

AAAS Project 2061

Assessing Students' Progress on the Energy Concept

Intermediate Test

Test Code = 02-02-A

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

NG59-3

1. Consider the following situations:

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

Situation 2: The sun shines on a plant.

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.
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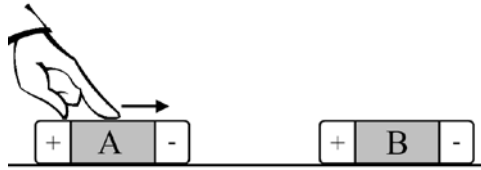
NG53-3

2. 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

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

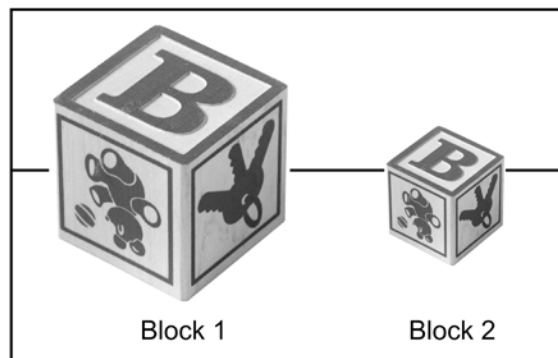
RG120-2



3. 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?
- No, energy is not transferred because magnets do not transfer energy unless they touch.
 - No, energy is not transferred because magnets do not have any energy.
 - Yes, energy is transferred because there is a change in speed.
 - Yes, energy is transferred, but the transfer of energy is not related to the change in speed.

EG27-4

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.



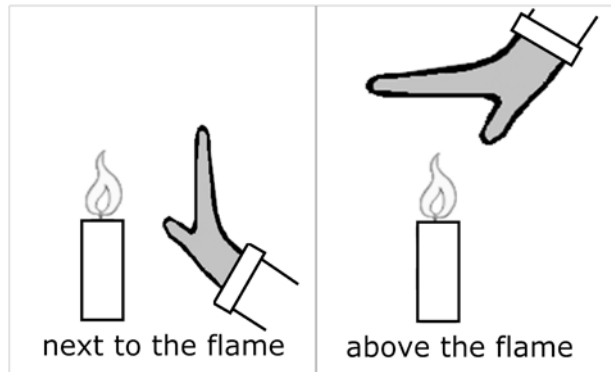
Which block has more thermal energy and why?

- Block 1 has more thermal energy because it weighs more.
- Block 2 has more thermal energy because it weighs less.
- Both blocks have the same amount of thermal energy because they are at the same temperature.
- 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

5. 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.

RG40-3

6. 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.



Photo by Helihark (CC-BY-SA-3.0)

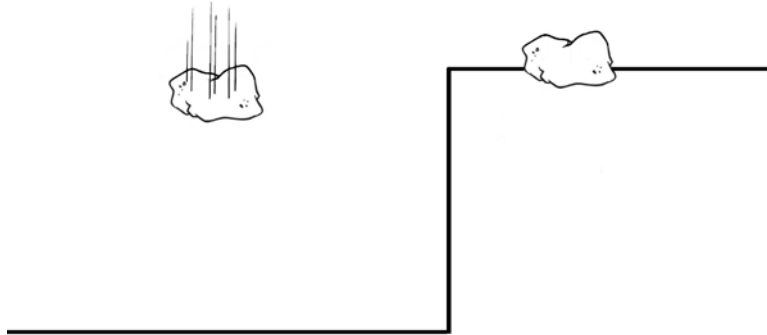
What happens to the energy of the tuning fork as the vibrations of the tuning fork slow down and eventually stop?

- 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.

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

RG161-2

7. 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.



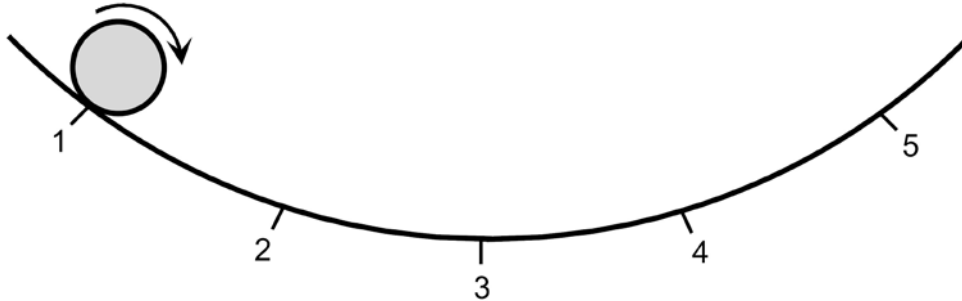
Does either rock have energy?

- 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.

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

NG67-3

8. 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.



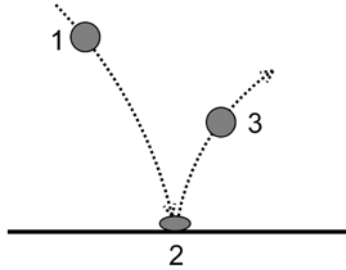
How does the total energy of the ball and track system change as the ball rolls along the track? (Assume that no energy is transferred to or from the surroundings.)

- 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.

NG12-3

9. 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

10. 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.
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RG196-1

11. 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.

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

 RG132-2

12. 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

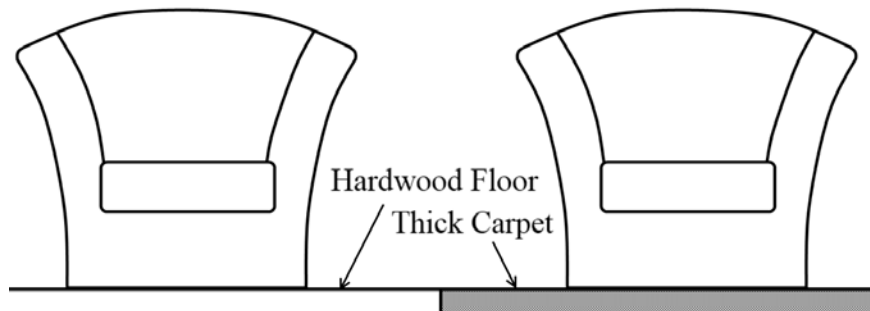
Based on his findings, the student decides that Spring 3 has the most elastic potential energy. Is the student's conclusion accurate?

- 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.

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

RG128-2

13. 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.



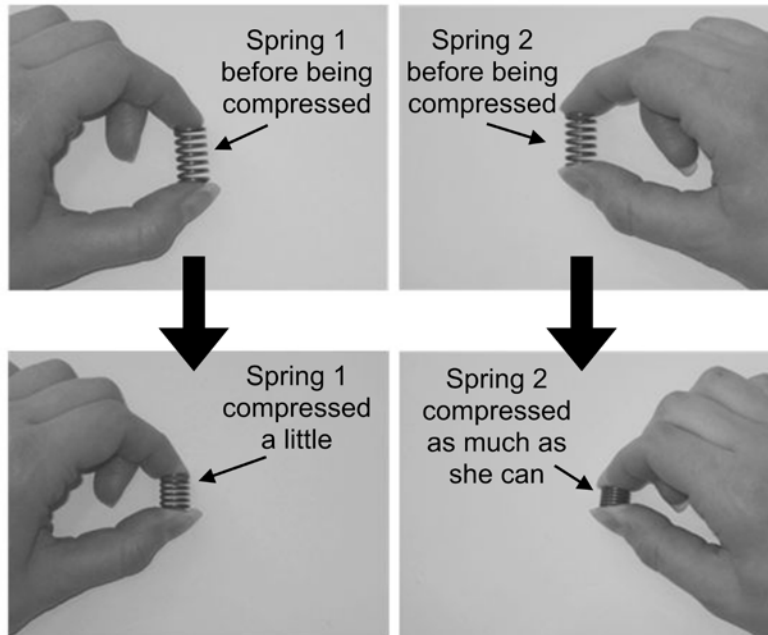
He notices that the chair on the thick carpet is more difficult to move than the chair on the hardwood floor and thinks that there is more friction between the chair and the carpet than the chair and the hardwood floor. Which of the following statements correctly describes the energy transferred while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

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

EG43-5

14. 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.

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

RG31-3

15. 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).



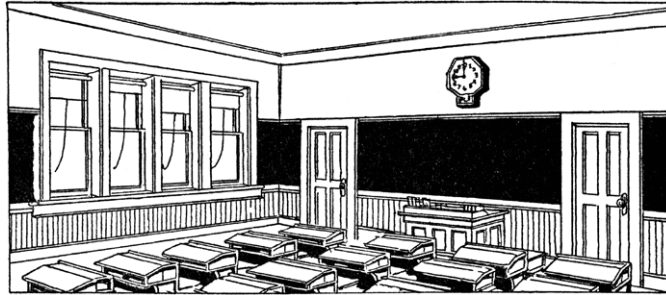
How does the chemical energy of the reactants (water and carbon dioxide) compare to the chemical energy of the products (sugars and oxygen)?

- 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.

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

RG154-2

16. 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.
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EG8-4

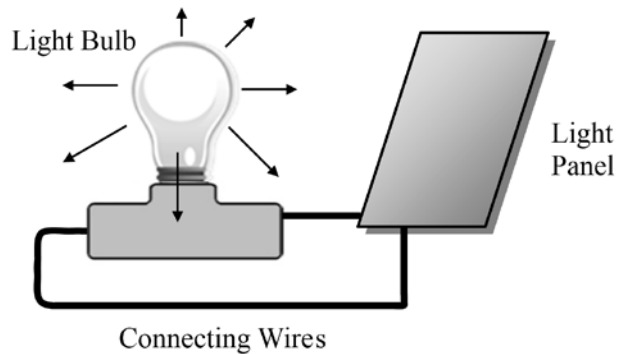
17. When does a ball have kinetic energy (motion energy)?

- 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.

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

RG145-2

18. 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.

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

NG25-4

19. 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.
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RG177-1

20. 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.

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

NG102-3

21. 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.
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EG60-1

22. 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

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

RG99-2

23. 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.



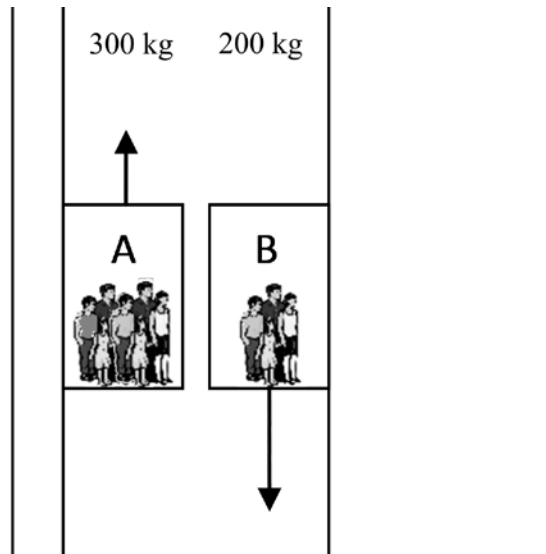
Which of the following correctly describes Car A's and Car B's speeds after the bump and why?

- 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.

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

RG134-2

24. 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.



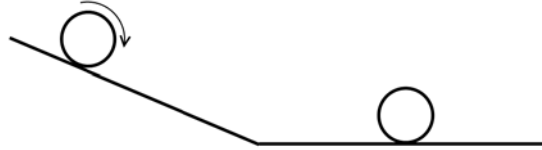
Which elevator has more gravitational potential energy at the exact moment when the two elevators are at the same height above the ground?

- 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.

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

RG114-2

25. 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.
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EG67-2

26. 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.

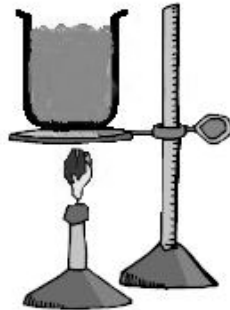
For each question, fill in one circle on the answer sheet.

EG36-5

27. 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
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RG8-3

28. 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.

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

NG24-3

29. 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
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RG152-2

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



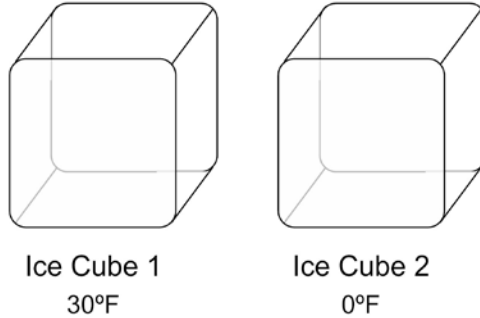
As the boy is pushing the girl on the swing, what happens to the energy each child has?

- 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.

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

EG31-4

31. 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.
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RG190-1

32. 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.

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

RG184-1

33. 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.



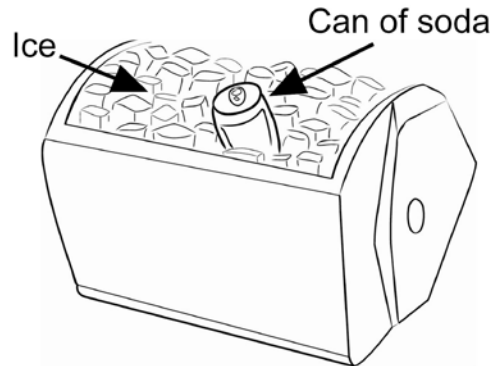
As the salt dissolves, is energy being released to the surroundings or taken in from the surroundings and why?

- 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.

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

NG28-3

34. 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 .



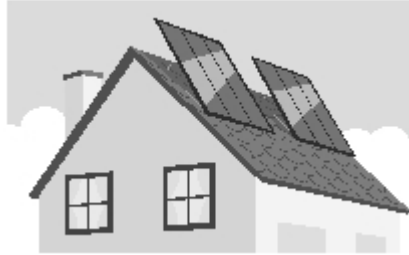
He closes the cooler. Before any of the ice starts to melt, which of the following describes the energy transfer between the ice and the can of soda in the cooler?

- 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.

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

RG23-3

35. 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.

End of Test