Waves (Wave-like)

TRANSVERSE

Students are divided into two groups to give both an opportunity to not only be a part of the wave but also observe the wave. Students will sit in chairs.

As you do this, go back and forth between rows so students have equal experiences being part of the wave model and the opportunity to observe the wave model.

First, just have each side do the human wave. Explain that we will sit (so they don’t get tired) and no yelling. ☺

After they’ve practiced, ask WHAT WERE SOME INCONSISTENCIES YOU NOTICED THAT MAY HAVE HAPPENED THAT WE CAN WORK ON TO MAKE OUR HUMAN WAVE BETTER? (some of the answers may include: timing, arms not at same time, etc.)

Focus on arms and have all students to raise their arms fully. Tell them this will be how they should move their arms during next wave. Give them time to practice just moving arms in wave-like motion all at once. Next, tell them to wave their arms with you as the trigger of when to raise arms. Do with both groups as many times as needed, walking slowly, regularly and at a run. Ask them what was different about the waves. They will notice speed. Ask questions about speed. (rate (what unit of measurement would we measure this wave?),etc.)

Next say, THIS TIME LETS DO A LOW WAVE. Show them how high their arms should be raised. (look like a t-rex) Tell them to do this on their own at a regular speed. Next do a medium height. Show how high to raise arms (even with top of head, eyes). Ask them to do a fast wave. Ask, IF WE ARE GOING TO DO A FAST WAVE, WHEN SHOULD WE BEGIN RAISING OUR ARMS? Come to an agreement. (usually when the next person’s hands leave their lap)

Do this with high, med, low wavespeed agreeing when to start for each one. Once that is established, will just remind them. After a little while introduce or ask about amplitude. Connect to height of hands. A misconception will be to slow arms during a slower wave. Remind them that the trigger of WHEN to start raising their arms determines the wavespeed, not the height of their arms.

\*\*\*Remind group that wavespeed is not in 4th grade standard.\*\*\*

Give one row a rope, cord, or something that will help others see the wave model. As they are doing the human wave that you describe (e.g., low amplitude/high wavespeed), yell FREEZE. If you do this at the right time, the wave will be obvious. May take a few tries to be able to see it.

Point out the crest(s) and trough(s). As they stay frozen, ask them how long the wave is in terms of students. Make sure you either have two crests or two troughs. Some will count total number of students in row. Some will eventually get that they count students from one crest to next (or troughs). May have to guide them toward this.

This time tell them their model will have multiple waves. Trigger the person on the end by snapping or tapping on shoulder. (will still have to give description of wave, e.g., high amplitude/high speed) Have the other side count how many times the wave went down the row. Introduce frequency. Discuss.

After multiple examples on both sides, put rope down and ask WHAT IS TRAVELING DOWN THE WAVE? DID A STUDENT MOVE DOWN THE ROW? Introduce medium during this time. Discuss ENERGY just a little. Have one person stand with a beach ball at end of row. Send a high amplitude wave down and have them observe the beach ball (the last person’s hands should hit the ball and knock it out of the other person’s hands.

Now do the other row with a LOW amplitude wave. The ball won’t go as high. Have a discussion about the energy in relation to amplitude. Parallel and perpendicular motion needs to come out sometime.

GROUP ACTIVITY WITH SLINKY.

LONGITUDINAL

Have students get in a straight line facing one end. Their hands are on the person’s shoulders in front of them with ELBOWS LOCKED. Tell them you are going to use a regular/medium amplitude. Push on person’s back who is last in line. Have them sit. Let other side of room tell observations they made. Let this side of room comment about what they FELT. Encourage them to discuss the ENERGY they felt. Ask about the backward and forward motion. How is that different than transverse? Discuss differences in longitudinal and transverse they notice.

Do this on other side of room with a HIGH Amplitude. Same discussion as before. Ask WHAT IS DIFFERENT ABOUT THE WAY I’M USING THE WORD AMPLITUDE IN A LONGITUDINAL WAVE. Higher amplitude gives higher energy.

GROUP ACTIVITY WITH SLINKY.

ELECTROMAGNETIC

Introduce electromagnetic by citing examples of this type of wave. Discuss that they are different than transverse and longitudinal in that they do NOT have a medium.

Conga Line - Tom told them radio stations have to shake electrons to get the wave started. That is the transmitter. Ask group WHAT HAPPENS WHEN AN ELECTRONIC FIELD IS FORMED? Our hs people will be able to answer. Middle schoolers would have to be told. He got an ‘electron’ label (circle with an e) and held it on his hip and ‘shook’ sideways. When the audience says magnetic field, one of the facilitators will grab a ‘magnetic’ field label. Get behind the ‘electron’ field and move the magnet label up and down with arms. Ask now what is this magnetic field going to form? ELECTRON FIELD Some other person will grab an electron label and get in line, shaking side to side. Form a conga line and keep adding the next field until all labels are used up. Discuss medium and parallel and perpendicular motion.

Transmitter/Receiver activity (MIDDLE OF ROOM)

One person will be transmitter. Another will be the receiver and one more will write down what the receiver tells them to write. The facilitator will show the transmitter what to transmit.

Explain that we can only send a one or zero and why. With a rope between the transmitter, who will ‘flick’ the rope the number of times (a one is 1 flick and a zero is two flicks) and the receiver, whose hand is a couple of inches away of rope. This person will feel the rope hit their hand and will tell the other person if it is a one or zero. (Code could be 1, 0, 0, 1, 1, 1)

Have two cups with a string. Get a volunteer to listen to what facilitator is saying. Do a code with ones and zeros. Now flick the string while the person holds the cup to ear. Which is easier to ‘decode’? Discuss digital and analog here. Explain about the number of codes that must be sent for a picture to be texted. (the resolution -1024x680, the color: ALL USING ONES AND ZEROS!) Technology has become so fast that digital is faster even though so many numbers.

GROUP ACTIVITY

With jump ropes at their tables, one person will create a code and transmit it to a receiver at the table.