UNIT 2

Sound

G9CBRG

TEXTBOOK EVALUATION

I. Choose the correct answer:

1. Which of the following vibrates when a musical note is produced by the cymbals in a orchestra?
   a) stretched strings
   b) stretched membranes
   c) air columns
   d) metal plates

   G9L7T4

   Ans: d) metal plates

2. Sound travels in air:
   a) if there is no moisture in the atmosphere.
   b) if particles of medium travel from one place to another.
   c) if both particles as well as disturbance move from one place to another.
   d) if disturbance moves.

   Ans: c) if both particles as well as disturbance move from one place to another.

3. A musical instrument is producing continuous note. This note cannot be heard by a person having a normal hearing range. This note must then be passing through
   a) wax b) vacuum
   c) water d) empty vessel

   Ans: b) vacuum

4. If the speed of a wave is 340 $m s^{-1}$ and its frequency is 1700 Hz, then wavelength λ for this wave in cm will be
   a) 34 b) 20 c) 15 d) 0.2

   Ans: b) 20

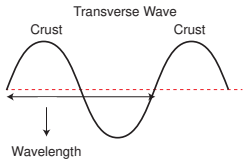
5. Which of the following statement best describes frequency?
   a) the number of complete vibrations per second.
   b) the distance travelled by a wave per second.
   c) the distance between one crest of wave and the next one.
   d) the maximum disturbance caused by a wave.

   Ans: a) the number of complete vibrations per second.

6. The maximum speed of vibrations which produces audible sound will be in
   a) seawater b) ground glass
   b) dry air d) Human blood

   Ans: b)ground glass

7. In the sound wave produced by a vibrating turning fork as shown in the diagram, half the wave length is represented by:



   a) BD b) AB c) AE d) DE

   Ans: a)BD

8. The sound waves travel faster
   a) in liquids b) in gases
   c) in solids d) in vacuum

   Ans: c) in solids

9. When the pitch of note by a harmonium is lowered, then the wave length of the note
   a) first decreases and then increases
   b) decreases
   c) remains the same
   d) increases

Ans: d) increases

10. The speeds of sound in four different media are given below. Which of the following is the most likely speed in $m\,s^{-1}$ with which the two under water whales in a sea can talk to each other when separated by a large distance?
   a) 5170 b) 1280
   c) 340 d) 1530

Ans: d) 1530

11. Which of the following can produce longitudinal waves as well as transverse waves under different conditions?
   a) TV transmitter b) tuning fork
   c) water d) slinky

Ans: c) water

12. The velocities of sound waves in four media P, O, Q, R and S are 18,00 km/h, 900 km/h, 0 km/h, and 1200 km/h respectively. Which could be a liquid medium?
   a) R b) Q c) P d) S

Ans: d) S

II. Fill in the blanks.

1. Vibration of object produces _____ .

Ans: Sound

2. Sound is a _____ wave and needs a material medium to travel.

Ans: Longitudinal

3. Number of vibrations produced in one second is _____ .

Ans: Frequency

4. The velocity of sound in solid is _____ than the velocity of sound in air.

Ans: Greater

5. Loudness is proportional to the square of the _____ .

Ans: Amplitude

6. A sound wave has a frequency of 4 k hz and wavelength 2 m. Then the velocity of sound is _____ .

Ans: 8000m/s

7. _____ is a medical instrument used for listening to sounds produced in the body.

Ans: Stethoscope

8. The repeated reflection that results in persistence of sound is called _____ .

Ans: reverberation

9. Ultrasounds can also be used to detect cracks and flows in _____ .

Ans: metal blocks

10. In the inner ear, the pressure variations are turned into electrical signals by the _____ .

Ans: cochlea

III. Match the following.

Tuning fork	The point where density of air is maximum
Sound	Maximum displacement from the equilibrium position
Compressions	The sound whose frequency is greater than 20,000 Hz
Amplitude	Longitudinal wave
Ultasonics	Production of sound

Ans:

Tuning fork	Production of sound
Sound	Longitudinal wave
Compressions	Maximum displacement from the equilibrium position
Amplitude	The sound whose frequency is greater than 20,000 Hz
Ultasonics	The point where density of air is maximum

IV. Matrix matching.

Loudness	Number of vibrations produced in unit time	decibel
Time period	The amount of sound produced / received	Metre
Amplitude	Distance travelled by sound in unit time	Hertz
Velocity of sound	The time required to produce one complete wave	Metre per second
Frequency	The maximum displacement from the mean position	second

Ans:

Loudness	The amount of sound produced / received	decibel
Time period	The time required to produce one complete wave	second
Amplitude	The maximum displacement from the mean position	Metre
Velocity of sound	Distance travelled by sound in unit time	Metre per second
Frequency	Number of vibrations produced in unit time	Hertz

V. Answer in brief.

1. Name the device which is used to produce sound in laboratory experiments.

Tuning fork is used to produce sound in laboratory experiments.

2. Through which medium sound travels faster, iron or water? Give reason.

Sound travels faster in iron.

Reason: * The speed of sound depends on the density of the medium

* Iron density is greater than water density.

3. What should an object do to produce sound?

* An object should vibrate to produce sounds.

* When the object is vibrate ,nearby air and things also vibrate then produce the sound.

4. Can sound travel through vacuum?

No, Sound travel through vacuum.Sound needs a material medium to travel.

5. Name the physical quantity whose SI unit is 'hertz'. Define.

Frequency:

* The number of vibrations produced in one second is called frequency of the wave.

* It is denoted as **"n"**

6. What is meant by supersonic speed?

When the speed of any object exceeds the speed of sound in air (330m/s) it is said to be travelling at supersonic speed.

Eg. Bullets,jet,etc.,

7. How does the sound produced by a vibrating object in a medium reach your ears?

when a rarefaction reaches it. In this way the eardrum vibrates. The vibrations are amplified several times by three bones (the hammer, anvil and stirrup) in the middle ear. The middle ear transmits the amplified pressure variations received from the sound wave to the inner ear. In the inner ear, the pressure variations are turned into electrical signals by the cochlea. These electrical signals are sent to the brain via the auditory nerve and the brain interrupts them as sound.

8. You and your friend are on the moon. Will you be able to hear any sound produced by your friend?

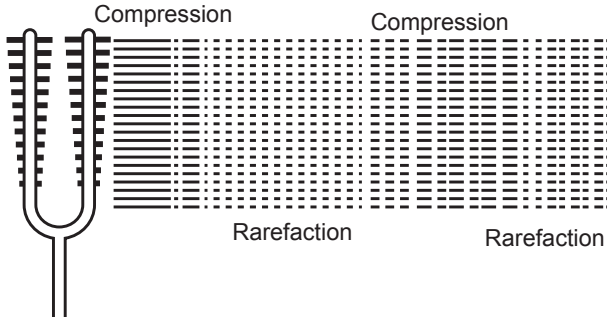
* Sound needs a medium to propagate, so we will not be able to hear any sound on the moon.

* Moon doesn't have any atmosphere.

VI. Answer in detail.

1. Describe with diagram, how compressions and rarefactions are produced.

The wave that propagates with compressions and rarefactions are called longitudinal waves. In longitudinal waves the particles of the medium move to and fro along the direction of propagation of the wave.Sound is also a longitudinal wave.



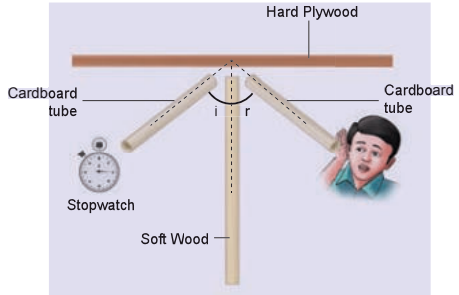
Sound can travel only when there are particleswhich can be compressed and rarefied. Compressions are the regions where particles are crowded together. Rarefactions are the regions of low pressure where particles are spread apart. A sound wave is an example of a longitudinal mechanical wave.

2. Verify experimentally the laws reflection of sound.

The laws of reflection are:

- The angle in which the sound is incident is equal to the angle in which sound is reflected.
- Direction of incident sound, direction of the reflected sound and the normal are in the same plane.

Take two identical pipes as shown in below. You can make the pipes using chart paper. The length of the pipes should be sufficiently long as shown in figure. Arrange them on a table near wall. Keep a clock near the open end of one of the pipes and try to hear the sound of the clock through the other pipe. Adjust the position of the pipes so that you can best hear the sound of the clock. Now, measure the angle of incidence and reflection and see the relationship between the angles. Lift the pipes on the right vertically to a small height, and observe what happens.



3. List the applications of sound.

Musical instruments:

Megaphones, loud speakers, horns, musical instruments such as nathaswaram, shehnai and trumpets are all designed to send sound in a particular direction without spreading it in all directions. In these instruments, a tube followed by a conical opening reflects sound successively to guide most of the sound waves from the source in the forward direction towards the audience.

Stethoscope:

Stethoscope is a medical instrument used for listening to sounds produced in the body. In stethoscopes these sounds reach doctor's ears by multiple reflections that happen in the connecting tube.

Applications of ultrasonic waves:

- ❖ Ultra sound can be used in cleaning technology. Minute foreign particles can be removed from objects placed in a liquid bath through which ultrasound is passed.
- ❖ Ultrasounds can also be used to detect cracks and flaws in metal blocks.
- ❖ Ultrasonic waves are made to reflect from various parts of the heart and form the image of the heart. This technique is called 'echo cardiography'.
- ❖ Ultrasound may be employed to break small 'stones' formed in the kidney into fine grains. These grains later get flushed out with urine.

Sonar:

SONAR stands for Sound Navigation And Ranging. Sonar is a device that uses ultrasonic waves to measure the distance, direction and speed of underwater objects.

ECG:

The electrocardiogram (ECG) is one of the simplest and oldest cardiac investigations

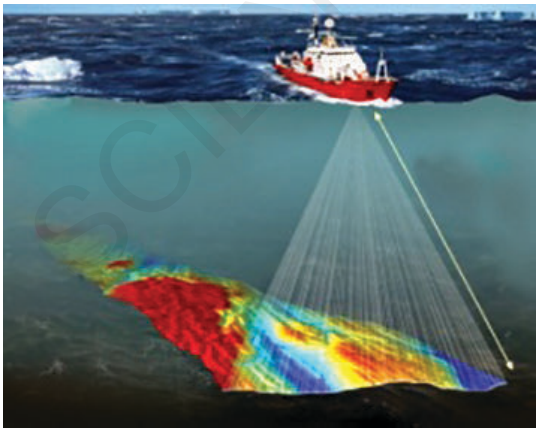
available. It can provide a wealth of useful information and remains an essential part of the assessment of cardiac patients. In ECG the sound variation produced by heart is converted into electric signals.

4. Explain how does SONAR work?

SONAR stands for Sound Navigation And Ranging. Sonar is a device that uses ultrasonic waves to measure the distance, direction and speed of underwater objects. Sonar consists of a transmitter and a detector and is installed at the bottom of boats and ships.The transmitter produces and transmits ultrasonic waves. These waves travel through water and after striking the object on the seabed, get reflected back and are sensed by the detector.

The detector converts the ultrasonic waves into electrical signals which are appropriately interpreted. The distance of the object that reflected the sound wave can be calculated by knowing the speed of sound in water and the time interval between transmission and reception of the ultrasound.

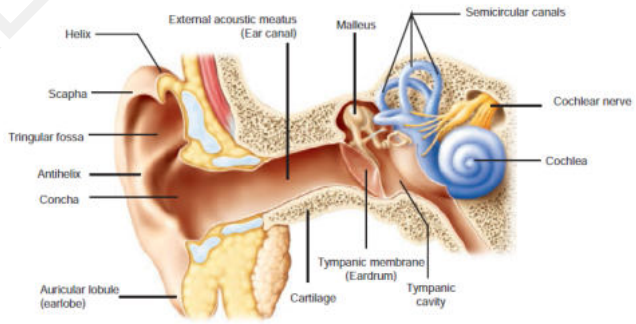
Let the time interval between transmission and reception of ultrasound signal be 't' and



the speed of sound through sea water be $2d = v \times t$. This method is called echo-ranging. Sonar technique is used to determine the depth of the sea and to locate underwater hills, valleys, submarine, icebergs etc.

5. Explain the working of human ear with diagram.

The outer ear is called 'pinna'. It collects the sound from the surroundings. The collected sound passes through the auditory canal. At the end of the ear is eardrum or tympanic membrane. When a compression of the medium reaches the eardrum the pressure on the outside of the membrane increases and forces the eardrum inward. Similarly the eardrum moves outward when a rarefaction reaches it. In this way the eardrum vibrates. The vibrations are amplified several times by three bones (the hammer, anvil and stirrup) in the middle ear. The middle ear transmits the amplified pressure variations received from the sound wave to the inner ear. In the inner ear, the pressure variations are turned into electrical signals by the cochlea.



These electrical signals are sent to the brain via the auditory nerve and the brain interrupts them as sound.

VII. Numerical problems.

1. The frequency of a source of sound is 600 Hz. How many times does it vibrate in a minute?

Frequency of sound is = 600Hz
1 sec = 600Hz
1 min = 60 sec
60 sec = 60 x 600
=36000 times
Source of vibrate 36000 times.

2. A stone is dropped from the top of a tower 750 m high into a pond of water at the base of the tower. When is the splash heard at the top? (Given g = 10 m s^{-2} and speed of sound = 340 m s^{-1})

height **(s) = 750m**

Speed of sound (U) = 0

g = 10 ms^{-2}

Speed of sound = 340 ms^{-2}

$\therefore$ $S = Ut_1 + 1/2at_1^2$

$750 = 0 (t_1) + 1/2 \times 10 \times t_1^2$

$750 = 5t_1^2$

$t_1^2 = 750/5$

$t_1^2 = 150$

$t_1 = 12.25s$

Time (t_2) = distance / speed

= 750/340

$t_2 = 2.205$ s

The time for splash sound heard at the top is $t = t_1 + t_2$

$= 12.25 + 2.205$

$t = 14.455$ s

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