Follow the Energy

Model how a wave moves energy from a source to an object.

PHS.6.3 "Generate wave models to explore energy transference."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Number the hand, traveling pulse, and block in the order that energy reaches them; circle the tape flag's motion and underline two other paths energy can take when the pulse reaches the block.

A Pulse Across the Table

1. At a makerspace, a student stretches a rope across a table and attaches its far end to a light foam block that can slide. A small tape flag marks one spot halfway along the rope. The student flicks the near end upward and then returns the hand to its starting place. A single bump travels toward the block. The tape flag rises and falls as the bump passes, but it does not travel down the table with the bump. The moving pattern carries energy along the rope, even though the marked section stays near its original position.

2. On two trials, the student makes pulses with the same shape but different heights, keeping the same rope and tension. The taller pulse carries more energy than the shorter one. In a sketch, the student could show the hand at the left, a bump on the rope, and the block at the right. An arrow along the rope would track the bump and its energy. A separate up-and-down arrow at the flag would track the rope's local motion. These arrows point in different directions because movement of a rope segment is not the same as travel of the pulse.

3. When a pulse reaches the block, the block slides a little. Its motion shows that some energy has moved from the rope to the block. A smaller pulse may travel back toward the hand, showing that some energy remains in the rope as a reflection. Friction between the block and table and internal friction in the rope can turn some organized motion into thermal energy. A useful model includes these possible paths rather than claiming that every bit of the incoming energy makes the block slide. If the block is heavier, the amounts transferred and reflected may change.

2 ANSWER WITH EVIDENCE

Use the passage

1. Describe two arrows you would add to a model: one for the pulse's energy and one for the tape flag's motion. Which way does each point?

2. The student makes two pulses with the same shape in the same rope at the same tension. How would you model the difference in their energy if one pulse is taller?

3. After the pulse reaches the block, the block slides and a smaller pulse travels toward the hand. Show where energy goes in a model of this event.

4. A student's model shows all the incoming energy becoming block motion. What two other energy paths should the student add?

3 YOUR TURN

Your own words

Draw a two-panel model of sound from a speaker transferring energy to thin plastic wrap stretched over a bowl. Label the speaker, compressed and spread-out air, an energy arrow, and the wrap's motion; add one sentence explaining why air does not need to travel from the speaker to the bowl.

ANSWER KEY

Follow the Energy

HIGH SCHOOL · PHS.6.3

PART 1 · READ AND MARK

Number the hand, traveling pulse, and block in the order that energy reaches them; circle the tape flag's motion and underline two other paths energy can take when the pulse reaches the block. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Describe two arrows you would add to a model: one for the pulse's energy and one for the tape flag's motion. Which way does each point?	**The energy arrow points along the rope toward the block. An up-and-down arrow shows the tape flag's motion.**
2	The student makes two pulses with the same shape in the same rope at the same tension. How would you model the difference in their energy if one pulse is taller?	**Draw the pulses at different heights and label the taller pulse as carrying more energy.**
3	After the pulse reaches the block, the block slides and a smaller pulse travels toward the hand. Show where energy goes in a model of this event.	**Show energy transferred to the moving block and energy traveling back along the rope in the reflected pulse.**
4	A student's model shows all the incoming energy becoming block motion. What two other energy paths should the student add?	**Add a reflected pulse carrying energy back along the rope and thermal energy produced by friction.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Panel 1: A speaker sends alternating compressed and spread-out regions through the air. A right-pointing arrow shows energy traveling toward the bowl, while a short double-headed arrow shows nearby air moving back and forth. Panel 2: The energy arrow reaches the plastic wrap, which has arrows showing it vibrating. Air moves back and forth near its starting place as the sound wave carries energy to the wrap.

Accept models that distinguish wave travel from local motion. For the sound model, air motion should be back and forth in the direction of wave travel, and the wrap should receive energy and vibrate.