Name_____ HR:_____ Date:_____

HW#13 - Pre-Field Trip Homework Packet

Intro to Energy!

Instructions: On this page is a graphic organizer to fill in while reading about energy. Use this organizer to take notes on potential and kinetic energy from the reading. In addition, you must also complete any question or activity in the packet that is marked by a butterfly. There are 9 butterflies in total!

Definition for **Energy**: (see p. 108) =

_____

_____

_____

The unit to measure Energy is:

_____

There are two main types of energy. Write each type in the circles below.

Type of Energy:

"K_____"

Definition of this kind of energy:

_____

_____

_____

Equation to calculate this kind of energy:

Type of Energy:

"P_____"

Definition of this kind of energy:

_____

_____

_____

There are two common forms of PE. Write them below:

One Kind of Potential Energy:

One Kind of Potential Energy:

LESSON 1

What Is Energy?

UNLOCK THE BIG QUESTION

- How Are Energy, Work, and Power Related?
- What Are Two Types of Energy?

MY PLANET DIARY

Wind Farms

Did you know that wind can be used to produce electricity? A wind farm is a group of very large windmills, or turbines, placed in a location that gets a lot of wind. The energy of the wind causes the propellers of the turbines to spin. The turbines are connected to generators. When the turbines are spinning, the generators produce electricity. The amount of electricity produced depends on the size of the propellers, the number of turbines, and the strength of the wind.

FUN FACT

Write your answer to the question below.

Analyze Costs and Benefits What are some advantages and disadvantages of using wind energy to create electricity?

PLANET DIARY Go to **Planet Diary** to learn more about energy.

Lab zone Do the Inquiry Warm-Up *How High Does a Ball Bounce?*

How Are Energy, Work, and Power Related?

Did you put a book in your backpack this morning? If so, then you did work on the book. Recall that work is done when a force moves an object. The ability to do work or cause change is called **energy.**

Work and Energy When you do work on an object, some of your energy is transferred to that object. You can think of work as the transfer of energy. When energy is transferred, the object upon which the work is done gains energy. Energy is measured in joules—the same units as work.

Vocabulary

- energy
- kinetic energy
- potential energy
- gravitational potential energy
- elastic potential energy

Skills

- Reading: Relate Cause and Effect
- Inquiry: Calculate

Power and Energy You may recall that power is the rate at which work is done. **Since the transfer of energy is work, then power is the rate at which energy is transferred, or the amount of energy transferred in a unit of time.**

$$\text{Power} = \frac{\text{Energy Transferred}}{\text{Time}}$$

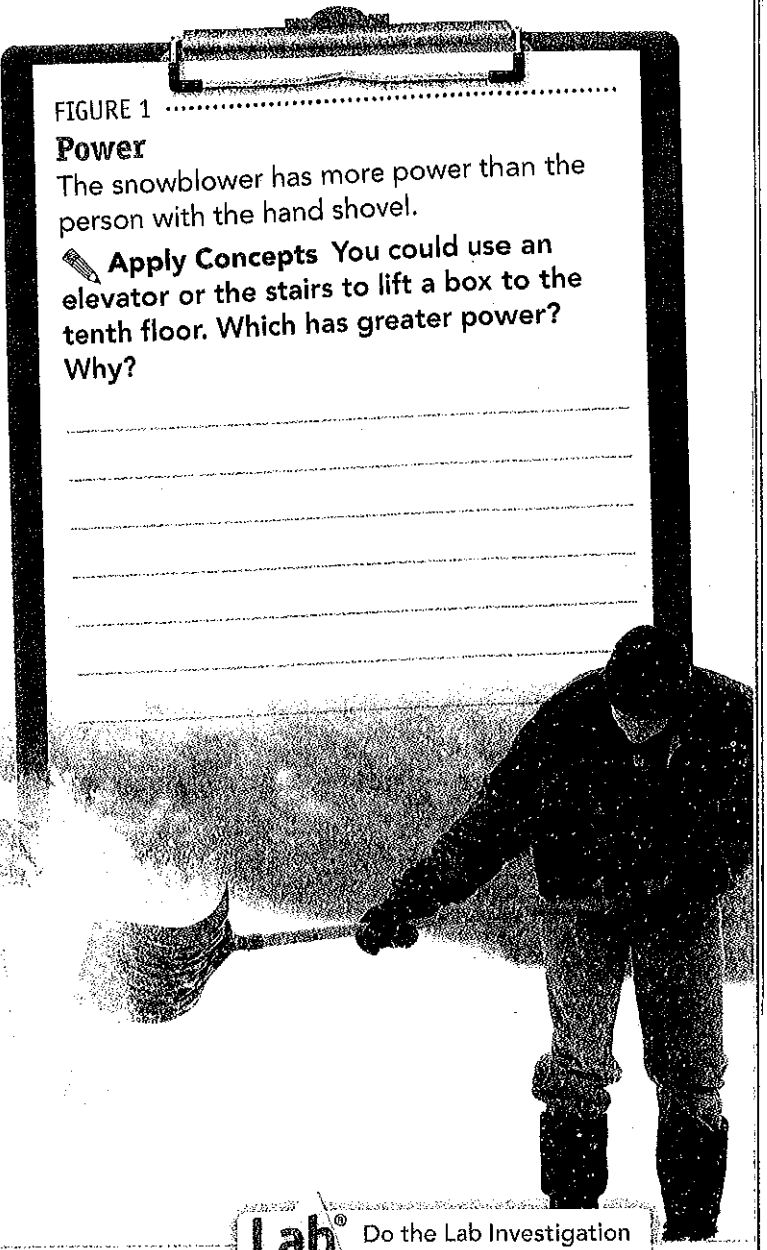
Different machines have different amounts of power. For example, you could use either a hand shovel or a snowblower, like the one in **Figure 1,** to remove snow from your driveway. Each transfers the same amount of energy when it moves the snow the same distance. However, you could move the snow faster using a snowblower than a hand shovel. The snowblower has more power because it transfers the same amount of energy to the snow in less time.

FIGURE 1

Power

The snowblower has more power than the person with the hand shovel.

Apply Concepts **You could use an elevator or the stairs to lift a box to the tenth floor. Which has greater power? Why?**



Lab zone® Do the Lab Investigation *Can You Feel the Power?*

Assess Your Understanding

got it?

○ I get it! Now I know that since the transfer of energy is work, then power is _____

○ I need extra help with _____

Go to MY SCIENCE COACH online for help with this subject.

What Are Two Types of Energy?

Moving objects, such as the vehicles shown in **Figure 2,** have one type of energy. A rock perched on the edge of a cliff or a stretched rubber band has another type of energy. **The two basic types of energy are kinetic energy and potential energy.** Whether energy is kinetic or potential depends on the motion, position, and shape of the object.

Kinetic Energy A moving object can do work when it strikes another object and moves it. For example, a swinging hammer does work on a nail as it drives the nail into a piece of wood. The hammer has energy because it can do work. The energy an object has due to its motion is called **kinetic energy.**

Factors Affecting Kinetic Energy The kinetic energy of an object depends on both its speed and its mass. Suppose you are hit with a tennis ball that has been lightly tossed at you. It probably would not hurt much. What if you were hit with the same tennis ball traveling at a much greater speed? It would hurt! The faster an object moves, the more kinetic energy it has.

Kinetic energy also increases as mass increases. Suppose a tennis ball rolls across the ground and hits you in the foot. Compare this with getting hit in the foot with a bowling ball moving at the same speed as the tennis ball. The bowling ball is much more noticeable because it has more kinetic energy than a tennis ball. The bowling ball has more kinetic energy because it has a greater mass.

FIGURE 2

ART IN MOTION **Kinetic Energy**

The kinetic energy of an object depends on its speed and mass.

Use the diagram to answer the questions.

1. **Interpret Diagrams** List the vehicles in order of increasing kinetic energy.

2. **Explain** Describe another example of two objects that have different kinetic energies. Explain why their kinetic energies are different.

Calculating Kinetic Energy You can use the following equation to solve for the kinetic energy of an object.

$$\text{Kinetic energy} = \frac{1}{2} \times \text{Mass} \times \text{Speed}^2$$

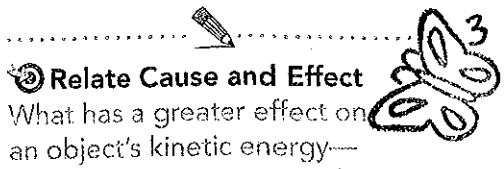
For example, suppose a boy is pulling a 10-kg wagon at a speed of 1 m/s.

$$\text{Kinetic energy of wagon} = \frac{1}{2} \times 10 \text{ kg} \times (1 \text{ m/s})^2$$

$$= 5 \text{ kg}\cdot\text{m}^2/\text{s}^2 = 5 \text{ joules}$$

$$\text{Note that } 1 \text{ kg}\cdot\text{m}^2/\text{s}^2 = 1 \text{ joule}$$

Do changes in speed and mass have the same effect on the kinetic energy of the wagon? No—changing the speed of the wagon will have a greater effect on its kinetic energy than changing its mass by the same factor. This is because speed is squared in the kinetic energy equation. For example, doubling the mass of the wagon will double its kinetic energy. Doubling the speed of the wagon will quadruple its kinetic energy.



3 Relate Cause and Effect What has a greater effect on an object's kinetic energy—doubling its mass or doubling its speed? Explain.

do the math!

A girl and her dog are running. The dog has a mass of 20 kg. The girl has a mass of 60 kg.

1 Calculate Suppose both the dog and the girl run at a speed of 2 m/s. Calculate both of their kinetic energies.

Kinetic energy of dog =

Kinetic energy of girl =

2 Calculate Suppose the dog speeds up and is now running at a speed of 4 m/s. Calculate the dog's kinetic energy.

Kinetic energy of dog =

3 Draw Conclusions Are your answers to Questions 1 and 2 reasonable? Explain.

Review Write the SI unit for each quantity in the table.

Quantity	SI Unit
Force	
Height	
Work	
Mass	
Energy	

Potential Energy An object does not have to be moving to have energy. Some objects have energy as a result of their shapes or positions. When you lift a book up to your desk from the floor or compress a spring by winding a toy, you transfer energy to it. The energy you transfer is stored, or held in readiness. It might be used later if the book falls or the spring unwinds. Energy that results from the position or shape of an object is called **potential energy.** This type of energy has the potential to do work.

Gravitational Potential Energy Potential energy related to an object's height is called **gravitational potential energy.** The gravitational potential energy of an object is equal to the work done to lift it to that height. Remember that work is equal to force multipled by distance. The force you use to lift the object is equal to its weight. The distance you move the object is its height above the ground. You can calculate an object's gravitational potential energy using this equation.

Gravitational potential energy = Weight × Height

For example, suppose a book has a weight of 10 newtons (N). If the book is lifted 2 meters off the ground, the book has 10 newtons times 2 meters, or 20 joules, of gravitational potential energy.

FIGURE 3

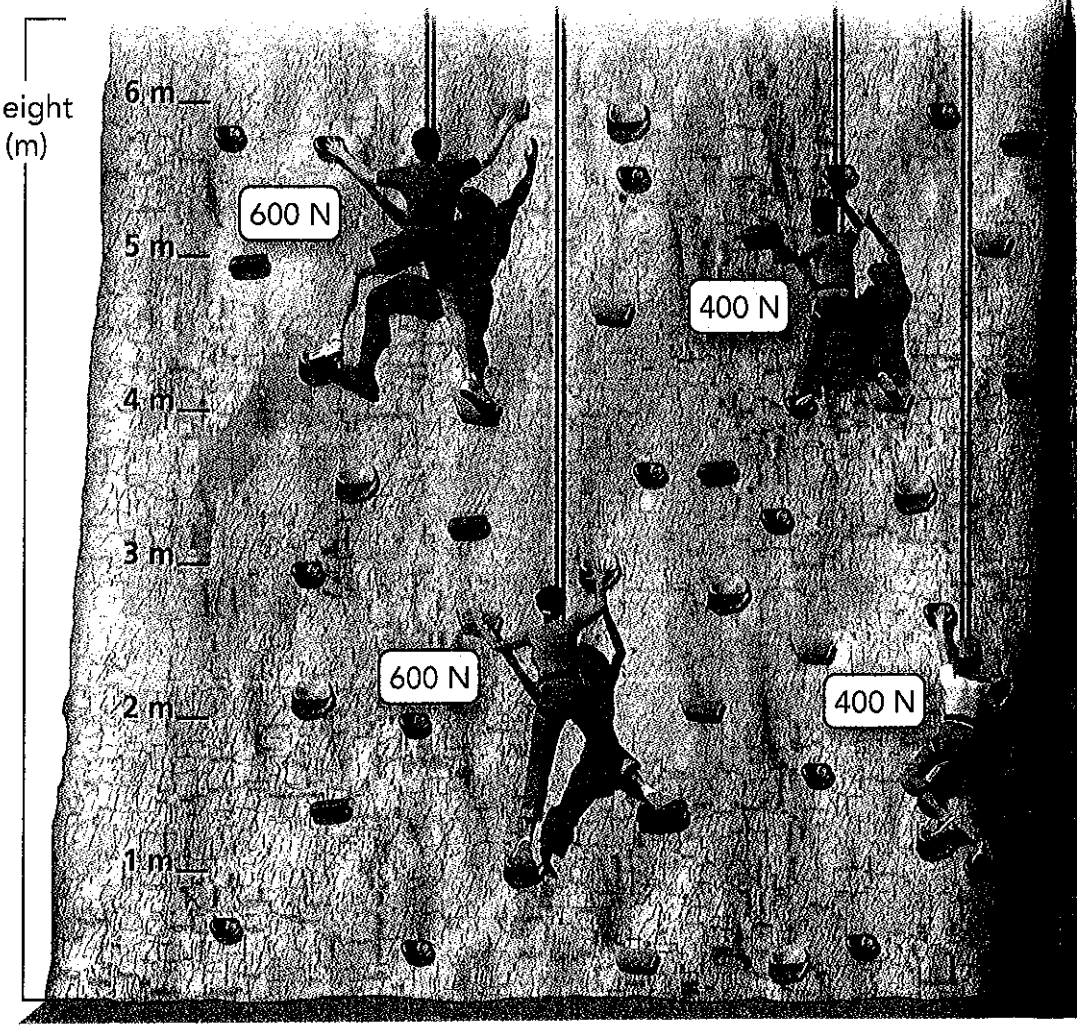
Gravitational Potential Energy

The rock climbers have gravitational potential energy.

Use the diagram to answer the questions.

1. **Identify** Circle the rock climber with the greatest potential energy. Calculate this potential energy. The height to be used is at the rock climber's lowest foot.

2. CHALLENGE Where would the rock climbers at the top have to be to have half as much potential energy?



Elastic Potential Energy An object has a different type of potential energy due to its shape. **Elastic potential energy** is the energy associated with objects that can be compressed or stretched. For example, when the girl in **Figure 4** presses down on the trampoline, the trampoline changes shape. The trampoline now has potential energy. When the girl pushes off of the trampoline, the stored energy sends the girl upward.

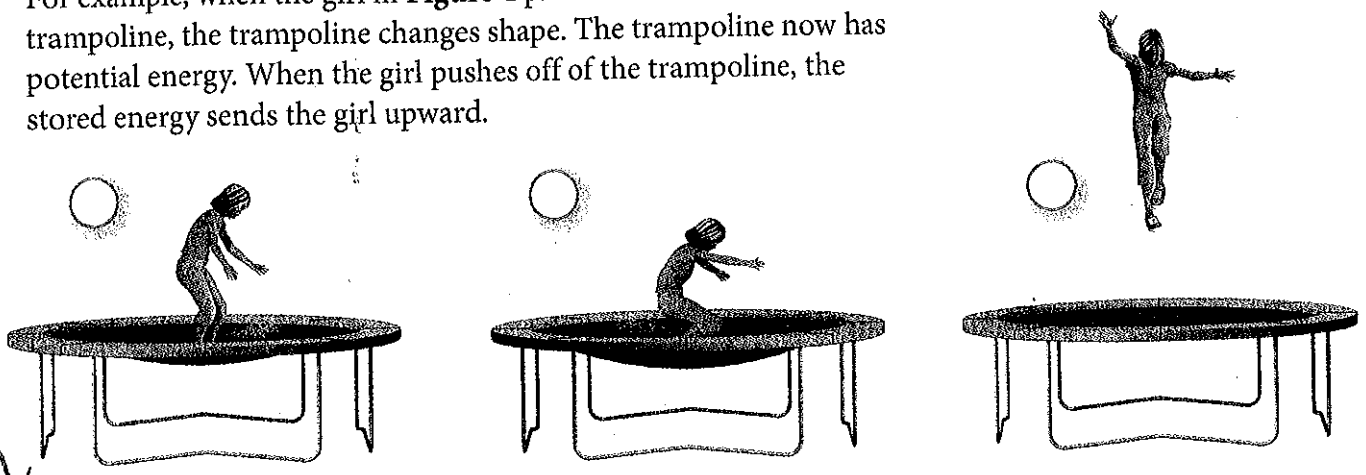


FIGURE 4

Elastic Potential Energy

The energy stored in a stretched object, such as the trampoline, is elastic potential energy.

Interpret Diagrams **Rank the amount of elastic potential energy of the trampoline from greatest to least. A ranking of one is the greatest. Write your answers in the circles. Then explain your answers in the space to the right.**

Lab zone® Do the Quick Lab *Mass, Velocity, and Kinetic Energy.*

Assess Your Understanding

7 **1a. Identify** The energy an object has due to its motion is called (kinetic/potential) energy. Stored energy that results from the position or shape of an object is called (kinetic/potential) energy.

8 **b. Summarize** What are the two factors that affect an object's kinetic energy?

9 **c. Apply Concepts** What type of energy does a cup sitting on a table have? Why?

got it?

○ I get it! Now I know that the two basic types of energy are

○ I need extra help with

Go to MY SCIENCE COACH *online for help with this subject.*

Field Trip Pledge
PHA 8th Grade
Museum of Science Visit March 10, 2011

I pledge to:

1. be respectful to the other people who will be riding on public transportation with us.
2. know where my teacher-leader is at ALL times, and be able to make eye contact with him/her. **STAY WITH ASSIGNED GROUP AT ALL TIMES.**
3. speak at an acceptable volume when inside the buildings.
4. be respectful of those that will be working in the buildings that we visit.
5. not complain about any walking or activities that we do.
6. not ask for money from any teacher or chaperone.
7. follow all directions given by teachers, chaperones and guides.
8. leave any electronic devices I have brought to school in my locker.
9. ask questions in a respectful manner.
10. actively listen and learn from each site that we visit.
11. stay positive.
12. HAVE AN ENJOYABLE DAY☺!

Student Name _____ **Date** _____

Student Signature _____ **Advisor** _____