QB365 - Question Bank Software

Acoustics Study Materials

10th Standard

Science

Multiple Choice Question

1) The sound waves are reflected from an obstacle into the same medium from which they were incident. Which of the following changes?
(a) speed (b) frequency (c) wavelength **(d) none of these**

2) Velocity of sound in the atmosphere of a planet is 500 m s^{-1}. The minimum distance between the sources of sound and the obstacle to hear the echo, should be
(a) 17 m (b) 20 m **(c) 25 m** (d) 50 m

3) A sound wave passes through gold rod and comes into the surrounding air. What is the relation between original wavelength A and new wavelength λ'?
(a) λ=λ' **(b) λ > λ'** (c) λ< λ' (d) None of the above

4) At what velocity should a source of sound move towards a listener so that apparent frequency is twice the actual frequency?
(a) 165 m/s (b) 330 m/s (c) 660 m/s (d) 110 m/s

5) The region of a sound wave having low pressure is
(a) interference (b) refraction **(c) rarefaction** (d) compression

Fill in the blanks

6) Rapid back and forth motion of a particle about its mean position is called _____
Longitudinal

7) For propagation of sound wave, the medium must possess_____.
volume elasticity

8) In a region of compression there is _____ in volume.
decrease

9) Velocity of sound in air _____ by _____ for every _____.
increases, 0.61 m/s, 1^0 C rise in temperature

10) To hear a distinct echo each time interval below the original sound and the reflected sound must be _____.
0.1 s

Match the following

11) Infrasonic
10 Hz

12) Ultrasonic
22 kHz

13) High pressure region
Compressions

14) Amplitude

$E \propto A^2$

15) Wave velocity

$v = n\lambda$

Assertion and reason

16) Assertion: The change in air pressure affects the speed of sound.
Reason: The speed of sound in a gas is proportional to the square of the pressure
a. If both the assertion and the reason are true and the reason is the correct explanation of the assertion.
b. If both the assertion and the reason are true but the reason is not the correct explanation of the assertion.
c. If the assertion is true, but the reason is false.
d. If the assertion is false, but the reason is true
Answer : c. If the assertion is true, but the reason is false.

17) Assertion: Speed of wave = wavelength/time period.
Reason: Wavelength the distance between two nearest rarefactions.
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Assertion is false but reason is true.
Answer : (b) Both assertion and reason are true but reason is not the correct explanation of assertion.

18) Assertion: Ocean waves hitting a beach are transverse waves.
Reason: Ocean waves hitting a beach are assumed to be plane wave.
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Assertion is false but reason is true.
Answer : (a) Both assertion and reason are true and reason is the correct explanation of assertion.

19) Assertion: Velocity of sound is maximum in solids than liquid and gases.
Reason: Gases are least elastic in nature.
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Assertion is false but reason is true.
Answer : (a) Both assertion and reason are true and reason is the correct explanation of assertion.

20) Assertion: Human ear can defect infrasonic waves.
Reason: Infrasonic waves have frequency greater than 20 Hz
(a) Both assertion and reason are true and reason is the correct explanation of assertion.

(b) Both assertion and reason are true but reason is not the correct explanation of assertion.

(c) Assertion is true but reason is false.

(d) Assertion is false but reason is true.

Answer : (d) Assertion is false but reason is true.

2 Marks

21) What is the audible range of frequency?

Answer : The audible range of frequency is 20 to 20,000 Hz.

22) Define wavelength.

Answer : Wave length (A) is the distance between two consecutive compressions or two consecutive rarefactions.

23) Define amplitude.

Answer : The maximum displacement of a vibrating particle on either side of the mean position in a medium is called amplitude.

24) Define frequency of a sound wave.

Answer : The number of vibrations (waves) produced per second is called the frequency of sound waves. The SI unit of frequency is hertz.

25) What does cause the rolling sound of thunder?

Answer : The sudden increase in pressure and temperature from lightning produces rapid expansion of the air surrounding and within a bolt oflightning. In turn, this expansion of air creates a sonic shock wave, similar to a sonic boom, which produces the sound of thunder.

4 Marks

26) Two observers are stationed in two boats 4.5 km apart. A sound signal sent by one, under water, reaches the other after 3 seconds. What is the speed of sound in the water?

Answer : Distance between two observers, d = 4.54 km

Time taken to reach underwater, t = 3s

To find:

speed of sound, $c = \frac{d}{t} = ?$

Solution:

Speed of sound in water

$$c = \frac{d}{t} = \frac{4.5}{3} km/s \quad (or) 1500 m/s$$

27) A strong sound signal is sent from a ship towards the bottom of the sea. It is received back after 1s.What is the depth of sea given that the speed of sound in water 1450 m s^{-1}?

Answer : Time taken by the signal to reach the bottom of the sea

$$t = \frac{1}{2} s$$

Speed of sound in water, c = 1450 m/s

Depth of the sea (or) distance travelled by signal, (d)

= Speed x Time

= cXt

$d = 1450 \times \frac{1}{2}$

Depth of the sea, d = 125m

28) How will you determine the velocity of sound by echo method?

Answer : A source of sound pulses, a measuring tape, a sound receiver, and a stop watch.

Procedure:

(i) Measure the distance "d" between the source of sound pulse and the reflecting surface using the measuring tape.

(ii) The receiver is also placed adjacent to the source. A sound pulse is emitted by the source.

(iii) The stop watch is used to note the time interval between the instant at which the sound pulse is sent and the instant at which the echo is received by the receiver. Note the time interval as "t".

(iv) Repeat the experiment for three or four times. The average time taken for the given number of pulses is calculated.

Calculation of speed of sound:

(i) The sound pulse emitted by the source travels a total distance of 2d while travelling from the source to the wall and then back to the receiver.

(ii) The time taken for this has been observed to be "t", Hence, the speed of sound wave is given by

Speed of sound $= \frac{Distance\ travelled}{Time\ taken}$

$= \frac{2d}{t}$

29) write the difference between the sound and light waves.

Answer :

No.	Sound	Light
1	Medium is required for the propagation	Medium is not required for the propagation.
2	Sound waves are longitudinal	Light waves are transverse
3	Wavelength ranges from 1.65 cm to 1.65m	Wavelength ranges from $4x10^{-7}$m to $7x10^{-7}$m
4	Sound waves travel in air with a speed of about 340 ms^{-1} at NTP.	Light waves travel in air with a speed of 3 x 10^8 ms^{-1}.

30) Write any two applications for reflection of sound?

Answer : Ear trumpet:

(i) Ear trumpet is a hearing aid, which is useful for people who have difficulty in hearing.

(ii) In this device, one end is wide and the other end is narrow.

(iii) The sound from the sources fall into the wide end and are reflected by its walls into the narrow part of the device.

(iv) This helps in concentrating the sound and the sound enters the ear drum with more intensity. and to hear the sound better.

Mega phone:

(i) A megaphone is a horn-shaped device used to address a small gathering of people.

(ii) Its one end is wide and the other end is narrow.

(iii) When a person speaks at the narrow end, the sound of his speech is concentrated by the multiple reflections from the walls of the tube.
(iv) Thus, his voice can be heard loudly over a long distance.

7 Marks

31) What is an echo?
a) State two conditions necessary for hearing an echo.
b) What are the medical applications of echo?
c) How can you calculate the speed of sound using echo?

Answer : a) An echo is the sound reproduced due to the reflection of original sound from various rigid surfaces such as walls, ceilings, surfaces of mountains, etc.

Conditions necessary for hearing an echo:
(i) Thus, the minimum time gap between the original sound and echo must be O.ls.
(ii) The minimum distance required to hear an echo is 17.2 m.

b) The medical applications of echo:
The principle of echo is used in obstetric ultrasonography, which is used to create real-time visual images of the developing embryo or fetus in the mother's uterus.

c) Calculate the speed of sound using echo:
(i) The sound pulse emitted by the source travels a total distance of 2d while traveling from the source to the wall and then back to the receiver.
(ii) The time taken for this has been observed to be "t" Hence, the speed of sound wave is given by

$$Speed of sound = \frac{Distance \quad travelled}{Time taen} = \frac{2d}{t}$$

32) Suppose that a sound wave and a light wave have the same frequency, then which one has a longer wavelength?
a) Sound b) Light c) both a and b d) data not sufficient

Answer : Light

7 Marks Problems

33) What is the frequency heard by a stationary observer when a train approaches with a speed of 30 ms^{-1}. The frequency of the train is 600 Hz and the speed of sound is 340 m/s?

Answer : Given
Speed of the train, V_s =30 rns^{-1}
Frequency of the train, n =600Hz
Speed of sound, v =340 ms^{-1}
To find: Apparent frequency n =?
Solution

$$n' = \left(\frac{v}{v - v_s}\right) \times 600$$

$$= \frac{340}{310} \times 600$$

Apparent frequency n' = 658 Hz

34) A boy hears two different sounds when a race car is moving toward and moving away. If the speed of sound in air is 340 ms^{-1}. The frequency emitted by the car is 800 Hz and the

car velocity is 120 ms^{-1}. Find the frequency heard by the boy? (when the car moving forward).

Answer : Given

Frequency g car's distance, n = 800 Hz

Velocity of source, Vs = 120ms^{-1}

Velocity of sound, v = 340 ms^{-1}

To find: Frequency emitted by the car, n' = ?

Solution

Apparent frequency, n' = $\left(\frac{v}{v-v_s}\right) \times n$

$= \frac{340}{340-120} \times 800$

$= \frac{340}{220} \times 80$

Apparent frequency, n' = 1236 Hz

35) At 10° C, how for away is a reflecting surface if you hear an echo in 0.274s?

Answer : Given

Temperature, T 10°C

Time, t = 0.274 s

Distance, D = ?

Velocity,v = (vo+ 0.61T) ms^{-1}

v = [331.4+ 0.61 x 10]

331.4 +6.1

v 337.5 ms^{-1}

Distance, D = vxt

D 337.5 x 0.274

D = 92.48m

Distance due to reflecting surface= $\frac{distance}{2}$

=46.2 m