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## 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, *Forces and Motion*. This assessment includes a number of multiple-choice questions, two constructed response questions, 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](mailto:nancy@bcamsc.org).



A S S E S S M E N T



Name: \_\_\_\_\_



Date: \_\_\_\_\_

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1. Roger and Mike were investigating and measuring the motion of a toy jumping frog. They wanted to find out how far the jumping frog would leap. They placed the frog behind a starting line and measured the distance the frog traveled. They repeated the procedure for three trials. Roger and Mike created the following data chart to record their results:

Motion of the Jumping Frog

Trials	Distance	Observations
Trial #1	37 cm	Frog veered slightly to the left
Trial #2	44 cm	Frog traveled in a straight path
Trial #3	20 cm	Frog made a sharp turn to the left

What did Roger and Mike use as a point of reference to determine the motion of the jumping frog?

- a. measuring tape
  - b. centimeters
  - c. starting line
  - d. observations
2. Use the chart above to determine the BEST conclusion for Roger and Mike’s investigation. The forces that made the frog jump were:
- a. unbalanced forces of different strength, resulting in a different path and distance.
  - b. non-contact forces of different strength, resulting in a different path and distance.
  - c. different balanced forces with each trial, resulting in a different path and distance.
  - d. forces in opposing directions, resulting in a different path and distance.
3. Choose the BEST description of the force of motion of the jumping frog.
- a. unbalanced forces
  - b. balanced forces
  - c. the force of gravity
  - d. the force of friction

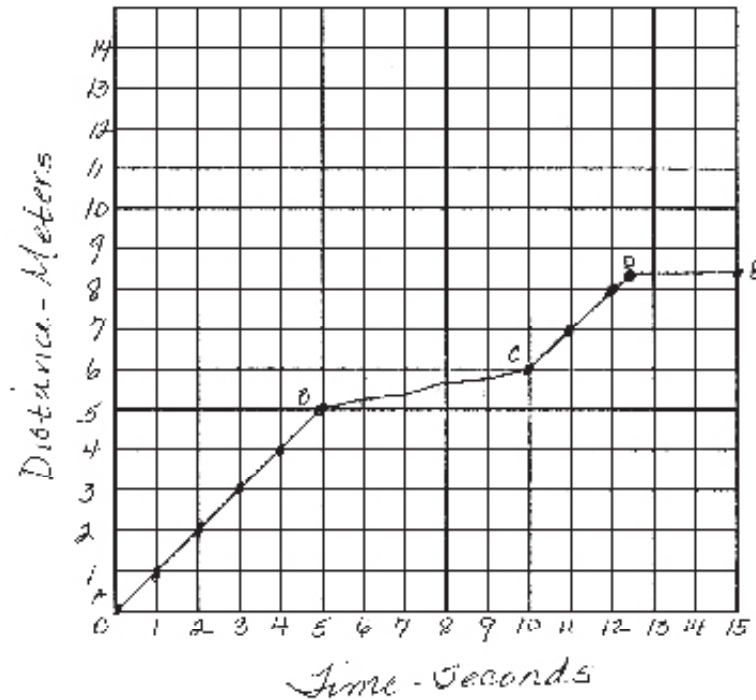


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4. Sally and Kristen were testing the flight of paper airplanes as they tossed them across the school gym. The airplanes flew across the gym and then came to a rest on the floor. What force made the paper airplanes land on the floor?
  - a. gravity
  - b. friction
  - c. air pressure
  - d. mass
  
5. Choose the correct tools for Sally and Kristen to measure the speed of their paper airplanes.
  - a. measuring tape, balance, stopwatch
  - b. spring scale, measuring tape
  - c. measuring tape, stopwatch
  - d. stopwatch, balance, spring scale
  
6. What measurements are needed to calculate the speed of an object?
  - a. grams and force
  - b. force and acceleration
  - c. mass, time, and force
  - d. time and distance
  
7. Friction can be described as a:
  - a. non-contact force
  - b. contact force
  - c. slowing of motion
  - d. rough surface



*Motion of Marble*



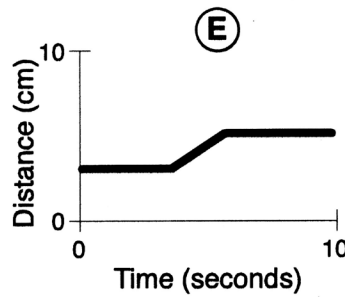
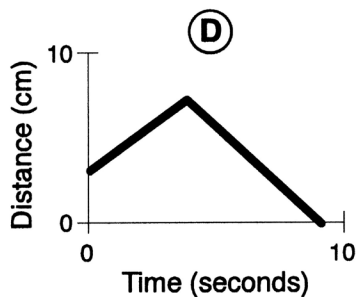
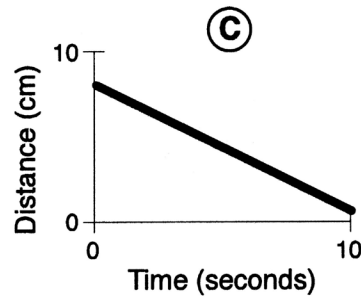
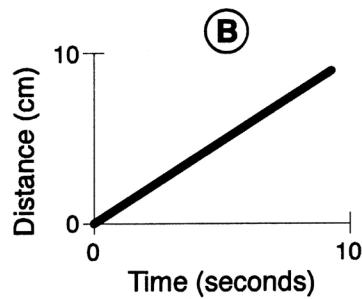
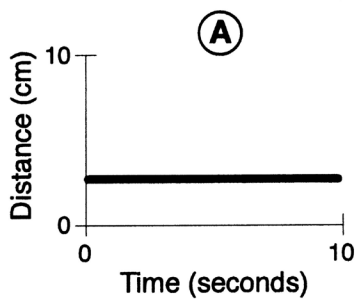
8. Alicia and Malcolm graphed the motion of a rolling marble in a maze. Use the graph above and choose the BEST answer that explains motion of the marble between point A and point B on the graph. The marble moved:
- at a rate of 5 meters per second.
  - at a rate of 1 meter per second.
  - steadily and accelerated for 5 seconds.
  - gradually and slowed down for 5 seconds.
9. Use the graph above and choose the BEST answer that explains the forces acting on the marble between point A and point B. The forces acting on the marble:
- pushed the marble.
  - pulled the marble using gravity.
  - were balanced.
  - were unbalanced.



## Forces and Motion (cont.)

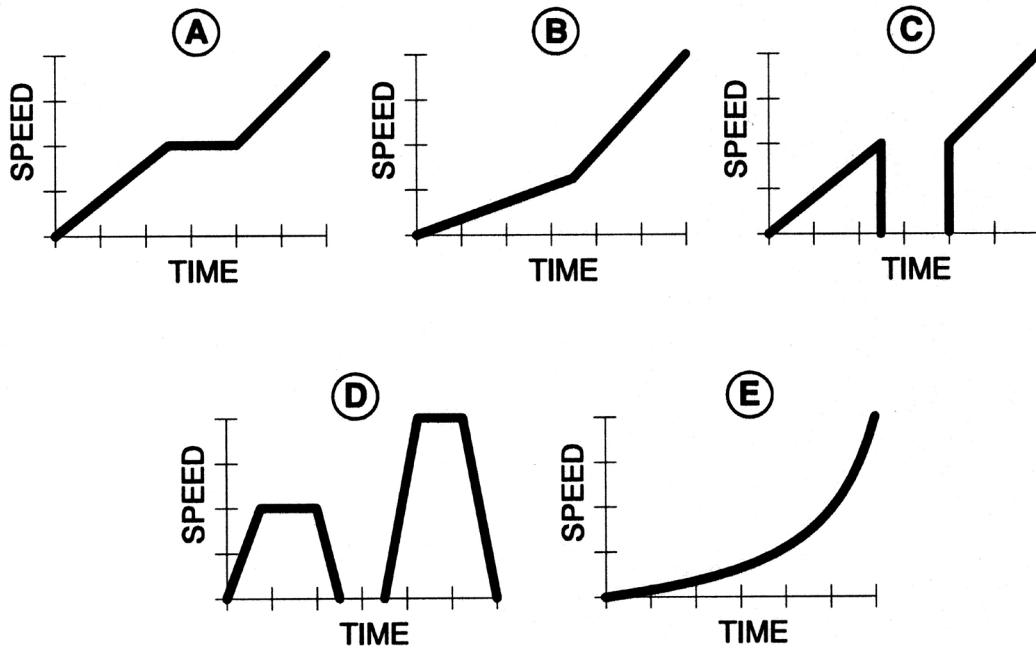
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10. Use the graph and choose the answer that describes what happened to the marble at point B.
- a. An unbalanced force made the marble slow down.
  - b. An unbalanced force made the marble change direction.
  - c. The forces of friction and gravity made the marble slow down.
  - d. A balanced force made the marble change direction and slow down.
11. Use the graph and choose the answer that describes the motion of the marble between point D and point E.
- a. The marble continued at a constant speed.
  - b. The marble slowed down.
  - c. The marble stopped.
  - d. The marble was pulled to the ground by gravity.
12. Kaitlyn is watching a wind-up toy walking across a table. She observes that the toy covers 1 cm every second for 10 seconds. Which graph below do you think most closely represents the toy's journey across the table?





13. Each morning Franklin walks a half mile to school. One morning, halfway to school, he stopped to watch some workers pour cement from a cement mixer onto the sidewalk. When he realized he was late, he ran the rest of the way to school to avoid a tardy mark. Which graph below shows Franklin's speed during his walk to school?



14. The fifth graders were playing a game of tug-of-war during gym class. The class was divided equally with half the class on one side of the rope and the other half on the opposite side. For 5 minutes the students pulled and pulled but neither side could pull the flag to one side or the other. Choose the description of the forces during the fifth grade tug-of-war.

- a. The forces were unbalanced in the game.
- b. The forces were friction, gravity, and chemical energy.
- c. The students all had the same amount of strength.
- d. The forces were balanced in the game.

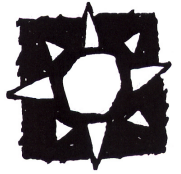


**Forces and Motion (cont.)**



15. Choose the BEST example of balanced forces.
- a. a car speeding up
  - b. a leaf blowing in the wind
  - c. a car moving at a constant speed
  - d. a tennis ball bouncing back and forth between players
16. Mr. Smith's class was exploring magnetism. The students noticed that the paper clips moved toward the magnet without the magnet touching the paper clips. What was the force that moved the paper clips?
- a. gravitational force
  - b. balanced force
  - c. contact force
  - d. non-contact force
17. Mitsu and Alex decided to investigate how far away they can hold the magnet before the paper clips begin to move. Choose the BEST question for their investigation.
- a. What part of the magnet is the strongest?
  - b. What type of magnet will pick up the most paper clips?
  - c. What distance between the paper clip and magnet will start the motion of the paper clip?
  - d. Does the mass of the paper clip affect the distance at which it will begin to move toward the magnet?
18. Choose the tools and equipment for Alex and Mitsu's investigation.
- a. paper clips, metric ruler, stopwatch, hand lens
  - b. paper clips, metric ruler, magnet
  - c. bar magnet, horseshoe magnet, ring magnet, paper clips
  - d. magnet, paper clip, balance, metric ruler, stopwatch
19. Choose the unit of measure for the data collection.
- a. centimeters and millimeters
  - b. centimeters and meters
  - c. inches and feet
  - d. grams and kilograms





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20. Choose the BEST answer that describes how the mass of an object affects its motion.
- a. The greater the mass of an object, the slower the motion of the object.
  - b. The greater the mass of an object, the faster the motion of the object.
  - c. The greater the mass of an object, the greater the force to move the object.
  - d. The greater the mass of an object, the greater the distance the object will travel.

21. Anthony and Sylvia were investigating the speed of two different balls of the same volume but different mass down the slope of a ramp. They measured the time it took for each ball to travel 5 meters. They collected the following data:

Ball/Mass	Trial 1	Trial 2	Trial 3
steel ball (68 grams)	1.37 seconds	1.40 seconds	1.35 seconds
wooden ball (7 grams)	1.39 seconds	1.38 seconds	1.35 seconds

Choose the BEST conclusion for their investigation.

- a. The mass of the ball does not affect the speed of the ball.
- b. The mass of the ball does not affect the distance the ball travels.
- c. The greater the mass of the ball, the slower the ball traveled.
- d. The greater the mass of the ball, the faster the ball traveled.

22. A force is a push or a pull. Forces have magnitude and direction. Describe what happens when two equal forces act on an object in the same direction.

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23. Describe what happens when two equal forces act on an object in opposing directions.

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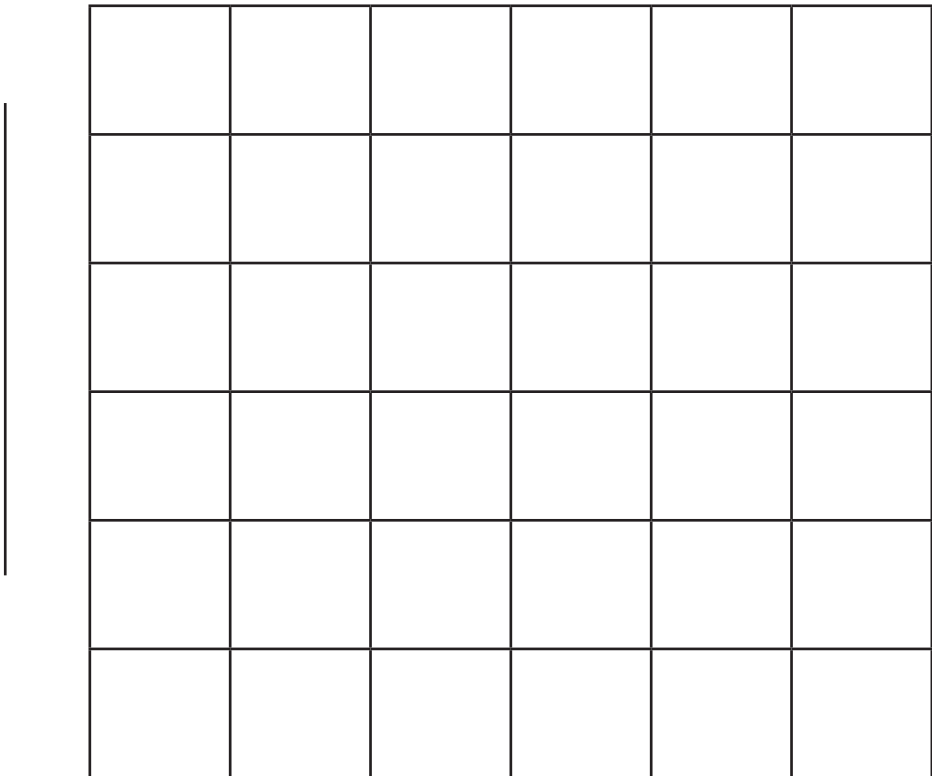
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24. Look at the data table below and make a line graph to represent the speed of the tortoise and the hare in their race. Label the x-axis and y-axis and write a title for your graph.

The Race Between the Tortoise and the Hare

Distance	Tortoise Time	Hare Time
0 meters - start	0 minutes	0 minutes
200 meters	20 minutes	2 minutes
400 meters	40 minutes	4 minutes
600 meters	60 minutes	98 minutes
800 meters	80 minutes	100 minutes
1,000 meters	100 minutes	102 minutes

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25. At what part of the race did the hare decide to take a nap? Use your line graph to explain your answer.

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26. Predict what would happen if the race was 200 meters longer. Explain your answer.

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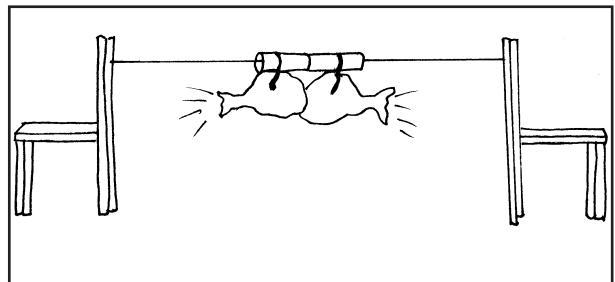
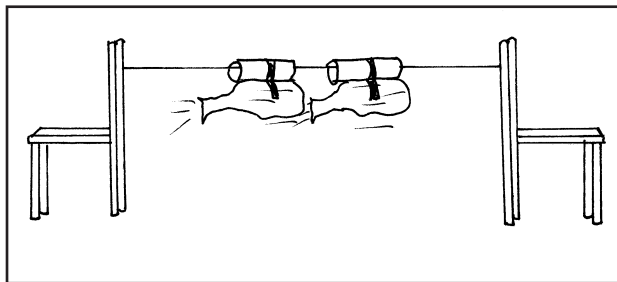
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27. Look at the drawings. Label the drawings as balanced or unbalanced.



a. \_\_\_\_\_

b. \_\_\_\_\_



28. Write how balanced forces acting on an object affect its motion.

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29. Write how unbalanced forces acting on an object affect its motion.

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30. Write how the magnetic force and electrical force are non-contact forces. Describe the difference between contact and non-contact forces.

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Rubric for Forces and Motion Summative Assessment

(Total Possible Points - 41)

Question #1: What did Roger and Mike use as a point of reference to determine the motion of the jumping frog? (P.FM.05.41)

Answer: c (1 point)

Question #2: Use the chart above to determine the BEST conclusion for Roger and Mike's investigation. The forces that made the frog jump were: (S.IA.05.11, P.FM.05.33)

Answer: a (1 point)

Question #3: Choose the BEST description of the force of motion of the jumping frog. (P.FM.05.32, P.FM.05.33)

Answer: a (1 point)

Question #4: The airplanes flew across the gym and then came to a rest on the floor. What force made the paper airplanes land on the floor? (P.FM.05.22)

Answer: a (1 point)

Question #5: Choose the correct tools for Sally and Kristen to measure the speed of their paper airplanes. (S.IP.05.12, S.IP.05.13)

Answer: c (1 point)

Question #6: What measurements are needed to calculate the speed of an object? (S.IP.05.14)

Answer: d (1 point)

Question #7: Friction can be described as: (P.FM.05.21)

Answer: b (1 point)

Question #8: Use the graph above and choose the BEST answer that explains motion of the marble between point A and point B on the graph. The marble moved: (S.IA.05.11, P.FM.05.43)

Answer: b (1 point)



**Forces and Motion  
Answer Key (cont.)**

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Question #9: Use the graph above and choose the BEST answer that explains the forces acting on the marble between point A and point B. The forces acting on the marble: (P.FM.05.32, P.FM.05.43)

Answer: c (1 point)

Question #10: Use the graph and choose the answer that describes what happened to the marble at point B. (S.IA.05.11, P.FM.05.33, P.FM.05.43)

Answer: a (1 point)

Question #11: Use the graph and choose the answer that describes the motion of the marble between point D and point E. (P.FM.05.21, P.FM.05.43)

Answer: c (1 point)

Question #12: Kaitlyn is watching a wind-up toy walking across a table. She observes that the toy covers 1 cm every second for 10 seconds. Which graph below do you think most closely represents the toy's journey across the table? (S.IA.05.11, P.FM.05.42)

Answer: b (1 point)

Question #13: Each morning Franklin walks a half mile to school. One morning, halfway to school, he stopped to watch a some workers pour cement from a cement mixer onto the sidewalk. When he realized he was late, he ran the rest of the way to school to avoid a tardy mark. Which graph below shows Franklin's speed during his walk to school?

Answer: d (1 point) (S.IA.05.11, P.FM.05.42)

Question #14: Choose the description of the forces during the fifth grade tug-of-war. (P.FM.05.31)

Answer: d (1 point)

Question #15: Choose the BEST example of balanced forces. (P.FM.05.32)

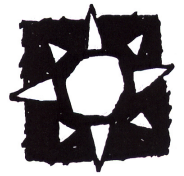
Answer: c (1 point)

Question #16: The students noticed that the paper clips moved toward the magnet without the magnet touching the paper clips. What was the force that moved the paper clips? (P.FM.05.21)

Answer: d (1 point)

Question #17: Mitsu and Alex decided to investigate how far away they can hold the magnet before the paper clips begin to move. Choose the BEST question for their investigation. (P.FM.05.21, S.IP.05.11)

Answer: c (1 point)



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Question #18: Choose the tools and equipment for Alex and Mitsu's investigation. (S.IP.05.12, S.IP.05.13)

Answer: b (1 point)

Question #19: Choose the unit of measure for the data collection. (S.IP.05.14)

Answer: a (1 point)

Question #20: Choose the BEST answer that describes how the mass of an object affects its motion. (P.FM.05.34)

Answer: c (1 point)

Question #21: Choose the BEST conclusion for their investigation. (S.IA.05.11, P.FM.05.34)

Answer: a (1 point)

Question #22: A force is a push or a pull. Forces have magnitude and directions. Describe what happens when two equal forces act on an object in the same direction. (P.FM.05.31)

Answer: (1 point)

Response includes that the object will move in the direction of the forces.

Question #23: Describe what happens when two equal forces act on an object in opposing directions. (P.FM.05.31)

Answer: (1 point)

Response includes that the object will remain at rest or not move.

Summative Assessment: Student Journal

Question #24 - Activity #4, Journal Entry Question #1: Look at the data table below and make a line graph to represent the speed of the tortoise and the hare in their race. Label the x-axis and y-axis and write a title for your graph. (S.IP.05.15, P.FM.05.42, P.FM.05.43)

Elements

- Graph includes title.
- Graph includes label (time or distance) on the x-axis.
- Graph includes label (time or distance) on the y-axis.
- Graph includes correct coordinates for tortoise.



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e. Graph includes correct coordinates for hare.

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 #25 - Activity #4, Journal Entry Question #2: At what part of the race did the hare decide to take a nap? Use your line graph to explain your answer. (S.IP.05.16, S.IA.05.11, S.IA.05.14)

Elements

- a. Response includes that the hare took a nap at the 400-meter mark.
- b. Response includes that the hare took a nap after 4 minutes of running.

Scoring (2 points)

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

Question #26 - Activity #4, Journal Entry Question #3: Predict what would happen if the race was 200 meters longer. Explain your answer. (S.IP.05.16, S.IA.05.11, S.IA.05.14)

Elements

- a. Response includes that the hare would win the race or tortoise would lose the race.
- b. Response includes that the hare would travel 200 more meters in 2 minutes.
- c. Response includes that the tortoise would travel 200 more meters in 20 minutes.

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





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Question #27 - Activity #6, Journal Entry Question #1: Look at the drawings. Label the drawings as balanced or unbalanced. (P.FM.05.31, P.FM.05.32, P.FM.05.33)

Elements

- a. Picture A is labeled as “unbalanced.”
- b. Picture B is labeled as “balanced.”

Scoring (2 points)

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

Question #28 - Activity #6, Journal Entry Question #2: Write how balanced forces acting on an object affect its motion. (P.FM.05.32)

Elements

- a. Response includes that balanced forces keep an object moving at the same speed.
- b. Response includes that balanced forces keep an object at rest or not moving.

Scoring (2 points)

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

Question #29 - Activity #6, Journal Entry Question #3: Write how unbalanced forces acting on an object affect its motion. (P.FM.05.33)

Elements

- a. Response includes that unbalanced forces change the speed and/or direction of an object in motion.
- b. Response includes that unbalanced forces cause an object at rest to move or change position.

Scoring (2 points)

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



Question #30 - Activity #15, Journal Entry: Write how the magnetic force and electrical force are non-contact forces. Describe the difference between contact and non-contact forces. (P.FM.05.21, P.FM.05.22)

Elements

- a. Response includes an accurate description of a non-contact force referring to like and unlike poles repelling and attracting objects.
- b. Response includes a comparison between a contact force as a force that touches the object to make it move or change direction, and a non-contact force that does not touch the object to make it move or change directions.

Scoring (2 points)

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