



Primary 6 Integrated Science

Term 1

Theme: Matter and Energy

Topic 2/4 – Sound Energy

Learning Outcomes The learner;

- appreciates the natural and artificial sources of sound.
- acquires scientific knowledge on how sound is produced, stored and reproduced.
- appreciate the importance of the ear as the organ of perceiving sound.

Sound energy

Sound is a form of energy that is produced when objects **vibrate**.

These vibrations travel through air, water, or solids as **waves** until they reach our ears.

Our ears then sense the vibrations and send signals to the brain, which interprets them as sound.

Key Points

- Produced by vibrations** – e.g., a guitar string or drum skin.
- Travels in waves** – moves through air, water, or solids.
- Heard by ears** – ears pick up vibrations and the brain understands them.

Sources of Sound

1. **Natural sources:** Thunder, wind, waterfalls, birds singing, animals.
2. **Artificial sources:** Radios, cars, machines, loudspeakers, musical instruments.

Exercise 1

- (i) What is sound?
- (ii) Name two sources of sound

Properties of sound

Pitch is the highness or lowness of sound.

Volume is the loudness or softness of sound

Sound travels fastest in solids, followed by liquids and lowest in gases.

Sound does not travel in vacuum (empty space)

Exercise 2

- (a) State the meaning of the following terms as related to sound
 - (ii) Pitch
 - (iii) Volume
 - (iv) Frequency
- (b) What determines the volume of sound?

Ways of producing sound

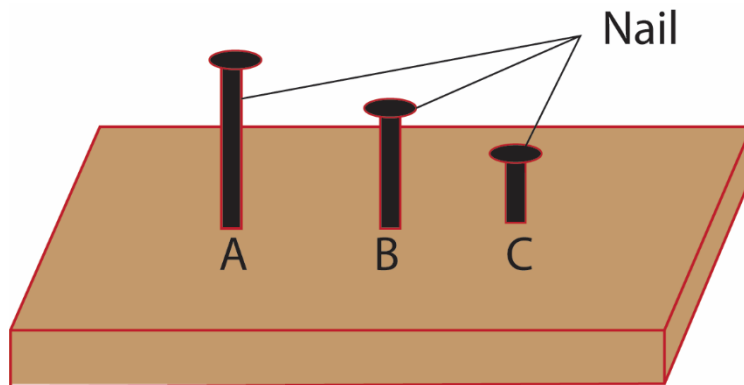
- (i) By hitting or beating a drum



The volume of the drum is determined by how hard one hits the drum

The pitch of the drum is determined by

- (a) **Tension of the skin:** the higher the tension, the higher the pitch
- (b) **Size of the drum:** small drums have high pitches than big drums



When hit C produce the highest pitch

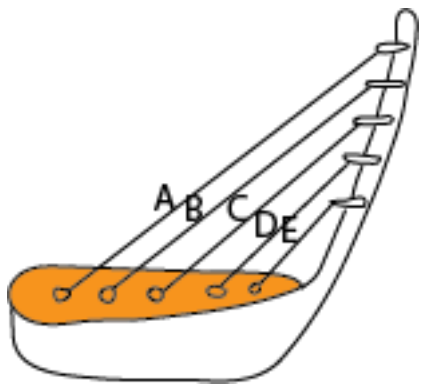
(ii) **Plucking like in guitars**

Volume is determined by how strong one plucks the string

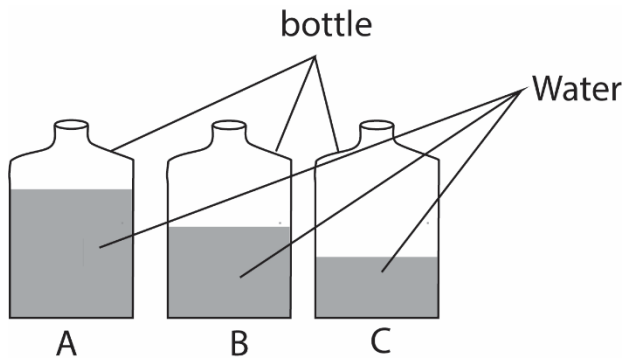
The pitch of the drum is determined by

- (a) **Tension of the string:** the higher the tension, the higher the pitch
- (b) **Size of the size of the string:** the smaller the string the higher the high pitches
- (c) **Length of the string:** shorter strings give higher pitch.

For instance in in guitar below string E has the highest pitch and A has the lowest pitch.



- (iii) Blowing such as blowing a trumpet, horn, bottles with water and flute



When blown, A produces the highest pitch of sound

- (iv) Clapping hand
- (v) Playing piano

Importance of sound

Sound and instruments in communication. Examples of special sounds are:

- (i) **Hooting** - a car hoots to mean move out of the way.
- (ii) **Ambulance siren** - this generally means move out of the road and let the ambulance pass. There is an emergency.
- (iii) **Screaming** - this means something dangerous or exciting is happening.
- (iv) **Ringing of a bell** - this means that you are being alerted or reminded that something you are aware of is happening. At school it means it is time to change from one lesson to another. In offices it may mean fire.
- (v) **Fire engine siren** - the siren means that there is need to move out of the way and let the fire engine proceed to where fire or danger might be. It also means an emergency.

Exercise 3

State three use of sound

Echo

An **echo** is the reflection of sound when it bounces off a surface like a wall, mountain, or building.

Importance of echoes

- (i) **Used in communication:** Animals like bats and dolphins use echoes to find their way and locate food (echolocation).
- (ii) **Helps in measuring distance:** Echoes can be used to measure the depth of an ocean, for example in sonar systems used by ships and submarines.
- (iii) **Entertainment and music:** Echo effects are used in music and sound systems to make sound richer.
- (iv) **Safety and navigation:** Ships and submarines use echoes (sonar) to detect obstacles under water.
- (v) **Scientific study:** Echoes help scientists study the depth of oceans and caves.

Disadvantages of echoes

Echoes make sound unclear and can disturb communication.

How to reduce echoes in a hall

- (i) Use of blanket on the walls
- (ii) Putting ceiling boards
- (iii) Thick carpet
- (iv) curtains

Means of storing sound

- (i) Writing solfa notation
- (ii) On devices like memory disc, flush disk, compact disc
- (iii) computer

Exercise 4

- (a) What is an echo?
- (b) Suggest one use of echoes to a sailor
- (c) State one disadvantage one echoes to a teacher.
- (d) Give one method of reducing echoes in a hall

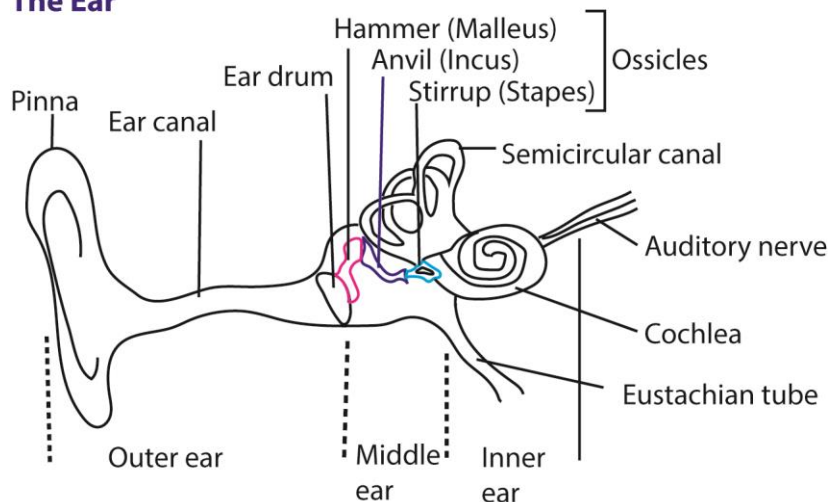
Pollution from sound

Loud sound such as loud music, shouting, industrial noise and screaming irritate the ears of the receiver.

Organs of Hearing in Animals

Animal Group	Organ of Hearing	Notes
Human	Ear	The ear helps humans hear by turning sound vibrations into messages for the brain.
Fish	Inner ear	Fish have no external ears; they use their inner ear and lateral line to detect sound vibrations in water.
Snakes	Inner ear bones	Snakes do not have external ears; they sense vibrations through the ground using their jawbones connected to the inner ear.
Insects	Tympanal organs / antennae	Insects hear using special organs on their legs, abdomen, or antennae that detect vibrations.
Amphibians	Tympanum (eardrum)	Frogs and toads have a visible round eardrum (tympanum) on the side of the head.
Birds	Inner ear with eardrum	Birds have no external ear flaps; they use an inner ear and a small external opening covered by feathers.

The Ear



Functions of Parts of the Ear

1. Outer Ear

- **Pinna (ear flap):** Collects sound waves from the environment.
- **Ear canal:** Directs sound waves to the eardrum.

2. Middle Ear

- **Eardrum (tympanum):** Vibrates when sound waves hit it.
 - **Hammer, Anvil, Stirrup (ossicles):** These three tiny bones amplify and pass vibrations from the eardrum to the inner ear.
 - **Eustachian tube:** Balances air pressure between the middle ear and the throat.
3. **Inner Ear**
- **Cochlea:** Changes vibrations into electrical signals.
 - **Auditory nerve:** Carries these signals to the brain.
 - **Semicircular canals:** Help maintain balance (not for hearing, but part of the inner ear).

Hearing Process in Humans

1. **Sound collection (Outer ear)**
 - The **pinna** (ear flap) collects sound waves and directs them into the **ear canal**.
2. **Vibration (Middle ear)**
 - The sound waves hit the **eardrum**, making it vibrate.
 - These vibrations are passed on to the three tiny bones (**hammer, anvil, stirrup**) which amplify the sound.
3. **Signal conversion (Inner ear)**
 - The vibrations move into the **cochlea**, which is filled with fluid.
 - Tiny hair cells inside the cochlea change the vibrations into electrical signals.
4. **Message to the brain**
 - The **auditory nerve** carries these signals to the brain.
 - The brain interprets them as sound (speech, music, noise, etc.).

Common Ear Diseases and Disorders

1. **Ear infection (Otitis media)**
 - Caused by germs entering the middle ear.
 - Leads to pain, swelling, and sometimes pus.
2. **Earwax blockage**
 - Too much wax can block the ear canal.
 - Causes difficulty in hearing.
3. **Deafness (Hearing loss)**
 - Can be partial or complete.
 - Caused by damage to the ear or auditory nerve.
4. **Tinnitus**
 - Ringing or buzzing sound in the ear.
 - Often caused by loud noise or ear damage.

5. **Ruptured eardrum**
 - A hole or tear in the eardrum.
 - Caused by loud sounds, injury, or infection.
6. **Balance problems (Vertigo)**
 - Caused by disorders in the inner ear (semicircular canals).
 - Leads to dizziness and loss of balance.

Caring for the ear

- (i) **Keep ears clean:** Wash the outer ear regularly with clean water. Do not insert sharp objects or sticks into the ear canal.
- (ii) **Avoid loud noise:** Stay away from very loud music, machines, or explosions that can damage hearing.
- (iii) **Treat infections early:** Visit a doctor if you feel pain, swelling, or discharge from the ear.
- (iv) **Protect ears from water and dust:** Dry ears properly after swimming or bathing. Avoid dirty environments that can cause infections.
- (v) **Do not share earphones or ear buds:** Sharing can spread germs and cause infections.
- (vi) **Balanced diet and good health:** Eating healthy food helps keep the ear and body strong.

Key Differences between human ear and hearing organs of other animals

- (i) **Humans** have a well-developed ear with three parts (outer, middle, inner).
- (ii) **Fish** rely on inner ear and lateral line (no external ear).
- (iii) **Snakes** sense vibrations through their jawbones.
- (iv) **Insects** use tympanal organs or antennae.
- (v) **Amphibians** have a visible tympanum.
- (vi) **Birds** have inner ears with small openings hidden by feathers.

Exercise 5

Mention any **four** hearing organs n animals.

Revision questions and answers

1. (a) Mention one example of musical instruments in each of the groups below:

- (i) String instrument: Guitar, Violin, **Harp**
- (ii) Percussion instruments: drum, xylophone, **Tambourine**

(b) Name any two methods of storing sound

Solfa notation, phones, memory cards, DVD, CD, magnetic tapes

2. Why does sound travel fastest in solids than any other any other states of matter?

Because the particles are closest in solids

3. The diagram below is of a musical instrument. Use it to answer questions that follow



(a) Name the instrument above

Flute

(b) How can the volume and pitch of the instrument be varied?

Volume is controlled by how strongly you blow.

Pitch is controlled by opening and closing holes to change the length of the air column.

Volume of a Flute

- **Blowing harder** → produces a **louder sound**.
- **Blowing gently** → produces a **softer sound**. ☞ Volume depends on the **strength of air blown into the flute**.

Pitch of a Flute

- **Covering more holes** → makes the air column longer → produces a **lower pitch (deeper sound)**.
- **Opening more holes** → makes the air column shorter → produces a **higher pitch (sharper sound)**. ↪ Pitch depends on the **length of the vibrating air column inside the flute**.

4. How is the eardrum useful in hearing process?

The **eardrum is useful because it changes sound waves into vibrations and passes them to the middle ear bones, making hearing possible.**

5. In the table below, Part A shows terms used to describe sound and Part B has the meanings of the terms. Match the terms to their meanings.

Part A	Part B
Volume	Number of vibrations per second
Pitch	Reflected sound
FREQUENCY	Loudness or softness of sound
Echo	Highness or lowness of sound

6. How is reflected sound useful to sailors

- Held to detect obstacles
- Determines the depth of water

7. What part of fish has the same function as human ear?

Lateral line system

8. What would you do to a guitar string to make it produce a high pitched sound?

Tighten the string or shorten the string by pressing the string against the fretboard (closer to the body of the guitar).

9. How does a flying be produce sound?

By vibration of its wings

10. When a drum is hit, you hear sound.

(a) How does the eardrum help you to hear sound?

It vibrates sending signals to the inner ear.

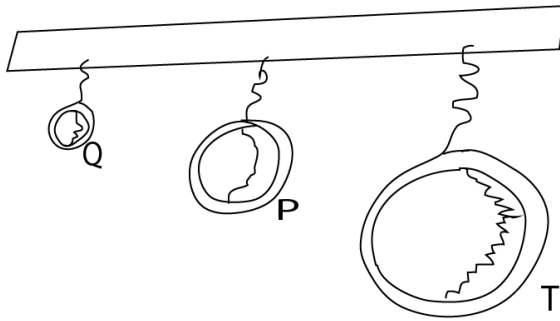
(b) There is wax in the outer ear. What is the function of wax?

To trap dust and foreign matter.

(c) What is the effect of too much wax in one's ear?

Blocks the ear canal leading loss of hearing

11. The diagram below shows three metallic rings Q, P, T.



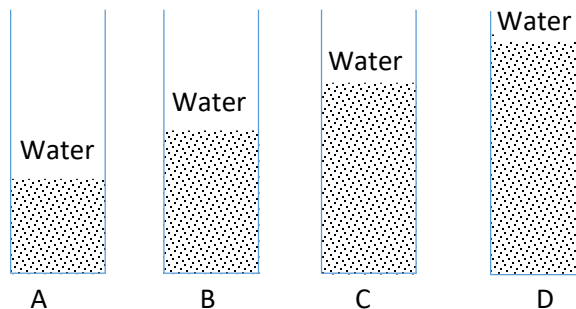
(a) Which ring will produce:

- (i) Sound of a low pitch? : **T**
- (ii) Sound of a high pitch? **Q**

(b) Name any two devices that can be used to store sound.

Sound tapes
Compact disc

12. The diagram below shows glass tubes of the same size with water at different levels as indicated. Study then and answer the questions that follow.



(a) If each tube is blown separately, which one will produce

- (i) Highest sound **D**
- (ii) Lowest sound: **A**

(b) What happens to the sound produced by A if water is increased to the level of the tube D?

The pitch will increase to that produced by D

(c) What happens to the sound produced by each of the tubes if water was replaced by the same quantity of milk?

They will produce sound with the same pitch as those produced with water

13. (a) What enables a drum to produce sound when it is hit with a stick?

By vibration of the skin

(b) Give a clear example that shows that light travels faster than sound.

A lightening is seen before thunder.

(c) State two ways in which sound can be stored.

(i) Compact disc

(ii) On cassettes

(iii) Tape recorder

(iv) On the computer

14. Susan shouted loudly in a big house, as she shouted, she heard another similar sound. Use it to answer the following question

(a) Give the name of the similar sound Susan heard after shouting.

Echo

(b) How was the sound you have named in question (a) formed?

Due to reflection of sound waves

15. What causes an echo?

Reflection of sound waves

16. (a) How does a guitar produce sound when its string is plucked?

By vibration

(b) How can the pitch of a guitar be changed?

- by tightening/loosening the string

- by adjusting the length of the string

- by changing the thickness of the string

(c) Name one way of storing sound.

On the compact disc (CD)

Through tape recorder.

(d) Give a reason why sound cannot travel through a vacuum.

There no matter to vibrate

17. Mary shouted in a big house and she heard the same sound repeated. Name the repeated sound she heard.

Echo

18. State **one** way in which echo can be reduced in a hall.

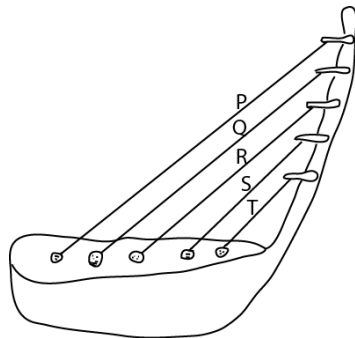
(v) **Use of blanket**

(vi) **Putting ceiling boards**

(vii) **Thick carpet**

(viii) **curtains**

19. The diagram below shows a well-tuned musical instrument. The string P, Q, R, S and T are of uniform thickness. Use it to answer the question that follows



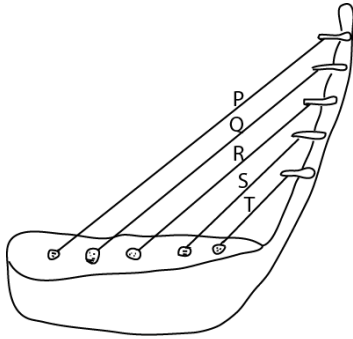
(a) Which string produces sound of the highest pitch?

T

(b) Give a reason for your answer in (a) above

It is the shortest hence vibrates at the highest frequency

20. The diagram below shows a well-tuned musical instrument. The string P, Q, R, S and T are of uniform thickness. Use it to answer the question that follows



Why does string T produce sound of the highest pitch?

Because it is the shortest, the shorter the string and the tighter the string the higher the frequency of vibration and hence the pitch.

21. (a) apart from using solfa notation, mention any other ways of storing sound
- (i) **On computer**
 - (ii) **On memory cards**
 - (iii) **On compact disc**

Name two instrument used to reproduce the sound stored by solfa notation

Piano

Guitar

22. What would you do to a guitar string to make it produce a high pitched sound

Increase the tension of the strings

Shorten the string

23. State any one reason why animal make sound.

To communicate

To express pain

To lure opposite sex into sex intercourse

24. How is a reflected sound helpful to sailors

To detect obstacles
To determine the depth of water

Thank You

Dr. Bbosa Science