Option Probability Curves for items on the ASPECt-MC Instruments

EG8-4

When does a ball have kinetic energy (motion energy)?

- A. A ball has kinetic energy only when it is moving.
- B. A ball has kinetic energy only when it is moving upwards.
- C. A ball has kinetic energy only when a person causes it to move.
- D. A ball has kinetic energy all of the time, even when it is not moving.



EG27-4

A student has two blocks made of the same type of wood. The wooden blocks are both at the same temperature, but Block 1 weighs more than the Block 2.



Which block has more thermal energy and why?

- A. Block 1 has more thermal energy because it weighs more.
- B. Block 2 has more thermal energy because it weighs less.
- C. Both blocks have the same amount of thermal energy because they are at the same temperature.
- D. Neither block has any thermal energy because they are not living things.



EG31-4

A student has two identical ice cubes except that the temperature of Ice Cube 1 is 30°F and the temperature of Ice Cube 2 is 0°F.



Which ice cube has more thermal energy and why?

- A. Ice Cube 1 has more thermal energy because it is at a higher temperature than Ice Cube 2.
- B. Ice Cube 1 has more thermal energy because things at 0°F do not have any thermal energy.
- C. Ice Cube 1 and Ice Cube 2 have the same amount of thermal energy because anything made of ice has the same amount of thermal energy no matter what its temperature is.
- D. Ice Cube 1 and Ice Cube 2 do not have any thermal energy because frozen things do not have thermal energy.



EG36-5

The elastic potential energy of an object that is being stretched depends on which of the following?

- A. Both how much the object is stretched and how difficult it is to stretch it
- B. How much the object is stretched but not how difficult it is to stretch it
- C. How difficult it is to stretch the object but not how much the object is stretched
- D. Neither how much the object is stretched nor how difficult it is to stretch it



EG43-5

A student has two identical springs, Spring 1 and Spring 2. She compresses Spring 1 a little bit, and she compresses Spring 2 as much as she can.



While the springs are compressed, which spring has more elastic potential energy and why?

- A. Spring 1 has more elastic potential energy because the student can still compress it more.
- B. Spring 2 has more elastic potential energy because it is compressed more than Spring 1.
- C. Both springs have the same amount of elastic potential energy because they are identical springs.
- D. Neither spring has any elastic potential energy because springs only have elastic energy when they are stretched and not when they are compressed.



EG45-2

Do all things have thermal energy? Why or why not?

- A. Yes, because thermal energy is the result of atoms rubbing together, and all things are made up of atoms that are rubbing together
- B. Yes, because thermal energy is the result of atoms moving, and all things are made up of atoms that are moving
- C. No, because only things that are warm or hot have thermal energy, and not all things are warm or hot
- D. No, because only things that are living have thermal energy, and not all things are living



EG51-4

A student has two glasses of water. Glass 1 and Glass 2 have the same number of water molecules in them.



If the average speed of the water molecules in Glass 1 is less than the average speed of the water molecules in Glass 2, which glass of water has less thermal energy?

- A. The water in Glass 1 has less thermal energy.
- B. The water in Glass 2 has less thermal energy.
- C. The water in Glass 1 and the water in Glass 2 have the same amount of thermal energy.
- D. The only way to tell which glass of water has less thermal energy is to also know the temperature of the water.



EG60-1

The thermal energy of an object depends on which of the following?

- A. Only the temperature of the object
- B. Only the temperature and the mass of the object
- C. Only the temperature of the object and the material it is made of
- D. The temperature of the object, the mass of the object, and the material it is made of



EG67-2

A space shuttle is launched and is traveling up into the sky.



How does the gravitational potential energy of the space shuttle change as it gets higher in the sky?

- A. The gravitational potential energy of the space shuttle increases as it gets higher.
- B. The gravitational potential energy of the space shuttle decreases as it gets higher.
- C. The gravitational potential energy of the space shuttle does not change as it gets higher.
- D. The gravitational potential energy of the space shuttle depends on how fast the rocket is moving.



NG11-4

A student shoves a box, and it slides across the floor. As the box slides across the floor, the box slows down, and both the box and the floor get a little warmer. What happens to the kinetic energy (motion energy) and the thermal energy of the box as it slows down and comes to a stop and why?

- A. The kinetic energy of the box decreases to zero, and its thermal energy increases because the kinetic energy is converted into thermal energy.
- B. The kinetic energy of the box decreases to zero, and its thermal energy stays the same because kinetic energy is used up and is not converted into thermal energy.
- C. The kinetic energy of the box stays the same, and its thermal energy increases because new energy in the form of thermal energy is made.
- D. Both the kinetic energy and the thermal energy of the box decrease to zero because an object has energy only when it is moving.



NG12-3

A rubber ball speeds up as it travels from Position 1 toward the floor. The ball is compressed as it hits the floor (Position 2) and then returns to its original shape as it bounces back up into the air (Position 3).



What happens to the elastic potential energy of the ball as it moves from Position 2 to Position 3?

- A. New energy is made in the form of elastic potential energy.
- B. The elastic potential energy of the ball is converted into kinetic energy (motion energy) and gravitational potential energy.
- C. The elastic potential energy of the ball is used up. It is not converted into any other form of energy.
- D. The elastic potential energy of a rubber ball cannot change, and, therefore, nothing happens to the elastic potential energy of the ball when it moves from Position 2 to Position 3.



NG24-3

The temperature of a plastic block is 60°F, and the temperature of a metal block is 40°F. A student puts the plastic block on top of the metal block. Will the blocks ever reach the same temperature? Why or why not?

- A. Yes, but only for a little while because the metal block will continue to get warmer and the plastic block will continue to cool
- B. Yes, because energy will be transferred from the plastic block to the metal block until they reach the same temperature
- C. No, because the temperature difference is not large enough for energy to be transferred
- D. No, because the blocks are made of different materials



NG25-4

A student is holding a cold piece of metal in her hand. While she is holding the piece of metal, her hand gets colder. Does the piece of metal get warmer? Why or why not?

- A. Yes, the piece of metal will get warmer because some energy is transferred from the metal to the student's hand.
- B. Yes, the piece of metal will get warmer because some energy is transferred from the student's hand to the metal.
- C. No, the piece of metal will stay at the same temperature because an equal amount of energy is exchanged between the student's hand and the metal.
- D. No, the piece of metal will stay at the same temperature because energy is not transferred between the student's hand and the metal.



NG28-3

A student places a warm can of soda into an ice-filled cooler. The temperature of the can of soda is 72° F, and the temperature of the ice is -5° F.



He closes the cooler. Before any of the ice starts to melt, which of the following describes the energy transfer between the ice and the can of soda in the cooler?

- A. Energy is transferred from the can of soda to the ice so the can of soda gets cooler and the ice stays the same temperature.
- B. Energy is transferred from the can of soda to the ice so the can of soda gets cooler and the ice gets warmer.
- C. Energy is transferred from the ice to the can of soda so the can of soda gets cooler and the ice stays the same temperature.
- D. Energy is transferred from the ice to the can of soda so the can of soda gets cooler and the ice gets warmer.



NG39-3

A radiator is a device used to heat up a room. When a student stands close to the radiator, he feels warm even though he is not touching the radiator.



What will happen if the student holds a blanket up so that the blanket is between himself and the radiator but not touching him?

- A. He will feel warmer because blankets keep people warm.
- B. He will feel cooler because the blanket is blocking the energy being given off by the radiator.
- C. He will feel the same because holding the blanket up will not change the temperature of the air in the room.
- D. He will feel the same because he will still receive the same amount of energy from the radiator even if the blanket is between himself and the radiator.



NG53-3

A student places a battery into a flashlight. When the student switches the flashlight on, a complete circuit is made, and the light bulb lights up. When the student switches the flashlight off, the circuit is no longer complete, and the light bulb goes out. Is energy being transferred electrically from the battery to the light bulb in the flashlight? Why or why not?

- A. No, because energy cannot be transferred electrically from one place to another
- B. No, because even though energy can be transferred electrically, it cannot be transferred from a battery
- C. Yes, but only when the flashlight is switched on because energy can be transferred electrically only when there is a complete circuit
- D. Yes, as long as the battery is in the flashlight because electrical sources, such as batteries, transfer energy to electrical devices, such as flashlights, all the time



NG55-3

Consider the following situations:

Situation 1: A battery is connected to a light bulb in a complete circuit, and the light bulb lights up.

Situation 2: Wind causes a windmill to rotate.

- A. Energy is transferred in both situations.
- B. Energy is NOT transferred in either situation.
- C. Energy is transferred in Situation 1, but energy is NOT transferred in Situation 2.
- D. Energy is transferred in Situation 2, but energy is NOT transferred in Situation 1.



NG57-3

Consider the following situations:

Situation 1: A person touches a cold piece of metal.

Situation 2: A lamp shines light on a table.

- A. Energy is transferred in both situations.
- B. Energy is NOT transferred in either situation.
- C. Energy is transferred in Situation 1, but energy is NOT transferred in Situation 2.
- D. Energy is transferred in Situation 2, but energy is NOT transferred in Situation 1.



NG58-3

Consider the following situations:

Situation 1: A person comes in contact with cold air.

Situation 2: An electric generator is used to run a motor.

- A. Energy is transferred in both situations.
- B. Energy is NOT transferred in either situation.
- C. Energy is transferred in Situation 1, but energy is NOT transferred in Situation 2.
- D. Energy is transferred in Situation 2, but energy is NOT transferred in Situation 1.



NG59-3

Consider the following situations:

Situation 1: A battery is used to power a cell phone.

Situation 2: The sun shines on a plant.

- A. Energy is transferred in both situations.
- B. Energy is NOT transferred in either situation.
- C. Energy is transferred in Situation 1, but energy is NOT transferred in Situation 2.
- D. Energy is transferred in Situation 2, but energy is NOT transferred in Situation 1.



NG67-3

A ball, starting from rest at Position 1, rolls back and forth along a curved track and eventually stops rolling. As the ball rolls along the curved track, the track and the ball get a little warmer.



How does the total energy of the ball and track system change as the ball rolls along the track? (Assume that no energy is transferred to or from the surroundings.)

- A. The total energy of the ball and track system increases because new energy in the form of thermal energy is made as the ball rolls along the track.
- B. The total energy of the ball and track system decreases because the ball loses all of its energy and eventually stops rolling, and the energy of the track stays the same.
- C. The total energy of the ball and track system increases as the speed of the ball increases, and it decreases as the speed of the ball decreases, and the energy of the track stays the same.
- D. The total energy of the ball and track system does not change because even though energy is transferred between the ball and track, no energy was added to or released from the ball and track system.



NG69-5

Imagine two slides that are shaped differently but start and end at the same height above the ground as shown below. Two students slide down from the top of the two different slides starting from rest. The students weigh the same.



Which student has the greater speed at the bottom of the slide and why? (Assume no energy is transferred between the students and the slides or between the students and the air around them.)

- A. The student on Slide 1 because that student traveled a longer distance, so there was more time for new energy in the form of kinetic energy (motion energy) to be made
- B. The student on Slide 2 because that student initially encountered a steeper slope, so more new energy in the form of kinetic energy (motion energy) was made
- C. The student on Slide 2 because that student traveled a shorter distance and did not lose as much kinetic energy (motion energy) or gravitational potential energy as the student on Slide 1
- D. The students have the same speed because the only source of kinetic energy (motion energy) is the change in gravitational potential energy, and both students experienced the same change in gravitational potential energy.



NG78-3

A student uses a rubber band to shoot a toy car across a level floor. Imagine that no energy is transferred between the car and the floor or between the car and the air.



What happens to the total amount of energy in the system (car and rubber band) as the rubber band is released, and the car moves across the floor?

- A. The total amount of energy in the system increases because the kinetic energy (motion energy) of the car increases, and the elastic potential energy of the rubber band stays the same.
- B. The total amount of energy in the system increases because the increase in the kinetic energy (motion energy) of the car is more than the decrease in the elastic potential energy of the rubber band.
- C. The total amount of energy in the system decreases because the increase in the kinetic energy (motion energy) of the car is less than the decrease in the elastic potential energy of the rubber band.
- D. The total amount of energy in the system remains the same because the increase in the kinetic energy (motion energy) of the car is the same as the decrease in the elastic potential energy of the rubber band.



NG84-2

Imagine a ball on a track where no energy is transferred between the ball and the track or between the ball and the air around it. The ball starts from rest at the position labeled Start and moves along the track toward Positions 1, 2, 3, and 4.



What is the highest position the ball will reach before stopping and going back down the track? (Remember that no energy is transferred between the ball and the track or between the ball and the air around it.)

- A. Position 1
- B. Position 2
- C. Position 3
- D. Position 4



NG102-3

A girl is sitting by a campfire. She feels warm even though she is not touching the fire.



What will happen if the girl holds a blanket up so that the blanket is between herself and the fire but not touching her?

- A. She will feel warmer because blankets keep people warm.
- B. She will feel cooler because the blanket is blocking the energy radiated by the fire.
- C. She will feel the same because holding the blanket up will not change the temperature of the air outside.
- D. She will feel the same because she will still receive the same amount of energy from the fire even though the blanket is between herself and the fire.



NG104-2

Imagine a ball on a track where no energy is transferred between the ball and the track or between the ball and the air around the ball. The ball goes past Position 1, then down and up a dip on the track, and past Position 2. Position 1 and Position 2 are at the same height.



Will the ball be going faster, slower, or at the same speed at Position 2 compared to Position 1? Why? (Remember that no energy is transferred between the ball and the track or between the ball and the air around it.)

- A. Faster, because new energy in the form of kinetic energy (kinetic energy) will be made when the ball goes down the long side of the dip
- B. Slower, because kinetic energy (motion energy) will be used up when the ball goes up the steep side of the dip
- C. The same speed, because the amount of kinetic energy (motion energy) that the ball has will remain the same the entire time it was moving along the track
- D. The same speed, because the total amount of energy in the system (ball and track) does not change as the ball moves along the track



RG4-2

A person wants to find out where to put his hands so that a candle will warm them as quickly as possible. He thinks that the best place to put his hands is where the most energy is transferred from the candle to his hands.



Will there be more energy transferred from the flame to his hand when it is above the flame compared to when it is next to the flame? Why or why not?

- A. No, the same amount of energy will be transferred to his hand whether it is above the flame or next to the flame because the flame radiates energy equally in all directions.
- B. Yes, more energy will be transferred to his hand when it is above the flame because in addition to the energy that is radiated by the flame, energy is also transferred by the movement of the warm air upward to his hand when it is above the flame.
- C. No, more energy will be transferred to his hand when it is next to the flame because the same amount of energy will be transferred by the movement of warm air to his hand in both positions, but more energy will be radiated by the flame in the sideways direction than in the upward direction.
- D. Yes, more energy will be transferred to his hand when it is above the flame because no energy is radiated by the flame. Energy from a flame is only transferred in an upward direction by the movement of warm air.



RG5-3

A person pours a hot drink into a cup and then places a room temperature spoon in the cup. After a while, the person notices that the handle of the spoon has gotten hotter. What caused the handle to get hotter?

- A. Heat molecules from the hot drink are absorbed by the spoon. These heat molecules travel to the handle of the spoon, making the handle hotter.
- B. The molecules that make up the hot drink are rubbing against each other harder than the molecules that make up the spoon. The rubbing creates new energy that flows through the spoon to the handle, making the handle hotter.
- C. The hot drink causes the molecules of the spoon to speed up. These faster moving molecules then move to the handle of the spoon, causing the handle to get hotter.
- D. The hot drink causes the molecules of the spoon to speed up. When these faster moving molecules collide with slower moving molecules, energy is transferred to the slower moving molecules. These collisions continue to occur throughout the spoon until they reach the handle, making the handle hotter.



RG8-3

A student fills a cup with room temperature water. Then she places the cup over a flame to heat the water.



What will happen to the thermal energy of the water in the cup?

- A. The thermal energy of the water at the bottom of the cup will increase as the cup of water is heated. The heated water will rise to the top of the cup, and the cooler water at the top of the cup will sink to the bottom where its thermal energy will be increased by the flame.
- B. The thermal energy of the water at the bottom of the cup will gradually spread from the bottom to the top of the cup until all the water has the same thermal energy. Warmer water at the bottom of the cup will not rise to the top, and cooler water at the top of the cup will not sink to the bottom.
- C. Heat molecules will form at the bottom of the cup and spread throughout the water as the water is heated. The thermal energy of the water will increase as the number of heat molecules increases.
- D. While the water is over the flame, the thermal energy of all parts of the water will increase at the same time.



RG9-3

A student fills a cup with room temperature water. Then she places the cup over a flame to heat the water.



Which of the following statements correctly describes what happens as the water is being heated?

- A. As the water at the bottom of the cup is heated, its thermal energy increases. Thermal energy then rises to the top of the cup separate from the water molecules. This heats the water at the top of the cup.
- B. As the water at the bottom of the cup is heated, heat molecules are produced. Heat molecules then travel from the bottom of the cup to the top of the cup and carry thermal energy with them as they rise. This heats the water at the top of the cup.
- C. As the water at the bottom of the cup is heated, it becomes less dense than the cooler water above it. The difference in densities causes the warmer water to rise. As the warmer water rises, it carries with it its thermal energy. This heats the water at the top of the cup.
- D. While the water is over the flame, the temperature of all of the water increases at a constant rate, which increases the thermal energy of all of the water at the same time.



RG12-2

A boy is drawing a picture with a crayon. He colors in a big part of the drawing by rubbing the end of the crayon back and forth on the paper.



Will the end of the crayon get warmer or cooler after the boy rubs it on the paper?

- A. The end of the crayon will get a little warmer.
- B. The end of the crayon will get a little cooler.
- C. The end of the crayon will not get warmer or cooler.
- D. Whether it gets warmer or cooler depends on what color the crayon is.



RG13-3

A woman picks up a laptop computer and notices that the bottom of it feels cool. She turns on the laptop and works on it for an hour. Then she turns it off and picks it up again.



Will the bottom of the laptop be warmer or cooler after being on for an hour?

- A. The bottom of the laptop will be a little cooler after being on for an hour.
- B. The bottom of the laptop will be the same after being on for an hour.
- C. The bottom of the laptop will be a little warmer after being on for an hour.
- D. Whether the bottom of the laptop will be warmer or cooler depends on how much she used it during that hour.



RG14-4

A person watches a candle burn. As the candle burns, the person sees the light of the flame. The person also notices that the air around the flame is warmer. Is energy given off or is energy taken in by the candle while it burns?

- A. Energy is taken in because the flame removes coldness from the air.
- B. Energy is given off because the flame gives off light and heats the air.
- C. Energy is not given off and not taken in because candles are not living things, and only living things give off or take in energy.
- D. Energy is not given off and not taken in because the candle is not moving, and only things that are moving give off or take in energy.



RG17-3

A man stops at a gas station on a sunny day and fills his car up with gasoline. Then he drives the car home.



How does the car get the energy it needs to move?

- A. The car gets the energy it needs to move by burning the gasoline.
- B. The car gets the energy it needs to move by absorbing light from the sun.
- C. The car gets the energy it needs to move from the man, not from burning gasoline or absorbing light from the sun.
- D. As the car moves, the car's motion makes the energy needed to keep the car moving.



RG19-4

The air in the room pictured is cool. A fire is warming the air near the fireplace. There is a fan next to the fireplace.



If a person turns on the fan to blow the warmer air across the room, will the air at the other end of the room get any warmer? Why or why not?

- A. No, because fans are only used to cool a room, they cannot be used to warm a room.
- B. No, because all of the air in a room is the same temperature, a blowing fan will not change the air temperature.
- C. Yes, because a fan can blow warmer air across a room, which makes the other end of the room warmer.
- D. It depends on the temperature of the air being blown by the fan. The air at the other end of a room will get warmer only if the air near the fire is a lot warmer than the air at the other end of the room.



RG23-3

A house has solar panels on its roof. The solar panels absorb light from the sun and use it to produce electricity for the house. They are designed to absorb the maximum amount of energy throughout the year for that location.



The brightness of the sunlight and the amount of time the sunlight shines on the panels change from day to day. Will these changes affect how much energy is transferred from the sun to the solar panels?

- A. Yes, changes in both the brightness of the sunlight and the amount of time the sunlight shines on the panels will change the amount of energy transferred.
- B. Yes, changes in the brightness of the sunlight will change the amount of energy transferred, but changes in the amount of time the sunlight shines on the panels will not.
- C. Yes, changes in the amount of time the sunlight shines on the panels will change the amount of energy transferred, but changes in the brightness of the sunlight will not.
- D. No, changes in the amount of time the sunlight shines on the panels and changes in the brightness of the sunlight will not change the amount of energy transferred.


RG24-3

A musician is playing a guitar. The musician plucks one of the guitar strings, and it begins to vibrate back and forth. The vibration produces a sound.



Which of the following describes the transfer of energy from the guitar to the musician's ear while the sound is being produced?

- A. Energy is transferred from the guitar to the ear only if the sound is loud because only loud sounds can cause the air in the room to vibrate, and it is these vibrations that transfer energy.
- B. Any sound can cause the air in the room to vibrate, and these vibrations transfer energy from the guitar to the ear.
- C. The energy from the sound travels from the guitar to the ear independent of the air in the room. The air does not play a role in the transfer of energy.
- D. Energy is not transferred from the guitar to the ear because sound has nothing to do with energy.



RG29-4

A boy puts batteries in a remote control so that he can play with a remote controlled car. He plays with the car for an hour. As the car moves around, the wheels of the car rub against the floor. After he is finished playing, he picks up the car.



Will the wheels and the remote control be warmer after the boy plays with them for an hour? Why or why not?

- A. The remote control will be a little warmer because things that use batteries get warmer when you use them. The temperature of the wheels will not change.
- B. The wheels will be a little warmer because things that move get warmer as parts of them rub against each other. The temperature of the remote control will not change.
- C. The remote control will be a little warmer because it uses a battery, and the wheels will be a little warmer because they rubbed against the floor.
- D. Neither the remote control nor the wheels will be warmer because things do not get warmer just by using batteries or by rubbing together.



RG31-3

A chemical reaction called photosynthesis occurs in a tree as the sun shines on its leaves. During this reaction, water and carbon dioxide (the reactants) react to form sugars and oxygen (the products).



How does the chemical energy of the reactants (water and carbon dioxide) compare to the chemical energy of the products (sugars and oxygen)?

- A. The reactants have *more* chemical energy than the products because energy is always given off during chemical reactions.
- B. The reactants have *less* chemical energy than the products because energy is created when sugars are made during photosynthesis.
- C. The reactants have *less* chemical energy than the products because energy from the sun is converted to chemical energy during photosynthesis.
- D. The reactants have the *same* amount of chemical energy as the products because the amount of energy given off during photosynthesis is balanced by the amount of energy from the sun that is converted to chemical energy.



RG34-4

During chemical reactions, atoms that make up the molecules of the starting substances are separated from each other. Is energy required to separate the atoms, or is energy released when the atoms are separated?

- A. Energy is always required to separate atoms of the reactant molecules.
- B. Energy is always released when atoms of the reactant molecules are separated.
- C. Whether energy is released or required depends on the temperature of the system.
- D. Whether energy is released or required depends on the types of atoms that are separated.



RG40-3

A repairman uses a tuning fork, like the one shown below, to tune a piano. He hits the tuning fork against the edge of a table. The tuning fork begins to vibrate. The vibrating tuning fork makes a specific sound, and the repairman adjusts the piano until it makes the same sound when played. After a while, the tuning fork stops vibrating, and the sound stops.



What happens to the energy of the tuning fork as the vibrations of the tuning fork slow down and eventually stop?

- A. Some of the energy is destroyed by the sound.
- B. Some of the energy is transferred to the surrounding air.
- C. Nothing happens to the energy because sound is not related to energy.
- D. The energy runs out because the force that was given to the tuning fork runs out.



RG42-3

Which of the following statements about the gravitational potential energy of a system of two objects is true?

- A. The gravitational potential energy of a system of two objects can be increased by pulling them farther apart.
- B. The gravitational potential energy of a system of two objects can be increased by bringing them closer together.
- C. The gravitational potential energy of a system of two objects can only be changed if one of the objects in the system is the earth.
- D. The gravitational potential energy of a system of two objects can only be changed if the mass of the one of the objects changes.



RG46-3

A rocket is launched from earth and travels through outer space.

What information must be used to determine the amount of gravitational potential energy in the system containing the rocket and the earth at a particular point in time?

- A. The mass of the rocket and the mass of the earth
- B. The distance between the rocket and the earth
- C. The distance between the rocket and the earth and the mass of the rocket
- D. The distance between the rocket and the earth, the mass of the rocket, and the mass of the earth



RG49-3

A person has two rocks that are exactly the same. She puts the rocks on top of two different posts as shown in the picture below. Then she pushes the rocks off the posts and they fall to the ground.



Which rock is more likely to break when it hits the ground and why?

- A. The rock that is on the higher post is more likely to break because it is farther from the ground.
- B. The rock that is on the lower post is more likely to break because it is closer to the ground.
- C. Both rocks are equally likely to break because they are the same shape.
- D. Both rocks are equally likely to break because they weigh the same.



RG52-3

A girl and a boy find two rubber bands that are exactly the same. They each stretch a rubber band between their fingers. The girl stretches her rubber band as far as she can without breaking it. The boy stretches his rubber band a little less than the girl.



After the rubber bands are stretched, which one has more energy and why?

- A. The girl's rubber band has more energy because it is stretched more than the boy's rubber band.
- B. The boy's rubber band has more energy because it can still be stretched farther, but the girl's rubber band is stretched as far as it can go.
- C. Both rubber bands have the same amount of energy because the amount of energy a rubber band has is not related to how much it is stretched.
- D. Neither one of the rubber bands has any energy because the rubber bands are not moving.



RG53-3

A child has a spring. She wants to see how high she can make the spring jump into the air. First she pushes the spring down just a little bit and lets it go. Then she pushes the spring down as far as she can and lets it go. For each try, she watches the spring jump and measures how high the spring went.



Did the spring jump higher on the first or second try? Why?

- A. The spring jumped higher on the first try because it was only pushed down a little bit.
- B. The spring jumped higher on the second try because it was pushed down more than on the first try.
- C. The spring jumped the same height on both tries because it is the same spring.
- D. More information is needed because how high a spring jumps does not depend on how much it is pushed down.



RG56-3

An adult wants to heat up some water to make hot tea. He fills two tea kettles that are exactly the same with water and places them on the stove. While the kettles are on the stove, the temperature of the kettles and the water increases. When the kettles are very hot, the adult measures the temperature of each kettle. He finds that one kettle is hotter than the other.



Which tea kettle has more energy?

- A. The hotter kettle has more energy because it has a higher temperature.
- B. The cooler kettle has more energy because it hasn't used up as much energy as the hotter kettle.
- C. The kettles have the same amount of energy because they are both very hot.
- D. The kettles have the same amount of energy because how much energy something has is not related to how hot it is.



RG59-3

A student flattens out an area of sand at the playground and then he drops a ball into the sand. He notices that the ball makes a dent in the sand. Next, he wants to see if throwing the ball from the same height into a new spot in the sand will make a deeper dent. When will the ball make the deeper dent and why?

- A. The ball will make a deeper dent when it is dropped because it takes longer to fall.
- B. The ball will make a deeper dent when it is thrown because it is moving faster.
- C. The dent will be the same if the ball is dropped or thrown because it is the same ball each time.
- D. The dent will be the same if the ball is dropped or thrown because it is traveling the same distance each time.



RG62-3

Two girls are playing with two paper airplanes that are exactly the same. The girls stand the same distance from a wall and throw the airplanes toward the wall at different speeds. The first girl throws her airplane faster than the second girl. As the airplanes are flying, which one has more energy and why?

- A. The faster airplane has more energy because if two things are exactly the same, the faster one will always have more energy.
- B. The slower airplane has more energy because it takes longer to hit the wall, and the amount of energy a thing has increases as it is moving.
- C. The airplanes have the same amount of energy because they are exactly the same type of airplane.



D. The airplanes have the same amount of energy because they are flying the same distance.

RG63-3

A person shines a light directly on to a fish bowl so that he can see the fish better. The fish bowl and the water start out at the same temperature as the air in the room.



What will happen to the temperature of the water in the fish bowl as the light shines on it?

- A. The water in the fish bowl will get a little warmer although it may be hard to notice.
- B. The water in the fish bowl will get a little cooler although it may be hard to notice.
- C. The water in the fish bowl will stay the same. It will not get warmer or cooler.
- D. Whether the water gets a little warmer, a little cooler, or stays the same depends on how cold the water is before the lamp is turned on.



RG68-3

In outer space, there is no air, only empty space between the stars and planets. Can energy be transferred by light and sound in outer space? Why?

- A. Energy can be transferred by light and by sound in outer space because light and sound can both travel without air carrying them.
- B. Energy can be transferred by light in outer space because light can travel without air carrying it, but energy cannot be transferred by sound because sound requires a medium such as air to carry it.
- C. Energy can be transferred by sound in outer space because sound can travel without air carrying it, but energy cannot be transferred by light because light requires a medium such as air to carry it.
- D. Energy cannot be transferred by light or sound in outer space because both light and sound require a medium such as air to carry them.



RG69-3

A person hits a musical instrument called a triangle. When it is hit, the triangle starts to vibrate, and a sound is produced. After a while, the vibration and sound stop.



How does the energy of the triangle change and why?

- A. The energy of the triangle decreases the entire time. Some energy is destroyed as the person hits the triangle, and some energy is transferred away from the triangle by sound.
- B. The energy of the triangle increases the entire time. Energy is transferred to the triangle as the person hits the triangle, and no energy is transferred away from the triangle by sound.
- C. The energy of the triangle increases when it is hit, and then the energy decreases. Energy is transferred from the person to the triangle as the person hits it, and then energy is transferred away from the triangle by sound after the person stops hitting it.
- D. The energy of the triangle does not change during this process. Energy is not transferred to the triangle when the person hits it, and energy is not transferred away from the triangle by sound.



RG74-2

A person has a magnet and a metal paper clip. He puts the paper clip on the table and then brings the magnet close to the paper clip. When the magnet gets close enough to the paper clip, the attractive force on the paper clip causes the paper clip to start accelerating toward the magnet. Which of the following statements describes the changes in kinetic energy (motion energy) and potential energy that occur while the paper clip is moving toward the magnet?

- A. The kinetic energy of the paper clip and the potential energy of the magnet/paper clip system both increase.
- B. The kinetic energy of the paper clip increases, and the potential energy of the magnet/paper clip system decreases.
- C. The kinetic energy of the paper clip increases, but the potential energy of the magnet/paper clip system does not change.
- D. The kinetic energy of the paper clip stays the same, and the potential energy of the magnet/paper clip system decreases.



RG78-3

A person put a battery into a flashlight. She used the flashlight several times over the next few months. After a while, the flashlight no longer worked, and the person had to put a new battery in the flashlight to make it work again. What happened to the energy that was in the original battery?

- A. Each time the person used the flashlight some of the energy from the battery was destroyed. Eventually all of the energy was destroyed and no longer exists.
- B. Each time the person used the flashlight some of the energy from the battery was transferred to the surrounding environment. Eventually all of the energy became uniformly distributed in the surrounding environment and was no longer available to make the flashlight work.
- C. Each time the person used the flashlight some of the energy from the battery was transferred to the surroundings. All of the energy remained as useful as it was before, but it was now located in a different place.
- D. Each time the person used the flashlight some of the energy from the battery was transferred to the surroundings, and some of the energy was destroyed. The energy that was transferred to the surrounding environment was still as useful as it was before in other processes, but the energy that was destroyed no longer exists.



RG79-2

A cook heats up some corn. Then she cuts a piece of cold butter and places it on top of the hot corn.



What will happen to the temperature of the corn and the butter as soon as she puts the butter on top of the corn?

- A. Both the corn and the butter will get cooler.
- B. Both the corn and the butter will get warmer.
- C. The corn will get cooler, and the butter will get warmer.
- D. The corn will stay the same temperature, but the butter will get warmer.



RG80-3

A man takes a cookie out of a hot oven. He places the hot cookie on a cool plate. What will happen to the temperature of the plate and the cookie?

- A. The plate will get warmer, and the cookie will get cooler until they are both the same temperature.
- B. The plate will get warmer, and the cookie will get cooler, but they will never be the same temperature.
- C. The plate will stay the same temperature, and the cookie will get cooler until it is the same temperature as the plate.
- D. The plate will stay the same temperature, and the cookie will get cooler, but they will never be the same temperature.



RG81-2

A boy makes a small snowball and then pushes it around in the snow to make it bigger. He pushes it at a constant speed as the snowball gets bigger.



If the snowball doubles in mass, what will happen to the kinetic energy (motion energy) of the snowball?

- A. The kinetic energy of the snowball will be less than what it was because even though the snowball is still moving at the same speed, the amount of kinetic energy it has decreases as it gets heavier.
- B. The kinetic energy of the snowball will be double what it was because the amount of kinetic energy an object has is directly proportional to the mass of the object.
- C. The kinetic energy of the snowball will be double what it was because the boy is now pushing harder and kinetic energy depends on the effort required to move an object.
- D. The kinetic energy of the snowball will stay the same because the amount of kinetic energy an object has depends only on the speed of an object and not its mass.



RG82-2

A child rolls a bowling ball down a flat lane toward a set of pins at a bowling alley. As the bowling ball rolls, it slows down.



When the bowling ball is traveling at half the initial speed, what will the kinetic energy (motion energy) of the bowling ball be?

- A. The kinetic energy of the bowling ball will be half of what it was because the amount of kinetic energy an object has is directly proportional to its speed.
- B. The kinetic energy of the bowling ball will be one fourth of what it was because the amount of kinetic energy an object has is directly proportional to the square of its speed.
- C. The kinetic energy of the bowling ball will be double what it was because the amount of kinetic energy an object has is inversely proportional to its speed.
- D. Even though the speed of the bowling ball is half of what it was, the kinetic energy of the bowling ball will stay the same because the amount of kinetic energy an object has is not related to the speed of a moving object.



RG84-2

Two classes put plants in clay pots. The pots and plants are exactly the same, and they each have the same amount of dirt and water. One class hangs its pot outside the window on the first floor of the school. The other class hangs its pot outside the window on the second floor of the school.



Does the clay pot that is hanging outside the second floor window have more energy than the clay pot that is hanging outside the first floor window? Why or why not?

- A. Yes, the pot that is hanging outside the second floor window has more energy because it is higher above the ground.
- B. Yes, the pot that is hanging outside the second floor window has more energy because it is more likely to fall.
- C. No, both pots have the same amount of energy because they are exactly the same.
- D. No, both pots have no energy because they are not moving.



RG86-2

A river flows into a lake. The river water is warm, and the lake water is cold. What happens to the temperature of the lake water when the warm river water flows into the lake?

- A. The lake water will get cooler.
- B. The lake water will get warmer.
- C. The lake water will not change temperature.
- D. The lake water will only change temperature if the river water is much warmer than the lake water.



RG97-2

A player rolls Ball A toward Ball B as pictured in Figure 1. Then Ball A hits Ball B. Both balls continue to roll after the collision as shown in Figure 2.



Which of the following statements correctly describes Ball A's speed in Figure 2 compared to its speed in Figure 1?

- A. Ball A is moving faster in Figure 2 because it gained energy from hitting Ball B.
- B. Ball A is moving slower in Figure 2 because it transferred energy to Ball B when the balls hit each other.
- C. Ball A is moving slower in Figure 2 because some energy was destroyed when the balls hit each other.
- D. Ball A is moving at the same speed because no energy was transferred when the balls hit each other.



RG99-2

A child is playing with toy cars. Both cars are moving along a track. Car A and Car B are both moving in the same direction. Car B is moving slower than Car A, and Car A bumps into the back of Car B.



Which of the following correctly describes Car A's and Car B's speeds after the bump and why?

- A. After the bump, Car A is moving slower and Car B is moving faster because energy was transferred from Car A to Car B.
- B. After the bump, Car A and Car B are both moving slower because some energy was destroyed when Car A hit Car B.
- C. After the bump, Car A and Car B are both moving faster because the cars create energy as they move.
- D. After the bump, Car A and Car B are both moving at the same speed because no energy was transferred when Car A hit Car B.



RG101-2

A student would like to investigate the energy transfer between a magnet and a piece of magnetic metal. He places a block of iron on a table and positions a barrier in front of the block of iron. Next, he moves a magnet close to the block of iron on the table, as shown in Figure 1. He raises the barrier, and the iron block moves toward the magnet (Figure 2). The iron block then sticks to the magnet and comes to a rest (Figure 3).



In which figure is energy being transferred by the magnetic force to the iron block?

- A. Energy is transferred in all of the figures because energy is transferred by a magnetic force whenever an iron object is close to a magnet.
- B. Energy is transferred in Figures 2 and 3 because energy is transferred whenever a magnet exerts a force on an iron object.
- C. Energy is transferred in Figure 2 because energy is transferred when a magnet exerts a force on an iron object and the position of the object changes.
- D. Energy is not transferred in any of the figures because magnets can only transfer energy to other magnets.



RG103-2

Can the amount of energy a rock has change?

- A. Yes, but the amount of energy something has can only change if a person moves it
- B. Yes, there are a number of different ways the amount of energy something has can change, for example, by changing its motion or heating it.
- C. No, because the amount of energy something has always stays the same no matter what is done to it
- D. No, because non-living things do not have any energy



RG111-2

A scientist is designing a new capacitor. A capacitor is a device that is used to store an electrostatic charge. It is composed of two large conductive plates separated by a nonconductive insulating layer. He can change the charge on the plates or the thickness of the insulating layer.



Which of the following would change the amount of electrostatic potential energy stored in the capacitor?

- A. Either increasing the charge of the plates or increasing the thickness of the insulating layer would change the amount of electrostatic potential energy.
- B. Increasing the charge of the plates would change the amount of electrostatic potential energy, but increasing the thickness of the insulating layer would not.
- C. Increasing the thickness of the insulating layer would change the amount of electrostatic potential energy, but increasing the charge of the plates would not.
- D. Neither increasing the thickness of the insulating layer nor increasing the charge of the plates would change the amount of electrostatic potential energy.



RG114-2

A student rolls a ball down a ramp toward an identical stationary ball.



He determines that the total energy of the two balls just after the collision is slightly lower than the total energy of the two balls before they collided. Why is the total energy of the two balls lower after the balls collide?

- A. A small amount of energy was destroyed in the collision.
- B. A small amount of energy was transferred to the environment as thermal energy.
- C. The student made an error; the total energy of the two balls should be higher after the collision because the first ball actually gained energy as it rolled down the hill.
- D. The student made an error; the total energy of the two balls should not change because the amount of energy in a system cannot change.



RG120-2



A girl moves Magnet A close to Magnet B as shown above. When Magnet A is a certain distance from Magnet B, Magnet B begins to move toward Magnet A. The speed of Magnet B increases as it moves toward Magnet A. Is energy transferred while Magnet B moves toward Magnet A?

- A. No, energy is not transferred because magnets do not transfer energy unless they touch.
- B. No, energy is not transferred because magnets do not have any energy.
- C. Yes, energy is transferred because there is a change in speed.
- D. Yes, energy is transferred, but the transfer of energy is not related to the change in speed.



RG128-2

A homeowner wants to move two chairs to make room for a new piece of furniture. The two chairs are identical in size and mass. However, the first chair is on a smooth hardwood floor, while the second chair is on thick carpet.



He notices that the chair on the thick carpet is more difficult to move than the chair on the hardwood floor and thinks that there is more friction between the chair and the carpet than the chair and the hardwood floor. Which of the following statements correctly describes the energy transferred while moving each of the chairs?

- A. Friction between the carpet and the chair will increase the amount of energy that is destroyed while the man is moving the chair, so in order to move the chair on the carpet, the man will have to transfer more energy to the chair.
- B. Friction between the carpet and the chair will increase the amount of energy transferred to the environment, so in order to move the chair on the carpet, the man will have to transfer more energy to the chair.
- C. Although friction between the carpet and the chair makes moving the chair more difficult, the man will transfer the same amount of energy to each chair if both are moved the same distance.
- D. Friction between the carpet and the chair means the man will transfer more energy to the chair on the carpet, but only before the chair begins moving. Once the chairs are in motion, the man will transfer the same amount of energy to each chair.



RG130-2

Figure 1 shows a spring that is neither stretched nor compressed. Figure 2 shows the same spring stretched by 5 cm.



How does stretching the spring affect the elastic potential energy of the spring and why?

- A. Stretching the spring increases the elastic potential energy because the distance between the molecules increases, and forces between the molecules act to restore the molecules to their original separation.
- B. Stretching the spring increases the elastic potential energy because the distance between the molecules increases, which causes the forces between the molecules to increase.
- C. Stretching the spring decreases the elastic potential energy because the distance between the molecules increases, which causes the forces between the molecules to decrease.
- D. Stretching the spring decreases the elastic potential because the distance between the molecules stays the same, but the act of stretching releases some of the energy stored in the spring.



RG132-2

A student has three springs and would like to compare the elastic potential energy the springs have when stretched. He stretches all three springs 5 cm and lets go, which allows them to go back to their unstretched lengths. He makes several observations about each spring and records his observations in the table below:

Spring	How difficult to stretch?	Unstretched Length	Weight
1	Easiest to stretch	Shortest	In between 2 and 3
2	Hardest to stretch	In between 1 and 3	Lightest
3	In between 1 and 2	Longest	Heaviest

Based on his findings, the student decides that Spring 3 has the most elastic potential energy. Is the student's conclusion accurate?

- A. Yes, Spring 3 has the most elastic potential energy because the heavier a spring is the more elastic potential energy it has.
- B. Yes, Spring 3 has the most elastic potential energy because the longer a spring is the more elastic potential energy it has.
- C. No, Spring 1 has the most elastic potential energy because the easier a spring is to stretch, the more elastic potential energy it has.
- D. No, Spring 2 has the most elastic potential energy because the harder a spring is to stretch, the more elastic potential energy it has.



RG134-2

An apartment building has two elevators as indicated in the figure below. Elevator A is traveling up to the tenth floor with passengers whose total mass is 300kg. Elevator B is traveling down to the lobby with a group of passengers whose total mass is 200kg. Elevator B is traveling faster than Elevator A.



Which elevator has more gravitational potential energy at the exact moment when the two elevators are at the same height above the ground?

- A. Elevator A has more gravitational potential energy because it is going up, which requires more gravitational potential energy than going down.
- B. Elevator A has more gravitational potential energy because it has greater mass, and gravitational potential energy increases as mass increases.
- C. Elevator B has more gravitational potential energy because it is moving faster, and gravitational potential energy increases as speed increases.
- D. Elevators A and B have the same amount of gravitational potential energy because they are both the same height above the ground, and gravitational potential energy depends only on the height above the ground.



RG141-2

An inventor is trying to create a device that measures the amount of energy transferred from an object by electromagnetic radiation. He needs to calibrate the instrument by finding an object that does not give off electromagnetic radiation so he can get a zero reading on his device. However, he notices that wherever he places the device, it always registers some amount of background radiation. He thinks that objects in and around his laboratory are radiating energy. What should the inventor do to isolate the device from potential sources of electromagnetic radiation?

- A. He should calibrate the device in an airtight vacuum chamber because electromagnetic radiation cannot travel in a vacuum.
- B. He should calibrate the device at a very low temperature $(0^{\circ}C)$ because electromagnetic radiation is only emitted by warm objects.
- C. He should calibrate the device while surrounded by a protective shield, such as lead, because some substances only absorb electromagnetic radiation and do not emit electromagnetic radiation.
- D. All objects give off electromagnetic radiation, so the inventor will never get a true zero reading on his device.


RG142-2

A scientist has two identical blocks of steel. She heats one block of steel to 600° F and chills the other to 0° F. She then places the two blocks near each other as pictured below. She leaves the blocks in place for five minutes.



Which of the following statements correctly describes the net transfer of energy between Block A and Block B over those five minutes?

- A. There is a net transfer of energy from Block A to Block B because Block A radiated more energy than it absorbed and Block B absorbed more energy than it radiated.
- B. There is a net transfer of energy from Block A to Block B because Block A radiated energy and Block B absorbed energy. Block A did not absorb any energy and Block B did not radiate any energy.
- C. There is a net transfer of energy from Block A to the surrounding environment, but neither Block A nor Block B absorbed any energy.
- D. There is no net transfer of energy because both Block A and Block B absorbed and radiated the same amount of energy.



RG145-2

An inventor has an idea to have a light bulb power itself. She finds a light panel, which is a device that absorbs light and uses that light to produce electricity. She connects the light bulb to the light panel in a complete circuit. She turns the other lights in the room off so that the light bulb is the only source of light.



Her idea is that the light panel will capture light from the light bulb and produce electricity to keep the light bulb lit. Will her idea work?

- A. Yes, but only if she uses a separate power source to begin the process because all processes require an input of energy to start
- B. Yes, but only if the panel completely surrounds the light bulb so that the panel can absorb all of the light given off by the bulb
- C. No, some energy will be transferred to the surrounding environment, and that energy will no longer be available to be used by the light bulb or panel.
- D. No, some energy will be destroyed during the process, so there will eventually not be enough energy for the light bulb to work.



RG148-2



Which of the objects in the figure above has energy?

- A. Only the rock, because the rock is moving
- B. Only the light bulb, because it is giving off light
- C. Only the speaker and light bulb, because they are using electricity
- D. All three objects, because all objects have energy



RG152-2

Two children are playing on a swing set. When the boy pushes the girl, her speed increases.



As the boy is pushing the girl on the swing, what happens to the energy each child has?

- A. The boy's energy increases, and the girl's energy increases because they are both moving.
- B. The boy's energy decreases, and the girl's energy decreases because they both use up energy while they move.
- C. The boy's energy decreases, and the girl's energy increases because the boy transferred some of his energy to the girl when he pushed her.
- D. The boy's energy decreases, and the girl's energy stays the same because the boy used energy to push the girl, and the girl just sat on the swing.



RG154-2

A student opens a window in her classroom, letting in air from the outside that is warmer than the air inside the classroom.



What happens to the warmer air that comes in from outside and to the thermal energy of that air when it comes into contact with the colder air in the classroom?

- A. The warmer air rises, but the thermal energy of the air does not.
- B. The thermal energy of the air rises, but the warmer air does not.
- C. Both the warmer air and thermal energy rise because thermal energy is associated with the movement of the molecules of the air.
- D. Both the warmer air and thermal energy rise, but they move separately because thermal energy is not associated with the movement of the molecules of the air.



RG159-2

Two carts are rolling on a smooth flat surface. Cart A is rolling faster than Cart B and hits the back of Cart B.



After Cart A hits Cart B, both carts continue rolling forward. Each cart is going a different speed than it was before. Was energy transferred from Cart A to Cart B?

- A. No, Cart A does not have any energy to transfer.
- B. No, energy is not transferred when two objects hit each other.
- C. Yes, the change in speed is a sign that energy was transferred.
- D. Yes, energy was transferred, but the change in speed is not related to the transfer of energy.



RG161-2

The figure below shows two identical rocks. The rock on the left is falling, while the rock on the right is sitting on a cliff.



Does either rock have energy?

- A. The falling rock has energy because it is moving, and things that move have energy. The rock on the cliff does not have energy because it is not moving.
- B. The rock on the cliff has energy because it has energy stored inside of it. The falling rock does not have energy because it gave off its energy when it started to fall.
- C. Neither rock has energy because rocks are not alive, and only living things have energy.
- D. Both rocks have energy because all things have energy.



RG162-2

A child is playing with a wind-up toy car on a level surface. The child winds the car's spring by using the wind-up key in the back of the car. A spring inside the car stores the energy the child has transferred to the car. As the spring is released, the elastic potential energy of the spring is converted into the kinetic energy (motion energy) of the car and thermal energy of the surrounding environment.



In the graphs below, Point A represents the time at which the child begins winding the toy. Point B represents the time at which the car was released and begins to travel across the floor. Point C is the time at which the car comes to a complete stop. Which of the following graphs correctly illustrates how concentrated the energy of the car is at each point?





RG166-1

A student has two blocks. One block is warmer than the other block. If the student stacks the warmer block on top of the cooler block, what will happen to the temperature of the blocks?

- A. The cooler block will stay the same temperature, and the warmer block will get cooler until it is the same temperature as the cooler block.
- B. The warmer block will stay the same temperature, and the cooler block will get warmer until it is the same temperature as the warmer block.
- C. The warmer block will get cooler and the cooler block will get warmer until both blocks are at the same temperature.
- D. The warmer block will get cooler and the cooler block will get warmer, but they will never be the same temperature.



RG167-2

A student stretches a rubber band. How does stretching the rubber band change the amount of elastic potential energy the rubber band has and why?

- A. Stretching the rubber band decreases the amount of elastic potential energy because the act of stretching releases some potential energy stored in the rubber band.
- B. Stretching the rubber band decreases the amount of elastic potential energy because the distance between the molecules that make up the rubber band increases, which causes the intermolecular forces to decrease.
- C. Stretching the rubber band increases the amount of elastic potential energy because the distance between the molecules that make up the rubber band increases, and intermolecular forces act to restore the molecules to the unstretched distance.
- D. Stretching the rubber band increases the amount of elastic potential energy because elastic potential energy depends only on how much an object is stretched, and the intermolecular forces do not play a role.



RG177-1

A 70 kg girl is riding her 3 kg skateboard along a level surface. She jumps as shown in the figure below, lands on the skateboard, and continues along at the same speed.



When the girl is in the air above her skateboard, does the girl or the skateboard have more kinetic energy (motion energy) and why?

- A. The skateboard has more kinetic energy than the girl because the girl gave the skateboard her energy.
- B. The girl has more kinetic energy than the skateboard because the girl is alive but the skateboard is not.
- C. The girl has more kinetic energy than the skateboard because the girl weighs more than the skateboard.
- D. The skateboard and the girl have the same amount of kinetic energy because they are traveling at the same speed.



RG180-1

A person puts a bottle of juice in a refrigerator. The juice gets cooler while it is in the refrigerator. As the juice gets cooler, what happens to the amount of energy the juice has?

- A. The amount of energy the juice has decreases as it gets cooler.
- B. The amount of energy the juice has increases as it gets cooler.
- C. Juice has the same amount of energy no matter what temperature it is.
- D. Juice does not have energy.



RG184-1

Cold packs are commonly used to treat athletic injuries. A cold pack contains two chambers. One is filled with water and the other is filled with salt. When the cold pack is squeezed, the chamber containing the salt breaks open, which allows the salt and the water to mix inside the cold pack. As the salt and water mix, the salt dissolves and the temperature of the cold pack decreases.



As the salt dissolves, is energy being released to the surroundings or taken in from the surroundings and why?

- A. Energy is released because the temperature of the surroundings decreases.
- B. Energy is released because energy is released whenever a substance dissolves.
- C. Energy is taken in because the temperature of the surroundings decreases.
- D. Energy is neither taken in nor released because energy changes do not occur when substances dissolve.



RG185-1

Which of the following correctly describes energy transfer by convection in a liquid that is heated from below?

- A. As the temperature of the liquid increases, the atoms that make up the molecules of the liquid rub faster against each other. The rubbing creates energy that spreads throughout the liquid.
- B. As the temperature of the liquid increases, heat molecules are transferred from the heat source to the liquid. These heat molecules travel upward between the molecules that make up the liquid, transferring energy as they move.
- C. The molecules of the liquid closest to the heat source spread apart and create a less dense region of liquid. An upward force on the less dense region then pushes the liquid and its energy upward.
- D. The molecules of the liquid closest to the heat source collide with molecules farther away from the heat source. Energy is transferred through the liquid by the force of these collisions, but the molecules themselves do not move from place to place until the liquid boils.



RG190-1

Consider the following situations:

Situation 1: Warmer air moves from one place to another.

Situation 2: A person listens to music on a radio.

Is energy being transferred in either of these situations?

- A. Energy is transferred in both situations.
- B. Energy is NOT transferred in either situation.
- C. Energy is transferred in Situation 1, but energy is NOT transferred in Situation 2.
- D. Energy is transferred in Situation 2, but energy is NOT transferred in Situation 1.



RG193-1

A girl is swimming underwater in a pool. Her friend calls to her from outside of the pool. What happens to the matter that makes up the water when the sound of the friend's voice travels through the water?

- A. As the sound travels through the water, the matter moves in the direction of the sound and travels to the girl who is underwater.
- B. As the sound travels through the water, the matter is displaced for a period of time but then returns to its original position after the sound passes.
- C. As the sound travels through the water, the matter moves randomly in all different directions.
- D. Nothing happens to the matter that makes up the water. Matter is not disturbed when sound travels through a liquid.



RG195-1

A submarine uses sonar to detect objects underwater. Sonar is a process by which a sender emits brief sounds. When the sound hits an object, a portion of the sound returns to the submarine as an echo. The sonar unit uses the length of time it took the sound to make the round trip to determine how far away the object is.



Does the sound from the sender transfer energy to the object in the figure above? Why or why not?

- A. Yes, sound pushes water molecules that are near the sender to the object and the force that those water molecules exerts on the object transfers energy to that object.
- B. Yes, sound transfers energy from one water molecule to the next when the molecules collide until the energy reaches the object, but the water molecules do not travel from the sender to the object.
- C. No, sound transfers forces from one water molecule to the next, but does not transfer energy.
- D. No, since the object reflects some of the sound back to the receiver, no energy was transferred to the object.



RG196-1

A woman places a new battery in a watch. A chemical reaction takes place inside the battery that causes the hands on the watch to move.



Which of the following describes how energy changes while the watch hands move?

- A. Kinetic energy (motion energy) is created by the movement of the watch hands.
- B. Kinetic energy (motion energy) is transformed into chemical energy.
- C. Chemical energy is transformed into kinetic energy (motion energy).
- D. Energy does not change because chemical reactions transform matter not energy.



RG200-1

An adult heats one end of a metal rod over a flame. Initially, the end closest to the flame is hotter than the other end of the rod. Which of the following correctly describes how energy is transferred through the rod?

- A. Energy is transferred through the rod by the friction that results when the atoms that make up the metal rub against one another.
- B. Energy is transferred through the rod by the movement of atoms from the hotter end of the rod to the cooler end.
- C. Energy is transferred through the rod by the random collisions of the atoms that make up the metal.
- D. Energy is transferred through the rod as heat moves past the atoms that make up the metal. The atoms that make up the metal do not move.



RG204-1

Two oppositely charged particles are positioned as pictured in Figure 1. A student moves the particles so that the distance between the two particles is decreased as shown in Figure 2. He secures the particles in place so neither can move. The strength of the charges remains the same the whole time.



Which of the following statements correctly describes the change in electrostatic potential energy of the system of two particles from Figure 1 to Figure 2?

- A. The electrostatic potential energy increased because the force between any two particles increases as the distance decreases.
- B. The electrostatic potential energy decreased because potential energy decreases when the distance between any two particles decreases.
- C. The electrostatic potential energy decreased because potential energy decreases when the distance between the oppositely charged particles decreases.
- D. The electrostatic potential energy did not changed because the only way to change the potential energy of a system of oppositely charged particles is to change the strength of the charges.



RG206-1

A battery is connected to a capacitor in a closed circuit. A capacitor is a device that is composed of two large conductive plates separated by a nonconductive insulating layer. When the battery is connected to the capacitor, a chemical reaction occurs in the battery that causes one of the plates in the capacitor to acquire a negative charge and the other an equal amount of positive charge. Which of the following describes how energy changes while the capacitor is being charged by the battery?

- A. Matter inside the battery is converted into electrostatic potential energy in the capacitor.
- B. Matter inside the battery is converted into kinetic energy (motion energy) in the capacitor.
- C. Chemical energy in the battery is converted into electrostatic potential energy in the capacitor.
- D. Chemical energy in the battery is converted into kinetic energy (motion energy) in the capacitor.



RG212-1

The graph below represents the amount of chemical energy in a system of reactants before a chemical reaction occurs and the amount of chemical energy in the system of products after the reaction occurs.



Is energy taken in from or released to the surroundings the surroundings during this reaction and why?

- A. Energy is taken in from the surroundings because the amount of energy released when bonds of the reactant molecules are broken is less than the amount of energy required to form bonds of the product molecules.
- B. Energy is taken in from the surroundings because the amount of energy required to break bonds of the reactant molecules is greater than the amount of energy released when bonds of the product molecules are formed.
- C. Energy is released to the surroundings because the amount of energy required to break bonds of the reactant molecules is less than the amount of energy released when bonds of the product molecules are formed.
- D. Energy is released to the surroundings because the amount of energy released when bonds of the reactant molecules are broken is greater than the amount of energy required to form bonds of the product molecules.



RG216-1

Inside a wall clock, a battery is connected in a complete circuit to a motor that turns the hands of the clock.



When a person puts a new battery in a clock, the hands of the clock start to turn. The hour and minute hands turn slowly while the second hand turns quickly. While the hands on the clock are turning, is energy being transferred? Why or why not?

- A. Yes, energy is transferred from the battery but only to the second hand because it is moving the fastest.
- B. Yes, energy is transferred from the battery to all of the hands because all the hands are moving.
- C. Yes, energy is transferred from the battery to all of the hands because batteries transfer energy all the time even when they are not connected in a complete circuit to a device.
- D. No, energy is not transferred from the battery to the hands because energy cannot be transferred by a battery.

