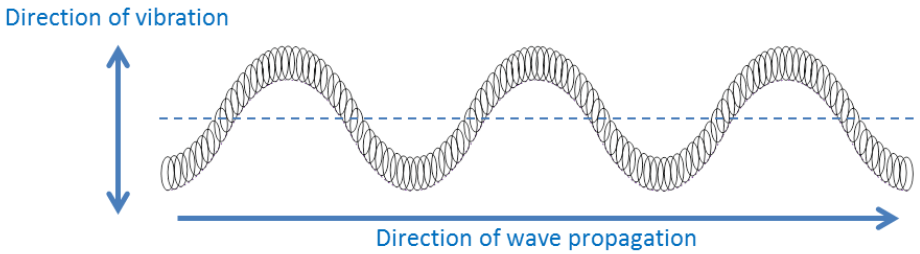
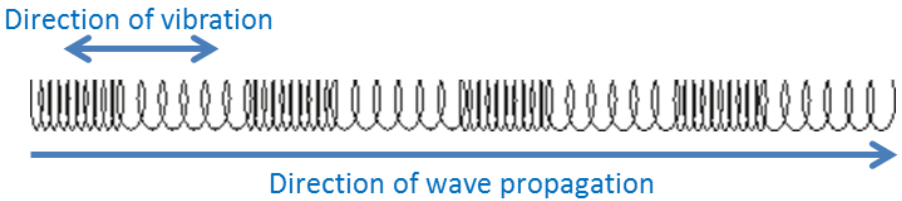
Mathematics of Waves and Materials

Activity 1. Slinky Waves



1. This is a *transverse / longitudinal* wave *(delete one)*
2. Label a *crest* and a *trough*
3. Mark the wavelength and amplitude on the diagram



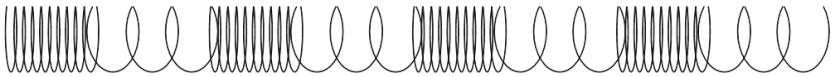
4. This is a *transverse / longitudinal* wave *(delete one)*
5. Label a *compression* and a *rarefaction*
6. Mark the wavelength on the diagram

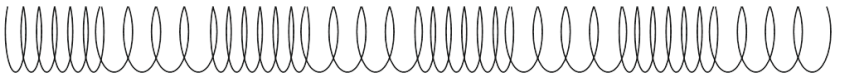
7. Sound waves are *transverse / longitudinal. (delete one).*
8. The A..... of a sound wave tells us about the V..... (how loud or soft the sound is).
9. The F..... of a sound wave tells us about the P..... (how high or low the sound is).

In sound waves, the amplitude is a measure of how densely the particles bunch together in a compression or how thinly they spread apart in a rarefaction, compared to the equilibrium position. Louder sounds have a greater difference.

The particles in a sound wave can be represented by the coils of a slinky.

10. Which of the slinky waves below (A or B) represents the louder sound?

A 

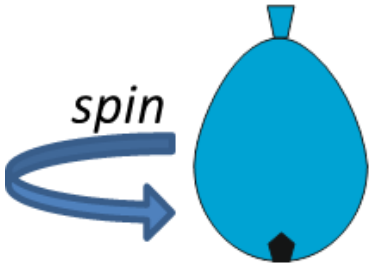
B 

Activity 2. Balloons: Thinking about sound as a vibration

1. Which balloon makes the loudest noise when spun: the one with the nut or the one with the marble?

2. Why is it louder (think about the shapes of the objects)?

3. What happens to the pitch of the noise when the balloon is spun more quickly?

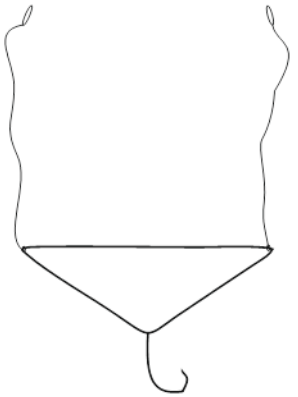


Activity 3. Objects on strings: Sound travelling through different media

1. When you are not touching your face what do the vibrations travel through to reach your ears?

2. When your fingers touch your face in front of your ears, what do the vibrations travel through to reach your ears?

3. *The sound travels more easily through the s……. than through the a…… because the p……in the s…… are closer together.*



Activity 4. Sci-fi slinky

1. What happens to the noise the slinky makes when the pot is attached?

It gets .....

2. Why do you think this happens? (Think about how the vibrations are transferred from the slinky to the air)

Activity 5. Box Guitars: investigating pitch and amplitude

The box amplifies the sound from the rubber band.

1. Can you name two musical instruments that amplify sound in a similar way?

2. Which rubber bands vibrate more quickly:

    a. *Thick or thin bands?*
    b. *Loose or taut bands?*

3. What happens to the pitch of the note as you move the pens closer together?

4. How does a guitarist or violinist alter the string length while they play?

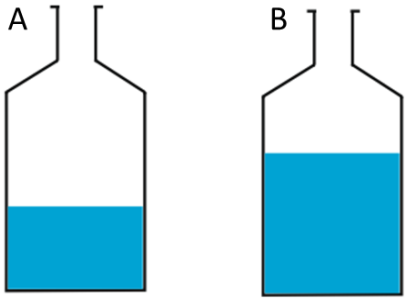
Activity 6. Bottles

1. Which bottle, A or B, will produce the highest note when gently tapped?

   Explain your answer.

2. Which bottle, A or B, will produce the highest note when blown across the opening?

   Explain your answer.



Activity 7. Wind instruments, length and pitch: straw oboes

1. What is the purpose of the “reed” shape cut into the straw oboe?

2. Will a longer straw will make a higher or lower pitched note?

Activity 8. Boomwhackers

1. Compare two Boomwhackers of different lengths. Which (longer or shorter) produces the highest note?

2. What happens to the pitch of the note when you cap one end of the Boomwhacker?

*The pitch goes up/down (*delete one*) by one o……..*

3. Measure a Boomwhacker.

   The length of the Boomwhacker is …….metres

4. An uncapped Boomwhacker plays a note with a wavelength twice its length

The wavelength of the note from my Boomwhacker is

…….metres

5. Use the table to find and circle the frequency of the note played by your Boomwhacker

Boomwhacker note	**Frequency in Hz (s^{-1})**
Low C (red)	256.0
D (orange)	288.0
E (yellow)	320.0
F (light green)	341.3
G (dark green)	384.0
A (purple)	426.7
B (pink)	480.0
High C (red)	512.0

Speed of sound (m/s) = Wavelength (m) x Frequency (s^{-1})

6. Use the formula above to calculate the speed of sound in air in metres per second.

   Answer …….m/s