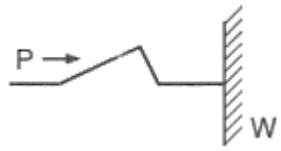
CBSE

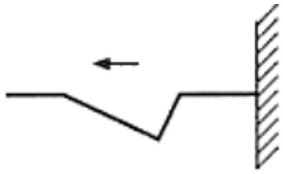
WAVES WS 5

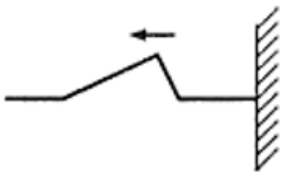
Class 11 - Physics

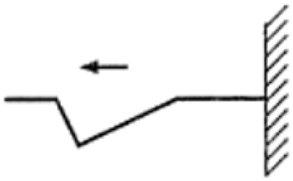
Section A

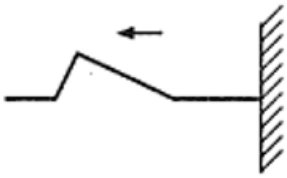
1. Figure shown here demonstrates a pulse P incident on a rigid wall. Which one of the following figures represents the reflected pulse correctly? **[1]**



a) 

b) 

c) 

d) 

2. SONAR emits which of the following waves? **[1]**

a) radio

b) ultrasound

c) ultrasonic

d) light

3. Sound waves of f = 600 Hz fall normally on a perfectly reflecting wall. The shortest distance from the wall at which all particles will have a maximum amplitude of vibration will be: (speed of sound = 300 m/s) **[1]**

a) $\frac{3}{8}$m

b) $\frac{1}{8}$m

c) $\frac{1}{4}$m

d) $\frac{7}{8}$m

4. The driver of a car travelling with speed 30 m/s towards a hill sounds a horn of frequency 600 Hz. If the velocity of sound in air is 330 m/s, the frequency of reflected sound as heard by the driver is **[1]**

a) 500 Hz

b) 550 Hz

c) 555.5 Hz

d) 720 Hz

5. The time of reverberation of a room A is one second. What will be the time (in seconds) of reverberation of a room, having all the dimensions double of those of room A? **[1]**

a) 2

b) 4

c) 1

d) $\frac{1}{2}$

6. Reverberation time can't be controlled by **[1]**

a) volume of room

b) changing carpet

c) size of window
d) temperature

7. When a wave undergoes reflection at rarer medium then it undergoes a phase difference of: **[1]**

a) $\frac{\pi}{2}$
b) $\frac{\pi}{4}$
c) No change in phase
d) π

8. **Assertion (A):** Shock waves produced by supersonic aircraft may be visible. **[1]**
Reason (R): The sudden decrease in air pressure in the shock waves caused water molecules in the air to condense, forming a fog.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

9. **Assertion (A):** Resonance is a special case of forced vibration in which the nature and frequency of vibration of the body is the same as the impressed frequency and the amplitude of forced vibration is maximum. **[1]**
Reason (R): The amplitude of forced vibrations of a body increases with an increase in the frequency of the externally impressed periodic force

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

10. **Assertion (A):** The phenomenon of interference is based on conservation of energy. **[1]**
Reason (R): For interference of two waves the amplitude must be nearly equal.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

11. **Assertion (A):** A vibrating tuning fork sounds louder, when its stem is pressed against a desk top. **[1]**
Reason (R): When a sound wave is incident on the surface of a desk, it is totally reflected.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

12. When a wave is reflected from a rigid surface, it undergoes a phase change given by_____. **[1]**

a) 3π
b) 2π
c) 0
d) π

13. A travelling wave, at a rigid boundary or a closed-end _____. **[1]**

a) is reflected with a phase difference of 30^o
b) is reflected with the same phase
c) is reflected with a phase difference of 70^o
d) is reflected with a phase reversal

14. The reverberation time is larger for an empty hall than in a crowded hall. Why? **[1]**

15. A rock underwater is 1595 m deep. Find the time in which an ultrasonic signal returns after reflection from the rock. Given the speed of ultrasonic waves in water = 1450 ms^{-1} **[1]**

16. Write the full name of the technique used in locating **[1]**

i. an under-water obstacle

ii. position of an aeroplane in space.

17. Why do the stages of large auditoriums give curved backs? **[1]**

18. What does cause the rolling sound of thunder? **[1]**

19. Explain why we cannot hear an echo in a small room? **[1]**

20. What is an echo? What should be the minimum distance between the source of the sound and the reflector for hearing a distinct echo? **[1]**

21. What is the difference between an echo and a reverberation? **[1]**

Section B

22. **Fill in the blanks:** **[2]**

    (a) When a wave travels from one medium to another, it suffers _____ phase change. **[1]**

    (b) If a wave is incident obliquely on the boundary between two different media, the transmitted wave is called the _____. **[1]**

23. A stone is dropped into a well and its splash is heard at the mouth of the well after an interval of 1.45 s. Find the depth of the well. Given that velocity of sound in air at room temperature is equal to 332 ms^{-1}. **[2]**

24. A rocket is moving at a speed of 200 ms^{-1} towards a stationary target. While moving, it emits a wave of frequency 1000 Hz. Some of the sound reaching the target gets reflected back to the rocket as an echo. Calculate **[2]**

    1. the frequency of sound as detected by the person at the position of target and
    2. frequency of echo as detected by the rocket.

25. If the splash is heard 4.23 seconds after a stone is dropped into a well. 78.4 metes deep, find the velocity of sound in air? **[2]**

Section C

26. A policeman on duty detects a drop of 15% in the pitch of the horn of a motor car as it crosses him. If the velocity of sound is 330 m s^{-1}, calculate the speed of the car. **[3]**

27. A whistle of frequency 540 Hz rotates in a circle of radius 2 m at an angular speed of 15 rad s^{-1}. What is the lowest and highest frequency heard by a listener a long distance away at rest w.r.t. centre of the circle? Can the apparent frequency be ever equal to the actual frequency? Take v = 330 ms^{-1}. **[3]**

28. A SONAR system fixed in a submarine operates at a frequency 40.0 kHz. An enemy submarine moves towards the SONAR with a speed of 360 km h^{-1}. What is the frequency of sound reflected by the submarine? Take the speed of sound in water to be 1450 ms^{-1}. **[3]**

29. A wire having a linear mass density of 5.0×10^{-3} kg m^{-1} is stretched between two rigid supports with a tension of 450 N. The wire resonates at a frequency of 420 Hz. The next higher frequency at which the same wire resonates is 490 Hz. Find the length of the wire. **[3]**

30. What are mechanical, electromagnetic and matter waves? Give an example of each type. **[3]**

31. Find the fundamental note emitted by a string of length $10\sqrt{10}$ cm under the tension of 3.14 kg. Radius of string is 0.5 mm and density = 9.8 g cm^{-3}. **[3]**

32. The speed of sound in dry air at S.T.P. is 332 ms^{-1} Assuming air as composed of 4 parts of nitrogen and one part of oxygen, calculate the velocity of sound in oxygen under similar conditions when the densities of oxygen and nitrogen at S.T.P. are in the ratio of 16:14. **[3]**

Section D

33. A stone hangs in air from one end of a wire which is stretched over a sonometer. The wire is in unison with a **[5]**

certain tuning fork when the bridges of the sonometer are 45 cm apart. Now the stone hangs immersed in water at A°C and the distance between the bridges has to be altered by 9 cm to re-establish unison of the wire with the same fork. Calculate the density of the stone.

34. A column of air and a tuning fork produce 4 beats per second when sounded together. The tuning fork gives the lower note. The temperature of air is 15° C. When the temperature falls to 10°C, the two product 3 beats per second. Find the frequency of the fork. **[5]**

35. A displacement wave is represented by $y = 0.25 \times 10^{-3} \sin(500t - 0.025 x)$ where y, t and x are in cm, sec and metres respectively. Deduce (i) amplitude (ii) period (iii) angular frequency, and (iv) wavelength. Also, deduce the amplitude of particle velocity and particle acceleration. **[5]**

36. A train stands at a platform blowing a whistle of a frequency of 400 Hz in still air. **[5]**

i. What is the frequency of the whistle heard by a man running

a. towards the engine at 10 ms^{-1},

b. away from the engine at 10 ms^{-1}?

ii. What is the speed of sound in each case?

iii. What is the wavelength of sound received by the running man in each case?

Take the speed of sound in still air = 340 ms^{-1}.

37. The first overtone of an open organ, n pipe beats with the first overtone of a closed organ pipe with a beat frequency of 2.2 Hz. The fundamental frequency of the closed organ pipe is 110 Hz. Find the lengths of the pipes. Velocity of sound in air = 330 ms^{-1}. **[5]**