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**Selina Physics Solutions “Sound” Exe- 7 (A)**

**Question 1**

What are mechanical waves?

**Answer 1**

Mechanical waves are the waves which require material medium to transfer energy.

**Question 2**

Define the following terms in relation to a wave: (a) amplitude (b) frequency (c) wavelength (d) wave velocity

**Answer 2**

a)Amplitude:The maximum displacement of the particle of medium on either side of its mean position is called the amplitude of wave. Its S.I. unit is metre (m).

(b) Frequency: The number of vibrations made by a particle of the medium in one second is called the frequency of the waves.

It is also defined as the number of waves passing through a point in one second. Its S.I. unit is hertz (Hz).

(c) Wavelength: The distance travelled by the wave in one time period of vibration of particle of medium is called its wavelength. Its S.I. unit is metre (m).

(d) Wave velocity: The distance travelled by a wave in one second is called its wave velocity. Its S.I. unit is metre per second (ms-1).v

**Question 3**

A wave passes from one medium to another medium. Mention one property of the wave out of speed, frequency or wavelength.

(i) which changes,

(ii) which does not change

**Answer 3**

(i) Wavelength (or speed) of the wave changes, when it passes from one medium to another medium.

(ii) Frequency of a wave does not change when it passes from one medium to another medium.

**Question 4**

State two factors on which the speed of a wave travelling in a medium depends?

**Answer 4**

Two factors on which the speed of a wave travelling in a medium depends are:

(i) Density: The speed of sound is inversely proportional to the square root of density of the gas.

(ii) Temperature: The speed of sound increases with the increase in temperature.

**Question 5**

State two differences between the light and sound waves.

**Answer 5**

1)The light waves can travel in vacuum while sound waves need a material medium for propagation.

2)The light waves are electromagnetic waves while sound waves are the mechanical waves.

**Question 6**

What do you mean by reflection of sound? State one condition for the reflecton of a sound wave. Name a device in which reflection of sound wave is used.

**Answer 6**

(i) Just as rays of light, sound waves travel back in the opposite direction on hitting an obstacle.

(ii) This is called the reflection of sound.

(iii) The laws of reflection for sound are the same as those for light.

(iv) Repetition of sound caused by reflection of sound waves from an obstacle is known as an echo.

(v) A hearing aid is one such device used by people who are hard of hearing. Here, sound waves, which are received by the hearing aid, are reflected into a narrower area leading to the ear.

**Question 7**

What is meant by an echo? State two conditions necessary for an echo to be heard distinctly?

**Answer 7**

If a person stands at some distance from a wall or a hillside and produces a sharp sound, he hears two distinct sounds: one is original sound heard almost instantaneously and the other one is heard after reflection from the wall or hillside, which is called echo.

The condition for the echo: An echo is heard only if the distance between the person producing the sound and the rigid obstacle is long enough to allow the reflected sound to reach the person at least 0.1 second after the original sound is heard.

**Question 8**

A man is standing at a distance of 12m from a cliff. Will he be able to hear a clear echo of his sound? Give a reason for your answer.

**Answer 8**

t = 2d/V = 2 x 12/340 = 24/340 < 0.1 seconds so the man will not be able to hear the echo. This is because the sensation of sound persists in our ears for about 0.1 second after the exciting stimulus ceases to act.

**Question 9**

State two applications of echo.

**Answer 9**

The applications of echo:

1)Dolphins detect their enemy and obstacles by emitting the ultrasonic waves and hearing their echo.

2)In medical science, the echo method of ultrasonic waves is used for imaging the human organs such as the liver, gall bladder, uterus, womb etc. This is called ultrasonography.

**Question 10**

Explain how the speed of sound can be determined by the method of echo?

**Answer 10**

Sound is produced from a place at a known distance say, d at least 50 m from the reflecting surface. The time interval t in which the echo reaches the place from where the sound was produced, is noted by a stop watch having the least count 0.01 s. then the speed of sound is calculated by using the following relation

V = total distance travelled / time interval =     m/s

**Question 11**

State the use of echo by a bat, dolphin and fisherman.

**Answer 11**

Bats, dolphin and fisherman detect their enemies or obstacles or position of fish by emitting/sending the ultrasonic waves and hearing/detecting the echo.

**Question 12**

How do bats avoid obstacles in their way, when in flight?

**Answer 12**

Bats can produce and detect the sound of very high frequency up to about 1000kHz. The sounds produced by flying bats get reflected back from any obstacle in front of it. By hearing the echoes, bats come to know even in the dark where the obstacles are. So they can fly safely without colliding with the obstacles.

**Question 13**

What is meant by sound ranging? Give one use of sound ranging.

**Answer 13**

The process of detecting obstacles with the help of echo is called sound ranging. It’s used by the animals like bats, dolphin to detect their enemies.

**Question 14**

Name the waves used for sound ranging. State one reason for their use. Why are the waves mentioned by you, not audible to us?

**Answer 14**

The ultrasonic waves are used for the sound ranging. Ultrasonic waves have a frequency more than 20,000 Hz but the range of audibility of human ear is 20Hz to 20,000 Hz

**Question 15**

What is sonar? State the principle on which it is based.

**Answer 15**

Sonar is sound navigation and ranging. Ultrasonic waves are sent in all directions from the ship and they are received on their return after reflection from the obstacles. They use the method of echo.

**Question 16**

State the use of echo in medical field.

**Answer 16**

In medical science, echo method of ultrasonic waves is used for the imaging of human organs such as liver, gall bladder, uterus, womb; which is called ultra sonography.

**Concise Physics Solutions “Sound” MCQ – 7 (A)  Selina Publishers**

**Question 1**

The minimum distance between the source and the reflector in air, so that an echo is heard is approximately equal to:

(a) 10 m

(b) 17 m

(c) 34 m

(d) 50 m

**Answer 1**

(b) 17 m

Explanation: An echo is heard distinctly if it reaches the ear at least 0.1 s after the original sound.

If d is the distance between the observer and the obstacle and V is the speed of sound, then the total distance travelled by the sound to reach the obstacle and then to come back is 2d and the time taken is,

t = Total distance travelled/Speed of sound = 2d/V

or, d = V t/2

Putting t = 0.1 s and V = 340 m/s in air at ordinary temperature, we get:

d = (340 x 0.1)/2 = 17 m

Thus, to hear an echo distinctly, the minimum distance between the source and the reflector in air is 17 m.

**Question 2**

To detect the obstacles in their path, bats produce:

(a) Infrasonic waves

(b) Ultrasonic waves

(c) Electromagnetic waves

(d) Radio waves

**Answer 2**

(b) Ultrasonic waves

**Numericals -7(A) Sound ICSE Class-10 for Selina Publishers**

**Question 1**

The wavelength of waves produced on the surface of water is 20cm. If the wave velocity is 24m s-1, calculate (i) the number of waves produced in one second and (ii) the time in which one wave is produced.

**Answer 1**

(i)Frequency or the number of waves produced per second

= Velocity/Wavelength

= 24 / 20 x 10-2

=120

(ii)Time = 1/ frequency = 1/ 120= 8.3 x 10-3 seconds

**Question 2**

Calculate the minimum distance in air required between the source of sound and the obstacle to hear an echo. Take the speed of sound in air = 350m s-1

**Answer 2**

Velocity = 2D/Time

350 = 2 x D/ 0.1

D =350 x 0.1 / 2 = 17.5 m

**Question 3**

What should be the minimum distance between the source and reflector in water so that echo is heard distinctly? (The speed of sound in water = 1400m/s)

**Answer 3**

Velocity = 2D/Time

1400 = 2 x D/ 0.1

D = 1400 x 0.1/ 2 = 70 m

**Question 4**

A man standing 25 m away from a wall produces a sound and receives the reflected sound. (a) Calculate the time after which he receives the reflected sound if the speed of sound in air is 350m/s-1. (b) Will the man be able to hear a distinct echo? Explain the answer.

**Answer 4**

(a)Velocity = 2D/Time

Time = 2 x 25 / 350 =0.143 seconds

(b)Yes, because the reflected sound reaches the man 0.1 second after the original sound is heard and the original sound persists only for 0.1 second.

**Question 5**

A RADAR sends a signal to an aeroplane at a distance 300 km away, with a speed of 3 × 108 m s-1. After how much time is the signal received back after reflecting from the aeroplane?

**Answer 5**



Thus, after 0.002 s, the signal is received back after reflecting from the aeroplane.

**Question 6**

A man standing 48 m away from a wall fires a gun. Calculate the time after which an echo is heard. (The speed of sound in air is 320m/s-1).

**Answer 6**

Velocity = 2 x D/Time

Time after which an echo is heard = 2 D/Velocity = 2 x 48 / 320 = 0.3 seconds

**Question 7**

A ship on the surface of water sends a signal and receives it back from the submarine inside water after 4s. Calculate the distance of submarine from the ship. (The speed of sound in water is 1450m/s-1).

**Answer 7**

2 D = velocity x time

D = (velocity x time) / 2 = 1450 x 4 / 2 = 2900 m = 2.9 km

**Question 8**

A pendulum has a frequency of 5 vibrations per second. An observer starts the pendulum and fires a gun simultaneously. He hears an echo from the cliff after 8 vibrations of the pendulum. If the velocity of sound in air is 340m/s-1 , find the distance between the cliff and the observer.

**Answer 8**

5 vibrations by pendulum in 1 sec

So8 vibrations in 8/5 seconds = 1.6 sec

Velocity = 2 x D/ time

340 = 2 x D/ 1.6

D = 340 x 1.6 / 2 = 272 m

**Question 9**

A person standing between two vertical cliffs produces the sound. Two successive echoes are heard at 4s and 6s. Calculate the distance between the cliffs. (Speed of sound in air = 320m/s)

**Answer 9**

The distance of first cliff from the person, 2 x D1 = velocity x time

D1 = 320 x 4 / 2 = 640 m

Distance of the second cliff from the person, D2 = 320 x 6 / 2 = 960 m

Distance between cliffs = D1 + D2 = 640 + 960 = 1600 m

**Question 10**

A person standing at a distance x in front of a cliff fires a gun. Another person B standing behind the person A at a distance y from the cliff hears two sounds of the fired shots after 2s and 3s respectively. Calculate x and y(take speed of sound 320m/s)

**Answer 10**

The person B hears two of the fired shots , the first one is direct from the gun while other sound comes after reflection from the cliff

Speed of sound 320m/s

Time taken by the sound to reach from A to B directly



**Question 11**

On sending an ultrasonic wave from a ship towards the bottom of a sea, the time interval between sending the wave and receiving it back is found to be 1.5s. If the velocity of wave in sea water is 1400m/s, find the depth of sea.

**Answer 11**

Depth of the sea = velocity x time/2 = 1400 x 1.5 / 2 = 1050 m

**Question 12**

Figure below shows the distance-displacement graph of two waves A and B. Compare (i) the amplitude, (ii) the wavelength of the two waves.



**Answer 12**

Amplitude is the maximum displacement from the mean position. For A the maximum displacement = 10cm and for B the maximum displacement = 5cm.

The ratio of maximum amplitude is  

Wavelength of A=8cm

Wavelength of B=16cm

The ratio of wavelength is  

**Selina Physics Solution “Sound” Exe- 7 (B)**

**Question 1**

What do you understand by free vibrations of a body? Give one example.

**Answer 1**

The vibrations of a body in the absence of any external force on it are called the free vibrations. Eg.: When we strike the keys of a piano, various strings are set into vibration at their natural frequencies.

**Question 2**

What is meant by the natural frequency of vibration of a body? On what factors does it depend?

**Answer 2**

When each body capable of vibrating is set to vibrate freely and it vibrates with a frequency f. It is the natural frequency of vibration of the body.

The natural frequency of vibration of a body depends on the shape and size of the body.

**Question 3**

(a) Draw a graph between the displacement from mean position and time for a body executing free vibrations in vacuum.

(b) Where can a body execute the natural vibrations?

**Answer 3**

(a) 

Displacement-time graph for the free vibrations

**(b)**

**Question 4**

State one condition for a body to execute free vibrations.

**Answer 4**

The free vibrations of a body occur only in vacuum because the presence of medium offer some resistance due to which the amplitude of the vibration does not remain constant, but it continuously decreases

**Question 5**

(a) Name one factor on which the frequency of sound emitted due to vibration in an air column depends.

(b) How does the frequency depend on the factor stated in part (a).

**Answer 5**

(a)   The frequency of sound emitted due to vibration in an air column depends on the length of the air column.

**(b)**The factor which influences the frequency of sound is the length of the air column.

As the length of the air column increases, the frequency decreases.

Thus, we can conclude that they are inversely proportional to each other.

f ∝

**Question 6**

State one way of increasing the frequency of a note produced by an air column.

**Answer 6**

The frequency of the note produced in the air column can be increased by decreasing the length of the air column.

**Question 7**

State two ways of increasing the frequency of vibration of stretched string.

**Answer 7**

The frequency of vibration of the stretched string can be increased by increasing the tension in the string, by decreasing the length of the string.

**Question 8**

How does the frequency of sound given by a stretched string depend on its (a) length, (b) tension?

**Answer 8**

(a) The frequency of sound is inversely proportional to the length of the string.

f ∝

(b) The frequency of sound is directly proportional to the square root of the tension in the string.

f ∝

**Question 9**

What adjustments would you make for tuning a stringed instrument for it to emit a note of a desired frequency?

**Answer 9**

A stringed instrument is provided with the provision for adjusting the tension of the string. By varying the tension, we can get the desired frequency.

**Question 14**

The diagram below in Fig. shows three ways in which the string of an instrument can vibrate.



(a)Which of the diagram shows the principal note?

(b)Which has the frequency four times that of the first?

(c) Which vibration is of longest wavelength?

(d)What is the ratio of the frequency of the vibration in (i) and (ii)?

**Answer 10**

( a) Diagram(i) is showing the principal note.

(b)Diagram (iii) has frequency four times that of the first.

(c) Diagram(i) is showing longest wavelength.

(d) ratio of the frequency of the vibration in (i) and (ii) is 1:2

**Question 11**

Explain why strings of different thickness are provided on a stringed instrument.

**Answer 11**

Strings of different thickness are provided on a stringed instrument to produce different frequency sound waves because the natural frequency of vibration of a stretched string is inversely proportional to the radius (thickness) of the string.

**Question 12**

A blade, fixed at one end, is made to vibrate by pressing its other end and then releasing it. State one way in which the frequency of vibrations of the blade can be lowered.

**Answer 12**

The frequency of vibrations of the blade can be lowered by increasing the length of the blade or by sticking a small weight on the blade at its free end.

**Question 13**

How does the medium affect the amplitude of free vibrations of the body?

**Answer 13**

The presence of the medium offers some resistance to motion, so the vibrating body continuously loses energy due to which the amplitude of the vibration continuously decreases.

**Question 14**

What are the damped vibrations? How do they differ from free vibrations? Give one example of each.

**Answer 14**

The periodic vibrations of a body of decreasing amplitude in the presence of resistive force are called the damped vibrations.

The amplitude of the free vibrations remains constant and vibrations continue forever. But, the amplitude of damped vibrations decreases with time and ultimately the vibrations ceases.

For eg, When a slim branch of a tree is pulled and then released, it makes damped vibrations.

A tuning fork vibrating in air excute damped vibrations.

**Question 15**

The diagram in figure shows the displacement-time graph of a vibrating body.



(i) Name the kind of vibrations.

(ii) Give one example of such vibration.

(iii) Why is the amplitude of vibrations gradually decreasing?

(iv) What happens to the vibrations of the body after sometime?

**Answer 15**

**(i)**Damped vibrations

(ii) Example: When a slim branch of a tree is pulled and then released, it makes damped vibrations.

(iii) The amplitude of vibrations gradually decreases due to the frictional (or resistive) force which the surrounding medium exerts on the body vibrating in it. As a result, the vibrating body continuously loses energy in doing work against the force of friction causing a decrease in its amplitude.

(iv) After sometime, the vibrating body loses all of its energy and stops vibrating.

**Question 16**

A tuning fork is set into vibrations in air. Name the kind of vibrations it executes.

**Answer 16**

The tuning fork vibrates with the damped oscillations.

**Question 17**

Draw a sketch showing the displacement of a body executing damped vibrations, against time.

**Answer 17**

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Displacement time graph of damped vibrations

**Question 18**

What are forced vibrations? Give one example to illustrate your answer.

**Answer 18**

The vibrations of a body which take place under the influence of an external periodic force acting on it, are called the forced vibrations. For example: when guitar is played, the artist forces the strings of the guitar to execute forced vibrations.

**Question 19**

On keeping the stem of a vibrating tuning fork on the surface of a table, a loud sound is heard. Give reason.

**Answer 19**

A loud sound is heard only when a special case of forced vibration (resonance) has occurred.

When the frequency of the periodic force applied on a body is equal to the natural frequency of that body, we hear a loud sound called resonance.

It is due to resonance that a loud sound is heard on keeping the stem of a vibrating tuning fork on the surface of a table.

**Question 20**

Distinguish between the free (or natural) and forced vibrations.

**Answer 20**

 1.The vibrations of a body in the absence of any resistive force are called the free vibrations. The vibrations of a body in the presence of an external force are called forced vibrations.

2.In free vibrations, the frequency of vibration depends on the shape and size of the body. In forced vibrations, the frequency is equal to the frequency of the force applied.

**Question 21**

What is meant by resonance? Describe a simple experiment to illustrate the phenomenon of resonance and explain it.

**Answer 21**

Resonance is a special case of forced vibrations. When the frequency of an externally applied periodic force on a body is equal to its natural frequency, the body rapidly begins to vibrate with an increased amplitude. This phenomenon is known as resonance.

Mount two identical tuning forks A and B of same frequency upon two separate sound boxes such that their open ends face each other as shown.



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If the prong A is struck on a rubber pad, it starts vibrating. On putting A on its sound box, tuning fork B also starts vibrating and a loud sound is heard. The vibrations produced in B are due to resonance.

**Question 22**

State the condition for the resonance to occur.

**Answer 22**

Condition for resonance:

Resonance occurs when the frequency of the applied force is exactly equal to the natural frequency of the vibrating body.

**Question 23**

Complete the following sentence:

Resonance is a special case of \_\_\_\_\_\_\_\_\_ vibrations, when the frequency of the driving force is \_\_\_\_\_\_\_\_\_ natural frequency of the body.

**Answer 23**

forced,equal to the

**Question 24**

Differentiate between the forced and resonant vibrations.

**Answer 24**

|  |  |
| --- | --- |
| Forced Vibrations | Resonant vibrations |
| These are vibrations of a body under an external periodic force of frequency different than the natural frequency of the body. | These are vibrations of a body under an external periodic force of frequency exactly equal to the natural frequency of the body. |
| The amplitude of the vibration is usually small. | The amplitude of vibration is very large. |

**Question 25**

Why is a loud sound heard at resonance?

**Answer 25**

At resonance, the body vibrates with large amplitude thus conveying more energy to the ears so a loud sound is heard.

**Question 26**

Figure 7.14  shows two tuning forks A and B of the same frequency mounted on separate sound boxes with their open ends facing each other. The fork A is set into vibration. (a) Describe your observation. (b) State the principle illustrated by this experiment.



**Answer 26**

 a)The vibrating tuning fork A produces the forced vibrations in the air column of its sound box. These vibrations are of large amplitude because of the large surface area of air in the sound box. They are communicated to the sound box of the fork B. The air column of B starts vibrating with the frequency of the fork A. Since the frequency of these vibrations is same as the natural frequency of the fork B, the fork B picks up these vibrations and starts vibrating due to resonance.

b)On putting the tuning fork A to vibrate, the other tuning fork B will also start vibrating. The vibrations produced in the second tuning fork B are due to resonance.

**Question 27 (imp)**

In figure, A, B, C and D are four pendulums suspended from the same elastic string XY. Length of pendulum A and D are equal, while the length of B is smaller and C is longer. The pendulum A is set into vibrations. (a) What is your observation? (b) Give reason for your observation.



**Answer 27**

(a)Set the pendulum A into vibration by displacing it to one side, normal to its length. It is observed that pendulum D also starts vibrating initially with a small amplitude and ultimately it acquires the same amplitude as the pendulum A initially had. When the amplitude of the pendulum D becomes maximum, the amplitude of the pendulum A becomes minimum since the total energy is constant. After some time the amplitude of the pendulum D will decreases and amplitude of A increases. The exchange of energy takes place only between the pendulums A and D because their natural frequencies are same. The pendulums B and C also vibrate, but with very small amplitudes.

(b) The vibrations produced in pendulum A are communicated as forced vibrations to the other pendulums B, C and D through XY. The pendulums B and C remain in the state of forced vibrations, while the pendulum D comes in the state of resonance.

**Question 28**

A vibrating tuning fork, held over an air column of a given length with its one end closed, produces a loud audible sound. Name the phenomenon responsible for it and explain the observation.

**Answer 28**

The phenomenon responsible for producing a loud audible sound is named resonance. The vibrating tuning fork causes the forced vibrations in the air column. For a certain length of air column, a loud sound is heard. This happens when the frequency of the air column becomes equal to the frequency of the tuning fork.

**Question 29 (imp)**

In the fig. 7.16 A, B, C and D represent test tubes each of height 20 cm which are filled with water up to the heights of 12cm, 14 cm, 16 cm and 18 cm respectively. If a vibrating tuning fork is placed over the mouth of test tube D, a loud sound is heard.



(a)Describe the observations with the tubes A, B and C when the vibrating tuning fork is placed over the mouth of these tubes.

(b)Give the reason for your observation in each case.

(c)State the principle to illustrate by the above experiment.

**Answer 29**

No loud sound is heard with the tubes A and C, but a loud sound is heard with the tube

.(a) Resonance occurs with the air column in tube B whereas no resonance occurs in the air column of tubes A and C. The frequency of vibrations of air column in tube B is same as the frequency of vibrations of air column in tube D because the length of the air column in tube D is 20-18 = 2cm and that in tube B is 20-14 = 6 cm (3 times). On the other hand, the frequency of vibrations of air column in tubes A and C is not equal to the frequency vibrations of air column in tube B.

When the frequency of vibrations of air column is equal to the frequency of the vibrating tuning fork, resonance occurs.

**Question 30**

When a troop crosses a suspension bridge, the soldiers are asked to break steps. Explain the reason.

**Answer 30**

When a troop crosses a suspension bridge, the soldiers are asked to break steps. The reason is that when soldiers march in steps, all the separate periodic forces exerted by them are in same phase and therefore forced vibrations of a particular frequency are produced in the bridge. Now, if the natural frequency of the bridge happens to be equal to the frequency of the steps, the bridge will vibrate with large amplitude due to resonance and suspension bridge could crumble

**Question 31**

Why are the stringed instruments like guitar provided with a hollow sound box?

**Answer 31**

The sound box is constructed such that the column of the air inside it, has a natural frequency which is the same as that of the strings stretched on it, so that when the strings are made to vibrate, the air column inside the box is set into forced vibrations. Since the sound box has a large area, it sets a large volume of air into vibration, the frequency of which is same as that of the string. So, due to resonance a loud sound is produced.

**Question 32**

How do you tune your radio set to a particular station? Name the phenomenon involved in doing so and define it.

**Answer 32**

When we tune a radio receiver, we merely adjust the values of the electronic components to produce vibrations of frequency equal to that of the radio waves which we want to receive. When the two frequencies match, due to resonance the energy of the signal of that particular frequency is received from the incoming waves. The signal received is then amplified in the receiver set.

The phenomenon involved is resonance. It is a special case of forced vibrations. When the frequency of an externally applied periodic force on a body is equal to its natural frequency, the body rapidly begins to vibrate with an increased amplitude. This phenomenon is known as resonance.

**Selina Concise Physics Solutions “Sound” MCQ- 7 (B)**

**Question 1**

A wire stretched between two fixed supports is plucked exactly in the middle and then released. It executes (neglect the resistance of the medium):

(a) Resonant vibrations

(b) natural vibrations

(c) Damped vibrations

(d) Forced vibrations

**Answer 1**

It executes natural vibrations.

Hint: The periodic vibrations of a body of constant amplitude in the absence of any external force on it are called natural  vibrations.

**Question 2**

When a body vibrates under a periodic force, the vibrations of the body are:

(a) natural vibrations

(b) Damped vibrations

(c) Forced vibration

(d) Resonant vibrations

**Answer 2**

Forced vibrations

Hint: The vibrations of a body which take place under the influence of external periodic force acting on it are called the forced vibrations.

**Question 3**

A tuning fork of frequency 256 Hz will resonate with another tuning fork of frequency:

(a)128 Hz

(b) 256 Hz

(c) 384 Hz

(d) 512 Hz

**Answer 3**

A tuning fork of frequency 256 Hz will resonate with another tuning fork of frequency 256 Hz.

Hint: Resonance occurs when the frequency of an externally applied periodic force on the body is equal to its natural frequency.

**Selina Concise ICSE Physics Solutions “Sound” Exe – 7 (C)**

**Question 1**

Name three characteristics of a musical sound.

**Answer 1**

The following three characteristics of sound are:

1) Loudness

2) Pitch or shrillness

3) Quality or timber.

**Question 2**

(a)Which of the following quantity determines the loudness of a sound wave?

(i)Wavelength (ii) frequency and (iii) amplitude

(b)How is the loudness related to the quantity mentioned in part (a)

**Answer 2**

(a)Amplitude – The louder sound corresponds to the wave of large amplitude.

(b)Loudness is directly proportional to the square of amplitude.

**Question 3**

If the amplitude of a wave is doubled, what will be the effect on its loudness?

**Answer 3**

Loudness will be four times because loudness is directly proportional to the square of amplitude.

**Question 4**

Two waves of the same pitch have amplitudes in the ratio 1:3. What will be the ratio of their (a) loudness (ii) frequencies?

**Answer 4**

(a) Ratio of loudness will be 1:9

(b) The ratio of frequency will be 1:1

**Question 5**

How does the wave pattern of a loud note differ from the soft note? Draw a diagram.

**Answer 5**



**Question 6**

Name the unit in which the loudness of sound is measured?

**Answer 6**

The unit of loudness is phon.

**Question 7**

Why is the loudness of the sound heard by the plucked wire increased when it is mounted on a sound board?

**Answer 7**

Because the board provides comparatively a large area and forces a large volume of air to vibrate and thereby increases the sound energy reaching our ears.

**Question 8**

Define the term intensity of a sound wave. State the unit in which it is measured.

**Answer 8**

The intensity at any point of the medium is the amount of sound energy passing per second normally through unit area at that point. Its unit is microwatt per metre2.

**Question 9**

How is the loudness of sound related to the intensity of wave producing it?

**Answer 9**

Relationship between loudness L and intensity I is given as:

L = K log I, where K is a constant of proportionality.

**Question 10**

Comment on the statement ‘loudness of sound is a subjective nature, while intensity is an objective nature’

**Answer 10**

The intensity at any point of the medium is the amount of sound energy passing per second normally through unit area at that point.

The loudness of a sound depends on the energy conveyed by the sound wave near the eardrum of the listener. Loudness, being a sensation, also depends on the sensitivity of the ears of the listener. Thus the loudness of sound of a given intensity may differ from listener to listener. Further, two sounds of the same intensity but of different frequencies may differ in loudness even to the same listener because of the sensitivity of ears is different for different frequencies.

 So, loudness is a subjective quantity while intensity being a measurable quantity is an objective quantity for the sound wave.

**Question 11**

State three factors on which the loudness of sound heard by the listener depends.

**Answer 11**

The loudness of the sound heard depends on:

1) Loudness is proportional to the square of the amplitude.

2) Loudness is inversely proportional to the square of distance.

3) Loudness depends on the surface area of the vibrating body.

**Question 12**

The bells of a temple are big in size. Why?

**Answer 12**

According to the study of bells (called campanology), larger bells provide less resonant frequency.

For a sound wave to travel long distances, it is essential that the frequency of the sound is less.

Also, it is observed that thicker the body of a bell, richer is the quality of sound.

This is the reason the bells of a temple are big in size.

**Question 13**

Name the unit used to measure the sound level.

**Answer 13**

Decibel is the unit used to measure the sound level

**Question 14**

What is the safe limit of sound level in dB for our ears?

**Answer 14**

Upto 120 dB

**Question 15**

What is meant by noise pollution? Name one source of sound causing noise pollution.

**Answer 15**

The disturbance produced in the environment due to undesirable loud and harsh sound of level above 120 dB from the various sources such as loudspeaker, moving vehicles etc. is called noise pollution.

**Question 16**

What determines the pitch of sound?

**Answer 16**

Pitch of sound is determined by its wavelength or the frequency. Two notes of the same amplitude and sounded on the same instrument will differ in pitch when their vibrations are of different wavelengths or frequencies.

**Question 17**

Name the subjective property of sound related to its frequency.

**Answer 17**

Pitch

**Question 18**

Name and define the characteristic which enables one to distinguish two sounds of same loudness, but of different frequencies given by the same instrument.

**Answer 18**

Pitch is the characteristic of sound which enables us to distinguish different frequencies sound. Pitch is the characteristic of sound by which an acute note can be distinguished from a grave or flat note.

**Question 19**

Draw a diagram to show the wave pattern of high pitch note and a low pitch note, but of the same loudness.

**Answer 19**



The first diagram is high pitch note and second one is low pitch note.

**Question 20**

How is it possible to detect the filling of a bottle under a water tap by hearing the sound at a distance?

**Answer 20**

As the water level in a bottle kept under a water tap rises, the length of air column decreases, so the frequency of sound produced increases i.e., sound becomes shriller and shriller. Thus by hearing sound from a distance, one can get the idea of water level in the bottle.

**Question 21**

The frequencies of notes given by flute, guitar and trumpet are respectively 400Hz, 200Hz and 500 Hz. Which one of these has the highest pitch?

**Answer 21**

Trumpet. Because its frequency is highest.

**Question 22**

Complete the following sentences:

(a)The pitch of sound increases, if its frequency \_\_\_\_\_\_\_\_\_\_\_.

(b)If the amplitude of the sound is halved, its intensity becomes \_\_\_\_\_\_\_\_\_\_.

**Answer 22**

(a) increases

(b) one-fourth

**Question 23                  ( imp)**

The diagram below shows three different modes of vibration P, Q and R of the same string of a givens length.



(a) Which vibration will produce a louder sound and why?

(b) Which vibration will produce sound of maximum shrillness (or pitch) and why?

(c) What is the ratio of wavelength of vibrations P and R?

**Answer 23**

(a) R will produce maximum sound because it has maximum amplitude.

(b) P will produce maximum shrillness because it has maximum frequency.

(c) Lets suppose string has length l

Then wavelength of P=2l/3

Wavelength of R=2l



**Question 24**

Name the characteristic which enables one to distinguish the sound of two musical instruments even if they are of the same pitch and same loudness.

**Answer 24**

Quality or timber of sound.

**Question 25**

How do the two sounds of same loudness and same pitch produced by different instruments differ? Draw diagrams to illustrate your answer.

**Answer 25**

The two sounds of same loudness and same pitch produced by different instruments differ due to their different wave forms.

The wave forms depend on the number of the subsidiary notes and their relative amplitude along with the principal note.

Diagram below shows the wave patterns of two sounds of same loudness and same pitch but emitted by two different instruments. They produce different sensation to ears because they differ in wave forms: one is a sine wave, while the other is a triangular wave.



**Question 26**

Two identical guitars are played by two persons to give notes of the same pitch. Will they differ in quality? Give a reason for your answer.

**Answer 26**

Since the guitars are identical, they will have a similar waveform and so the similar quality.

**Question 27**

Two musical notes of the same pitch and same loudness are played on two different instruments. Their wave patterns are as shown in the diagram below.



Explain why the wave patterns are different.

**Answer 27**

Different instruments emit different subsidiary notes. A note played on one instrument has a large number of subsidiary notes while the same note when played on other instrument contains only few subsidiary notes. So they have different wave forms.

**Question 28**

Which characteristic of sound make  it possible to recognize a person by his voice without seeing him?

**Answer 28**

It is because the vibrations produced by the vocal chord of each person have a characteristic waveform which is different for different persons.

**Question 29**

State the factors that determine :

(i)The pitch of a note

(ii)The loudness of the sound heard

(iii)The quality of the note

**Answer 29**

(i)Frequency

(ii)Amplitude

(iii)Waveform

**Question 30**

Name the characteristic of a sound affected due to the change in its

(i) amplitude

(ii) waveform

(iii) frequency.

**Answer 30**

(i) Loudness

(ii) Quality or timbre

(iii) Pitch

**Question 31**

The sketches I to IV in Fig show sound waves, all formed n the same interval.



Which diagram shows

(i)A note from a musical instrument

(ii)A soft (not loud) note

(iii)A bass (low frequency) note

**Answer 31**

(i)IV

(ii)I

(iii)II

**Question 32**

Shows the wave patterns of three sounds A, B and C. Name the characteristic of sound which is same between (i) A and B, (ii) B and C, and (iii) C and A.



**Answer 32**

(i) Since both have same amplitude and waveform therefore loudness and quality is same.

(ii) Neither amplitude nor waveform is same. Hence no characteristic is same.

(iii) Frequency of both the sound is same in this case hence pitch is same.

**Question 33**

A microphone is connected to the Y-input of a C.R.O. Three different sounds are made in turn in front of the microphone. Their traces (a), (b) and (c) produced on the screen are shown in Fig.



(i)Which trace is due to the loudest sound? Give reason for your answer

(ii)Which trace is due to the sound with the lowest pitch? Explain your answer.

**Answer 33**

(i)b, since amplitude is largest

(ii)a, since frequency is lowest

**Question 34**

In what respect does the wave pattern of a noise and a music differ? Draw diagram to explain your answer.

**Answer 34**

Wave pattern is regular in music while it is quite irregular in noise.



**Question 35**

State one difference between a musical note and a noise.

**Answer 35**

Musical note is pleasant, smooth and agreeable to the ear while noise is harsh, discordant and displeasing to the ear.

In musical note, waveform is regular while in noise waveform is irregular.

**Selina Physics Solutions “Sound” MCQ- 7 (C)**

**Question 1**

By reducing the amplitude of the sound wave, its:

(a) Pitch increases

(b) Loudness decreases

(c) Loudness increases

(d) Pitch decreases

**Answer 1**

By reducing the amplitude of the sound wave, its loudness decreases.

Hint: Loudness of sound is proportional to the square of the amplitude.

**Question 2**

Two sounds of same loudness and same pitch produced by two different instruments differ in their:

(a) Amplitudes

(b) Frequencies

(c) Waveforms

(d) All of the above.

**Answer 2**

Waveforms

Explanation: The waveform of a sound depends on the number of the subsidiary notes and their relative amplitude along with the principal note. The resultant vibration obtained by the superposition of all these vibrations gives the waveform of sound.

**Question 3**

Two sounds A and B are of same amplitudes, same waveforms but of frequencies f and 2f respectively, then:

(a) B differs in quality from A

(b)Sound of  B is grave, A is shrill

(c) and B is shrill, A is grave

(d) while B is louder than A

**Answer 3**

B is shrill, A is grave

Explanation: Shrillness or pitch of a sound is directly proportional to the frequency of the sound wave. Greater the frequency, shriller will be the note.