize the Engineering/Design Model (ten steps) to design a CO2 airplane to specified tolerances.
- Student(s) prepare a set of sketches and scaled drawing of their CO2 airplane air foil & fuselage using appropriate drafting equipment.
- Student(s) will examine the physical properties that act on a heavier-than-air vehicle i.e. Bernoulli's Law, center of gravity, center of lift, chord-line, force, lift, thrust, pressure, angle of attack.
- Student(s) will identify the major parts of an airplane: fuselage, wing, horizontal stabilizer, vertical stabilizer.
- Student(s) will select appropriate materials for construction of their CO2 airplane.
- Student(s) will practice safe operation of machines & hand tools for production of their CO2 airplane.
- Student(s) will produce a foam model airplane according to specifications of the activity.
- Student(s) will prepare airplane for flight; assemble all parts, find C.G. point, and balance the plane.
- Student(s) will conduct a bungee cord glide test on airplanes to establish straight & level flight. (increase or decrease angle of attack)
- Student(s) will perform powered flight of their planes; and collect & complete data sheet based upon performance of the airplane.
- Student(s) will calculate & solve averages of distance, rate, time aloft (sec) of their airplanes. Utilizing lap-top computers & Microsoft Excel program student will enter data in tables and use formulas and functions to analyze data in a spreadsheet format.
- Student(s) will analyze and interpret data from the performance of the flight and make adjustments to their plane (feedback).
- Student(s) will summarize activity by completing post-evaluation activity.

Technology Systems Unit 6:

- Student(s) will identify and utilize the Engineering/Design Model (ten steps) to design a rocket to specified tolerances.
- Student(s) will read "The Laws of Motion and Model Rocketry" curriculum packet by Robert L. Cannon, Estes Industries, 1979; and complete a quiz on each of Newton's Laws of Motion.
- Student(s) will examine the physical properties that act on a rocket i.e.: thrust, gravity, propulsion, velocity, drag, altitude, orbit, momentum, mass, unbalanced

force, inertia, feet per second, acceleration.
• Students will identify the major parts of a rocket: body tube, launch lug, nose cone, shock cord, recovery parachute, fins, engine mount, engine w/ igniter.
• Student(s) will select appropriate materials for construction of their rocket kit.
• Student(s) will practice safe operation of hand tools for production of their rocket.
• Student(s) will produce a model rocket according to specifications of the activity.
• Student(s) will prepare rocket for launch: install wadding, pack parachute, install rocket engine w/ igniter.
• Student(s) will safely launch and recover their rockets; and complete data sheet based upon performance of the Rocket.
• Student(s) will calculate & solve for height of rocket, angle of apex, altitude, baseline, velocity, and feet per second of their rocket. Student will enter data in tables and use formulas and functions to analyze data.
• Student(s) will analyze and interpret data from the performance of the launch and make adjustments to their rocket (feedback).
• Student(s) will summarize activity by completing post-evaluation activity.

Understanding of:

Bernoullis Principal
Forces that act on an aircraft during flighs
Newton's Laws of Motion
Lab Safety
Machine Usage

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UNIT: 1 Technological Systems

Big Idea # 1: Technology is created, used and modified by humans

Essential Questions: What knowledge and skills are essential for humans to make sound decisions about creating, using and modifying technologies?

Concepts: Decisions about the use of products and systems can result in known and unexpected consequences.

Competencies: Explain how making informed decisions about the development and use of technology may have known and unexpected consequences.

Big Idea #2: Technology is created, used and modified by humans

Essential Questions: What knowledge and skills are essential for humans to make sound decisions about creating, using and modifying technologies?

Concepts: Decisions about the use of products and systems can result in known and unexpected consequences.

Competencies: Describe the nature of technology and the consequences of technological activity which impact society and the world.

UNIT: 2 Mouse Trap Powered Vehicles

Big Idea # 1: Technological design is a creative process that anyone can do which may result in new inventions and innovations.

Essential Questions: How would you apply technological design and problem solving methods in the development of inventions and innovations?

Concepts: Technological design & problem solving utilizes a series of steps that take place in a well-defined sequence.

Competencies: Use design and problem solving skills to solve technological challenges.

Big Idea # 2: Technological design is a creative process that anyone can do which may result in new inventions and innovations.

Essential Questions: How would you apply technological design and problem solving methods in the development of inventions and innovations?

Concepts: Technological design & problem solving utilizes a series of steps that take place in a well-defined sequence.

Competencies: Transform ideas into technological products and/or systems.

Big Idea # 3: Technological design is a creative process that anyone can do which may result in new inventions and innovations.

Essential Questions: How would you apply technological design and problem solving methods in the development of inventions and innovations?

Concepts: Technological design & problem solving utilizes a series of steps that take place in a well-defined sequence.

Competencies: Use hands-on skills to create useful products and solve technological challenges.

UNIT: 3 Production Systems: Construction

Big Idea # 1: A technological world requires that humans develop capabilities to solve technological challenges and improve products for the way we live.

Essential Questions: How have technological developments impacted devices, processes, and systems to fulfill human wants and needs?

Concepts: The abilities required in a technological world include diagnosing, troubleshooting, analyzing and maintaining systems.

Competencies: Use and maintain technological products and systems and describe their functions, advantages/disadvantages and hazards/benefits.

Big Idea # 2: A technological world requires that humans develop capabilities to solve technological challenges and improve products for the way we live.

Essential Questions: How have technological developments impacted devices, processes, and systems to fulfill human wants and needs?

Concepts: The abilities required in a technological world include diagnosing, troubleshooting, analyzing and maintaining systems.

Competencies: Through a structured engineering design process, select an existing product and design, build, and assess an improved version.

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UNIT: 4 Model Crane Building

Big Idea # 1: A technological world requires that humans develop capabilities to solve technological challenges and improve products for the way we live.

Essential Questions: How have technological developments impacted devices, processes, and systems to fulfill human wants and needs?

Concepts: The abilities required in a technological world include diagnosing, troubleshooting, analyzing and maintaining systems.

Competencies: Through a structured engineering design process, select an existing product and design, build, and assess an improved version.

Big Idea # 2: A technological world requires that humans develop capabilities to solve technological challenges and improve products for the way we live.

Essential Questions: How have technological developments impacted devices, processes, and systems to fulfill human wants and needs?

Concepts: Innovation is the process of modifying an existing product, process, or system to improve it.

Competencies: Use tools and machines safely and explain the common and particular hazards of specific technological devices.

Big Idea # 3: Technology is created, used and modified by humans.

Essential Questions: What knowledge and skills are essential for humans to make sound decisions about creating, using, and modifying technologies?

Concepts: The goal of technology is to improve the human condition by maximizing positive impacts and minimizing negative one.

Competencies: Design, build, and test/evaluate a technological system to analyze its positive and negative consequences and impacts on individuals, societal institutions and our environment.

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UNIT: 5 CO2 Powered Airplanes

Big Idea # 1: Technology is created, used and modified by humans.

Essential Questions: What knowledge and skills are essential for humans to make sound decisions about creating, using, and modifying technologies?

Concepts: Decisions about the use of products and systems can result in known and unexpected consequences.

Competencies: Design, build, and test/evaluate a technological system to analyze its positive and negative consequences and impacts on individuals, societal institutions and our environment.

Big Idea # 2: Each area of technology has a set of characteristics that separates it from others; however, many areas overlap in order to meet human needs and wants.

Essential Questions: How do various areas of technology influence the economy, the environment, society, and political decisions?

Concepts: Manufacturing is the process of turning raw materials into useful products.

Competencies: Select and safely and effectively use appropriate tools, materials, and processes to design, engineer, manufacture, test, and analyze products that meet human needs and wants.

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UNIT: 6 Solid Fuel Rocket

Big Idea # 1: Technological literacy is the ability to use, assess and manage technology around us.

Essential Questions: What is technological literacy?

Concepts: Technology and society mutually impact each other.

Competencies: Describe how technological development impacts economics, culture, and policies.

Big Idea # 2: Each area of technology has a set of characteristics that separates it from others; however, many areas overlap in order to meet human needs and wants.

Essential Questions: How do various areas of technology influence the economy, the environment, society, and political decisions?

Concepts: Manufacturing is the process of turning raw materials into useful products.

Competencies: Select and safely and effectively use appropriate tools, materials, and processes to design, engineer, manufacture, test, and analyze products that meet human needs and wants.

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Curriculum Plan

Unit: Technology Systems / Technological Systems Unit #1

Time Range in Days: 4-5 days

PA Academic Standard(s): 3.4 Technology and Engineering Education

Standards Addressed: 3.4.12.A2, 3.4.10.A3, 3.4.12.A3, 3.4.10.C1, 3.4.10.C2, 3.4.12.C2, 3.4.10.C3, 3.4.12.C3, 3.4.10.D1

Anchor(s): S11.A.1.1, S11.A.2.2, S11.A.3.1, S11.B.3.3, S11.C.3.1

Overview:

Read Chapter 1 Fundamentals of Technology in the Technology – Engineering & Design textbook. (2 Periods)

- o Class discussion on various key concepts from the chapter
- o Students will complete Chapter 1 Worksheet
- o Students will complete Chapter 1 Unit Exam.

Review safety rules of the classroom & safe operation & use of equipment. (2-3 Periods)

- o Students will review rules of the materials lab
- o Demonstration of power equipment & machines utilized in the course.

Focus Question(s):

What is a technological system?

What are the components that make up a system?

Goals:

Students will be able to accurately describe a system, and list the various components in a system.

Objectives:

- • Student(s) will recognize that technological systems are designed to satisfy human needs & wants. (Level 1)
- • Student(s) will identify that all systems have inputs, a process and outputs. (Level 1)
- • Student(s) will demonstrate how the basic systems model can be used to analyze all kinds of systems. (Level 4)

- Student(s) will explain in a technological system, a technological process combines resources to provide an output in response to a command input. (Level 2)
- Student(s) will summarize how feedback is used to make the actual result of a system come close as possible to the desired result. (Level 2)
- Student(s) will differentiate between desirable & undesirable outputs of a system. (Level 3)
- Student(s) will discuss how subsystems can be combined to produce more powerful system. (Level 1)
- Student(s) will demonstrate a mature attitude for their own safety as well as their classmates. (Level 2)

Core Activities and Corresponding Instructional Methods:

Read Chapter 1 Fundamentals of Technology in the Technology – Engineering & Design textbook. (2 Periods)
Review safety rules of the classroom & safe operation & use of equipment. (2-3 Periods)

Assessments:

Diagnostic: Oral Response
Formative: Chapter 1 Review Session
Summative: Chapter 1 Worksheet/ Chapter 1 Exam

Extensions:

Students will demonstrate understanding of what a system is by analyzing a transportation system (vehicle) of their choice and creating a subsystem tree of all the systems within that vehicle.

Correctives:

Individual instruction and demonstrations will be given to students having difficulty.

Materials and Resources:

Technology – Engineering & Design reference textbook (Chapter 1), chapter handouts, pencils, machines: band saw, scroll saw, drill press, belt & disk sander, and various hand tools.

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Unit: Technology Systems / Mouse Trap Powered Vehicle Unit #2

Time Range in Days: 25 days

PA Academic Standard(s): 3.4 Technology and Engineering Education

Standards Addressed: 3.4.12.A2, 3.4.10.A3, 3.4.12.A3, 3.4.10.C1, 3.4.10.C2, 3.4.12.C2, 3.4.10.C3, 3.4.12.C3, 3.4.10.D1

Anchor(s):

S11.A.1.1, S11.A.3.1, S11.C.2.1, S11.C.3.1, M11.A.1.1, M11.A.3.1, M11.A.3.2

Overview:

Introduction to Design Brief MTPV's

Designing a MTPV

Construction of a MTPV

Testing of MTPV's

Focus Question(s):

What are the systems that are part of a MTPV?

What are the subsystems of your MTPV?

How can you maximize distance of your MTPV?

How do you calculate MPH when given FPS?

Goals:

Students will safely use various hand and power tools to design and build a MTPV that is capable of moving a specified object a predetermined distance.

Objectives:

- Student(s) will identify and utilize the Engineering/Design Model (ten steps) to design an MTPV. (Level 1)
- Student(s) will identify all the subsystems of an MTVP. (Level 1)
- Student(s) design a set of sketches and scaled drawing of their MTVP using appropriate drafting equipment. (Level 4)
- Students will apply the concepts of multi-view projection (orthographic projection)

to their final/working drawing. Centering and dimensioning of their drawing will also be encouraged. (Level 4)
• Student(s) will examine the physical properties that act on vehicle i.e. friction, inertia, force, acceleration, momentum, center of mass, rotational inertia, potential energy, kinetic energy, mechanical advantage (MA). (Level 4)
• Student(s) will select appropriate materials for construction of their MTPV. (Level 3)
• Student(s) will practice safe operation of machines & hand tools for construction of their MTVP. (Level 3)
• Student(s) will test their vehicles; and collect & complete a data sheet based upon performance of the vehicle. (Level 3)
• Student(s) will calculate & solve miles per hour (MPH), feet per second (F/S), averages of distance traveled, time (sec) of their vehicles. (Level 4)
• Student(s) will analyze and interpret data from the performance of the vehicle and make modifications to their design (feedback). (Level 4)
• Student(s) will summarize activity by completing post-evaluation activity. (Level 1)

Core Activities and Corresponding Instructional Methods:

Introduction to Design Briefs

Lecture/Discussion on MTPV requirements and materials.

Watch video “How to Build a Mouse Trap Car.” (Pitsco)

Distribute resource material for project planning.

Designing a MTPV

Lecture/discussion on the physical properties that act on a vehicle such as friction, inertia, force, acceleration, momentum, center of mass, rotational inertia, potential energy, kinetic energy and mechanical advantage (MA).

Hands on: Students will research their design through the use of resource materials provided.

Students will complete design brief

Students will illustrate their designs by completing a multi-view drawing to scale with dimensions.

Students will provide a materials list to construct their MTPV.

Students will submit plans for approval prior to construction of the vehicle.

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Construction of MTPV's

Students will gather materials and supplies needed for the activity.

Students will layout materials to be processed.

Students will practice safe operational usage of equipment for construction of their vehicles.

Students will assemble their vehicle and prepare for testing (modification)

Students will submit vehicle for evaluation of construction quality and specifications.

Testing of MTPV's

Students will test their MTPV's and compile the results in a data sheet.

Students will calculate MPH, FPS and average distance traveled and travel time.

Students will summarize activity by completing post evaluation questions and will also identify the subsystems of their MTPV.

Assessments:

Diagnostic: Oral Response

Visual Inspection of daily progress of the MTPV activity

Formative: Student testing of MTPV's

Visual observation of performance of the MTPV's

Collecting performance data of vehicles and recording it on a data sheet.

Summative: Evaluation of vehicle Construction

Post evaluation questions

Performance data sheet calculations

Extensions:

Students will complete various informative worksheets about Mouse Trap Science

Define glossary of terms for the MTPV project.

Correctives:

Individual instruction and demonstration of procedures. Provide example of vehicles for students to view if they are having difficulty.

Materials and Resources:

To include but not limited to; chalkboard, design brief MTVP'S, design brief / problem solving form, data sheet, evaluation sheet, resources: Mouse Trap Science is Fun (book), Mouse Trap Vehicles Pitsco (book), Mouse Trap Cars by Alden J. Balmer 1998. video: How to Build a Mouse Trap Vehicle (Pitsco); drafting equipment, tape, pencils, paper, rulers, mouse traps, fishing line, solder iron, solder, pliers, hacksaw, steel rod axels, wheels, cd's, balsa wood, luan plywood, pine scraps, plastics straws, screw eyes, wood glue, super glue, hot glue gun & glue, mechanical fasteners, rubber bands, band saw, drill press, scroll saw, belt & disk sander, hand tools, calculators, stopwatch, laptop computers & excel software, printer.

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Unit: Technology Systems / Production Systems: Construction #3

Time Range in Days: 5 days

PA Academic Standard(s): 3.4 Technology and Engineering Education

Standards Addressed: 3.4.12.A2, 3.4.10.A3, 3.4.12.A3, 3.4.10.C1, 3.4.10.C2, 3.4.12.C2, 3.4.10.C3, 3.4.12.C3, 3.4.10.D1

Anchor(s): S.11.A.1.1, S.11.A.2.2, S.11.B.3.1, S.11.B.3.3, S.11.C.3.1

Overview:

Students will read Chapter 16 Construction Fundamentals in the Technology-Engineering and Design reference textbook.

Focus Question(s):

Where are construction projects built?

What are the resources needed to complete a construction project?

What are the 3 subsystems in a construction project?

What is the difference between a structure and a superstructure?

Goals:

Students will gain an in-depth understanding of construction projects as it relates to resources, inputs, outputs, processes and feedback.

Students will be able to identify the three subsystems within the construction system (designing, managing and building).

Objectives:

• Student(s) will recognize that construction refers to producing a structure on a site. (Level 1)

• Student(s) will identify that a construction system combines resources to provide a structure as an output. (Level 1)

• Student(s) will explain the three subsystems within the construction system

(designing, managing, and building). (Level 3)

• Student(s) will identify that construction sites must be chosen to fit in with the needs of people and the environment. (Level 1)

• Student(s) will determine that a foundation is built to support a structure. (Level 1)
• Student(s) will Identify the usable part of a structure is called the superstructure. (Level 1)

• Student(s) will know the various types of structures (bridges, buildings, dams, roads, towers, canals, and tunnels). (Level 1)

Core Activities and Corresponding Instructional Methods:

Read Chapter 16 Construction Fundamentals
Class discussion on various key concepts from the chapter
Students will complete Chapter 16 Worksheet
Students will complete Chapter 16 Unit Exam.

Assessments:

Diagnostic: Oral Response
Formative: Chapter 16 Review Session
Summative: Chapter 16 Worksheets
Chapter 16 Unit Exam

Extensions:

Students will complete "Understanding Concepts" for the chapter, then select a structure and complete a construction systems model with the subsystems identified.

Correctives:

Individual instruction and demonstration will be given to students having difficulty.

Materials and Resources:

Chalkboad, Technology- Engineering and Design reference textbook Chapter 16, chapter handouts and pencils.

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Unit: Technology Systems / Model Crane Building #4 Time Range in Days: 30 days

PA Academic Standard(s): 3.4 Technology and Engineering Education

Standards Addressed: 3.4.12.A2, 3.4.10.A3, 3.4.12.A3, 3.4.10.C1, 3.4.10.C2, 3.4.12.C2, 3.4.10.C3, 3.4.12.C3, 3.4.10.D1, 3.4.10.E7, 3.4.12.E7

Anchor(s): S.11.A.1.1, S.11.A.2.2, S.11.B.3.1, S.11.B.3.3, S.11.C.3.1, M11.A.2.1, M11.C.1.2

Overview:

Students will design a model crane by following the steps outlined in the design brief. Upon completion of the design, each student will then build their crane and test the design on a stress analyzer to determine the amount of force their structure was able to hold. They will then redesign their crane and rebuild the portion that failed, as well as add additional support and will retest the crane to determine the results.

Focus Question(s):

How does the technological problem solving method apply to designing and building a structure??

How do sketches help you visualize the final structure?

What types of joint construction would support a substantial amount of weight?

What shapes should be used in your design/build of the crane? Why?

Goals:

Students will gain an in-depth understanding of the technological problem solving method, and learn how to apply it to real world situations.

Students will be able to identify faults with different designs and determine several ways to correct those faults.

Objectives:

• Student(s) will identify and utilize the Engineering/Design Model (ten steps) to design a model crane. (Level 1)

• Student(s) will recall the types of modern crane designs. (Level 1)

• Student(s) prepare a set of sketches and scaled drawing of their structure using appropriate drafting equipment. (Level 1)

• Student(s) will explore the roles of a Civil Engineer: drafting, surveying, soil

science, mathematics, materials & processes, transportation, physics, and environmental issues. (Level 2)

• Student(s) will compare the physical properties that act on structure i.e. friction, equilibrium, elasticity, thrust line, stress & strain: compression, tension, shear, torsion, and bending. (Level 3)

• Student(s) will identify that all structures experience several types of force/load: dead, live, static, and dynamic. (Level 1)

• Student(s) will examine how geometric shapes effect structural design i.e. arches, and triangles. (Level 2)

• Student(s) will select appropriate materials for construction of their crane. (Level 2)

• Student(s) will practice safe operation of machines & hand tools for construction of their crane. (Level 2)

• Student(s) will test their structures; and collect & complete a data sheet based upon performance of the structure. (Level 4)

• Student(s) will calculate & solve efficiency rating. (Level 4)

• Student(s) will analyze and interpret data from the performance of their structure for future planning. (feedback). (Level 4)

• Student(s) will summarize activity by completing post-evaluation activity. (Level 2)

Core Activities and Corresponding Instructional Methods:

Designing a model crane

Student(s) will complete design brief /problem solving form

Student(s) will research their design through the use of resource materials provided.

Student(s) will illustrate their designs by completing a multi-view drawing to scale with dimensions.

Student(s) will provide a materials list to construct their crane.

Student(s) will submit plans for approval prior to construction of the crane.

Construction of a Crane

Student(s) will gather materials & supplies needed for the activity.

Student(s) will layout material to be cut.

Student(s) will practice safe use of equipment for construction of their crane.

Student(s) will glue and assemble their crane and prepare for testing (modification)

Student(s) will submit crane for evaluation of construction.

Testing of Crane

Student(s) will test their crane and compile their results (data) and record on data sheet.

Student(s) will calculate efficiency of structure with provided formula.

Student(s) will summarize activity by completing post-evaluation questions.

Assessments:

Diagnostic: Oral Response

Visual inspection of daily progress of the crane building activity

Formative: Student testing of cranes/structures

Visual observation of performance of the cranes/structures

Collecting performance data of cranes and recording it on a data sheet.

Summative: Student testing of cranes/structures

Post evaluation questions

Performance and data sheet calculations

Extensions:

Students will complete a glossary of crane building terms and discuss their meanings.

Students will design other structures that utilize the same design elements such as towers and windmills.

Correctives:

Individual instruction and demonstration will be given to students having difficulty. Provide examples of crane structures for students to view if they are having difficulty with the activity.

Materials and Resources:

Technology – Engineering & Design reference textbook, chalkboard, design brief for crane building /structures, design brief / problem solving form, data sheet, evaluation sheet, drafting equipment, tape, pencils, paper, rulers, cardboard, plastic laminate, building plans, building pins, pine wood 5/16” x 5/16” x 12”, structural stress analyzer & software.

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Unit: Technology Systems / CO2 Powered Airplanes #5 Time Range in Days: 10 days

PA Academic Standard(s): 3.4 Technology and Engineering Education

Standards Addressed: 3.4.12.A2, 3.4.10.A3, 3.4.12.A3, 3.4.10.C1, 3.4.10.C2, 3.4.12.C2, 3.4.10.C3, 3.4.12.C3, 3.4.10.D1, 3.4.10.E7, 3.4.12.E7

Anchor(s): S.11.A.1.1, S.11.A.2.2, S.11.B.3.1, S.11.B.3.3, S.11.C.3.1, M11.A.2.1, M11.C.1.2

Overview:

Students will design a CO2 powered airplane following the steps outlined in the design brief. Upon completion of the design, each student will then build their airplane and test the design on an airplane launcher to determine the distance/flight path their airplane achieved.

Focus Question(s):

How does the technological problem solving method apply to designing and building a airplane?
What are the forces that are acting on an airplane at all times?

List and explain the principle that identifies how airplanes fly (Bernoullis Principle).

How is lift created with an airplane?

What shape should be used in your wing construction? Why?

How does your angle of inclination affect the amount of lift created.

Goals:

Students will gain an in-depth understanding of the technological problem solving method, and learn how to apply it to real world situations.
Students will identify the 4 forces that are acting on an airplane.

Students will explain how Bernuollis principle applies to airplanes.

Objectives:

- Student(s) will identify and utilize the Engineering/Design Model (ten steps) to design a CO2 airplane to specified tolerances. (Level 1)
- Student(s) prepare a set of sketches and scaled drawing of their CO2 airplane air foil & fuselage using appropriate drafting equipment. (Level 2)

• Student(s) will examine the physical properties that act on a heavier-than-air vehicle i.e. Bernoulli's Law, center of gravity, center of lift, chord-line, force, lift, thrust, pressure, angle of attack. (Level 2)

• Student(s) will identify the major parts of an airplane: fuselage, wing, horizontal stabilizer, vertical stabilizer. (Level 1)

• Student(s) will select appropriate materials for construction of their CO2 airplane. (Level 3)

• Student(s) will practice safe operation of machines & hand tools for production of their CO2 airplane. (Level 2)

• Student(s) will produce a foam model airplane according to specifications of the activity. (Level 3)

• Student(s) will prepare airplane for flight; assemble all parts, find C.G. point, and balance the plane. (Level 3)

• Student(s) will conduct a bungee cord glide test on airplanes to establish straight & level flight. (increase or decrease angle of attack) (Level 2)

• Student(s) will perform powered flight of their planes; and collect & complete data sheet based upon performance of the airplane. (Level 3)

• Student(s) will calculate & solve averages of distance, rate, time aloft (sec) of their airplanes. (Level 4)

• Student(s) will analyze and interpret data from the performance of the flight and make adjustments to their plane (feedback). (Level 4)

• Student(s) will summarize activity by completing post-evaluation activity. (Level 2)

Core Activities and Corresponding Instructional Methods:

Introduction to CO2 AIRPLANES (Powered Flight Transportation)

Lecture /discussion of CO2 airplane requirements & materials.

Distribute handouts & resource materials for project planning.

Student(s) will read CO2 airplane curriculum packet by Production Systems (No Author or Copyright) and complete study guide

Student(s) will be administered a CO2 airplane quiz upon completion of study guide.

Planning & Designing a CO2 AIRPLANE

Student(s) will complete design brief / problem solving form
Lecture /discussion on the physical systems that act on vehicle, i.e.

Bernoulli's Law, center of gravity, center of lift, chord-line, force, lift, thrust, pressure, angle of attack.

Student(s) will research their design through the use of resource materials provided.

Student(s) will illustrate their designs by completing a multi-view drawing to scale with dimensions.

Student(s) will provide a materials list to produce their CO2 airplane.

Student(s) will submit plans for approval prior to production of their CO2 airplane.

Production of CO2 AIRPLANE

Student(s) will gather materials & supplies needed for the activity.
Student(s) will layout material to be cut & shaped.

Student(s) will practice safe use of equipment for production of their plane.

Student(s) will shape fuselage, air foils, & stabilizers to final dimensions.

Student(s) will prepare airplane for flight: assemble all parts of the plane, and using a C.G. locator student will find the C.G. point of airplane.

Student(s) will conduct a bungee cord glide test on airplane to establish straight & level flight. Student will increase or decrease the angle of attack by placing shims between fuselage & air foil at either the leading edge or the trailing edge of the wing.

Student(s) will submit airplane for evaluation of production.

Testing of CO2 AIRPLANE (2 Days)

Student(s) will perform Powered Flight of their CO2 Airplanes with the intent to establish straight & level flight and compile their results (data) and record in data sheet.
Student(s) will calculate miles per hour (MPH), averages of rate,

time (sec) of their CO2 airplanes with provided formulas.
Student(s) will summarize activity by completing post-evaluation questions, and will also identify the subsystems of their CO2 airplanes.

Assessments:

Diagnostic: Oral Response

Visual inspection of daily progress of the CO2 airplanes

Formative: Student testing of CO2 Airplanes

Visual observation of performance of the CO2 Airplanes

Collecting performance data of planes and recording it on a data sheet.

Summative: Student testing of CO2 Planes

Post evaluation questions

Performance and data sheet calculations

Extensions:

Students can examine different airfoil and stabilizer shapes and design experimental wings and stabilizers for their aircraft.
Students can design model airplanes out of paper and compare the flight pattern between the different designs.

Correctives:

Individual instruction and demonstration will be given to students having difficulty.
Provide examples of CO2 airplanes for students to view if they are having difficulty with the activity.

Materials and Resources:

Chalkboard, design drief CO2 airplanes, design brief /problem solving form, data sheet, evaluation sheet, resources: CO2 Airplane Curriculum Packet (No Author or Copyright); CO2 airplane study guide, CO2 airplane test, drafting equipment, tape, pencils, paper, rulers, markers, patterns, CO2airplane launch ramp with bungee cord tester, CO2 cartridges, center of gravity locator, shims, sheet metal screws, rubber bands, Styrofoam-cutter, hot glue gun & glue, scroll saw, sand paper, paints, brushes, duct tape, stopwatch, scissors, hand tools, 100 FT. tape measure, calculators, outdoor area for testing, computers and printer.

DELAWARE VALLEY SCHOOL DISTRICT

Unit: Technology Systems / Solid Fuel Model Rockets #6 Time Range in Days: 10 days

PA Academic Standard(s): 3.4 Technology and Engineering Education

Standards Addressed: 3.4.12.A2, 3.4.10.A3, 3.4.12.A3, 3.4.10.C1, 3.4.10.C2, 3.4.12.C2, 3.4.10.C3, 3.4.12.C3, 3.4.10.D1, 3.4.10.E7, 3.4.12.E7

Anchor(s): S.11.A.1.1, S.11.A.2.2, S.11.B.3.1, S.11.B.3.3, S.11.C.3.1, M11.A.2.1, M11.C.1.2

Overview:

Students will design a solid fuel model rocket using following the model rocket packet. Upon completion of the build, each student will then test their rocket to determine the altitude/flight path their rocket achieved.

Focus Question(s):

What are the forces that are acting on an rocket at all times?
List and explain Newton's 3 laws of motion.
How fast (in MPH) must an object go to be set into orbit?

Goals:

Students will have an in-depth understanding of Newton's Laws of Motion.
Students will identify the forces that are acting on a rocket.

Objectives:

• Student(s) will identify and utilize the Engineering/Design Model (ten steps) to design a rocket to specified tolerances. (Level 1)

• Student(s) will read "The Laws of Motion and Model Rocketry" curriculum packet by Robert L. Cannon, Estes Industries, 1979; and complete a quiz on each of Newton's Laws of Motion. (Level 1)

• Student(s) will compare the physical properties that act on a rocket i.e.: thrust, gravity, propulsion, velocity, drag, altitude, orbit, momentum, mass, unbalanced force, inertia, feet per second, acceleration. (Level 2)

• Students will identify the major parts of a rocket: body tube, launch lug, nose cone, shock cord, recovery parachute, fins, engine mount, engine w/ igniter. (Level 1)

• Student(s) will select appropriate materials for construction of their rocket kit. (Level 2)

• Student(s) will practice safe operation of hand tools for production of their rocket. (Level 1)

• Student(s) will create a model rocket according to specifications of the activity. (Level 4)

• Student(s) will construct rocket for launch: install wadding, pack parachute, install rocket engine w/ igniter. (Level 3)

• Student(s) will safely launch and recover their rockets; and complete data sheet based upon performance of the Rocket. (Level 3)

• Student(s) will calculate & solve for height of rocket, angle of apex, altitude, baseline, velocity, and feet per second of their rocket. Utilizing computers, student will enter data in tables and use formulas and functions to analyze data. (Level 3)

• Student(s) will analyze and interpret data from the performance of the launch and make adjustments to their rocket (feedback). (Level 3)

• Student(s) will summarize activity by completing post-evaluation activity. (Level 1)

Core Activities and Corresponding Instructional Methods:

Introduction to Rocketry (Space Transportation)

Lecture /discussion of rocketry activity requirements & materials.

Student(s) will view “Ignite The imagination” video by Estes 1996

Distribute handouts & resource material for project.

Student(s) will read “The Laws of Motion and Model Rocketry”

curriculum packet by Robert L. Cannon, Estes Industries,1979 and complete study guide.

Student(s) will be administered a rocketry quiz for each of Newton’s Laws of Motion studied in curriculum packet.

Planning & Procedures for Rocket Construction

Student(s) will complete design brief / problem solving form

Lecture / discussion on the physical properties that act on a rocket i.e.: thrust, gravity, propulsion, velocity, drag, altitude, orbit, momentum, mass, unbalanced force, inertia, feet per second, acceleration.

Instructor demonstration of the main body tube & fin layout and construction.

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Construction of Model Rocket

Student(s) will gather materials & supplies needed for the activity.

Student(s) will follow step-by-step building procedures for their model rocket.

Student(s) will practice safe use of hand tools & equipment for construction of their rocket.

Student(s) will prepare rocket for launch: install wadding, pack parachute, install rocket engine w/ igniter.

Student(s) will conduct a balance chord test on rocket to establish straight launch.

Student(s) will submit rocket for evaluation of construction.

Testing of Rocket

Student(s) will launch & recover rockets with two different size engines 1st launch with A8-3 engine approx. distance 100 – 150 ft. 2nd launch with B6-4 engine approx. distance 200 – 250 ft.

Student(s) will measure altitude with an altimeter, time with stopwatch, and compile their results (data) and record in data sheet.

Student(s) will calculate height of rocket, angle of apex, altitude, baseline, velocity, and feet per second of their rocket with provided formulas. Utilizing computers student will enter data in tables and use formulas and functions to analyze data in a spreadsheet format.

Student(s) will summarize activity by completing post-evaluation questions, and will also identify the subsystems of their rockets.

Assessments:

Diagnostic: Oral Response

Visual inspection of daily progress of the rocketry activity

Formative: Student testing of rockets

Visual observation of performance of the rocket

Collecting performance data of planes and recording it on a data sheet.

Summative: Evaluation of rocket construction

Post evaluation questions

Performance and data sheet calculations

Extensions:

Students can examine different fin styles and design experimental fins for their rocket.

Students can purchase a store bought rocket kit and construct a more complex rocket or a rocket that can travel a greater distance.

Correctives:

Individual instruction and demonstration will be given to students having difficulty. Provide examples of rockets for students to view if they are having difficulty with the activity.

Materials and Resources:

Chalkboard, design brief rocketry, design brief / problem solving form, data sheet, evaluation sheet, resources: “The Laws of Motion and Model Rocketry” curriculum packet by Robert L. Cannon, Estes Industries,1979; Rocketry Study Guide, law of motion rocketry test, “Ignite The imagination” Video by Estes 1996, tape, pencils, paper, rulers, markers, patterns, rocketry launch pad with launcher, rocket engines (A8-3 & B6-4), model glue, sand paper, utility knives, wadding, batteries, igniters w/ plugs, rocket fin locator, altimeter, two-way radios, stopwatch, scissors, hand tools, 100 ft. tape measure, calculators, outdoor area for testing, computers, software, printer.

Appendix

Primary Textbook(s) Used for this Course of Instruction

-There are no primary textbooks used in this class

Standards:

3.4. Technology and Engineering Education

3.4.A. The Scope of Technology

2. Core Concepts of Technology

3.4.12.A2.Describe how management is the process of planning, organizing, and controlling work.

3. Technology Connections

3.4.10.A3. Examine how technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function.

3.4.12.A3. Demonstrate how technological progress promotes the advancement of science, technology, engineering and mathematics (STEM).

3.4.C. Technology and Engineering Design

1. Design Attributes

3.4.10.C1. Apply the components of the technological design process.

2. Engineering Design

3.4.10.C2. Analyze a prototype and/or create a working model to test a design concept by making actual observations and necessary adjustments.

3.4.12.C2. Apply the concept that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly

3. Research & Development, Invention & Innovation, Experimentation/ Problem Solving and Troubleshooting

3.4.10.C3. Illustrate the concept that not all problems are technological and not every problem can be solved using technology.

3.4.12.C3. Apply the concept that many technological problems require a multi-disciplinary approach.

3.4.D. Abilities for a Technological World

1. Applying the Design Process

3.4.10.D1. Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of a final product.

3.4.E. The Designed World

7. Construction Technologies

3.4.10.E7. Evaluate structure design as related to function, considering such factors as style, convenience, safety, and efficiency.

3.4.12.E7. Analyze the technologies of prefabrication and new structural materials and processes as they pertain to constructing the modern world.

Anchors:

S11.A.1 Reasoning and Analysis
S11.A.1.1 - Analyze and explain the nature of science in the search for understanding the natural world and its connection to technological systems.
S11.A.2 Processes, Procedures, and Tools of Scientific Investigations
S11.A.2.2 - Evaluate appropriate technologies for a specific purpose, or describe the information the instrument can provide
S11.A.3 Systems, Models, and Patterns
S.11.A.3.1 - Analyze the parts of a simple system, their roles, and their relationships to the system as a whole.
S11.B.3 Ecological Behavior and Systems
S11B.3.3 - Compare and analyze repeated processes or recurring elements in patterns.
S11.C.3 Principles of Motion and Force
S11.C.3.1 - Use the principles of motion and force to solve real-world challenges.
M11.A.2.1 - Apply ratio and/or proportion in problem-solving situations

M11.C.1 Analyze characteristics and properties of two- and three- dimensional geometric shapes and demonstrate understanding of geometric relationships

M11.C.1.2 - Recognize and/or apply properties of angles, triangles and quadrilaterals

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Checklist to Complete and Submit with Curriculum:

_____ **A hard copy of the curriculum using The template entitled "Planned Instruction," available on the district website**

_____ **Hard copies of all supplemental resources not available electronically**

_____ **The primary textbook form(s)**

_____ **The appropriate payment form, in compliance with the maximum curriculum writing hours noted on the first page of this document**

_____ **A USB/Flash Drive containing a single file that will print the curriculum in its intended sequence from beginning to end and all supplemental resources that are available in electronic format.**

Each principal and/or department chair has a schedule of First and Second Readers/Reviewers. Each Reader/Reviewer must sign & date below.

First Reader/Reviewer Printed Name_____

First Reader/Reviewer Signature_____ Date_____

Second Reader/Reviewer Printed Name_____

Second Reader/Reviewer Signature _____ Date_____