EXAM

Name Date Class

Part I: Multiple Choice

1. What is the evidence that an object is increasing in its motion energy?

a) The object is not moving.
b) The object is turning.
c) The object is slowing down.
d) The object is speeding up.
e) The object is moving at a constant speed.

(Questions 2–3) A cookie box slides across a table.

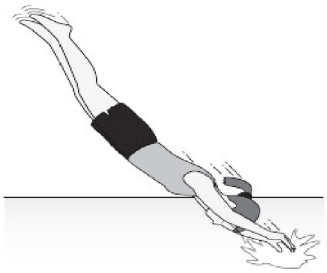
2. What kind of interaction occurs as the bottom surface of the cookie box rubs against the table surface?

a) applied interaction
b) elastic interaction
c) friction interaction
d) drag interaction
e) magnetic interaction

3. During this interaction between the cookie box and the table, what happens to the objects?

a) The cookie box speeds up and warms up while the table cools down.
b) The cookie box slows down and warms up while the table cools down.
c) The cookie box slows down and cools down while the table warms up.
d) The cookie box slows down and warms up while the table warms up.
e) The cookie box slows down and cools down while the table cools down.

(Questions 4–5) A girl dives into a swimming pool full of water.



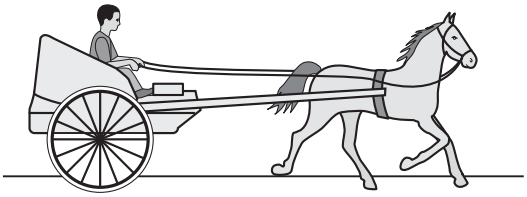
4. As the girl enters the water, what happens to the girl and the water near her?

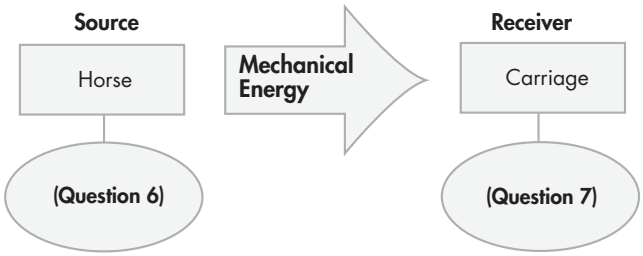
a) There is no change in speed for either the girl or the water.
b) The girl and the water speed up.
c) The girl and the water slow down.
d) The water slows down while the girl speeds up.
e) The water speeds up while the girl slows down.

5. As the girl enters the water, what kind of interaction occurs?

a) applied
b) elastic
c) friction
d) drag
e) magnetic

(Questions 6–8) In the interaction between the horse and the carriage, the carriage speeds up. The following energy diagram shows the source and receiver for this interaction.





6. When the horse pulls the carriage, how does the energy change in the **source**?

a) decreases in motion energy
b) decreases in thermal energy
c) decreases in stored chemical energy
d) decreases in stored elastic energy
e) There is no energy change in the source.

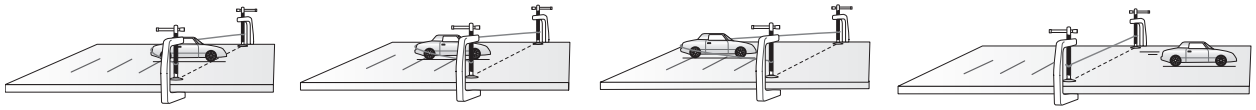
7. When the horse pulls the carriage, how does the energy change in the **receiver**?

a) increases in motion energy
b) increases in thermal energy
c) increases in stored chemical energy
d) increases in stored elastic energy
e) There is no energy change in the receiver.

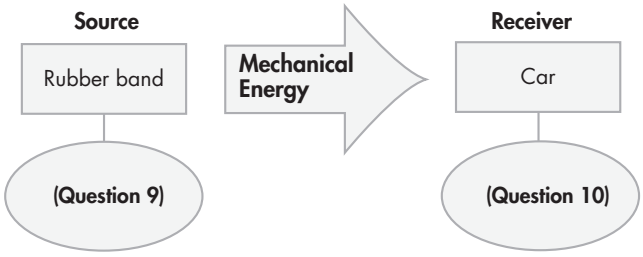
8. When the horse pulls the carriage, what kind of interaction occurs?

a) applied
b) elastic
c) friction
d) drag
e) magnetic

(Questions 9–11) In one of the activities, you pulled a rubber band back different amounts to see what effect it had on the distance a toy car was launched.



The following energy diagram shows the source and receiver for the interaction when the toy car is launched by the rubber band.



9. When the rubber band launches the car, how does the energy change in the **source**?

- **a)** decreases in motion energy
- **b)** decreases in thermal energy
- **c)** decreases in stored chemical energy
- **d)** decreases in stored elastic energy
- **e)** There is no energy change in the source.

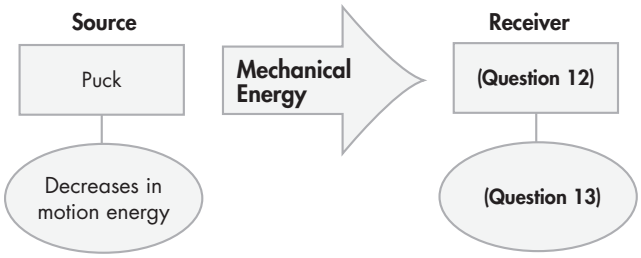
10. When the rubber band launches the car, how does the energy change in the **receiver**?

- **a)** increases in motion energy
- **b)** increases in thermal energy
- **c)** increases in stored chemical energy
- **d)** increases in stored elastic energy
- **e)** There is no energy change in the receiver.

11. The **responding variable** that was tested in this exploration is

- **a)** the roughness of the surface.
- **b)** the distance the toy car moves.
- **c)** the length the rubber band is stretched.
- **d)** the amount of friction interaction between the rubbing wheel parts in the car.
- **e)** the mass of the toy car.

(Questions 12–13) An ice hockey puck slows down as it slides across an ice rink. The following energy diagram shows that the source decreases in motion energy.



12. In the energy diagram, what is the receiver?

a) puck

b) ice

c) puck & ice

13. How does the energy change in the receiver?

a) increases in motion energy

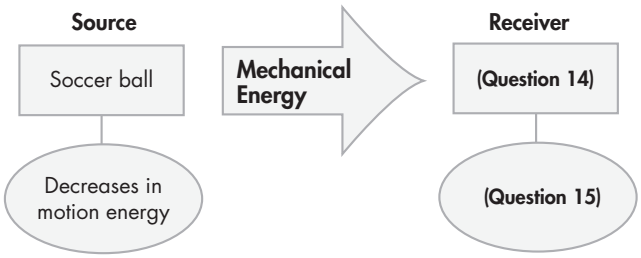
b) increases in thermal energy

c) increases in stored chemical energy

d) increases in stored elastic energy

e) There is no energy change in the receiver.

(Questions 14–15) As a soccer ball flies through the air, it decreases in motion energy.



14. In the energy diagram, what is the receiver?

a) goal

b) foot

c) soccer ball

d) air

15. In the energy diagram, how does the energy change in the receiver?

a) increases in motion energy

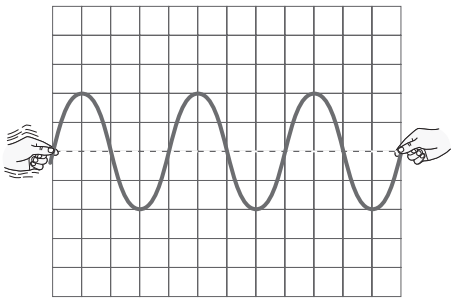
b) increases in stored chemical energy

c) increases in stored elastic energy

d) There is no energy change in the receiver.

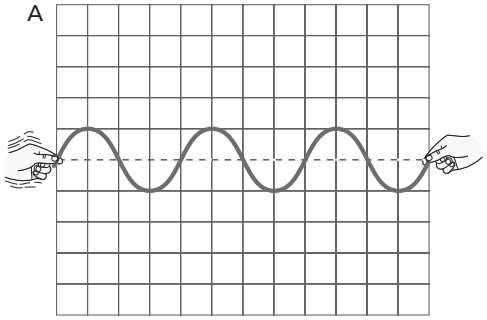
(Questions 16–17) Liz and her friend Ray take a long, stretchy rubber cord and hold it on each end. Liz shakes her wrist back and forth repeatedly to create a wave that looks like the one in the first (original) picture below.

original wave picture:

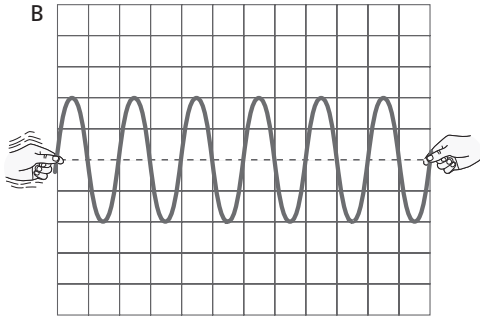


By changing how she vibrates her hand, Liz then generates several other wave patterns, shown in pictures A through D. A background grid is shown to help you make fair comparisons of these wave pictures.

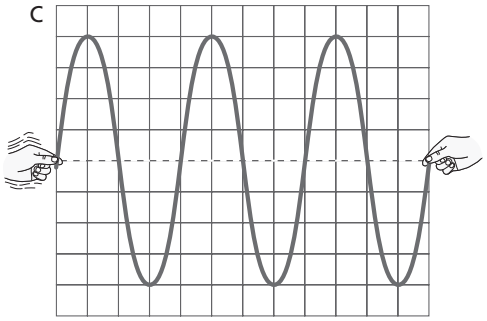
A



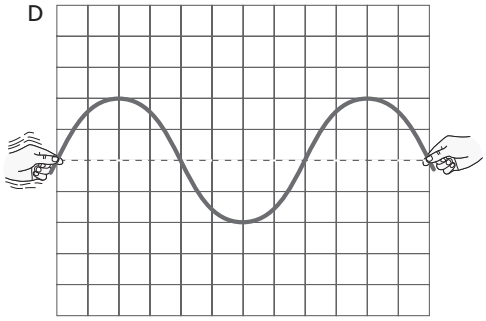
B



C



D



16. Compared to the first picture, which of the above pictures (A, B, C, or D) best represents what the wave would look like if Liz *increases* only the frequency of the wave?

a) A

b) B

c) C

d) D

17. Compared to the first picture, which of the above pictures (A, B, C, or D) best describes what the wave would look like if Liz creates a wave with only a **reduced** (decreased) amplitude?

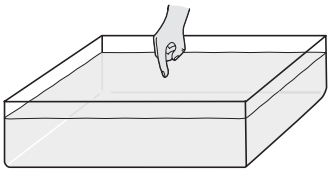
a) A

b) B

c) C

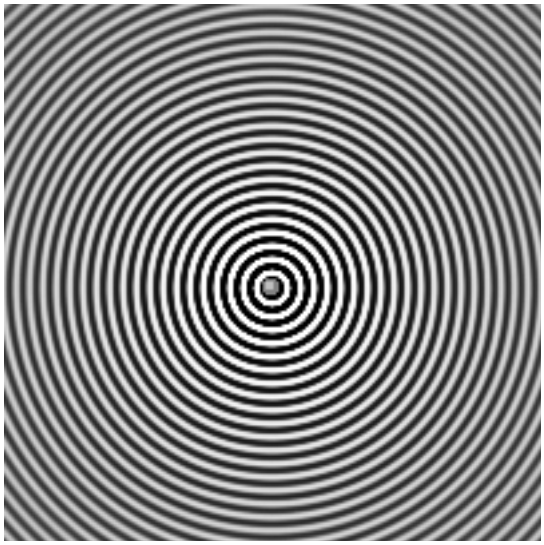
d) D

18. Suppose you dip your finger in and out of water in a large container at four different frequencies. The four wave patterns (**A** through **D**) shown below represent pictures from a top view looking down on the water's surface from above. Which wave pattern (**A**, **B**, **C,** or **D**) has the shortest wavelength?

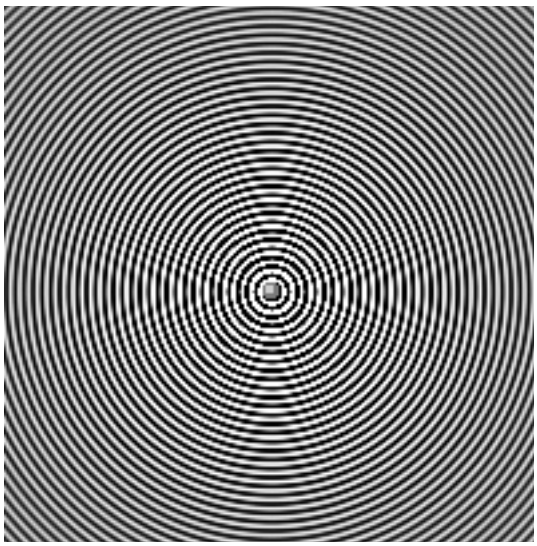


A.

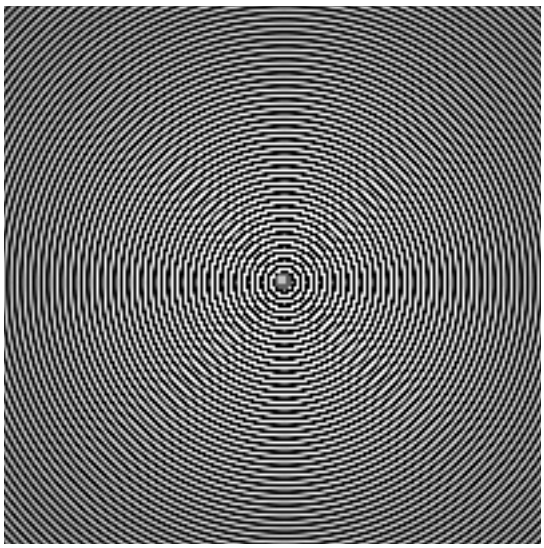
B.



C.



D.



a) A
b) B
c) C
d) D

19. A meter stick is used to measure the amplitude of ocean water waves. At noon, the measured amplitude of a water wave is 50 cm. Later that afternoon, the measured amplitude of a water wave is 70 cm, while all of the other variables are the same for the two water waves. Based on these amplitudes, which of these statements correctly describes the difference between the 50 cm and 70 cm amplitude water waves?

a) The 70 cm wave has a greater frequency than the 50 cm wave.

b) The 70 cm wave transfers less energy than the 50 cm wave.

c) The 70 cm wave transfers more energy than the 50 cm wave.

d) The 70 cm wave has a longer wavelength than the 50 cm wave.

e) The 70 cm wave has a shorter wavelength than the 50 cm wave.

20. Where can sound waves **NOT** travel?

a) through water

b) through air

c) through the ground

d) through metals

e) through a vacuum

21. In a Secondary earthquake wave (S wave), the Earth's material (medium) moves back and forth at right angles (sideways) to the direction that the wave travels through the medium. Which kind of wave does this particle motion in the S wave describe?

a) compression wave

b) transverse wave

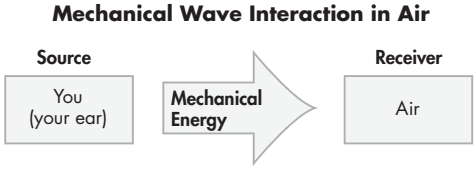
c) sound wave

d) surface wave

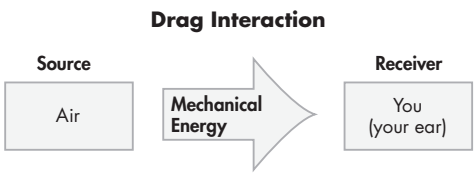
e) long wave (L wave)

22. During lunch, a friend yells for you to sit with him. Which energy diagram best describes the source, receiver, and type of interaction related to the sound your friend makes in calling you?

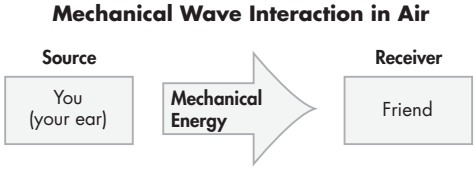
a)



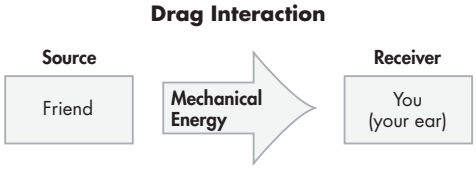
b)



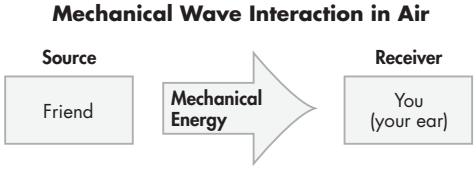
c)



d)



e)

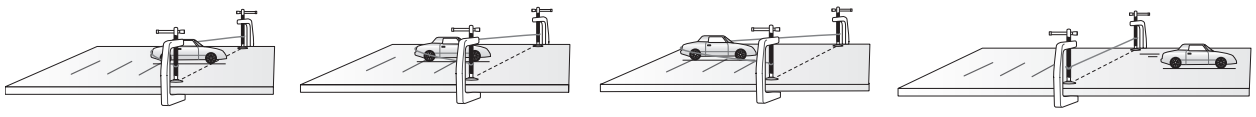


Part II: An Exploration with Rubber Bands

(Questions 23–25) Refer to the following situation.

A group of students were investigating elastic interactions and were interested in determining the answer to the following question:

If the width of a rubber band used to launch a toy car changes then what happens to the distance the toy car moves?



To find out, they did an exploration using three rubber bands of the same material, length, and thickness but with different widths: thin, medium, and wide. The toy car was then launched by a rubber band that was pulled back the same amount for each rubber band. The toy car rolled across the floor, and the distance it rolled was measured in centimeters with a meter stick.

The car was launched four times for each rubber band and the distance the toy car moved was measured each time. These distances for each of the four trials were averaged and the students recorded this average as the best value in the table below.

Table: Width of Rubber Band vs. Average Distance Toy Car Moved

Width of Rubber Band	Average Distance Toy Car Moved (cm)
thin	75
medium	94
wide	113

Assume the exploration was a fair test. The uncertainty for each distance was 3 cm. Answer the following questions.

23. The **manipulated variable** in this exploration was

a) the material that the rubber bands are made of.

b) the width of the rubber band.

c) the distance the toy car moved.

d) the length the rubber band was stretched.

e) the mass of the toy car.

24. Which variable was kept the same (**controlled**) during the exploration?

a) the width of the rubber band

b) the distance the toy car moved

c) the length the rubber band was stretched

25. Write your **experiment conclusion** and evidence in this form:

If the _____ increases,
(Write the *manipulated variable*.)

then the _____
(Write the *responding variable* and whether it *increases*, *decreases*, or *stays the same*.)

because _____
(Write your reasons supported by evidence.)

Use *How To Evaluate an Experiment Conclusion* to evaluate whether your conclusion is good. If it is poor, rewrite it.

_____

_____

_____

_____

Part III: Analyzing and Explaining a Mechanical Interaction

(Questions 26–28) When writing your analysis and explanation for this task, use interaction and energy ideas from *InterActions*. Your analysis and explanation should be able to pass an evaluation using *How To Evaluate an Analysis and Explanation*.

A softball is thrown toward a stretchy net called a "pitch-back." The softball bounces off the net and returns to the thrower.

Task: Analyze and explain why the softball slows down when it hits the net.

26. Analysis: Identify the interacting objects and their type of interaction.

27. Draw the energy diagram.

28. Explanation: Write your explanation using complete sentences.

Part IV: Learning About Questions

29. A bus comes to a stop to drop off and pick up passengers. It slows down from 14 m/s to a stop over a distance of 56 meters in 10 seconds. While the bus is slowing down, what is its average speed?

a) 1.4 m/s

b) 4.0 m/s

c) 5.6 m/s

d) 7.0 m/s

30. Jasper, a young dolphin, wandered away from his pod while chasing after a tuna fish. Now he wants to return home. He emits a high-frequency whistle and 6 seconds later, he hears an echo that he recognizes as having reflected off his mother. If the speed of sound in ocean water is approximately 1500 m/s, about how far does Jasper have to swim to find his mother? (Assume that she doesn't wander off.)

a) 500 meters

b) 1500 meters

c) 4500 meters

d) 9000 meters

31. The plot shows how distance changes with time for a car whose speed varies over a period of 10 seconds. What is the average speed of the car?

a) 5.0 m/s

b) 9.0 m/s

c) 10.0 m/s

d) 15.0 m/s