Subject: Science

Level: Standard 4

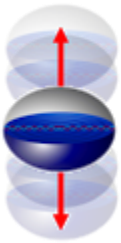
Strand: Form and Function

Topic: Properties of Materials –Ability to transmit sound

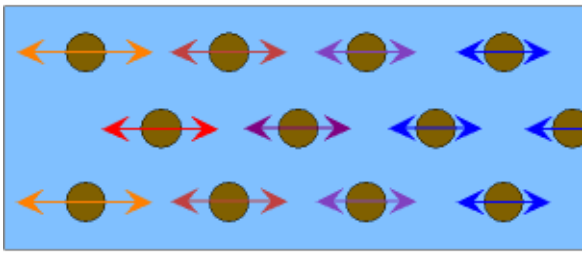
Key Points:

- Sound is a type of energy.
- Sound is made by plucking, striking, shaking, scrapping and blowing.
- Sound travel through matter
- There is no sound in outer- space as sound needs a matter/medium to travel through e.g. solid, liquid or a gas
- Sound is heard when sound waves enter the ear and a message is sent from the ear to the brain.
- Sound waves causes vibrations (movement of particles back and forth or up and down)

Particle Vibration



http://energywavetheory.com/photons/vibration.htm



https://www.gcsescience.com/pen5-heat-conduction-

- Vibrations which can also be felt by different parts of the body for eg.by placing the fingers at the front of the neck while speaking
- The transmission of sounds by materials deals with movement of sound from one material to another.

Activity: Experimenting with sound

Sound energy travels through vibrations of the material it passes through.

Sound energy passes better through solids than liquids or gases.

i.	A square of plastic wrap is placed over the open end of a plastic bowl.
ii.	The wrap is secured tightly in place with a rubber band (see picture).
iii.	Pieces of paper are tightly rolled into balls and then placed on the plastic wrap cover.
iv.	The bowl with paper balls is plaed next to and touching the speaker attached to a CD player (laptop or phone).
v.	The music is turned, first softly and then the volume is increased. The paper balls are observed.

a) What do you think happens to the paper balls as the loudness of the music is increased?

_____

b) What else can be done to make the paper balls move/jump higher?

_____

c) What would happen if the volume of the music is kept the same but the bowl (with paper balls) is moved further away from the speaker?

_____

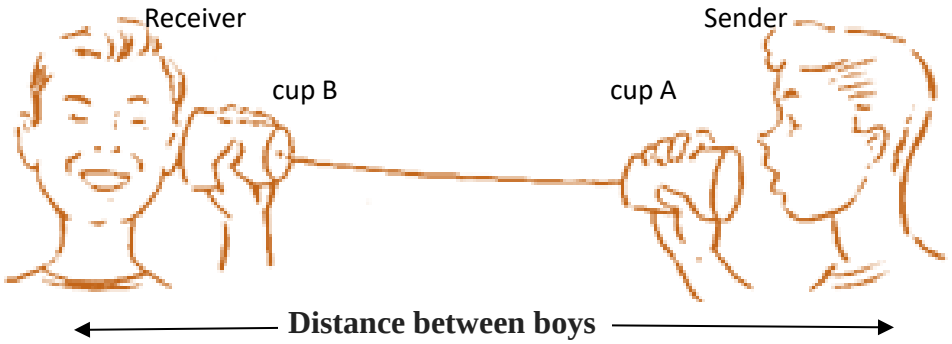
Give a reason for your answer.

_____

_____

d) Would the paper balls move as high, if crepe paper is used instead of plastic wrap?

_____



How does a string phone work?

STEP 1: The sound of the person who is speaking (sender) cause the air inside of the cup to vibrate (move back and forth).

STEP 2: This causes the bottom of the cup (A) to vibrate.

STEP 3: The vibrating cup sets the string into motion, so the string also vibrates.

STEP 4: From the string the vibrations go into the bottom of the other person's (receiver) cup (B).

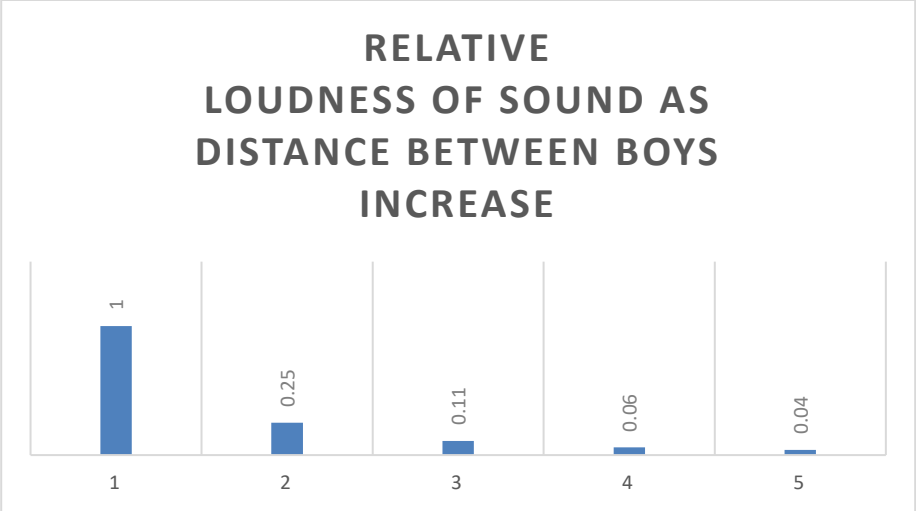
STEP 5: The air inside the cup held by the other person then vibrates and the sound of the sender makes is heard.

Assessment.

- The boys begin standing at a distance between them of **1 meter (m)**
- Firstly, the boys whisper a message to each other.
- They then move further away from each other at distances 2m, 3m, 4m and 5m and repeat the message at the same softness each time.

The loudness of the sound they hear is recorded in the table below:

Distance between boys/m	Relative Loudness of sound
1	1
2	0.25
3	0.11
4	0.06
5	0.04



i. As the distance between the boys increase, did the loudness of their message, increase or decrease? _____

The boys then repeat the message but whispered it into the cup of a string phone instead.

ii. If the boys are at a distance of 1m from each other would the message whispered into the cup, be louder or softer than when they just whispered into the air? _____

Give a reason for your answer to part ii.

_____

_____

iii. If the sender's cup is made larger, will the sound heard by the receiver be louder or same?

_____

iv. Give a reason for your answer.

_____

Answer Key:

Acitivity.

a) What do you think happens to the paper balls as the loudness of the music is increased?

The paper balls begin to move up and down (jump) as the sound increases in loudness. The louder the sound, the higher the paper balls jump.

b) What else can be done to make the paper balls move higher?

You can use smaller and lighter paper balls.

c) What would happen if the volume of the music is kept the same but the bowl (with paper balls) is moved further away from the speaker?

As the bowl is moved away from the speaker, with the sound remaining the same loudness, the paper balls jump less high.

Give a reason for your answer.

When the bowl was touching the speaker, the vibrations from the speaker transferred to the plastic wrap through the solid bowl. So the paper balls receive stronger vibrations.

As the bowl moves away from the speaker, it no longer touches the speaker so the vibrations now move through the air to reach the bowl. Since sound travels poorly in air (than the solid bowl), the vibrations that reach the plastic wrap is now weaker.

d) Would the paper balls move as high, if crepe paper is used instead of plastic wrap?

Crepe paper is heavier than plastic wrap and also stiffer.

When the sound vibrations reach the crepe paper it will vibrate less easily than the lighter plastic wrap, so the balls not move as high.

Assessment.

i. As the distance between the boys increase, did the loudness of their message, increase or decrease? The loudness decrease.

The boys then repeat the message but whispered it into the cup of a string phone instead.

ii. If the boys are at a distance of 1 m from each other, would the message whispered into the cup, be louder or softer than when they just whispered into the air? At the same distance "r", the message whispered into the cup would be louder than when whispered into the air.

Give a reason for your answer to part ii.
The message whispered into the cup causes the sound vibrations to travel through string instead of air, as when whispered into air. Sound travels better in solids than gases, so the message via the cup will be louder.

iii. If the sender's cup is made larger, will the sound heard by the receiver be louder or same? Louder.

iv. Give a reason for your answer.
A larger cup means more particles will vibrate when the message is whispered into the cup. More vibrations means the receiver will hear a louder sound.

References:

1. **https://i.pinimg.com/236x/ee/82/57/ee8257d10c86c58097929afe92a3ebc7.jpg**
2. cups-string-phones - Gun Lake Area Sewer AuthorityGun Lake Area ... gunlakesewer.org
3. Data for sound: http://www.e-braam.nl/index.php?id=inverse-square-law

Answer Key

1. (i) **You hear a sound faster if you are swimming under water .**

(ii). Reason for your answer:

Sound travels faster through liquids than gases.

2. (i) **The sound be louder.**

(ii). Reason for your answer:

The larger cup has more air to set into motion when the sender speaks. Thus the base of the cup vibrates more and so the sound travelling to the receiver is louder.

4. (i) **No, the sound becomes more faint**

(ii). Reason for your answer:

When vibrations have far to travel far, they lose energy and slow down. Hence, the vibrations after travelling a longer distance will have less energy causing smaller vibrations to be received by the cup of the receiver. So the sound receive is softer.

(iii) The sound will be softer.

(The vibrating plastic base sets the string into vibration so the sound travels to the receiver's cup. Plastic is more flexible than metal sheet so the metal base will not vibrate as easily as the plastic base when the send speaks into the cup. So the receiver gets smaller vibrations and the sound is softer).