Name ______________________ Date ____________ Class ____________

Enrich

What Are Waves?

Waves are all around you, even in plants and animals. Read the passage and study the diagrams. Then answer the questions that follow on a separate sheet of paper.

Waves in the World Around You

- The cowboy shown in Figure 1 is practicing his rope tricks. The whirling loop of the lasso spins in a circle just above the ground. As it spins, it develops a kink. This kink is a traveling wave.
- In Figure 2, the plastic frog "jumps" when the spring is compressed and then released. A wave travels through the spring with each jump the frog makes.
- The garden snake shown in Figure 3 is slithering across the ground. As it moves, two types of waves pass through its body. When the snake moves forward, its body makes an S-shaped wave. In addition, contractions ripple down the snake's body as it slithers along. Muscles underneath the snake's skin extend from its head down its body towards its tail. These muscles contract and relax in a steady pattern in the direction of the arrows. The periodic contraction and relaxation of the snake's muscles propel it forward through the grass.

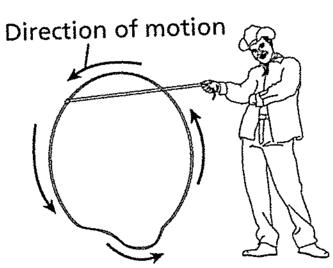


Figure 1

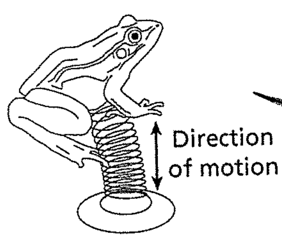


Figure 2

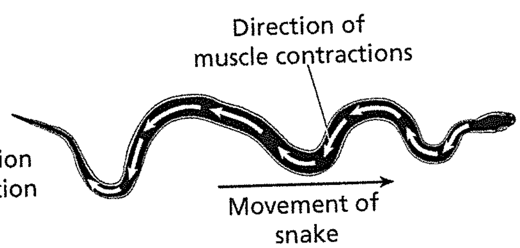


Figure 3

1. Does the kink in the lasso travel as a transverse or longitudinal wave? Explain your answer.
2. What type of wave passes through the spring in the frog toy? Explain.
3. What type of wave does the snake's body make as the snake moves forward? Explain your answer.
4. What type of wave do the contractions of the snake's muscles make as the snake moves forward? Explain.
5. Describe another plant or animal in which you can observe wave motion.

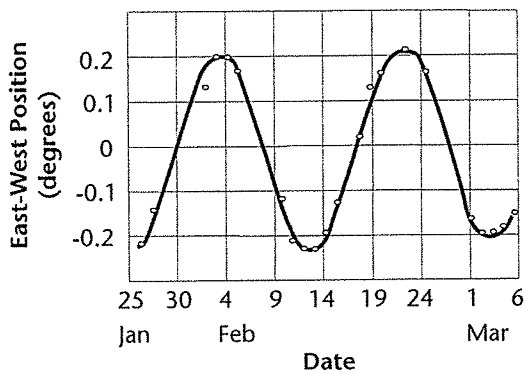
Name ______________________ Date ____________ Class ____________

Enrich

Properties of Waves

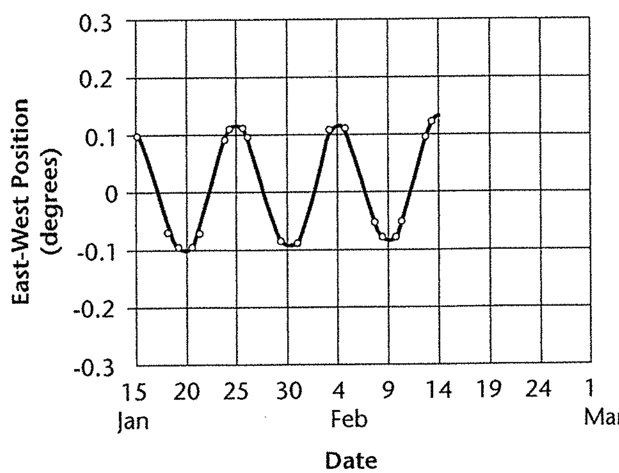
The graph below shows data the Italian astronomer Galileo collected based on his observations of the position in Earth's sky of Callisto, one of Jupiter's moons. The *x*-axis shows the dates when the observations were made, and the *y*-axis indicates the east-west position of Callisto in the night sky. Study the graph, read the passage, and then answer the questions that follow on a separate sheet of paper.

Moon Waves



This wavelike pattern of motion is due to the fact that Callisto is revolving around the planet Jupiter. The wavelength of this graph, about 17 days, represents the time it takes for Callisto to complete one orbit around Jupiter. (In most wave diagrams, wavelength is a measure of distance. Notice that in this case, wavelength is a measure of time.)

The amplitude of the wave diagram can be used to determine the diameter of Callisto's orbit around Jupiter. The amplitude of the motion is about 0.2 degree. Each degree corresponds to about 10,000,000 km. So, the diameter of Callisto's orbit is about 4,000,000 km (0.2 × 2 × 10,000,000).



1. Imagine that you have discovered a new moon of Jupiter. You observe the moon's position in the sky over a period of several nights. You use your data to make the graph at the right. How long does it take this moon to revolve around Jupiter?
2. What is the amplitude of this moon's motion? What is the diameter of its orbit around Jupiter? (*Hint:* Remember that each degree equals 10,000,000 km.)
3. Predict the motion of this moon over the next few nights. Continue the line of the graph to show this motion.

Name ______________________ Date ____________ Class ____________

Enrich

Interactions of Waves

Read the passage and study the diagrams. Then answer the questions that follow on a separate sheet of paper.

Interference of Pulses

If you and a friend hold a rope between you and one of you flicks the rope, the wave that travels along the rope is called a pulse. If you and your friend each give an upward flick to the rope at the same time, two pulses will travel down the rope in opposite directions. Figure 1 shows what happens as the pulses travel through each other.

Figure 2 shows what would happen if you gave an upward flick to the rope at the same time as your friend gave a downward flick to the rope. When these two pulses travel through each other, their amplitudes also "combine." But in this case, the amplitude of the downward pulse is "subtracted" from the amplitude of the upward pulse.

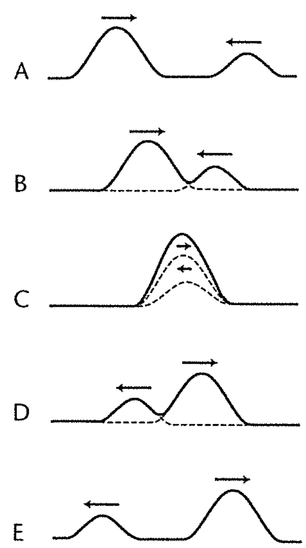


Figure 1

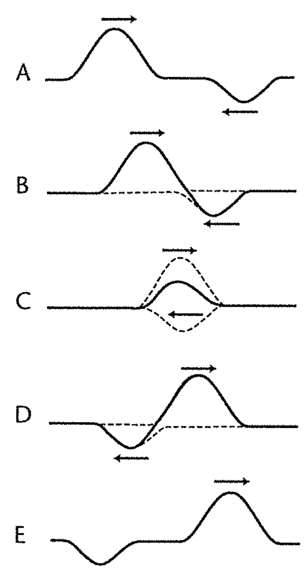


Figure 2

1. Does Figure 1 show constructive or destructive interference? Figure 2? Explain.
2. The pulse traveling toward the left in Figure 1A has an amplitude of 2 cm. The pulse traveling toward the right has an amplitude of 4 cm. What is the amplitude of the pulse in Figure 1C?
3. Refer to question 2. What are the amplitudes of the pulses in Figure 1E?
4. The pulse traveling toward the left in Figure 2A has an amplitude of 3 cm. The pulse traveling toward the right has an amplitude of 5 cm. What is the amplitude of the pulse in Figure 2C?