32 Waves

EQUIPMENT

Slinky spring
Plastic cups (or empty tins) with holes in the base
String
Scissors
Baby wipes

RISKS

Cut injuries from scissors (and sharp edges on tins if used).

SESSIONS

1). Discuss what is a 'wave'.
Show video of surfer on a large wave.

2). Discuss what happens to the water in a water wave.
Rotating action.
Show animation of water being sucked back by the waves on a beach.

3). Show Exams hall video as an example of a Mexican wave.
https://www.youtube.com/watch?v=BBPlTa64Aeg

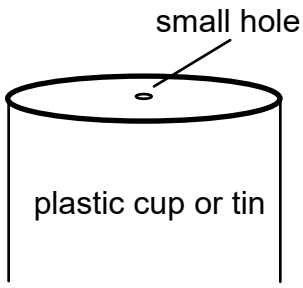
4). Set up a Mexican wave with students.
Repeat with Mexican wave passing objects (books).
Emphasise that parts of a wave do not move very far (vibrate), but energy (objects) pass along the wave.

5). Demonstrate waves on a slinky spring.
Transverse and Longitudinal
Discuss sound waves as Longitudinal
Show longitudinal wave animation.
Sound waves need a medium.

6). Make string telephones in pairs and test.
The holes in the plastic cups/tins can be drilled using a drill of around 3mm.
To make the hole in a plastic cup, heat the blade end of a thin screwdriver in a gas flame and then push the heated end through the centre of the base of the plastic cup.
To make the hole in a tin, place the tin on a firm surface with the base upwards. hold a sharp, thin nail in the centre of the base of the tin and gently tap with a hammer until the hole is formed.

7). Convert string telephones to screechers.
Discuss why they work.

Tin Can Telephone



You will need:-

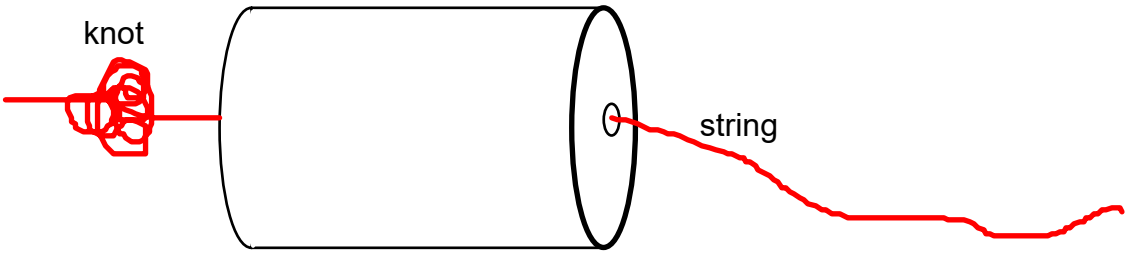
Two clean and empty tins, or plastic drinking cups,
a length of thin string,
thin screwdriver for hole in plastic cups,
a small nail, and hammer for hole in tins,
or use a 3mm drill for either
(match stick)

Construction

1). Ensure that the tins/cups are clean and that there are no sharp edges.

2). To make the hole in a plastic cup, heat the blade end of a thin screwdriver in a gas flame and then push the heated end through the centre of the base of the plastic cup.
To make the hole in a tin, place the tin on a firm surface with the base upwards. hold a sharp, thin nail in the centre of the base of the tin and gently tap with a hammer until the hole is formed.

3). Thread one of the ends of the string through the hole in the bottom of the cup/tin and tie several knots in the string to stop it from slipping back through the hole.
If the hole is very large, the string can be tied around half of a match stick.
Do the same for the other tin/cup.

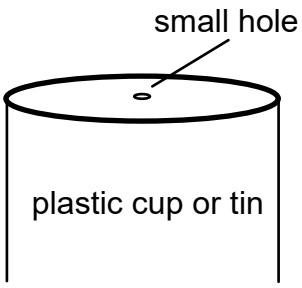


4). With a partner, each hold a tin and walk apart until the string becomes tight.
One person holds their tin to their ear and the other speaks into their tin, while keeping the string tight. The person with the tin to their ear should be able to hear, through the tin, what the other person is saying.

How it works.

When the person talks into the cup/tin, the sound makes the bottom of the cup/tin vibrate. These vibrations pass along the string to the other cup/tin, where they make the bottom vibrate. These vibrations make the air in the tin vibrate, enabling the person listening to hear what the other person said.

Screecher, Howler and Growler



You will need:-

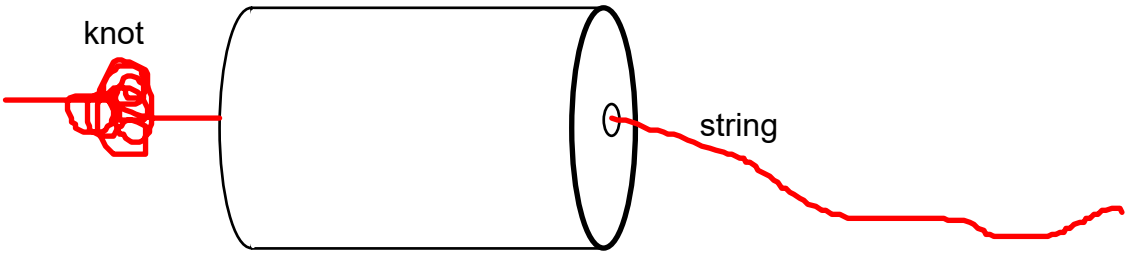
Two clean and empty tins, or plastic drinking cups,
a length of thin string,
thin screwdriver for plastic cups,
a small nail, and hammer for tins,
or use a 3mm drill for either
(match stick)

Construction

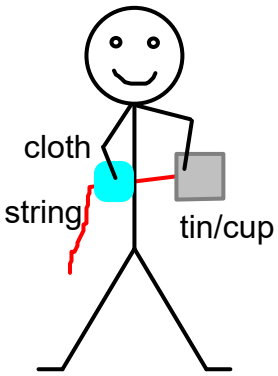
1). Ensure that the tin or plastic cup is clean and that there are no sharp edges.

2). To make the hole in a plastic cup, heat the blade end of a thin screwdriver in a gas flame and then push the heated end through the centre of the base of the plastic cup.
To make the hole in a tin, place the tin on a firm surface with the base upwards. hold a sharp, thin nail in the centre of the base of the tin and gently tap with a hammer until the hole is formed.

3). Thread one of the ends of the string through the hole in the bottom of the cup/tin and tie several knots in the string to stop it from slipping back through the hole.
If the hole is very large, the string can be tied around half of a match stick.
Pull the knot to the bottom of the cup/tin.



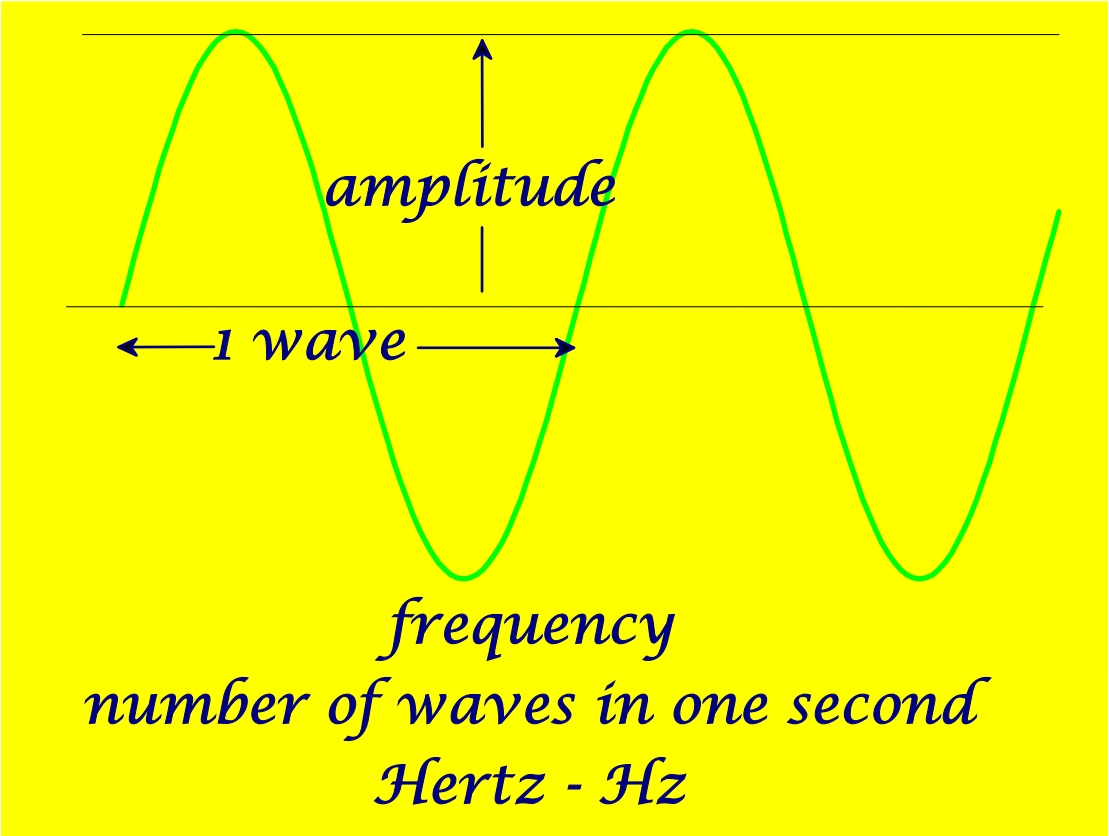
4). Holding the cup/tin near to the base with one hand, pull a wet cloth along the string.
You may need to adjust how tightly you hold the cloth on the string, but when you get it right, the tin/cup should produce a loud screeching noise.



5). The pitch of the sound produced depends on the size of the tin/cup. Small tins/cups produce high pitched screeches, while larger tins and cups produce lower pitched howls.
To produce growls, a large cardboard box can be used.
For a cardboard box, it is worth tying the string around a pencil, to secure it inside the base of the box. This is easier than trying to tie a very large knot.

How it works.

When the wet cloth is pulled along the string, friction between the cloth and the string prevents the cloth moving until the pulling force exceeds a certain value (dependent on the cloth and string).
When this value is exceeded, the cloth slips, the pulling force is reduced, which sends a pulse along the string to the base of the cup/tin. This produces a loud click from the cup/tin.
With the pulling force reduced, friction again stops the cloth moving until the pulling force again exceeds the frictional force, and the process repeats.
When this repeats quickly, the loud clicks form a screeching/howling/growling noise.
Bowing a violin string works in much the same way.


amplitude
1 wave
frequency
number of waves in one second
Hertz - Hz