AAAS Project 2061
Assessing Students' Progress on the Energy Concept

Advanced Test

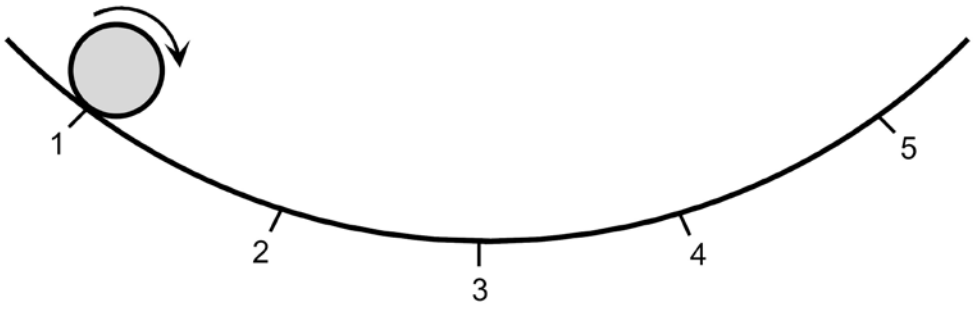
Test Code = 03-03-B

The Assessing Students' Progress on the Energy Concept (ASPECt) project was supported by the Institute of Education Sciences, U.S. Department of Education, through Grant R305A120138 to the American Association for the Advancement of Science. The opinions expressed are those of the authors and do not represent views of the Institute or the U.S. Department of Education. For more information about the ASPECt project, contact Cari Herrmann Abell at cabell@aaas.org.

For each question, fill in one circle on the answer sheet.

NG67-3

1. 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.

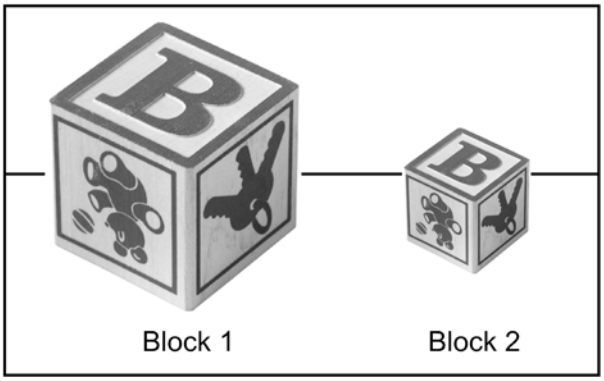
C. The total energy of the ball and track system increases as the speed of the ball increases, and it decreases as the speed of the ball decreases, and the energy of the track stays the same.

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.

For each question, fill in one circle on the answer sheet.

EG27-4

2. 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.

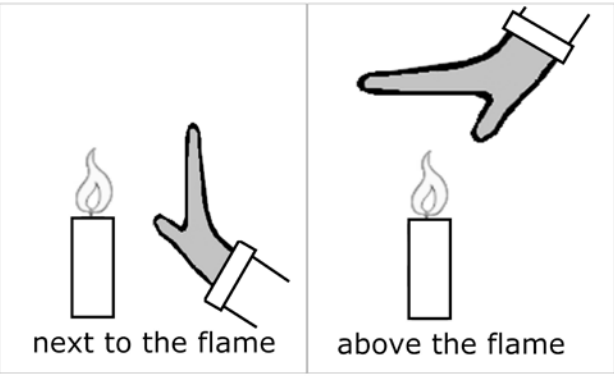
C. Both blocks have the same amount of thermal energy because they are at the same temperature.

D. Neither block has any thermal energy because they are not living things.

For each question, fill in one circle on the answer sheet.

RG4-2

3. 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.

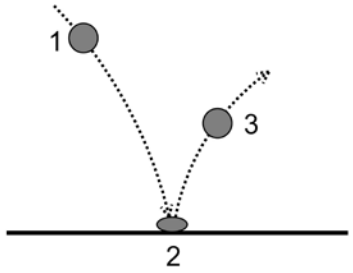
C. No, more energy will be transferred to his hand when it is next to the flame because the same amount of energy will be transferred by the movement of warm air to his hand in both positions, but more energy will be radiated by the flame in the sideways direction than in the upward direction.

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.

For each question, fill in one circle on the answer sheet.

NG12-3

4. 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.

For each question, fill in one circle on the answer sheet.

RG68-3

5. 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.

RG34-4

6. 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.

For each question, fill in one circle on the answer sheet.

EG45-2

7. 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

---

RG82-2

8. 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.

For each question, fill in one circle on the answer sheet.

RG141-2

9. 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°C) because electromagnetic radiation is only emitted by warm objects.

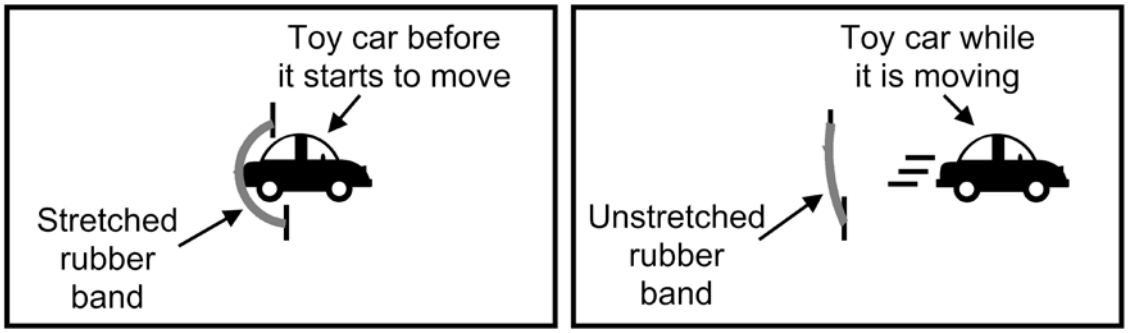
   C. He should calibrate the device while surrounded by a protective shield, such as lead, because some substances only absorb electromagnetic radiation and do not emit electromagnetic radiation.

   D. All objects give off electromagnetic radiation, so the inventor will never get a true zero reading on his device.

For each question, fill in one circle on the answer sheet.

NG78-3

10. 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.

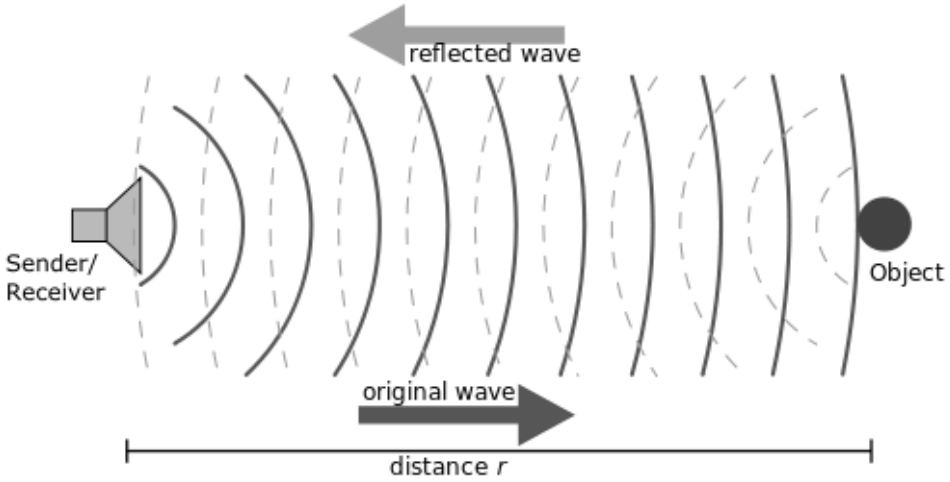
C. The total amount of energy in the system decreases because the increase in the kinetic energy (motion energy) of the car is less than the decrease in the elastic potential energy of the rubber band.

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.

For each question, fill in one circle on the answer sheet.

RG195-1

11. 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.

For each question, fill in one circle on the answer sheet.

RG42-3

12. 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.

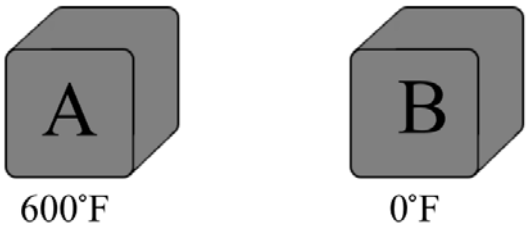
    C. The gravitational potential energy of a system of two objects can only be changed if one of the objects in the system is the earth.

    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.

For each question, fill in one circle on the answer sheet.

RG142-2

13. 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.

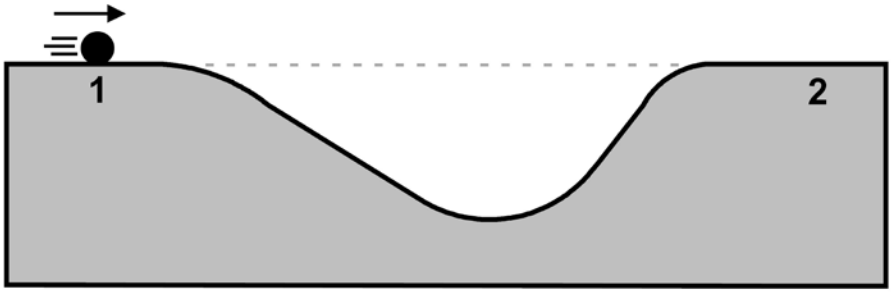
C. There is a net transfer of energy from Block A to the surrounding environment, but neither Block A nor Block B absorbed any energy.

D. There is no net transfer of energy because both Block A and Block B absorbed and radiated the same amount of energy.

For each question, fill in one circle on the answer sheet.

NG104-2

14. 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

For each question, fill in one circle on the answer sheet.

RG193-1

15. 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.

RG5-3

16. 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.

For each question, fill in one circle on the answer sheet.

RG46-3

17. 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

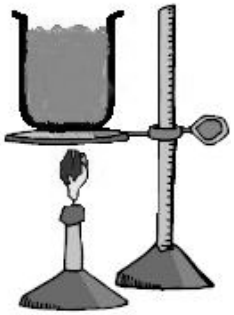
C. The distance between the rocket and the earth and the mass of the rocket

D. The distance between the rocket and the earth, the mass of the rocket, and the mass of the earth

For each question, fill in one circle on the answer sheet.

RG9-3

18. 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.

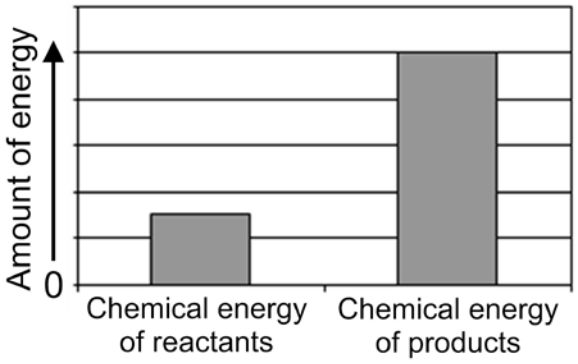
C. As the water at the bottom of the cup is heated, it becomes less dense than the cooler water above it. The difference in densities causes the warmer water to rise. As the warmer water rises, it carries with it its thermal energy. This heats the water at the top of the cup.

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.

For each question, fill in one circle on the answer sheet.

RG212-1

19. 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.

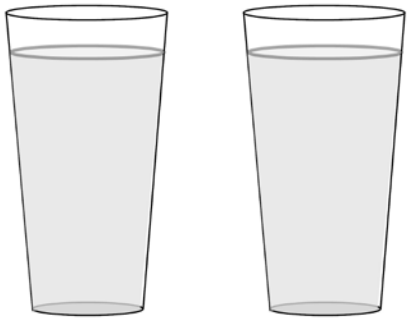
C. Energy is released to the surroundings because the amount of energy required to break bonds of the reactant molecules is less than the amount of energy released when bonds of the product molecules are formed.

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.

For each question, fill in one circle on the answer sheet.

EG51-4

20. 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.

For each question, fill in one circle on the answer sheet.

RG162-2

21. 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.

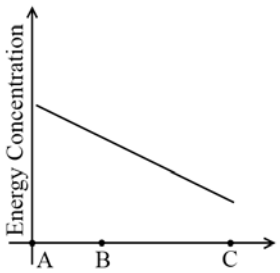
#21 continued on next page

For each question, fill in one circle on the answer sheet.

#21 continued

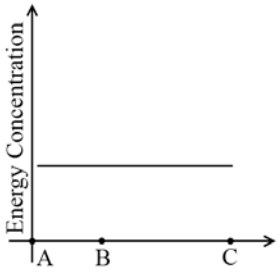
Which of the following graphs correctly illustrates how concentrated the energy of the car is at each point?

A.



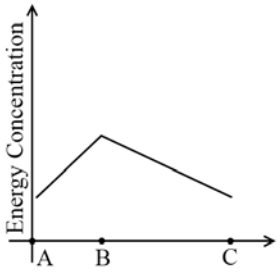
Because energy always becomes less concentrated and cannot be made more concentrated

B.



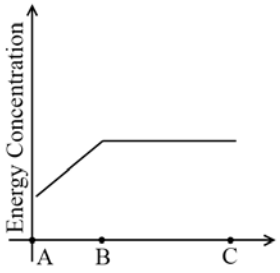
Because the energy of a system cannot become more or less concentrated

C.



Because energy is concentrated as the spring is wound up and then becomes less concentrated as energy is transferred to the surrounding environment

D.

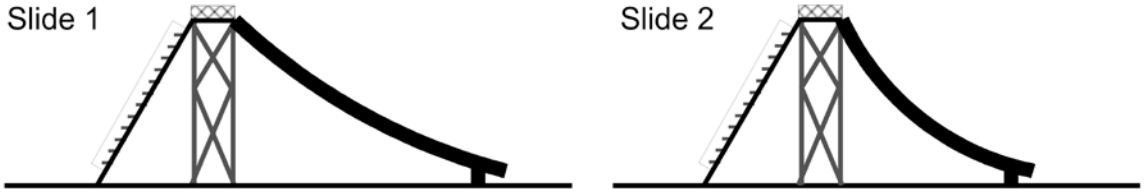


Because energy is concentrated as the spring is wound up and then stays constant

For each question, fill in one circle on the answer sheet.

NG69-3

22. Imagine two frictionless slides that are shaped differently but are 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? (Remember that there is no friction, so the students do not transfer any energy to the slides or the air around them.)

A. The student on Slide 1 because that student traveled a longer distance, so there was more time to create motion energy (kinetic energy).

B. The student on Slide 2 because that student initially encountered a steeper slope, so more motion energy (kinetic energy) was created.

C. The student on Slide 2 because that student traveled a shorter distance, so this student did not lose as much motion energy (kinetic energy) or gravitational potential energy as the student on Slide 1.

D. The students have the same speed because they both experienced the same change in height, so the same amount of gravitational potential energy was transformed into motion energy (kinetic energy).

For each question, fill in one circle on the answer sheet.

RG185-1

23. 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.

RG167-2

24. 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.

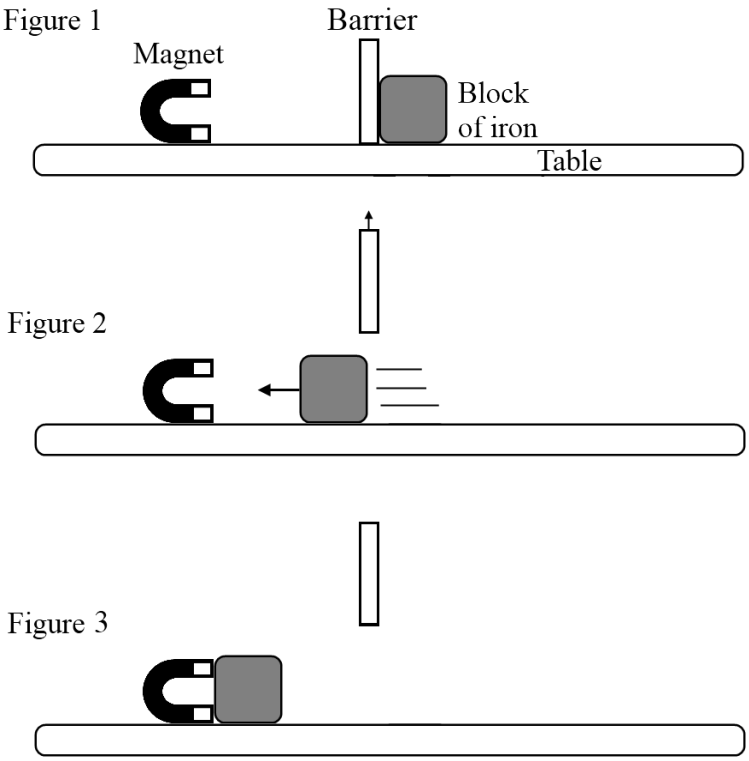
    C. Stretching the rubber band increases the amount of elastic potential energy because the distance between the molecules that make up the rubber band increases, and intermolecular forces act to restore the molecules to the unstretched distance.

    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.

For each question, fill in one circle on the answer sheet.

RG101-2

25. 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.

For each question, fill in one circle on the answer sheet.

RG200-1

26. 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.

RG78-3

27. 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.

For each question, fill in one circle on the answer sheet.

RG204-1

28. 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.

Figure 1

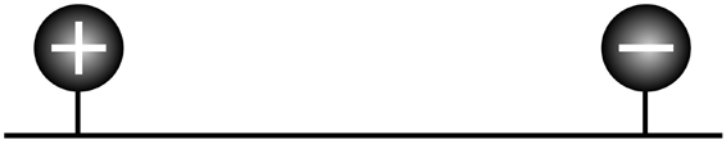
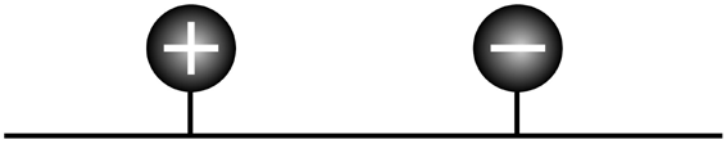


Figure 2



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.

For each question, fill in one circle on the answer sheet.

RG81-2

29. 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.

For each question, fill in one circle on the answer sheet.

RG206-1

30. 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.

RG74-2

31. 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.

For each question, fill in one circle on the answer sheet.

RG130-2

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

Figure 1 

Figure 2 

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.

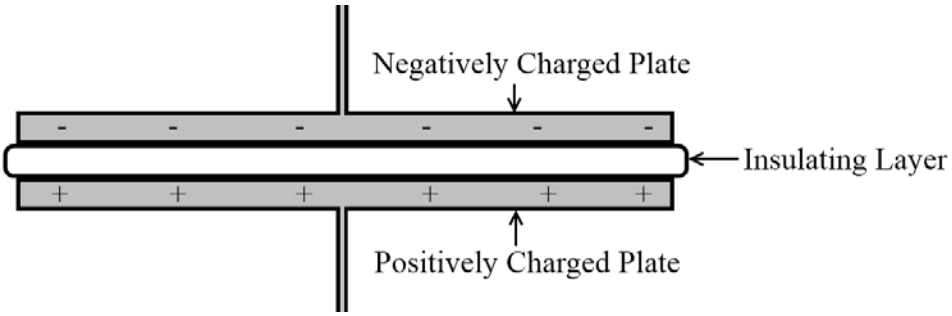
C. Stretching the spring decreases the elastic potential energy because the distance between the molecules increases, which causes the forces between the molecules to decrease.

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.

For each question, fill in one circle on the answer sheet.

RG111-2

33. 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.

For each question, fill in one circle on the answer sheet.

NG55-3

34. 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.

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.

NG11-4

35. 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.

End of Test