

Energy

Reading

Directions: 1. Read the information on the left. 2. Use the red circles on the left to identify key words. 3. Answer the questions by putting answers and key details onto the right. 4. Write a one sentence synthesis statement that explains the big idea of the text.

What is kinetic energy?
Let's say you have a bowling ball and a golf ball. You drop them from the same height onto the sand. Which one will create a larger hole? If you said the bowling ball you are correct. It takes a lot of work to move the sand aside and create the hole. As the balls are dropped, they have the ability to do this work because of their motion. The work is transformed into energy of motion, or kinetic energy. Kinetic energy is the energy an object has because of its motion. Objects that have more mass or are moving faster have more kinetic energy.

How do we calculate kinetic energy?
How much kinetic energy an object has is dependent upon its mass and its velocity. To find the kinetic energy of an object, we multiply its mass by its velocity squared and then divide that number in half. The formula for finding kinetic energy is $KE = \frac{1}{2}mv^2$. The standard unit for kinetic energy is the joule (J). Let's look at our bowling ball (4 kg) and golf ball (0.25 kg) example again. Diagram 1. If they both have the speed of 10 m/s when dropped, then the bowling ball would have a kinetic energy of 200 J and the golf ball would have a kinetic energy of 12.5 J. This difference would allow the bowling ball to create a larger hole in the sand than the golf ball.

Figure 1: bowling ball vs a golf ball

4 kg = 10 m/s = 20 J
4 kg = 10 m/s = 20 J
4 kg = 10 m/s = 20 J

0.25 kg = 10 m/s = 1.25 J
0.25 kg = 10 m/s = 1.25 J
0.25 kg = 10 m/s = 1.25 J

TOPIC	GUIDING QUESTION
Kinetic energy	What is kinetic energy and how is it calculated?
QUESTION	KEY DETAILS
What is kinetic energy?	Add text
QUESTION	KEY DETAILS
How can we calculate kinetic energy?	Add text
SYNTHESIS SENTENCE: BIG IDEA OF THE TEXT IN ONE SENTENCE	
Add text	



comprehension passages
3 Guided Note templates
worksheets

Potential Energy

Energy? _____

the picture (elastic, chemical, gravitational)?

 elastic / chemical / gravitational	 elastic / chemical / gravitational	 elastic / chemical / gravitational
 elastic / chemical / gravitational	 elastic / chemical / gravitational	 elastic / chemical / gravitational

4. Circle the picture that shows the object with the greatest potential energy.

Kinetic Energy

Big Idea Question: What is kinetic energy and how is it calculated?

What is kinetic energy?

Let's say you have a bowling ball and a golf ball. You drop them from the same height onto the sand. Which one will create a larger hole? If you said the bowling ball you are correct. It takes a lot of work to move the sand aside and create the hole. As the balls are dropped they have the ability to do this work because of their motion. The work is transferred into energy of motion or kinetic energy. Kinetic energy is the energy an object has because of its motion. Objects that have more mass or objects that are moving faster have more kinetic energy.

How do we calculate kinetic energy?

How much kinetic energy an object has is dependent upon its mass and its velocity. To find the kinetic energy of an object we multiply its mass by its velocity squared and then divide that number in half. The formula for kinetic energy is $KE = \frac{1}{2}mv^2$ (m is mass, v is velocity). The standard unit for kinetic energy is the joule (J). Let's look at our bowling ball (4 kg) and golf ball (0.25 kg) again, figure 1. If they both have a speed of 25 m/s when dropped, the bowling ball would have a kinetic energy of 1,250 J and the golf ball would have a kinetic energy of 31.25 J. This difference would allow the bowling ball to create a larger hole in the sand than the golf ball.

Interesting Facts about kinetic energy

Here are some interesting facts about kinetic energy:

1. An object's kinetic energy is proportional to its mass and the square of its velocity.
2. Two objects with the same mass moving in opposite directions have the same kinetic energy.
3. When an object's speed doubles, its kinetic energy increases by a factor of four.
4. An object's kinetic energy is zero when it is at rest.
5. The kinetic energy of an object is always positive.

Figure 1: bowling ball vs a golf ball



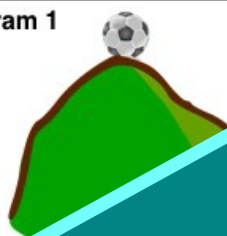
Potential Energy

Big Idea Question: Describe potential energy and the different types of potential energy.

What is potential energy?

You place one ball at the bottom of a hill and another at the top of the hill. Later an earthquake happens. The ball at the bottom of the hill rolls only a short distance, whereas the ball at the top of the hill rolls all the way down the hill. Why do the balls act so differently? The reason is that they both had potential energy to start with. Potential energy is the energy that an object has because of its position or motion. The higher the object is the more potential energy it has. This potential energy is converted into kinetic energy when it starts to move.

Diagram 1



The ball at the top of the hill has potential energy.

Short passages with Guided Notes

When your car moves a little bit, the energy that is transferred to your car is called the kinetic energy. The law of conservation of energy states that energy cannot be created or destroyed, only transferred from one form to another.

After the two cars collide the energy is transferred between the two cars causing them to move backward in the opposite direction.

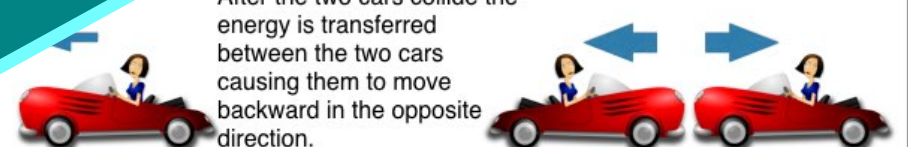


Diagram 2

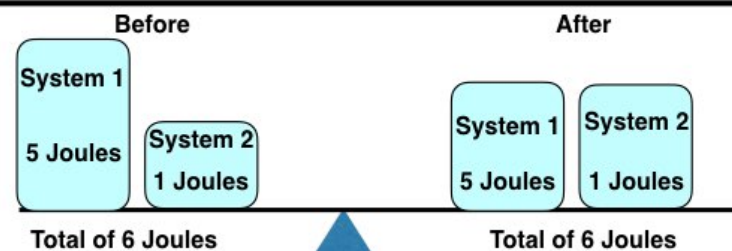
High elastic potential energy

Compressed spring

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In a closed system, or a system in isolation, the total amount of energy between two objects before they interact and after they interact is the same or equal to each other. To simplify this, we will make each car a system. The first car, system one has an energy of 5 Joules and the second car, system two has an energy of 1 Joules. Joule is the unit for energy. Combined the two systems have a total of 6 Joules of energy. When they interact some of the energy between the systems is transferred. System one after the interaction now has 3 Joules and system two after the interaction now has 3 Joules. Combined the two systems have a total of 6 Joules after the interaction. This transfer of energy can be transferred into heat energy, mechanical energy, electrical energy, light energy, or chemical energy. Look at diagram 2 for a visual understanding of this concept.

Diagram 2



In physics we see the conservation of energy as an object rolls down the hill. At the top of the hill the object has a lot of potential energy. As it rolls down the hill the amount of potential energy is transferred into kinetic energy. We also see the conservation of energy in chemical reactions. As the bonds between compounds are broken the energy used to hold the atoms together is transferred. Some of the energy is used to create new bonds and others are transferred into heat energy.

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Directions: Follow the directions on each slide to complete this guided reading activity notebook

ENERGY

1

Directions: 1. Read the information on the left. 2. Use the red circles on the left to identify key words. 3. Answer the questions by putting answers and key details onto the left. 4. Write a one sentence synthesis statement that explains the big idea of the text.

What is kinetic energy?
Let's say you have a bowling ball and a golf ball. You drop them from the same height onto the sand. Which one will create a larger hole? If you watch the bowling ball you are correct. It takes a lot of work to move the sand aside and create the hole. As the balls are dropped they have the ability to do this work because of their motion. The work is transformed into energy of motion or kinetic energy. Kinetic energy is the energy an object has because of its motion. Objects that have more mass or objects that are moving faster have more kinetic energy.

How do we calculate kinetic energy?
How much kinetic energy an object has is dependent upon its mass and its velocity. To find the kinetic energy of an object we multiply its mass by its velocity squared and then divide that number in half. The formula for finding kinetic energy is $KE = \frac{1}{2}mv^2$ (m is mass, v is velocity). The standard unit for kinetic energy is the joule (J), which is equal to one newton-meter (N·m). Let's look at our bowling ball (4 kg) and golf ball (0.025 kg) example again, figure 1. If they both have the speed of 10 m/s when dropped then the bowling ball would have a kinetic energy of 1,200 J and the golf ball would have a kinetic energy of 7.8 J. This difference would allow the bowling ball to create a larger hole in the sand than the golf ball.

Figure 1: bowling ball vs a golf ball

4 kg 10 m/s
0.025 kg 10 m/s

$KE = \frac{1}{2}mv^2$
 $KE = \frac{1}{2}(4)(10)^2$
 $KE = 200$
 $KE = \frac{1}{2}(0.025)(10)^2$
 $KE = 0.125$

TOPIC: Kinetic energy
GUIDING QUESTION: What is kinetic energy and how is it calculated?

QUESTION: What is kinetic energy?
KEY DETAILS: Add text

QUESTION: How can we calculate kinetic energy?
KEY DETAILS: Add text

SYNTHESIS SENTENCE: BIG IDEA OF THE TEXT IN ONE SENTENCE!
Add text

2

Directions: 1. Read the information on the left. 2. Use the red circles on the left to identify key words. 3. Answer the questions by putting answers and key details onto the left. 4. Write a one sentence synthesis statement that explains the big idea of the text.

Interesting Facts about kinetic energy
Here are some interesting facts about kinetic energy:
1. An object's kinetic energy does not change unless it speeds up or slows down.
2. Two objects with the same mass and speed will have the same kinetic energy no matter which direction they are moving.
3. When an object's speed doubles, its kinetic energy quadruples. This means that a car going 60 mph will cause four times more destruction in a crash than a car going 30 mph.
4. An object going uphill loses kinetic energy because the speed of the object becomes less.
5. The faster an object moves, the more kinetic energy it has.

TOPIC: Kinetic energy
GUIDING QUESTION: What is kinetic energy and how is it calculated?

QUESTION: What is kinetic energy?
KEY DETAILS: Add text

QUESTION: What are some interesting facts about kinetic energy?
KEY DETAILS: Add text

SYNTHESIS SENTENCE: BIG IDEA OF THE TEXT IN ONE SENTENCE!
Add text

3

Directions: 1. Answer the questions on the left. 2. Place the different colored circles on the correct amount of kinetic energy. 3. Solve the problems below.

What is the definition of kinetic energy?
Add text

How is kinetic energy calculated?
Add text

What is the kinetic energy of a bowling ball with a mass of 1.2 kg and is thrown at a velocity of 12 m/s?
Add text

What is the kinetic energy of a 1000 kg car that is traveling with a velocity of 15 m/s?
Add text

What is the kinetic energy of a 0.7 kg baseball that is hit with a velocity of 10 m/s?
Add text

Place the blue circle on the ball with the most kinetic energy and the red circle on the ball with the least kinetic energy.

4

Directions: 1. Read the information on the left. 2. Use the red circles on the left to identify key words. 3. Answer the questions by putting answers and key details onto the left. 4. Write a one sentence synthesis statement that explains the big idea of the text.

What is potential energy?
You place one ball at the bottom of a hill and another at the top of the hill. A few seconds later an earthquake happens. The ball at the bottom of the hill rolls only a few inches, whereas the ball at the top of the hill rolls all the way down the hill at a fast speed. Why did the balls act so differently? The reason is that they both had a different amount of potential energy to start with. Potential energy is the energy that is stored in an object when it is not in motion. The higher the object is the more potential energy it has. This potential energy gets converted into kinetic energy when it starts to move.

Diagram 1
The higher the soccer ball is, the more potential energy it has.
Before the earthquake
After the earthquake
The ball with the most potential energy moves the farthest.

TOPIC: Potential Energy
GUIDING QUESTION: Describe potential energy and the different types of potential energy.

QUESTION: What is potential energy?
KEY DETAILS: Add text

SYNTHESIS SENTENCE: BIG IDEA OF THE TEXT IN ONE SENTENCE!
Add text

5

Directions: 1. Read the information on the left. 2. Use the red circles on the left to identify key words. 3. Answer the questions by putting answers and key details onto the left. 4. Write a one sentence synthesis statement that explains the big idea of the text.

Types of potential energy
There are three different types of potential energy: elastic, gravitational, and chemical.
Elastic potential energy deals with anything that can stretch like springs and rubber bands. When you stretch a rubber band you are storing energy. The energy you use gets converted into potential energy. The more you stretch a rubber band the more potential energy it has. The same goes for springs when you stretch or compress them (Diagram 2).
Gravitational potential energy is what we are most familiar with. Everything is attracted to Earth. When you lift something it takes energy. This energy is converted into potential energy. So the higher the object, the more potential energy it has. This is why, as shown in diagram 1, the soccer ball at the top of the hill has more potential energy than the soccer ball at the bottom of the hill.
Chemical potential energy occurs between the attraction of atoms in a compound. Some atoms form strong chemical bonds and some form weak chemical bonds. The stronger the bond the less energy there is between the bonded atoms because the potential for them to break apart is less. This is why strong bonds have low potential energy and weak bonds have high potential energy.

Diagram 2
Low elastic potential energy
High elastic potential energy
Compressed spring
Stretched spring

TOPIC: Potential Energy
GUIDING QUESTION: Describe potential energy and the different types of potential energy.

QUESTION: What are the types of potential energy?
KEY DETAILS: Add text

QUESTION: How can you increase the potential energy in an object?
KEY DETAILS: Add text

SYNTHESIS SENTENCE: BIG IDEA OF THE TEXT IN ONE SENTENCE!
Add text

6

Directions: 1. Answer the questions on the left.

What is the definition of potential energy?
Add text

How is potential energy different from kinetic energy?
Add text

Use the labels on the right to identify if the picture is showing elastic, chemical, or gravitational.

Gravitational
Chemical
Elastic

Circle the picture that shows the object with the greatest potential energy.
Add text

Circle the picture that shows the object with the least potential energy.
Add text

7

Directions: 1. Read the information on the left. 2. Use the red circles on the left to identify key words. 3. Answer the questions by putting answers and key details onto the left. 4. Write a one sentence synthesis statement that explains the big idea of the text.

Have you ever been in a bumper car? As you hit a car head-on you can move a little backward. This is because some of the energy from the other car gets transferred to your car causing you to move in the opposite direction. This transfer of energy is called the conservation of energy. The conservation of energy states that energy cannot be created or destroyed it is just transferred from one thing to another.

Diagram 1
After the two cars collide the energy is transferred between the two cars causing them to move backward in the opposite direction.

In a closed system, or a system in isolation, the total amount of energy between two objects before they interact and after they interact is the same or equal to each other. To simplify this, we will make each car a system. The first car, system one, has an energy of 5 Joules and the second car, system two, has an energy of 1 Joule. Joule is the unit for energy. Combined the two systems have a total of 6 Joules of energy. When they interact some of the energy between the systems is transferred. System one after the interaction now has 3 Joules and system two after the interaction now has 3 Joules. Combined the two systems have a total of 6 Joules after the interaction. This transfer of energy can be transferred into heat energy, mechanical energy, electrical energy, light energy, or chemical energy. Look at diagram 2 for a visual understanding of this concept.

TOPIC: Conservation of energy
GUIDING QUESTION: What is the conservation of energy?

QUESTION: What is the conservation of energy?
KEY DETAILS: Add text

QUESTION: How is energy transferred from one object to another?
KEY DETAILS: Add text

SYNTHESIS SENTENCE: BIG IDEA OF THE TEXT IN ONE SENTENCE!
Add text

8

Directions: 1. Read the information on the left. 2. Use the red circles on the left to identify key words. 3. Answer the questions by putting answers and key details onto the left. 4. Write a one sentence synthesis statement that explains the big idea of the text.

Diagram 2
Before
After
System 1: 3 Joules
System 2: 1 Joule
Total of 4 Joules
System 1: 3 Joules
System 2: 1 Joule
Total of 4 Joules

In physics we see the conservation of energy as an object rolls down the hill. At the top of the hill the object has a lot of potential energy. As it rolls down the hill the amount of potential energy is transferred into kinetic energy. We also see the conservation of energy in chemical reactions. As the bonds between compounds are broken the energy used to hold the atoms together is transferred. Some of the energy is used to create new bonds and others are transferred into heat energy.

TOPIC: Conservation of energy
GUIDING QUESTION: What is the conservation of energy?

QUESTION: What is the conservation of energy?
KEY DETAILS: Add text

QUESTION: What are some examples of energy transfer?
KEY DETAILS: Add text

SYNTHESIS SENTENCE: BIG IDEA OF THE TEXT IN ONE SENTENCE!
Add text

9

Directions: 1. Answer the questions on the left. 2. Identify the amount of energy in system two after the collision.

What is the definition of conservation of energy?
Add text

How much energy does system 2 have after the two systems collide?

Before
System 1: 4 Joules
System 2: 3 Joules
After
System 1: 3 Joules
System 2: # Joules

How much energy does system 2 have after the two systems collide?

Before
System 1: 8 Joules
System 2: 2 Joules
After
System 1: 4 Joules
System 2: # Joules

A pendulum has 50 Joules of potential energy at the top of its swing. What is the amount of kinetic energy it has at the bottom?
Add text

A ball has 10 Joules of kinetic energy as it reaches the bottom of the hill. Approximately how much potential energy did the ball have at the top of the hill?
Add text

A 0.5 kg ball falls from a building that is 50 meters high. How much kinetic energy will it have when it has fallen halfway to the ground?
Add text

10

Directions: 1. Answer the questions

TASK 1
What is the similarity between chemical, gravitational, and elastic potential energy?
Add text

TASK 2
You are riding a bike at the top of a hill. Your potential energy is 1,182 J. Your mass is 60 kg. What will your speed be at the bottom of the hill?
Add text

Directions: 1. Answer the questions

TASK 3
How does the height of an object affect its potential energy?
Add text

TASK 4
A roller coaster that is moving 20 m/s down the top of a 60 m hill weighs 900 kg. What type of energy does the moving coaster have how much of this energy does it have?
Add text

Digital or Print

Name: _____ Class: _____

Topic: Conservation of energy Date: _____

Big Idea Question: What is the conservation of energy?

Questions	Notes
What is the conservation of energy?	
How is energy transferred from one object to another?	
What are some examples of energy transfer?	

Note-taking templates

Summary:

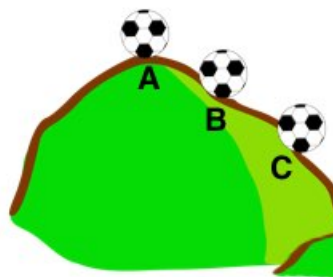
Kinetic Energy

Define and describe:

1. What is the definition of kinetic energy: _____

2. How is kinetic energy calculated? _____

Identify: This diagram show a ball rolling down a hill



3. Which letter shows the ball with the most potential energy?
4. Which letter shows the ball with the most kinetic energy?

Calculate:

5. What is the kinetic energy of a ball with a mass of 12 m/s?

6. What is the kinetic energy of a ball with a mass of 12 m/s?

7. What is the kinetic energy of a ball with a mass of 12 m/s?

Potential Energy

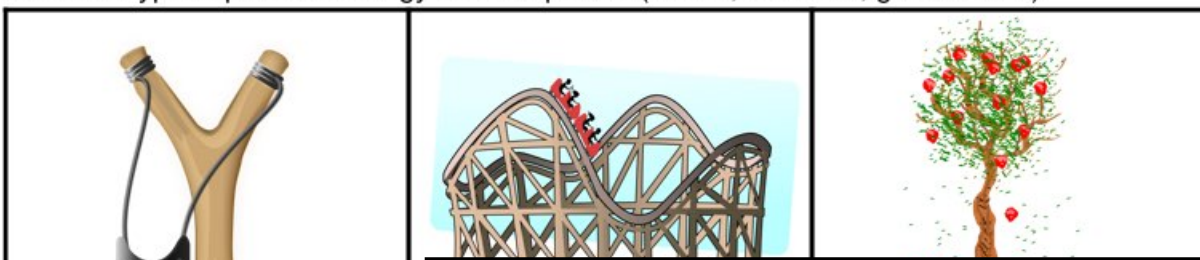
Define and describe:

1. What is the definition of potential energy: _____

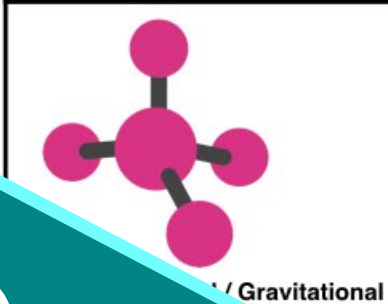
2. How is potential energy different from kinetic energy? _____

Identify:

3. Which type of potential energy is in the picture (elastic, chemical, gravitational)



Elastic / Chemical / Gravitational



Gravitational

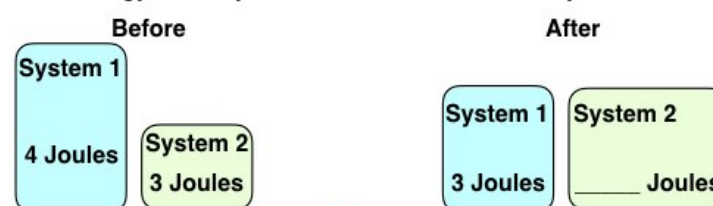
Conservation of Energy

Define and describe:

1. What is the definition of conservation of energy? _____

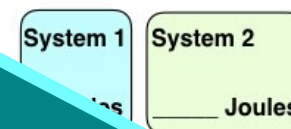
Identify:

2. How much energy does system 2 have after the two systems collide?



How much energy does system 2 have after the two systems collide?

After



What is the amount of

Approximately

How much kinetic energy will it

Comprehension
Worksheets
with answer key

TASK 1

What is the similarity
chemical, gravitational
elastic potential energy

TASK 2

You are riding a bike at the
top of a hill. What type of potential
energy do you have? Your
speed at the bottom of the hill
will be the same as the
speed at the top of the hill.

Extension Task Cards

How does the mass of
an object affect its
potential energy?

TASK 4

A roller Coaster that is
moving 20 m/s down the top
of a 60 m hill weighs 950 kg.
What type of energy does
the moving coaster have
how much of this energy
does it have?



Teaching STEM Through Inquiry

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