Name:_____

12th Science Review

Potential and Kinetic Energy

1. Introduction

There are two kinds of energy that will be dealt with in this experiment: Kinetic and Potential Energies. Work is equal to the product of force multiplied by distance. Energy is "something" that enables an object to do work. A rubber band has energy stored in it – Potential energy. When stretched and released as in a sling shot, the Potential energy is converted to Kinetic energy. Energy therefore can be interchangeable.

2. Background

In the experiment we will explore the core concepts of kinetic and potential energy, and discover how they are, related to each other. One of the ways an object can store energy is by changing its position as in the case of Gravitational Potential Energy. If you take a pen and rise it in the air the pen will gain Potential Energy which means it will fall harder on the floor if released. In case you lower the pen it will possess less Potential Energy and it won't hit the floor as hard if released. Gravitational potential energy is equal to the work done against gravity in lifting an object.

Work=Force * distance
Gravitational Potential Energy=weight * Height
Potential Energy =PE=m*g*h

If object is already in motion it acquires another kind of energy called Kinetic Energy. Formula for Kinetic Energy is:

KE=1/2 mass * speed2

For example throwing a ball requires work to be done on the ball. This work is stored as Kinetic Energy. When the ball hits something it will transform Kinetic energy back in to work.

It is very important to understand that there is a direct relationship between work and Energy. Whenever work is done Energy changes, therefore we conclude that if there is no change in energy there is no work done. This is known as Work-Energy theorem:

Work= change in Energy = ΔE

One of the most basic and most important laws of physics is the law of conservation of energy: Energy cannot be created or destroyed. It can be transformed from one form into another, but the total amount of energy never changes.

Observing this might be a little difficult but let's go back to the slingshot example. As you load it and pull back the string, the string stores Energy. When you release the string energy is transformed to the stone through work. When the stone hits the target the Kinetic energy is transferred to work. But when you measure the work done on the fence it wont match the kinetic energy of the stone and there might be quite a few reasons for that. Energy was dissipated into temperature, sound, air resistance etc… There are many of the things that come in to play and you must be aware of them.

Mr. Bauta

Determine whether the objects in the following problems have kinetic or potential energy. Then choose the correct formula to use: **$KE = 1/2\ m\ v^2$** OR **$PE = mgh = F_w h$**

1. You serve a volleyball with a mass of 2.1 kg. The ball leaves your hand with a speed of 30 m/s. The ball has _____ energy. Calculate it.

2. A baby carriage is sitting at the top of a hill that is 21 m high. The carriage with the baby weighs 12 N. The carriage has _____ energy. Calculate it.

3. A car is traveling with a velocity of 40 m/s and has a mass of 1120 kg. The car has _____energy. Calculate it.

4. A cinder block is sitting on a platform 20 m high. It weighs 79 N. The block has _____ energy. Calculate it.

5. There is a bell at the top of a tower that is 45 m high. The bell weighs 190 N. The bell has _____ energy. Calculate it.

6. A roller coaster is at the top of a 72 m hill and weighs 966 N. The coaster (at this moment) has _____ energy. Calculate it.

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7. What is the kinetic energy of a 3-kilogram ball that is rolling at 2 meters per second?

8. The potential energy of an apple is 6.00 joules. The apple is 3.00-meters high. What is the mass of the apple?

9. Two objects were lifted by a machine. One object had a mass of 2 kilograms, and was lifted at a speed of 2 m/sec. The other had a mass of 4 kilograms and was lifted at a rate of 3 m/sec.
a. Which object had more kinetic energy while it was being lifted?

b. Which object had more potential energy when it was lifted to a distance of 10 meters? Show your calculation.

10. You are on roller blades on top of a small hill. Your potential energy is equal to 1,000.0 joules. The last time you checked your mass was 60.0 kilograms.
a. What is your weight in Newtons?

c. If you start skating down this hill, your potential energy will be converted to kinetic energy. At the bottom of the hill, your kinetic energy will be equal to your potential energy at the top. What will be your speed at the bottom of the hill?

11. Answer the following:
a. What is the kinetic energy of a 1-kilogram ball is thrown into the air with an initial velocity of 30 m/sec?

b. How high into the air did the ball travel? **KE=PE

12. What is the potential energy of a 3 kilogram-ball that is on the ground?

13. What is the kinetic energy of a 2,000-kilogram boat moving at 5 m/sec?

14. What is the velocity of a 500-kilogram elevator that has 4,000 joules of energy?

15. What is the mass of an object that creates 33,750 joules of energy by traveling at 30 m/sec?