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ABSTRACT

The purpose of this team unit is to provide students with knowledge, experience and an appreciation of technology. This unit is designed to give students an opportunity to solve problems in technology through cooperative learning activities in addition to addressing the needs of the individual student. This unit is intended to take 6 weeks for proper implementation and is conducted by a team of teachers. It can be used effectively in the sixth, seventh, or eighth grade team level. It allows students to construct and understanding of force, work, and energy. (ZWH)

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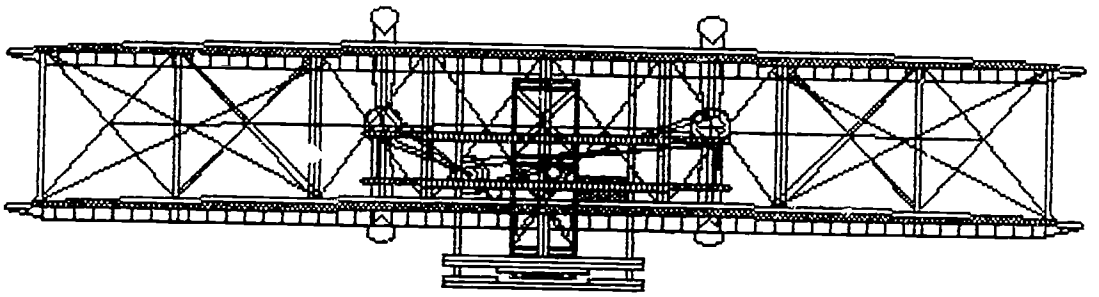
THUNDERSTRIKE!

A UNIT OF MOTION & FORCE



Grade Seven Team Teachers

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Project SEED

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General Description

Through interdisciplinary cooperative learning activities, the project traces the progress of technology culminating in the construction and testing of ~~three~~ two vehicles.

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Goals and Objectives

1.) Students will gain an understanding of forces, work, and the use of energy to do work. The team will focus on how these forces have changed over time and what effects they have had on society.

2.) Students will gain an understanding of simple and compound machines and how they do work. The students will also study the history of machines and how they affect the course of events in the world.

3.) Students will gain an understanding of how forces produce, change, and stop motion of objects.

4.) Students will gain an understanding of fluids and how they are related to forces and motion. Students will examine how understanding of these concepts was important in the development of flight in balloons, planes, rockets, etc. The students will also study the development of water craft such as boats and ships.

GENERAL OVERVIEW OF THE THUNDERSTRIKE! VEHICLE COMPETITION

Time Frame: This unit takes six weeks to properly implement, with a final competition that lasts approximately two and a half hours. Unit is planned and carried out during regular class periods.

Cost: In general, the cost of materials for inclusion in the boxes is under $100.00. Careful shopping and looking around the school's shop, your own shop and begging from other members of the staff is smiled upon.

Special Considerations: This unit can only be implemented by a group or team of teachers.

Problem: Construct a vehicle from the materials in the box or from the list of materials provided to you that will perform the following tasks better than all other vehicles.

Tasks to Perform:

1. Travel the Greatest Distance
2. Travel the Fastest Speed
3. Travel a measured distance–Most accurate vehicle to travel an exact distance.

Materials:

Wooden Block
4 Wheels
Dowels
Rubber Bands
Balloons
Straws
Eye Hooks
Tape
Tacks
Sandpaper
Tongue Depressors
Wooden Sticks
Clothes Pins
Ping Pong Ball
Washers
String
Fishing Line
Glue
Screws

Competitions

1. Greatest Distance
2. Fastest speed of a measured distance.
3. Greatest Accuracy: travel a distance of at least 10 meters but no more than 12 meters. Vehicle closest to 10 meters without going under 10 meters will win.

Vehicle Power

The vehicle may be powered by any of the following methods:

1. Elastic Power
2. Wind Power–Balloon
3. Inclined Plane

RULES *note-Students may work in pairs or alone.

1. Once a vehicle has departed the starting line, you may not touch the vehicle.
2. The vehicle can only be constructed from materials in the box or listed on the materials list.
3. All vehicles must carry a ping pong ball.
4. Vehicle must stay within the one-meter wide track or it will be disqualified

Interdisciplinary Work

Team teachers and students will cooperatively seek knowledge through various techniques which will also provide for individual learning styles in order to successfully master the outlined goals.

Social Studies (To be accomplished in S.S. and Science Classes)

1.) History of the automobile and how it has affected our world. Field trip to Cole's Museum to study the influence of transportation has had on Maine's economy and growth. Pamphlets obtained from Cole's entitled, "History of the Automobile."

2.) The Industrial Revolution--how machines change the course of history in the U.S. and the world, such as the cotton gin, spinning jenny, waterwheels and steam engine.

3.) The role that simple machines played in the development of England, Europe and the Middle East. Machines such as the catapult, bow and arrow, lance, drawbridge, block and tackle, pulley, wheel, etc..

4.) World War II- the importance of machines and transportation in the course of the war. The use of hot air balloons, pigeons, gliders, rockets, parachutes and helicopters, etc..

5.) Tracing the progression of flight from the Chinese to the present. How did flight change the course of history?

Language Arts (To be accomplished in L.A. Class and Science)

Students will write on the following topics:

1.) "The Wheel" -Rolling through Time.

2.) Roller Coasters and amusement parks.

3.) Isaac Newton and others who contributed to understanding of force and motion.

4.) Bernoulli's contribution to flight.

5.) Robots

6.) Submarines

7.) Pyramids

8.) Choose one race and write an essay in which you describe the race, its significance and its history:

AMERICA'S CUP TRIPLE CROWN INDY 500

BOSTON MARATHON TOUR DE FRANCE

9.) Students will do library research and write a biography of Archimedes. A great deal of information is available on this famous man, so students will work in small groups to prepare their reports.

10.) An Imaginary Machine-Write a 200 word story about a machine that does some very special job. Include the following words in your tale as you describe how your machine functions.(efficiency, effort force, power, resistance force, friction, lubricant, work input, work output). Then draw a diagram of your imaginary machine.

11.) Reaction Engines: Newton's third law of motion is the basis for the operation of reaction engines. Using books and other reference materials in the library, find out what a reaction engine is. Then find out how the following devices operate as reaction engines. (Reaction Engine, Automatic Lawn Sprinkler, Hero's Engine, Jet and Rocket Motors).

12.) James Watt and the Steam Engine. James Watt did not invent the steam engine. But he did build the first practical steam engine. Using books and other reference materials in the library, find out more about James Watts and his work with steam engines. Your report should include information on how he improved the steam engine and how the steam engine changed the way work was done by people. Outline your main ideas.

Reading (To be accomplished in Reading and Science Class)

The following is a list of the readings we use. Many have been gathered from a variety of texts and monthly science magazines. You will probably have to create your own bibliography, as copying this material is unfeasible. Whatever relevant readings you choose, discussions of the readings will be an important component of the activities.

1. Guion Bluford: Challenger in Space
2. Robots: Do They Signal Automation or Unemployment?
3. Hypersonic Planes: Flying Faster Than the Speed of Sound.
4. When Newton Rocks----
5. The Indy 500-Centripetal Force
6. Fantastic Falls
7. NASA'S Mission to Mars
8. Undersea Robots
9. The Fifth Force: Is It With Us?
10. Dick Rutan and Jeana Yeager: Making Aviation History
11. Frisbees and Aerobics
12. Highway Detectives

Possible Reading Assignments:

a.) Choose a career that has to do with motion and report on it.

b.) Read a novel that deals with motion in some way (allow for a great deal of latitude). Examples: The Black Stallion, The Adventures of Tom Sawyer, From the Earth to the Moon, 20,000 Leagues Under the Sea, Charlie and the Chocolate Factory.

Math and Science

Students will be involved in hands on activities which will require measurement and graphing of forces in motion. The lab experiences will be integrated with other class work and research into the following topics:

1. Frames of References
2. Momentum
3. Velocity
4. Force
5. Newton's Laws of Motion
6. Gravity
7. Friction
8. Fluids and Pressure
9. Hydraulic Devices
10. Pressure and Gravity
11. Buoyancy
12. Fluids in Motion
13. Work, Power, and Machines
14. Energy

TEAM PROJECTS

1. THUNDERSTRIKE!
2. Flying Aces
    6. Field Trips
    a. Cole's Land Transportation Museum, Bangor
    b. Leonards' Mill, Bradley
    c. Owl's Head Land Transportation Museum, Owls Head
    d. Bangor Air National Guard Base, Bangor

VIDEO PACKETS

1. Newton's Apple-Roller Coasters
2. Bill Nye, the Science Guy- Machines
3. Work, Energy and Simple Machines
4. Egypt and the Great Pyramids
5. Pyramid, Cathedral, Castle, and City by David Macauley
6. Life Force
7. Scientific American Frontiers
    Show 202-Wheelchairs and Robots
    Show 201-Submarines
    Show 205-Rollercoasters
    Show 305-Ancient Egypt
8. NOVA-History of Roller Coasters and Amusement Parks
9. A&E's Biography Series: The Wright Brothers

The Competition

The Thunderstrike unit culminates in a large competition which takes about two and a half hours to complete. A large area, like a parking lot or a gym is preferable. Group leaders will be responsible for judging the events for their own group.

RULES OF THE COMPETITION:

1. Group will have five minutes to run their vehicles through all three competitions.
   a. Greatest distance
   b. Fastest Speed
   c. Most Accurate-closest to 10 meters.
2. Each group may have 3 runs for each competition for a total of 9 runs.
3. Once a vehicle has departed the starting line, you may not touch the vehicle.
4. The vehicle can only be constructed from materials in the box or listed on the materials list.
5. All vehicles must stay within the one-meter wide track or it will be disqualified.

THUNDERSTRIKE!

JUDGES DATA SHEET

CLASS NAME:_____

Name	/ Top Speed	/ Longest Distance	/10-12m
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			

THUNDERSTRIKE!
STUDENT DATA SHEET

Vehicle Name:_____

Student Names:_____

Mass_____grams Speed_____ft/sec

Distance_____feet Momentum_____grams/ft/sec

Acceleration_____ft/sec/sec

Formulas for your use:

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

Momentum=Mass X Velocity (Speed)

$$\text{Acceleration} = \frac{S2 - S1}{\text{Time}}$$

THUNDERSTRIKE!
STUDENT WORKSHEET

NAME:_____

1.) Define the following terms. Write each word in a sentence relating it to the project.

a.) friction
b.) momentum
c.) Speed
d.) force
e.) inclined plane
f.) Wheel and Axle
g.) inertia
h.) gravity
i.) action force
j.) reaction force

2. QUESTIONS

a. How did you determine the speed of your vehicle?

b. What problems were you confronted with in designing and testing your vehicle? How did you overcome the problems?

c. How did you determine the acceleration?

d. How did you determine momentum of your vehicle?

THUNDERSTRIKE!
FLYING ACES COMPETITION
GENERAL INFORMATION

Purpose

The purpose of the Flying Aces Competition is to introduce aerodynamics and solve the problem of flight. Students will produce a plane that outperforms all the others in that competition.

Procedure

1. Form teams of two students.
2. Teams choose plane design.
3. Discussion of the basic principles of flight.
   (Lift,Drag,Yaw,Pitch,Camber,Roll)
4. Teams assemble planes using instruction sheets to aid them in the assembly. Teams brainstorm best designs to use to accomplish the task they desire.
5. Teams test and modify plane's design.
6. Competition Events:
   a.) Distance (Longest distance traveled)
   b.) Accuracy of flight-Through the Hoop
   c.) Aerobatics - flying loop, turn to right or left, Climbing.
   d.) Time Aloft-longest time in flight.

Building and Competition Procedures

1. Students will construct planes from cutouts photo-copied from WhiteWings paper airplane kit which can be purchased from many bookstores and catalogs. Photocopies are made on thick oaktag stock.
2. Students will decorate and name their plane.
3. Students will discuss their strategy for the competition and review the principles of flight.
4. Teachers will escort students to competition area.

5. Teachers will review rules of the competition before leaving the classroom.

Station Assignments:

Station One: DISTANCE
Station Two: AEROBATICS
Station Three: TIME ALOFT
Station Four: ACCURACY

Each student will have two minutes to put their plane through the exercise at each station. Students need to remain with their team and be ready when the team's turn comes up at each station.

Each group of students will have 25 minutes at each station before they move to the next station. This allows each team about two minutes to fly their plane.

Each team will be allowed as many flights as they can manage within the two minute time span.

When not flying the plane, students are to sit behind the lines planning their strategies for the competition while waiting for their turn.

In Closing

The hands-on, problem-solving approach of this unit provides students with a chance to actually see and feel the application of what they have learned in the classroom. Its cooperative nature also provides Middle-Level students with a chance to constructively interact while solving a real-life problem, developing interpersonal skills which cannot be taught from a book or lecture. Perhaps the most intriguing aspect of this unit is that it is interdisciplinary in nature. Much is already set down, but each group of teachers will add new features and procedures. Teachers working closely with each other to effect a variety of lessons throughout all of the academic disciplines sends a strong message to the students about cooperation, meaningful learning and creativity.