

Chapter 5: Work, Energy and Power

Teacher: Kenneth O'Rourke

Subject: Physical Science

Dates: 1-02-06 to 1-7-06

Time: 9 to 12 days

Topic: Work/Energy

Grade: 9 inclusion classroom

Note: Intelligences- Linguistic, logical math, spatial, kinesthetic, musical, interpersonal, intrapersonal, naturalist.

Per. Standards- active learning, coherence, critical/creative thinking, real world connections, reflection, fosters understanding of content

Vocabulary- Energy, energy transformation, heat, joule, potential energy, kinetic energy, work, power, law of conservation of energy

Objectives:

Students will be able to:

- Calculate the work done by a simple machine 1-3, lab 5-1
- Calculate the potential and kinetic energy 1-5 to 1-11
- Apply the law of conservation of energy as it applies to force and distance in simple machines 1-5
- Calculate power in machines 1-4
- Calculate the efficiency of a machine 1-4
- Apply the law of conservation of energy as it applies to perpetual motion machines 1-12

Learning topic one: Work *Monday 1-2*

- 1) Bell Ringer
- 2) Work is the application of a force over a distance
- 3) $W=Fd$
- 4) Practice worksheets for the formula
- 5) Bowling ball vs Basketball work demonstration. I demonstrate the work formula by lifting a bowling ball a distance- calculate the work (force times distance) the force is the weight of the ball (kilograms) times 9.8 m/s/s. I then do the same for the basketball. The idea is that they will associate lifting the bowling ball as doing more work than lifting a basketball, and our calculations will support that.
- 6) Formative assessment cards for the lesson

Learning topic two: Power *Wednesday 1-4*

- 1) Bell ringer
- 2) Power is the speed at which work is done
- 3) $P= \text{Work}/\text{time}$
- 4) Power worksheets
- 5) Power demonstration, winch with a large cylinder winch, and a small cylinder winch. The same work done faster has more power. Students will then brainstorm examples of different power machines.
- 6) Formative assessment cards for the lesson-

Learning topic three: Efficiency *Tuesday 1-4*

- 1) Bell Ringer
- 2) Efficiency of a machine
- 3) Efficiency= work output/work input
- 4) Worksheets
- 5) Examples of appliances, their efficiency, and why it is important- and cheaper. Student supply examples as well.
- 7) Formative assessment cards for the lesson- Can a machine's output ever be more than its input? If a machine has an input of 50j and an output of 45 j, what is its efficiency? A-110% B-90% C- 0% D- can't be calculated Can a machine ever have an efficiency greater than 1?
- 8) Formative assessment cards for the lesson

Lab 5.1 WORK- *Monday 1-3* The students will use a block and tackle system to find out what is sacrificed when you gain a mechanical advantage. It is a 4 question strategy lab, and Monday is the introduction of the lab. We tie the concept of mechanical advantage with Work, Power, and Efficiency. The students will develop an experiment to find out if you do less work using a machine. We will develop a hypothesis, procedures, materials, and data table in order to investigate the relationship between work and mechanical advantage.

Learning topic three: Energy *Wednesday 1-5*

- 1) Bell Ringer
- 2) Energy is the ability to do work
- 3) Any object that has energy has the ability to create a force
- 4) Units for energy and work are the same, the joule
- 5) Demonstration of the ability of an objects position being used to do work. The falling mass raising a lever.
- 6) Formative assessment cards for the lesson

Learning topic four: Potential Energy *Wednesday 1-5*

- 1) Bell Ringer
- 2) Potential energy is stored energy or the energy of position. In other words gravitational energy. A high object will have more potential energy than an object of the same mass at a lower height.
- 3) Formula: $E_p = mgh$
- 4) Practicing calculating potential energy
- 5) Formative assessment cards for the lesson

Learning topic five: Kinetic energy *Thursday 1-8*

- 1) Bell Ringer
- 2) Kinetic energy is the energy of motion. An object moving with a greater velocity than an object with the same mass will have more energy than the object with a smaller velocity
- 3) Formula: $E_k = 1/2mv^2$
- 4) Practicing calculating potential energy
- 5) Formative assessment cards for the lesson

Learning topic six: Conservation of energy 1-9

- 1) Bell Ringer each day
- 2) Energy cannot be created or destroyed, just transformed from one form into another
- 3) Energy transformations
- 4) PE to KE Scion Image presentation
- 5) Potential energy to kinetic energy problems $PE_1 + KE_1 = PE_2 + KE_2$
- 6) PE to KE worksheets
- 7) Preview lab 5.2
- 8) Formative assessment cards for the lesson each day

Energy Conservation Lab 5.2, 1-9, 1-10 - By measuring the height, speed, and mass of the marble at different points on the roller coaster, we can calculate the PE and KE to compare to our measured values.

Learning topic seven: 1-11 Other forms of energy

- 1) Bell Ringer
- 2) Other forms of energy
- 3) Energy Transformation worksheet
- 4) Perpetual motion machines
- 5) Formative assessment cards for the lesson

Home Learning: Vocabulary, worksheets, lab reports, reading

Assessment:

- 1) Question and answer sessions asking students to cite examples
- 2) Worksheets
- 3) Quizzes
- 4) MOLP extra help session (one on one evaluation)
- 5) Formative assessment cards for the lesson each day
- 6) Bell Ringers

Reflection: