



Battle Creek Area Mathematics and Science Center Summative Assessment - End of Unit Exam

Attached is the Summative Assessment for the Battle Creek Area Mathematics and Science Center Science Unit, *Energetic Connections*. This assessment includes a number of multiple-choice questions, one constructed response question, and several items from the unit's Student Journal. Summative assessment of targeted concepts and skills provides feedback to the individual student and the teacher on conceptual understanding, demonstration of achievement of selected content, and determination of readiness for refinement and application of new knowledge and skills. The inclusion of the Student Journal items provides the opportunity to determine the level of understanding and ability of key knowledge and skills targeted in this unit. The Student Journal items evaluate individual student learning and the effectiveness of instruction. Rubrics are included in the Summative Assessment to ensure consistent scoring of the items. All components of this assessment provide multiple opportunities to assess student understanding of each science content expectation addressed in the unit.

The BCAMSC Summative Assessments are in draft form and may change based on student performance and teacher feedback. The BCAMSC Outreach Staff will use data collected from participating districts to make adjustments for the following school year.

If you have any questions or suggestions regarding the Summative Assessment, please direct your calls to Nancy Karre at (269) 965-9584 or email: nancy@bcamsc.org.



A S S E S S M E N T



Name: _____



Date: _____

.....

1. Choose the BEST answer that is an example of an energy transformation from potential energy to kinetic energy.
 - a. a ball rolling down a ramp
 - b. a picture hanging on the wall
 - c. a swing swaying back and forth
 - d. a coat hanging on a hook

2. Cory spilled grape juice on a favorite shirt. His mom said to take two tablespoons of the powdered laundry detergent and mix it with 2 oz. of water and then scrub the spot with the soap solution. He mixed the detergent and water, then rubbed the solution into the spot. He noticed that the detergent and water solution began to get very warm. He told his mom that an energy transfer occurred when he mixed the detergent and water. Choose the BEST evidence that led Cory to conclude that an energy transfer occurred.
 - a. The change in temperature is evidence of an energy transfer.
 - b. The removal of the stain is evidence of an energy transfer.
 - c. The presence of bubbles is evidence of an energy transfer.
 - d. The mixing of substances is evidence of an energy transfer.

3. Which energy transfer occurred when Cory mixed the detergent with water?
 - a. Kinetic energy transferred to potential energy.
 - b. Chemical energy transferred to heat energy.
 - c. Heat energy transferred to a chemical energy.
 - d. Mechanical energy transferred to heat energy.

4. Heat energy transfer is:
 - a. the transfer of heat from one object to another.
 - b. the radiation of heat from an object.
 - c. an increase in heat energy.
 - d. a loss of heat energy.



Energetic Connections (cont.)

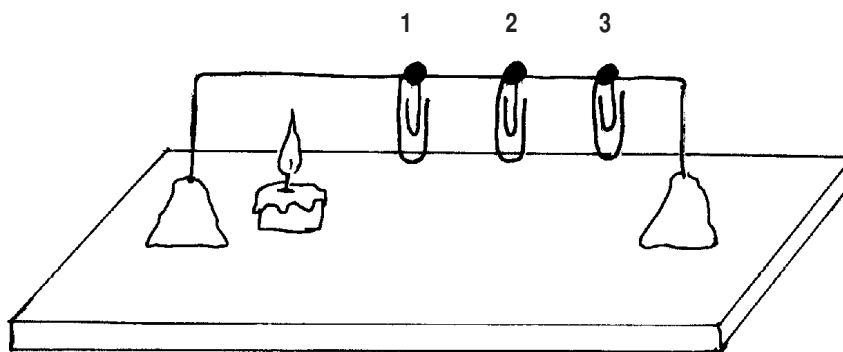
.....

5. Mrs. Murphy's class was investigating the heat flow with warmer objects and colder objects. Sean and Ben decided to observe what happened when an ice cube was placed in the palm of their hand. After a few minutes of holding the ice cube in their hands, the ice cubes began to melt. Then the boys began to complain that their palms were freezing! Mrs. Murphy told Sean and Ben to put their ice cubes away and write a conclusion based on their observations. Using what you know about heat transfer, choose the BEST conclusion statement for Sean and Ben's investigation.
- a. The cold from the ice cube transferred to the palms of their hands.
 - b. The heat from the palms of their hands transferred to the ice cube.
 - c. Ice cubes are colder than the palms of their hands.
 - d. The palms of their hands get cold when they hold an ice cube.
6. What evidence from Sean and Ben's investigation supports the conclusion you chose in Question #5?
- a. The palms of their hands were wet when the ice changed from a solid to a liquid.
 - b. The palms of their hands were cold when the ice transferred cold to their palms.
 - c. The ice began to change to liquid water when it touched their palms.
 - d. The ice was too cold for the boys to hold due to the energy transfer.
7. Which statement describes the motion and arrangement of molecules during a change from a solid to a liquid?
- a. The molecules in a solid slow down and vibrate in place to change to a liquid.
 - b. There is no change in the motion of the molecules in a solid when changing to a liquid.
 - c. The molecules in a solid speed up and move about more freely to change to a liquid.
 - d. The molecules speed up in a solid, break apart, and join other molecules to change to a liquid.



8. Choose the BEST example of convection:
- Heat leaves a coffee cup as the currents of steam and air rise.
 - Heat leaves the hot soup and heats the spoon.
 - Heat from a liquid melts an ice cube.
 - Water droplets form on the outside of a glass of water.

9. Clara and Jamie decided to investigate the heat flow from warmer to cooler objects using wire, a candle, paper clips, clay, aluminum foil, a ruler, and a stopwatch. They built the apparatus pictured below:



Clara and Jamie recorded the following data:

Trial	Paper Clip #1	Paper Clip #2	Paper Clip #3
Trial #1	20 seconds	28 seconds	35 seconds
Trial #2	18 seconds	27 seconds	33 seconds
Trial #3	19 seconds	28 seconds	34 seconds

Choose the BEST conclusion for Jamie and Clara's investigation:

- The flame from the candle warmed the wire equally, making the paper clips fall off the wire at the same time.
- The wax changed states and went from a solid to a liquid, and gravity pulled the paper clips from the wire.
- Heat from the candle warmed the wire closest to the flame, and then moved along the wire from the warmest end to the coolest end.
- It is important to test your data at least three times to make sure the results are consistent.



.....

10. Jan and Kyle were asked to design an investigation that answered the question, “What changes occur when you combine baking soda and vinegar?” Jan’s hypothesis stated that there would be a chemical change. Kyle’s hypothesis stated that there would be a physical change. After completing their procedure, Jan and Kyle observed that mixing the two compounds created bubbling and a gas was released, a clear liquid remained, and a white powder remained. Choose the BEST conclusion based on Jan and Kyle’s observations.
- A chemical change occurred when vinegar and baking soda were combined.
 - A physical change occurred when vinegar and baking soda were combined.
 - The gas released was oxygen when the vinegar and baking soda were combined.
 - Water and salt were produced when the vinegar and baking soda were combined.
11. Water molecules in the ocean:
- move slower as they gain energy from the sun.
 - move farther apart as they cool down.
 - move quickly as they change shapes.
 - move faster as they gain energy from the sun.
12. Which of the following is an example of potential energy?
- a ball rolling down a ramp
 - a stretched rubber band
 - a baseball flying into the outfield
 - a snail moving across a rock
13. Sally and Monica were investigating the energy in a ball that was dropped from different heights. They wanted to find out if a ball dropped from a greater height would bounce the same or higher than the ball dropped from a lower height. Choose the list of materials they will need to conduct their investigation:
- two balls of different mass and volume, measuring tape, stopwatch
 - two balls of different volume but the same mass, stopwatch, measuring tape, masking tape
 - one ball and measuring tape
 - two ramps at different angles, measuring tape, stopwatch



14. Sally and Monica collected the following data:

Height of Table	Trial	Height of Bounce
1 meter (100 cm)	Trial #1	56 cm
1 meter (100 cm)	Trial #2	58 cm
1 meter (100 cm)	Trial #3	57 cm
2 meters (200 cm)	Trial #1	148 cm
2 meters (200 cm)	Trial #2	150 cm
2 meters (200 cm)	Trial #3	144 cm

Choose the BEST conclusion based on Sally and Monica's data:

- a. The height of the table or dropped ball does not affect the height of the bounce of the ball.
 - b. The height of the bounce of the ball is the same as the height of the table.
 - c. The ball will only bounce a different height each time it is dropped from tables at different heights.
 - d. The ball dropped from a greater height will bounce higher than a ball dropped from a lower height.
15. Sally thought that the ball that was dropped from the greater height had more potential energy than the ball dropped from the lower height. Choose the BEST explanation that supports Sally's statement:
- a. The greater the distance between the ball and the floor, or Earth, the greater the potential energy.
 - b. The greater the distance between the ball and the floor, or Earth, the greater the force that acts on the ball.
 - c. Kinetic energy increases as the ball bounces.
 - d. The ball at rest demonstrates potential energy.



Energetic Connections (cont.)

.....

16. Ralph and Teresa were building a roller coaster to demonstrate potential and kinetic energy. When the marble on the roller coaster is in motion, it is an example of:
- a. mechanical energy and potential energy
 - b. kinetic energy and potential energy
 - c. friction and mechanical energy
 - d. potential energy and friction
17. Ralph and Teresa's roller coaster had hills, valleys, curves, and flat sections. Ralph and Teresa described the peaks of the hills as the part of the roller coaster that demonstrated:
- a. kinetic energy and mechanical energy
 - b. friction and gravity
 - c. potential energy and kinetic energy
 - d. heat energy transfer
18. Tony and Carlos wanted to find out if the mass of water changed during a phase change from solid to liquid and liquid to solid. They conducted an investigation to find out if mass of water changes during a phase change. They placed an ice cube in a closed container, measured the mass of the ice cube in its solid state, and then measured the mass of the water in its liquid state. They recorded their results in the data table below:

Mass of ice cube (solid)	76 grams
Mass of melted ice cube (liquid)	76 grams

What can Tony and Carlos conclude from their investigation?

- a. The mass of water stays the same during a phase change from a solid to a liquid.
- b. The volume changes from a solid to a liquid but the mass stays the same.
- c. Mass is not affected when water changes from a solid to a liquid to a gas.
- d. The heat transfer from the warm air to the cold ice caused the ice to change from a solid to a liquid.



19. Explain why it was necessary in Tony and Carlos' investigation for them to place the ice cube in a closed container while it melted.
- a. To prevent the ice cube from moving around and losing volume.
 - b. To maintain a constant temperature in the container.
 - c. To maintain a constant volume in the container.
 - d. To prevent any water molecules from evaporating into the air.

20. Steven's little brother was playing with a toy top. When the top stopped spinning, he told Steven it ran out of energy and asked him to start the top spinning again. Explain how the energy in the top was transferred, but no energy was gained or lost in the spinning and stopping of the top.

21. Draw and label a picture of two set-ups using one ramp and one ball for each set-up. Include different heights for each ramp and the position of the ball when it has potential energy and kinetic energy. Label the transformation between potential and kinetic energy.

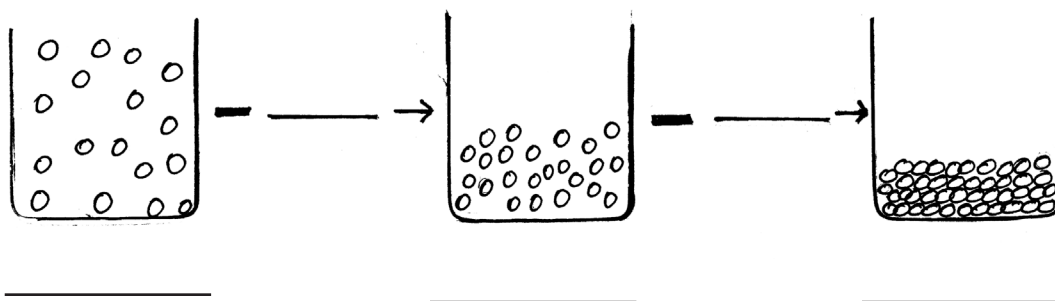
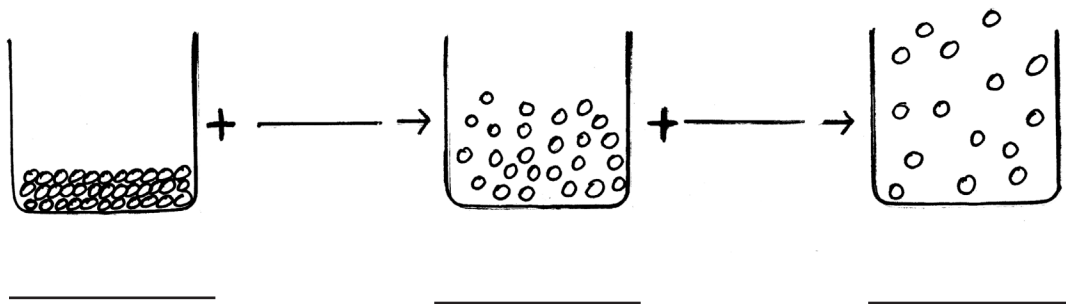


Energetic Connections (cont.)



22. Describe the force that starts the ball moving down the ramps. Identify the potential energy, kinetic energy, balanced forces, and unbalanced forces in the investigation.

23. Label the drawings to demonstrate phase changes in states of matter. Include what is increased (+) or decreased (-) between states.





**Energetic Connections
Answer Key**

.....

Rubric for Energetic Connections Summative Assessment

(Total Possible Points - 34)

Question #1: Choose the BEST answer that is an example of an energy transformation from potential energy to kinetic energy. (P.EN.06.11, P.EN.06.12)

Answer: c (1 point)

Question #2: Choose the BEST evidence that led Cory to conclude that an energy transfer occurred. (P.EN.06.41)

Answer: a (1 point)

Question #3: Which energy transfer occurred when Cory mixed the detergent with water? (P.EN.06.41)

Answer: b (1 point)

Question #4: Heat energy transfer is: (P.EN.06.41, P.EN.06.42)

Answer: a (1 point)

Question #5: Using what you know about heat transfer, choose the BEST conclusion statement for Sean and Ben's investigation: (P.EN.06.41)

Answer: b (1 point)

Question #6: What evidence from Sean and Ben's investigation supports the conclusion you chose in Question #5? (P.EN.06.41)

Answer: c (1 point)

Question #7: Which statement describes the motion and arrangement of molecules during a change from a solid to a liquid? (P.CM.06.11)

Answer: c (1 point)

Question #8: Choose the BEST example of convection: (P.EN.06.41)

Answer: a (1 point)

Question #9: Choose the BEST conclusion for Jamie and Clara's investigation: (P.EN.06.41)

Answer: c (1 point)



.....

Question #10: Choose the BEST conclusion based on Jan and Kyle's observations. (P.EN.06.41, S.IA.06.11, S.IA.06.14)

Answer: a (1 point)

Question #11: Water molecules in the ocean: (P.CM.06.41)

Answer: d (1 point)

Question #12: Which of the following is an example of potential energy? (P.EN.06.11, P.EN.06.12)

Answer: b (1 point)

Question #13: Choose the list of materials they will need to conduct their investigation: (P.EN.06.11, P.EN.06.12, S.IP.06.12)

Answer: c (1 point)

Question #14: Choose the BEST conclusion based on Sally and Monica's data: (P.EN.06.11, P.EN.06.12, S.IA.06.11, S.IA.06.14)

Answer: d (1 point)

Question #15: Choose the BEST explanation that supports Sally's statement: (P.EN.06.11, P.EN.06.12)

Answer: a (1 point)

Question #16: Ralph and Teresa were building a roller coaster to demonstrate potential and kinetic energy. When the marble on the roller coaster is in motion, it is an example of: (P.EN.06.11, P.EN.06.12)

Answer: b (1 point)

Question #17: Ralph and Teresa described the peaks of the hills as the part of the roller coaster that demonstrated: (P.EN.06.11, P.EN.06.12)

Answer: c (1 point)

Question #18: What can Tony and Carlos conclude from their investigation? (P.CM.06.12)

Answer: a (1 point)



**Energetic Connections
Answer Key (cont.)**



Question #19: Explain why it was necessary in Tony and Carlos' investigation for them to place the ice cube in a closed container while it melted. (P.CM.06.12)

Answer: d (1 point)

Question #20: Explain how the energy in the top was transferred, but no energy was gained or lost in the spinning and stopping of the top. (P.EN.06.42)

Elements

- a. Response includes an explanation of the kinetic energy of the spinning top.
- b. Response includes an explanation of the heat energy due to friction in the air (air resistance) and on the surface.
- c. Response includes an explanation of the energy transfer from the energy of motion to heat energy.

Scoring (3 points)

- 3 - Response includes all three elements
- 2 - Response includes two elements
- 1 - Response includes one element
- 0 - No response, no elements, can't read the answer

Summative Assessment: Student Journal

Question #21 - Activity #2, Journal Entry Question #1: Draw and label a picture of two set-ups using one ramp and one ball for each set-up. Include different heights for each ramp and the position of the ball when it has potential energy and kinetic energy. Label the transformation between potential and kinetic energy. (P.EN.06.11, P.EN.06.12)

Elements

- a. Response includes drawing of two ramps at different angles with labels of height of ramps.
- b. Response includes position of ball that demonstrates potential energy.
- c. Response includes position of ball that demonstrates kinetic energy.

Scoring (3 points)

- 3 - Response includes all three elements
- 2 - Response includes two elements
- 1 - Response includes one element
- 0 - No response, no elements, can't read the answer



.....

Question #22 - Activity #2, Journal Entry Question #2: Describe the force that starts the ball moving. Identify the potential energy, kinetic energy, balanced forces, and unbalanced forces in the investigation. (P.EN.06.11, P.EN.06.12)

Elements

- a. Response includes gravity as the force that started the ball rolling.
- b. Response includes the stationary ball as having potential energy.
- c. Response includes the stationary ball as balanced forces.
- d. Response includes the rolling ball as kinetic energy.
- e. Response includes the rolling ball as unbalanced forces.

Scoring (5 points)

- 5 - Response includes all five elements
- 4 - Response includes four elements
- 3 - Response includes three elements
- 2 - Response includes two elements
- 1 - Response includes one element
- 0 - No response, no elements, can't read the answer

Question #23 - Activity #13, Journal Entry Question #1: Label the drawings to demonstrate phase changes in states of matter. Include what is increased (+) or decreased (-) between states. (P.CM.06.11)

Elements

- a. Response includes correct labeling of solid, liquid, and gas.
- b. Response includes correct labeling of addition or subtraction of energy.

Scoring (2 points)

- 2 - Response includes both elements
- 1 - Response includes one element
- 0 - No response, no elements, can't read the answer



**Energetic Connections
Answer Key (cont.)**



Question #24 - Activity #13, Journal Entry Question #2: Describe the relationship between matter and energy when matter goes through a phase change. (P.CM.06.11)

Elements

- a. Response includes heat energy as part of the phase change.
- b. Response includes the relationship between heat energy and the motion of molecules.

Scoring (2 points)

- 2 - Response includes both elements
- 1 - Response includes one element
- 0 - No response, no elements, can't read the answer