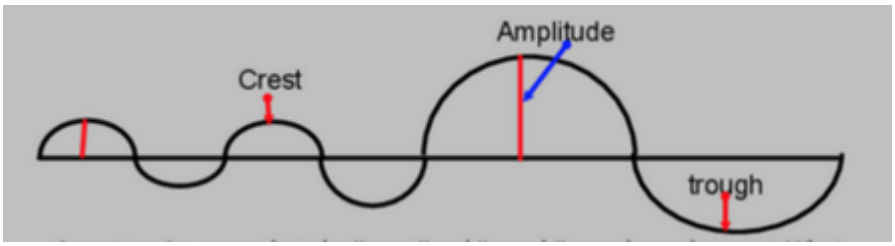
4-PS-1. Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move. [Clarification statement: Examples of models could include diagrams, analogies, and physical models using wire to illustrate wavelength and amplitude of waves.] [*Assessment boundary: Assessment does not include interference effects, electromagnetic waves, non-periodic waves, or quantitative models of amplitude and wavelength.*]

Practice: Developing and Using Models

Crosscutting Concept: Patterns

Task 1



1. Describe the pattern in this diagram of a wave.

2. What is a wave?

3. What is an example of a wave that you experience in everyday life? Explain your example. What makes it a wave?

adapted from: http://betterlesson.com/lesson/resource/3209499/using-what-we-have-learned-and-observed-to-move-on?from=lessonsection_narrative

Task 2

(Students have a tuning fork.) With the tuning fork, the answer the following questions:

1. Strike a tuning fork and place one of its tines against a cup of water. What happens to the water?

2. Record your observations in table below:

Object	Volume: Was the sound loud or soft?	Pitch: Was the sound high or low?	Frequency: Did the water vibrate fast or slow?
Tuning Fork			

3. Draw a scientific model that shows what happens when you strike the tuning fork and place it against the cup. Label each thing in your model. Be sure to show amplitude and wavelength.

4. Use your model to explain how the water moves.

Adapted from:

https://www.teachengineering.org/view_activity.php?url=collection/cub_/activities/cub_energy2/cub_energy2_lesson05_activity1.xml

Task 3

You toss a giant rock into a pond with leaves floating on top of the water. Complete the storyboard below to model how and why the leaves move after the rock lands in the water. Draw where the leaves might move in each box and write a description explaining what is going on above the box.

1. The leaves in the water before the rock.

2. _____

3. _____

4. _____

Task 4

1. What is **amplitude**?

a) The highest part of a transverse wave.

b) The lowest part of a transverse wave.

c) The distance between one crest and the next in a transverse wave.

d) The height from the resting position to the crest of the transverse wave.

2. How do you find the **wavelength** of a transverse wave?

a) Find the distance between one crest and the next trough of the wave.

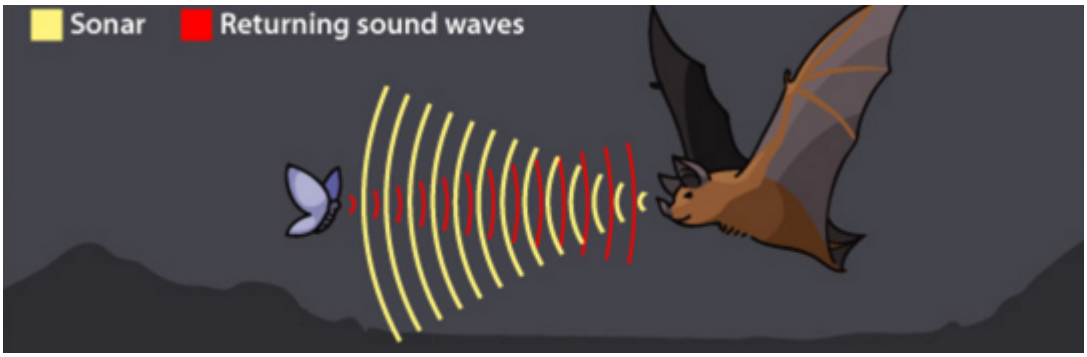
b) Find the distance between one trough and the next crest of the wave.

c) Find the distance between one trough and the next trough of the wave.

d) Find the amplitude.

Task 5

Echolocation is the use of sound waves and echoes to determine where objects are in space. Bats use echolocation to navigate and find food in the dark. To echolocate, bats send out sound waves from their mouth or nose. When the sound waves hit an object they produce echoes. The echo bounces off the object and returns to the bats ears. Bats listen to the echoes to figure out where the object is, how big it is, and its shape. The image below shows an example of the sound waves involved.



A. Draw a model showing how echolocation works - include amplitude and wavelength in your model.

B. Using your model, write an explanation for how the sound waves work when bats are using echolocation.

C. Referring to your model, describe what pattern of waves would result in the bat recognizing it was very close to an object.

Echolocation Source: https://askabiologist.asu.edu/echolocation