Name: Answer Key

Explain the difference between Potential Energy and Kinetic Energy

PE is the amount of energy an object has because of its relative position and height. KE is one way to describe the energy of motion

Experiment 1:

Carefully drop a ping pong ball straight down onto a flat hard surface from a height of 1 meter. Complete the trial 3 times and take the average.

Trial	Observations after impact (e.g., broken, bounced, dented, splash size)			Average
Hard Flat Surface				
Inflated Bag				

What was the energy when the ball was held at 1 meter high? Kinetic or Potential

Did energy transfer back into the ball when it hit the ground? How do you know?

Yes, because it bounces. The ball has KE when it bounces

For which trial will the landing area absorb more kinetic energy? Why?

the inflated bag absorbed more energy. We could tell because the ball didn't bounce as high and the bag deformed when hit by the ball.

Experiment 2:

Carefully drop a ping pong ball straight down onto an inflated bag from a height of 1m. Complete the trial 3 times and take the average.

Trial	Observations after impact (e.g., broken, bounced, dented, splash size)			Average
50g balloon				
200g balloon				

What balloon had the most kinetic energy? How do you know?

the 200g balloon had more ~~KE~~ energy. We could tell because it deformed more upon landing. The greater the mass the more the energy.

Experiment 3:

Drop the marble from the edge of the table, and make a mark on a sheet of paper taped to the floor where it falls. Now release the marble from 3", 6", 12" marks on the ruler, and again note where they strike the floor, marking a sheet of paper taped to the floor. Repeat the measurement three times to check. Record the distance the marble travels horizontally from the edge of the table to the point where it strikes the floor.

Trial	Record distance to stop in inches.			Average
Edge				
3 inches				
6 inches				
12 inches				

Which height did the marble strike the ground the furthest? Explain what is happening based on your knowledge of how energy is transferred.

The marble struck the ground the furthest when ~~[illegible]~~ released from 12". The greater the height the more the PE the more PE then the more the KE. this is because of the Law of Conservation of Energy. Energy is neither created or destroyed.

Potential Energy Calculations

The formula for potential energy is $PE = mgh$

where:

- g gravity is 9.8 m/s²
- m is the mass of the object (measured in kilograms, kg)
- h height of the object (measured in meters)

Calculate the potential energy for:

50g balloon at 1 m height	200g balloon at 1 m height
$PE = mgh$ $= (0.05\,kg)(9.8\,\frac{m}{s^2})(1\,m)$ $= 0.049\,kg\,\frac{m^2}{s^2}$ $PE = 0.049\,j$	$PE = mgh$ $= (0.02\,kg)(9.8\,\frac{m}{s^2})(1\,m)$ $= 0.196\,kg\,\frac{m^2}{s^2}$ $PE = 0.196\,j$

Which object had the most Potential Energy? Would a 500 g balloon have more or less potential energy? Why?

The 200g object had the most PE because it was heavier. 500g object would have more PE. because it is heavier

Kinetic Energy Calculations

$$KE = \frac{1}{2}mv^2$$

Where:

- KE is the kinetic energy (measured in Joules, J)
- m is the mass of the object (measured in kilograms, kg)
- v is the velocity (or speed) of the object (measured in meters per second, m/s)

Calculate the kinetic energy for an object at:

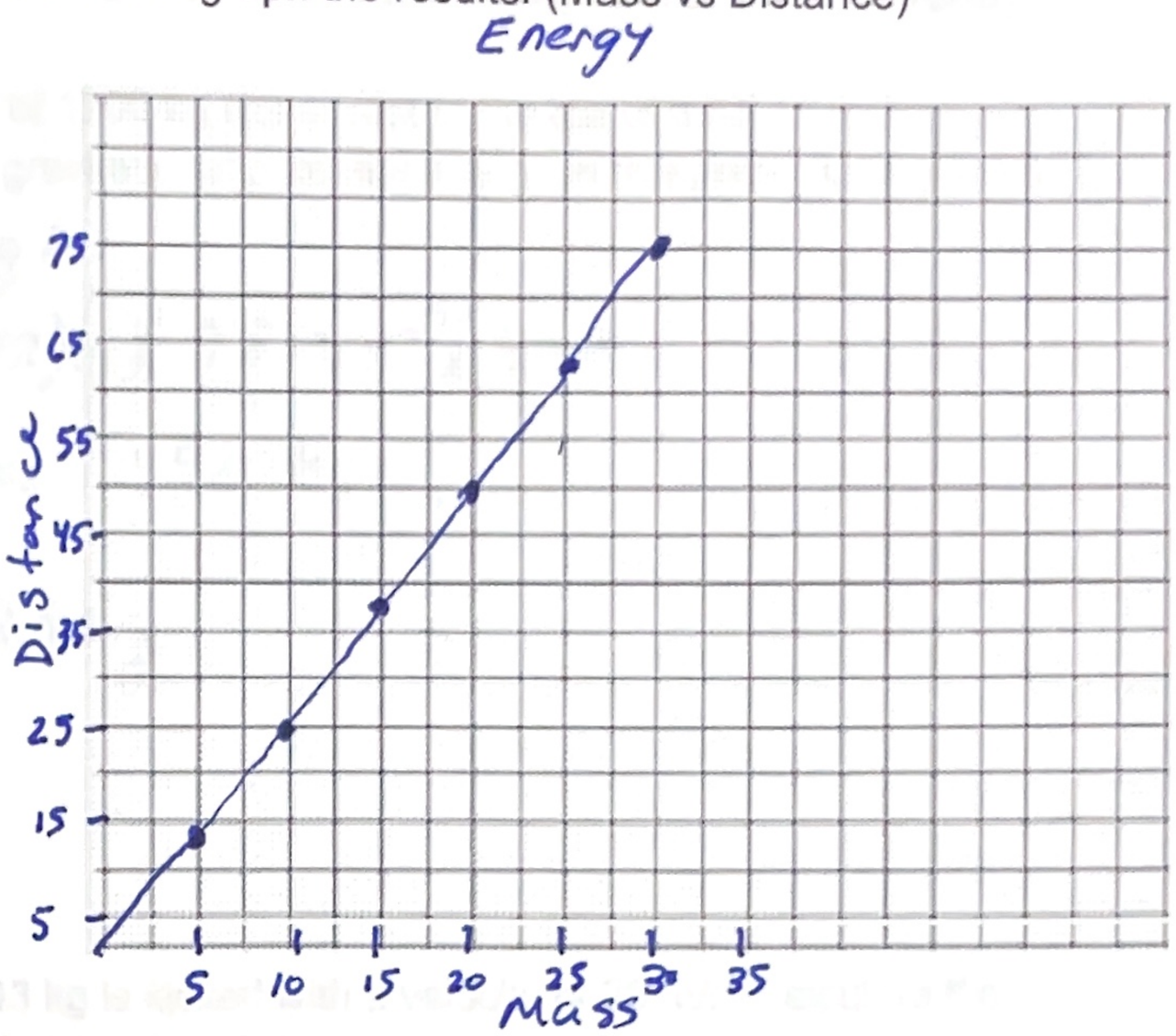
50 g balloon at 20 m/s height	50 g balloon at 40 m/s height
$KE = \frac{1}{2}mv^2$ $= \frac{1}{2}(.005\,kg)(20\,\frac{m}{s})^2$ $= 1\,kg\,\frac{m^2}{s^2}$ $KE = 1\,j$	$KE = \frac{1}{2}mv^2$ $= \frac{1}{2}(0.005)(40\,\frac{m}{s})^2$ $= 4\,kg\,\frac{m^2}{s^2}$ $= 4\,j$

Which object had the most Kinetic Energy? Would an object dropped at a 5 meter per second ~~faster~~ have more or less kinetic energy? Why?

The object traveling 40 m/s had more kE. An object traveling 5 m/s would have less kE because its velocity is slower.

Using the following simulation fill in the table and graph the results. (Mass vs Distance)

Mass (g)	Velocity (m/s)	Distance (m)
5	10	12.5
10	10	25
15	10	37.5
20	10	50
25	10	62.5
30	10	75

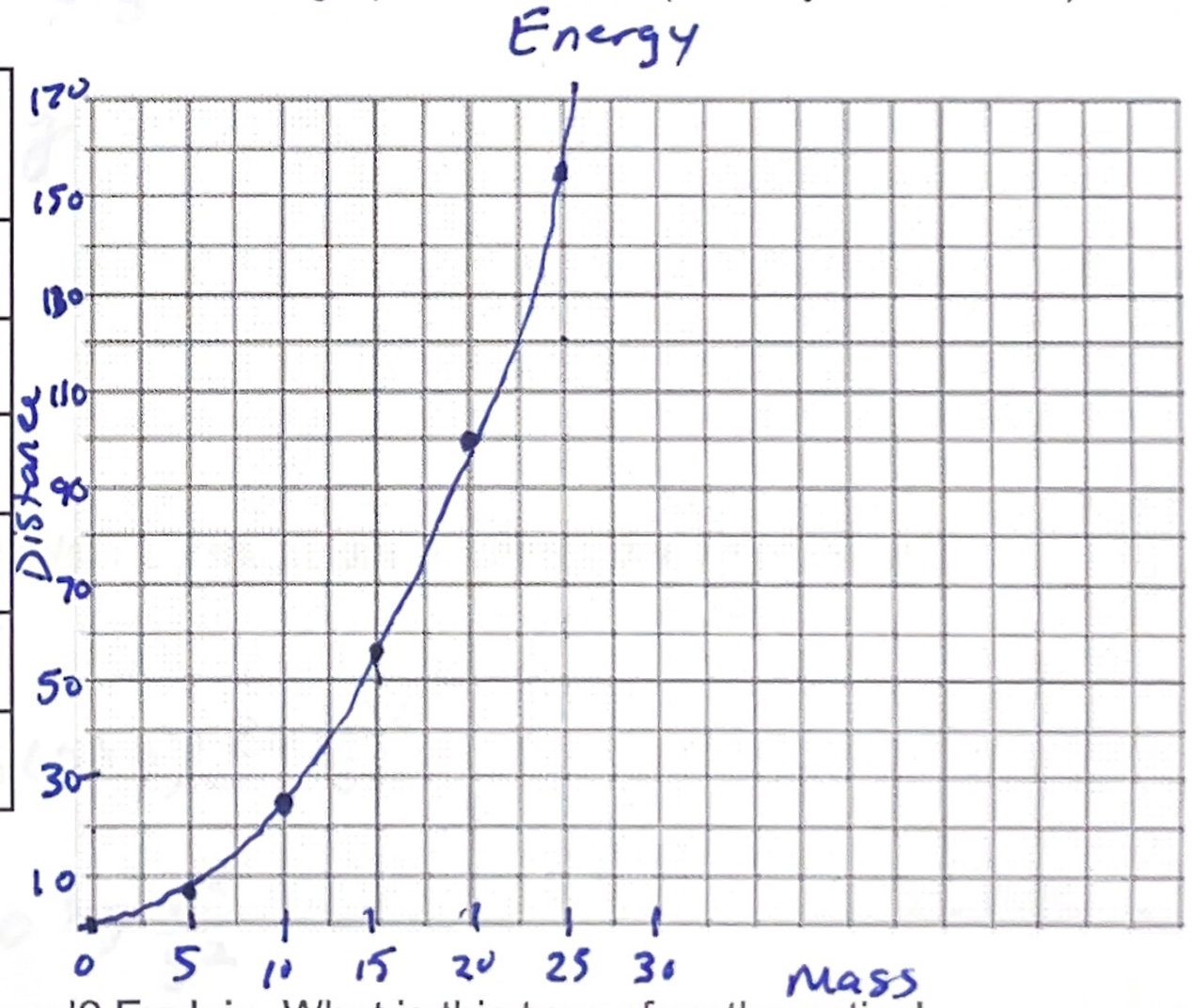


What happens as the mass is increased? Explain. What type of mathematical relationship is this?

as the mass increase the distance the car pushes on the object increases. because there is more energy produced. This is a linear relationship

Using the following simulation fill in the table and then graph the results. (Velocity vs Distance)

Mass (g)	Velocity (m/s)	Distance (m)
10	5	6.3
10	10	25
10	15	56.2
10	20	100.1
10	25	156.4
10	30	225.1



What happens as the velocity is increased? Explain. What is this type of mathematical relationship?

As the velocity increases the distance increases because the car pushing on the object has more energy.

this is an expotential relationship.

Kinetic and Potential Energy (Round answers to the hundredth place if needed)

1. A roller coaster car with a mass of 1200 kg sits at rest at the top of a hill 45 meters above the ground. Calculate its gravitational potential energy at this point. (Use g = 9.8 m/s²)

$PE = mgh$

$= (0.12\text{kg})(9.8\ m/s^2)(45\ m)$

$= 52.92\ kg\frac{m^2}{s^2}$

$PE = 52.92\ j$

2. A soccer ball with a mass of 0.43 kg is kicked with a velocity of 25 m/s. Calculate the kinetic energy of the ball immediately after it's kicked.

$KE = \frac{1}{2}mv^2$

$= \frac{1}{2}(0.43)kg)(25\frac{m}{s})^2$

$= 134.38\ kg\frac{m^2}{s^2}$

$KE = 134.38\ j$

3. A 1500 kg car is traveling at 20 m/s. How much kinetic energy does it possess?

$KE = \frac{1}{2}mv^2$

$= \frac{1}{2}(1500\ kg)(20\frac{m}{s})^2$

$= 300\,000\ kg\frac{m^2}{s^2}$

$KE = 300,000\ j$

4. A toy car with a mass of 0.3 kg rolls down a ramp from a height of 0.8 meters. Assuming no energy is lost to friction, what will be its kinetic energy at the bottom of the ramp? (Use g = 9.8 m/s²)

$KE = \frac{1}{2}mv^2$ $PE = mgh$ $PE = KE$

$PE = \frac{1}{2}(0.3\,kg)(9.8\,\frac{m}{s^2})(0.8m)$

$= 2.35\,k\,\frac{m^2}{s^2}$

$PE = KE$

$KE = 2.35\,j$

5. A golf ball with a mass of 0.0459 kg is hit with a velocity of 40 m/s. What is its kinetic energy at this moment?

$KE = \frac{1}{2}mv^2$

$= \frac{1}{2}(0.0459\,kg)(40\,\frac{m}{s})^2$

$= 36.72\,kg\,\frac{m^2}{s^2}$

$KE = 36.72\,j$

6. A baseball with a mass of 0.145 kg is thrown straight up with an initial velocity of 15 m/s. What is the maximum height the ball will reach? (Use g = 9.8 m/s²)

$KE = PE$

$KE = \frac{1}{2}mv^2$

$= \frac{1}{2}(0.145\,kg)(15\,\frac{m}{s})^2$

$KE = 16.31\,kg\,\frac{m^2}{s^2} = 16.31\,j$

$PE = 16.31 = mgh$

$16.31 = (0.145\,kg)(9.8\,\frac{m}{s^2})(h)$

$16.31 = 1.421(h)$

$11.48 = h$

$height = 11.48\,m$