LESSON 107

DEMO AND COMPUTER ACTIVITY

Make It Work Work

Name _____

Date _____ Period _____

Purpose

To explore how the energy from chemical change is converted into work.

Part 1: Demos

1. List two ways you could use a chemical change to move a ping-pong ball.

2. How did the two demonstrations use chemical change differently to do work?

Part 2: Calculations Involving Work

When work is done to move an object, a force or a "push" is applied to the object. If the object moves in the same direction as the force applied, the work done can be calculated.

$$\text{Work} = \text{force} \cdot \text{distance} \quad \text{or} \quad W = F \cdot d$$

The unit of force is newtons and the unit of distance is meters, so work is expressed in units of newton-meters, which are equivalent to joules. If you know the force in pounds, you can convert it to newtons.

1 Newton-meter (N m) = 1 Joule (J) 1 pound (lb) = 4.45 Newton (N)

1. A book weighs about 2 lb. You lift the book from the floor to a spot about 2 m above the floor.

a. How many newtons of force did you apply?

b. How much work have you done, in newton-meters?

c. How much work have you done in joules?

Part 3: Work Done by a Gas

Work is frequently done by expansion or contraction of matter, especially of gases. In these cases, work is expressed as pressure times the change in volume, or $W = P \cdot \Delta V$.

So work done by a gas is expressed in units of liter atmospheres; 1 L atm = 101 J.

1. Gas in a piston expands from a volume of 2 L to a volume of 10 L. It pushes against a pressure of 1 atm. How much work is done? Express your answer in joules.

Part 4: Steam Engine

1. What causes the piston to move back and forth in the cylinder?

2. Explain how the wheels go around on a steam train.

3. Explain why it would be more correct to call it a water vapor engine rather than a steam engine.

4. **Making Sense** Explain how chemical change can be used to do work.

5. **If You Finish Early** The combustion of hydrogen causes the space shuttle to launch. Write a balanced equation for the reaction, draw an energy diagram to explain the role of a spark, and use the diagram to explain what pushes the shuttle up into the air.