

**1. How does study of sound help us?**

- a) Study of sound produced by heart and lungs can signal the medical problems.
- b) Study of properties of sound helps in improvement of acoustics in theatres, concert halls.

**2. What is an echo?**

The sound heard after reflection from a rigid surface is called an echo.

**3. Write the formula to find the time taken by an echo.**

$$\text{time} = \frac{\text{Total distance travelled}}{\text{Speed of sound}} = \frac{2d}{v}$$

**4. Derive the minimum distance required for an echo to be heard.**

The sensation of sound persists in our ear for about 0.1s. To hear a distinct echo, the time interval between the original sound and the reflected sound must be later or equal to 0.1s. By substituting  $t=0.1\text{s}$  and  $v=340\text{ms}^{-1}$  in air

$$d = \frac{340 \times 0.1}{2} = 17\text{m}$$

**5. What are the conditions necessary for an echo to be heard?**

- a) The time interval between the original sound and the reflected sound must be later or equal to 0.1s.
- b) The minimum distance between the reflecting surface and the source must be 17m.

**6. Why is an echo weaker than the original sound?**

Sound waves carry energy. When sound waves hit a reflecting surface, it imparts energy to the surface from which it bounces.

**7. A boy standing in front of a hill claps. He hears an echo after two seconds. The speed of sound in air is  $340\text{ms}^{-1}$ . What is the distance of the hill from him?**

**8. Give reason: Sometimes echoes are heard more than once.**

Echoes heard more than once is due to multiple reflections from number of reflecting surfaces.

**9. Why do we hear roaring of thunder?**

Roaring of thunder is due to multiple reflections of sound from many reflecting surfaces of clouds.

**10. Give two examples where multiple echoes are heard.**

- a) In the whispering gallery of Golgumbuz at Bijapur, sound is echoed seven times.
- b) Echo produced by mountain Lake Killarney in Ireland is repeated almost hundred times.

**11. How is sound produced?**

Sound is produced when a body vibrates in a particular range of frequency.

**12. What is meant by audible range?**

The range of frequency from 20Hz to 20,000 Hz (20 kHz) is called audible range. Or human audible frequency.

**13. What is infrasonic or subsonic sound?**

Sounds of frequency below 20Hz are called infrasonic sound or subsonic sound.

**14. What are ultrasonic sounds?**

Sounds of frequency beyond 20,000Hz (20 kHz) are called Ultrasonic sounds.

**15. What is ultrasonics?**

The branch of science that deals with ultrasound is called ultrasonics.

**16. Name some animals that can hear ultrasonic sounds.**

Animals like dogs, cats and bats.

**17. What is the difference between normal sound and ultrasonic sounds?**

Normal sounds have low frequency where as ultrasonic sounds have high frequency.

**18. Give reason: Ultrasonic sounds have high frequency.**

Ultrasonic sounds have high frequency because it has high energy.

**19. How can ultrasonic sounds be produced?**

A thin quartz slice is placed between two thin metallic plates. The metallic plates are connected to an A.C. source frequency more than 20 kHz. When the current flows through the metallic plates, the quartz slice vibrates with a frequency more than 20 kHz and produce ultrasonic sound.

**20. Mention the uses of ultrasonic waves.**

- a) By studying the ultrasonic waves passing through a medium, we can infer about its physical properties like elasticity, configuration of atoms.
- b) They can be used to detect cracks and flaws in metal mouldings.
- c) They are used in homogenizing two immiscible liquids.
- d) They are used in manufacturing of alloys.
- e) They are used in manufacturing emulsion for photographic films.
- f) They are used in dry cleaning to remove grease and dirt.
- g) They serve as insect repellants.
- h) They are used for sterilization purposes.
- i) They are used to cure neuralgic and rheumatic pains.
- j) They are used in bloodless surgery.
- k) They are used to break gallstones.

**21. How are bats able to navigate with ultrasonic waves?**

Bats produce and hear sounds of frequency upto 100 kHz. The sound produced by flying bats gets reflected from obstacle in front of it. By hearing this reflected sound it can detect obstacle even during night.

**22. Mention the industrial uses of ultrasonic waves.**

- a) They can be used to detect cracks and flaws in metal mouldings.
- b) They are used in homogenizing two immiscible liquids.
- c) They are used in manufacturing of alloys.

**23. Mention the medical uses of ultrasonic waves.**

- a) They are used for sterilization purposes.
- b) They are used to cure neuralgic and rheumatic pains.
- c) They are used in bloodless surgery.
- d) They are used to break gallstones.

**24. Give reason: Ultrasonic waves are used in sterilization.**

Ultrasonic waves can kill bacteria. Hence it is used for sterilization purpose.

**25. What is the minimum frequency of sound wave needed to prepare emulsion from two immiscible liquids?**

Greater than 20 kHz.

**26. Expand SONAR.**

SONAR stands for SOund Navigation And Ranging.

**27. What is SONAR?**

SONAR is a technique by which ultrasonic waves are used to measure the distance, direction and speed of underwater objects.

**28. What are the uses of SONAR?**

Sonar is used to locate underwater hills, valleys, submarines, icebergs and sunken ships.

**29. Explain how the depth of underwater objects is measured using sonar.**

Sonar consists of a transmitter and a detector installed on a boat/ship.

The transmitter produces and transmits ultrasonic waves. These waves travel through water until they strike an object or floor of the sea or ocean. They get reflected and the reflected waves return to the sonar. They are sensed by the detector. The detector converts the ultrasonic waves into electrical signals which are interpreted. The time interval between transmission and reflection is recorded and the depth or distance is calculated.

**30. Write the formula to calculate the depth of sea/ocean or underwater objects.**

Distance of the objects is given by  $d = \frac{v \times t}{2}$

**31. What is meant by echo-ranging?**

Echo ranging is a technique of using ultrasonic waves used to calculate the distance of objects.

**32. A ship sends ultrasonic sound, it returns from seabed and its is detected after 4s. If the speed of ultrasonic sound through seawater is  $1.5\text{kms}^{-1}$ . What is the depth of the sea?****33. The ultrasonic signal send by sonar takes 3 seconds to return. Find the distance of the object if the velocity of sound in water is  $1.5\text{km/s}$ .****34. Ultrasonic waves emitted at the ocean water take 3.5 seconds to return. Find the depth of ocean.**

35. A ship on the surface of a sea sends an ultrasonic signal vertically downwards into the sea. The signal is reflected from a submarine and is received after 2 seconds. Calculate the depth (in km) of the submarine. [Assume the velocity of sound in water=1450m/s]

36. An ultrasonic sound sent from a ship travels with the speed of 1530 m/s in sea water. How deep is the water if the time delay of the echo from the sea bed is 6 seconds?

37. What is ultrasound scanning?

The technique used to get images of internal organs of human body is called ultrasound scanning.

38. Give reason: Ultrasound scanning is widely used than x- rays.

Ultrasound scanning is less harmful than x-rays. Hence it is widely used.

39. What is echo Cardiograph?

Echo cardiograph is a technique which uses ultrasound to examine the heart.

40. Mention the application of ultrasound scanner.

- Ultrasound scanner is used to get the images of internal organs of human body like bladders, kidneys, ovaries.
- It is used to examine the heart.
- It is used in examination of the foetus during pregnancy to detect congenial and growth abnormalities.

41. How does ultrasound scanner work?

Ultrasound scanner probe is placed over the part of the body to be examined. Lubricating jelly is put on the skin so that the probe makes good contact with the body. The probe is

connected by wire to the ultrasound machine and monitor. Pulses of ultrasound are sent from the probe to the body. Ultrasound waves bounce back from the various structures in the body. This is detected by the probe and the image is displayed on the monitor.

**42. What is the principle of ultrasound scanner?**

Ultrasound waves travel through fluid and soft tissues, but are reflected back when it hits dense surface.

**43. What is Doppler Effect?**

Doppler effect is the apparent change in the frequency of wave motion due to relative motion between the source of sound and the observer.

**44. When can we observe Doppler Effect?**

Doppler Effect is observed when either the source or the observer or both are in relative motion.

**45. Explain Doppler Effect with an example.**

Example 1:

When a speeding fire engine/ambulance passes a stationary observer, the pitch of the siren drops as it passes the observer. The waves in front appear to be compressed and the observer feels the pitch to be higher. When the fire engine/ambulance passes the observer, the waves behind the engine appear to be far apart. So the observer feels the pitch lower.

Example 2:

A person standing on the railway platform feels a change in the pitch of the whistle of a train which is moving past the observer. The pitch of the whistle appears to be lower as the engine passes the person.

**46. Give reason:**

**a) A person in the front of an engine feels the pitch of whistle of the train higher.**

When the engine is moving, the waves in front appears to be compressed.

**b) A person behind the engine feels the pitch of the whistle of an engine to be lower.**

When the engine moves past a person, the waves behind the engine appears to be faster apart.

**47. Mention the applications of Doppler Effect.**

- a) Doppler Effect can be used to track artificial satellites.
- b) It can be used to determine the velocity of submarines.
- c) It can be used to calculate the speed at which the objects of the universe are receding from us.
- d) It can be used to gauge the movements of stars with relative to the earth.

**48. Mention the uses of Doppler Effect in astrophysics.**

- a) It can be used to calculate the speed at which the objects of the universe are receding from us.
- b) It can be used to gauge the movements of stars with relative to the earth.

**49. What is meant by red shift?**

When a source of light moves away from the observer with a velocity comparable to that of light, the frequency of the light noticed will be less. It shifts towards the red end of the spectrum. This effect is called red shift.

**50. What is the significance of red shift?**

The study of the spectrum of the stars indicated that all stars in the universe are moving away from us at very high speed. This indicated that the universe is expanding.

**51. What is meant by blue shift?**

When the source of light wave approaches the observer with a velocity comparable to that of light, the frequency of light noticed is high. It shifts to blue end of the spectrum. This shift is called blue shift.

**52. Give reason: Ultrasonic waves cannot be used to track artificial satellites.**

Ultrasonic waves require a material medium for its propagation. Ultrasonic waves also lose energy to the medium in which they travel. Hence ultrasonic waves cannot be used to track satellites.

**53. Expand RADAR.**

RADAR stands for RAdio Detection And Ranging.

**54. What is RADAR?**

Radar is a device which uses electromagnetic waves (radio waves) in place of ultrasonic waves to determine the range, altitude, direction or speed of moving objects.

**55. Give reason: Radio waves are used to track artificial satellites.**

Radio waves are electromagnetic waves which can travel through vacuum and also very large distances. Hence Radiowaves are used to track artificial satellites.

**56. Give reason: We require an accurate instrument which can measure radar.**

The time taken by radar to cover distance is very less as it travels with the speed of light. Hence very accurate instrument which can measure very small time interval of the order of microseconds is necessary.

**57. Explain how radar works.**

Radar makes use of pulse of waves from an antenna and detects the reflected wave after it bounces off the target. By knowing the speed of radio waves and the time taken for the signal to bounce off the object and hit the receiver, the distance of the object can be detected.

**58. Mention the uses of Radar.**

Radar is used to track aircraft, artificial satellites and motor vehicles.

**59. What is radar gun?**

Radar gun is an instrument used to determine the speed of moving objects like vehicles.

**60. How do traffic authorities use radar/ Doppler Effect to detect speed of vehicles?**

Radiowaves are sent in the direction of speeding vehicles and the reflected waves are received. The change in the frequency of the waves is used to determine the speed of vehicles.

**Fill in the blanks:**

1. The sound heard after reflection from a rigid surface is called an **echo**.
2. The formula to find the time taken by an echo is  $t = \frac{2d}{v}$ .
3. The sensation of sound persists in our ear for about **0.1seconds**.
4. The time interval between the original sound and the reflected sound for an echo to be heard is  **$\geq 0.1s$** .
5. The minimum distance between the reflecting surface and the source for an echo to be heard must be **17m**.
6. More than one echo is heard due to **multiple reflections** from the reflecting surfaces.
7. In the whispering gallery of Golgumbuz at Bijapur, sound is echoed **seven** times.
8. The human audible frequency range is **20Hz to 20,000 Hz**.
9. Sounds of frequency below 20Hz are called **infrasonic sound or subsonic sound**.
10. Sounds of frequency beyond 20,000Hz (20 kHz) are called **Ultrasonic sounds**.
11. The branch of science that deals with ultrasound is called **ultrasonics**.
12. Animals that can hear ultrasonic sound is **dogs/ cats/ bats**.
13. Ultrasonic waves have high frequency because it has **high energy**.
14. Bats can produce and hear sounds of frequency upto **100 kHz**.
15. The wave used to detect cracks and flaws in metal mouldings is **ultrasonic waves**.
16. Two immiscible liquids can be homogenized by using **ultrasonic waves**.
17. The wave used in manufacture of emulsion for photographic films is ultrasonic waves.
18. The wave used in manufacture of emulsion for photographic films must have frequency **greater than 20kHz**.
19. The wave used in insect repellent is **ultrasonic waves**.
20. The wave used in sterilization is **ultrasonic waves**.
21. The wave used in bloodless surgery is **ultrasonic waves**.
22. The wave used to break gallstones is **ultrasonic waves**.
23. A device which uses ultrasonic sound waves to measure the distance of an object is **SONAR**.
24. SONAR stands for Sound navigation and ranging.
25. The formula used to find depth of
26. A wave having a frequency of 30 kHz belongs to **ultrasonic sound**.
27. Sound propagates with maximum velocity (speed) through **solids**.
28. Echo cardiograph by ultrasound waves is helpful in the study of **heart**.
29. The technique used to study heart diseases is **echo cardiography**.
30. The working principle of radar gun is **Doppler Effect**.
31. Doppler Effect in sound is observed as a change in its **pitch**.
32. The wave used in radar gun used by traffic police to detect over speeding vehicles is **Radiowaves**.

33. The name of sound waves whose frequency is greater than 20 kHz is ultrasonic sound.
34. Doppler Effect of light can be applied in the study of stars.
35. A strong beam of ultrasonic waves kill bacteria – this property is used in sterilization.
36. Gallstones in a person can be removed by using ultrasonic waves.
37. The unit related to waves used by traffic police to detect the speed of vehicle is Hertz.