Topic: Introduction

Section: Multiple Choice Questions

1. Which of the following is the primary characteristic of a wave?

(a) Transfer of matter

(b) Transfer of energy without transfer of matter

(c) Transfer of momentum only

(d) Transfer of both matter and energy

2. Which of the following is a non-mechanical wave?

(a) Sound wave

(b) Water wave

(c) Light wave

(d) Seismic wave

3. In a transverse wave, the particles of the medium oscillate:

(a) Parallel to the direction of wave propagation

(b) Perpendicular to the direction of wave propagation

(c) At an angle of 45 degrees to the direction of wave propagation

(d) In a circular path

4. The product of frequency (f) and wavelength (λ) of a wave gives its:

(a) Amplitude

(b) Period

(c) Speed

(d) Intensity

5. The maximum displacement of a particle of the medium from its equilibrium position due to a wave is called its:

(a) Wavelength

(b) Frequency

(c) Amplitude

(d) Period

6. Which of the following statements about sound waves is correct?

(a) They are electromagnetic waves.

(b) They can travel through vacuum.

(c) They are longitudinal waves.

(d) They are transverse waves in air.

7. Electromagnetic waves travel in vacuum with a speed of approximately:

(a) 3 x 10^8 m/s

(b) 3 x 10^5 m/s

(c) 3 x 10^2 m/s

(d) It depends on their frequency.

8. When a wave passes from one medium to another, which of the following properties remains unchanged?

(a) Wavelength

(b) Speed

(c) Frequency

(d) Amplitude

9. The time taken by a particle of the medium to complete one oscillation is called the:

(a) Wavelength

(b) Frequency

(c) Speed

(d) Period

10. If the frequency of a wave is doubled, and its speed remains constant, its wavelength will:

(a) Be halved

(b) Be doubled

(c) Remain unchanged

(d) Be quadrupled

11. The SI unit of intensity of a wave is:

(a) Watt per meter (W/m)

(b) Joule per second (J/s)

(c) Watt per square meter (W/m^2)

(d) Newton per square meter (N/m^2)

12. Which of these is an example of a longitudinal wave?

(a) Light waves

(b) Water ripples

(c) Sound waves in air

(d) Waves on a stretched string

13. The phase difference between two points on a progressive wave separated by one full wavelength is:

(a) 0 degrees or 0 radians

(b) 90 degrees or pi/2 radians

(c) 180 degrees or pi radians

(d) 360 degrees or 2pi radians

14. The speed of sound in a medium primarily depends on the medium's:

(a) Temperature and density

(b) Frequency of the sound

(c) Amplitude of the sound

(d) Wavelength of the sound

15. Which of the following is NOT a property of electromagnetic waves?

(a) They are transverse in nature.

(b) They can be polarized.

(c) They require a material medium for propagation.

(d) They travel at the speed of light in vacuum.

Answers

1. (b)

2. (c)

3. (b)

4. (c)

5. (c)

6. (c)

7. (a)

8. (c)

9. (d)

10. (a)

11. (c)

12. (c)

13. (d)

14. (a)

15. (c)

Topic: Types of waves, (progressive, stationary, mechanical, non-mechanical, transverse, longitudinal)

Section: Multiple Choice Questions

16. Which of the following statements accurately describes a mechanical wave?

(a) It can propagate through a vacuum.

(b) It requires a material medium for its propagation.

(c) It always travels at the speed of light in a vacuum.

(d) Its energy is always carried by oscillating electric and magnetic fields.

17. Which of the following is an example of a non-mechanical wave?

(a) Sound waves in air

(b) Water ripples

(c) Seismic P-waves

(d) X-rays

18. In a transverse wave, the particles of the medium oscillate:

(a) In the same direction as the wave propagation.

(b) Perpendicular to the direction of wave propagation.

(c) At an angle of 45 degrees to the direction of wave propagation.

(d) In a circular path.

19. An example of a longitudinal wave is:

(a) Light waves

(b) Radio waves

(c) Sound waves in air

(d) Ocean waves on the surface

20. The phenomenon of polarization is exclusively exhibited by which type of wave?

(a) Longitudinal waves

(b) Mechanical waves

(c) Transverse waves

(d) Stationary waves

21. A key characteristic distinguishing a progressive wave from a stationary wave is:

(a) Progressive waves have fixed positions of maximum and minimum displacement, while stationary waves do not.

(b) Stationary waves transfer energy across the medium, while progressive waves do not.

(c) Progressive waves transfer energy through the medium, while stationary waves do not exhibit net energy transfer through the medium.

(d) Stationary waves can only be formed in a vacuum, while progressive waves require a medium.

22. In a stationary wave, the points where the amplitude of oscillation is maximum are called:

(a) Nodes

(b) Antinodes

(c) Crests

(d) Troughs

23. If the frequency of a wave is doubled and its speed remains constant, its wavelength will:

(a) Double

(b) Halve

(c) Remain unchanged

(d) Quadruple

24. The speed of a mechanical wave in a medium depends primarily on:

(a) The amplitude of the wave.

(b) The frequency of the wave.

(c) The properties of the medium (elasticity and inertia).

(d) The wavelength of the wave.

25. The frequency of a wave is determined by:

(a) The medium through which it travels.

(b) The amplitude of the wave.

(c) The source that generates the wave.

(d) The speed of the wave.

26. Which of the following is a wave that is both mechanical and transverse?

(a) Sound wave in a solid

(b) Light wave in vacuum

(c) Surface waves on water

(d) Ultrasound waves in tissue

27. The maximum displacement of particles of the medium from their mean position during wave propagation is called:

(a) Wavelength

(b) Frequency

(c) Amplitude

(d) Phase

28. Compared to sound waves, electromagnetic waves:

(a) Require a medium for propagation.

(b) Travel at a slower speed in vacuum.

(c) Do not transfer energy.

(d) Can be polarized.

29. When a progressive wave reflects from a denser medium, which of the following typically undergoes a phase change of pi radians (180 degrees)?

(a) Frequency

(b) Wavelength

(c) Amplitude

(d) Displacement

30. A wave is described as having particles oscillating parallel to the direction of energy propagation. This wave is most accurately classified as a:

(a) Transverse wave

(b) Stationary wave

(c) Electromagnetic wave

(d) Longitudinal wave

Answers

16. (b)

17. (d)

18. (b)

19. (c)

20. (c)

21. (c)

22. (b)

23. (b)

24. (c)

25. (c)

26. (c)

27. (c)

28. (d)

29. (d)

30. (d)

Topic: Frequency, wavelength, periodic time and their relations

Section: Multiple Choice Questions

31. If the periodic time of a wave is 0.02 seconds, what is its frequency?

(a) 50 Hz

(b) 0.02 Hz

(c) 20 Hz

(d) 500 Hz

32. A sound wave travels at a speed of 340 m/s and has a frequency of 680 Hz. What is its wavelength?

(a) 0.5 m

(b) 2 m

(c) 1 m

(d) 4 m

33. Which of the following properties of a wave remains unchanged when it passes from one medium to another?

(a) Wavelength

(b) Speed

(c) Frequency

(d) Amplitude

34. In a transverse wave, the particles of the medium oscillate:

(a) Parallel to the direction of wave propagation.

(b) Perpendicular to the direction of wave propagation.

(c) In a circular path.

(d) Without any definite direction.

35. The speed of electromagnetic waves in vacuum is given by:

(a) $c = 1 / (\mu_0 \varepsilon_0)$

(b) $c = \sqrt{(\mu_0 \varepsilon_0)}$

(c) $c = 1 / \sqrt{(\mu_0 \varepsilon_0)}$

(d) $c = \mu_0 \varepsilon_0$

36. If the amplitude of a progressive wave is doubled, how does its intensity change?

(a) It remains the same.

(b) It doubles.

(c) It becomes four times.

(d) It becomes half.

37. The reciprocal of the periodic time of a wave is known as its:

(a) Wavelength

(b) Speed

(c) Amplitude

(d) Frequency

38. Which of the following is a characteristic of longitudinal waves only?

(a) They can be polarized.

(b) They require a medium for propagation.

(c) They exhibit compressions and rarefactions.

(d) They can travel through vacuum.

39. A wave is described by the equation $y(x,t) = A \sin(kx - \omega t)$. The term 'k' represents the:

(a) Angular frequency

(b) Wave speed

(c) Angular wave number

(d) Phase constant

40. Which type of wave is an ordinary light wave?

(a) Mechanical longitudinal wave

(b) Mechanical transverse wave

(c) Electromagnetic longitudinal wave

(d) Electromagnetic transverse wave

41. Total internal reflection occurs when light travels from:

(a) A rarer medium to a denser medium.

(b) A denser medium to a rarer medium, and the angle of incidence is less than the critical angle.

(c) A denser medium to a rarer medium, and the angle of incidence is greater than the critical angle.

(d) Any medium to vacuum.

42. The phenomenon of echo is a direct consequence of:

(a) Refraction of sound

(b) Reflection of sound

(c) Diffraction of sound

(d) Interference of sound

43. For which of the following applications are ultrasonic waves primarily used?

(a) Remote controls for televisions

(b) Communication with satellites

(c) Sonar and medical imaging

(d) Heating food in microwave ovens

44. If the frequency of a wave source is 100 Hz, how many waves are produced by the source in one minute?

(a) 100

(b) 600

(c) 6000

(d) 1000

45. The relationship between angular frequency (ω) and linear frequency (f) is:

(a) $\omega = f / (2\pi)$

(b) $\omega = 2\pi f$

(c) $\omega = \pi f$

(d) $\omega = f$

Answers

31. (a)

32. (a)

33. (c)

34. (b)

35. (c)

36. (c)

37. (d)

38. (c)

39. (c)

40. (d)

41. (c)

42. (b)

43. (c)

44. (c)

45. (b)

Topic: Properties and applications of electromagnetic waves (ordinary light, LASER) and sound waves (ultrasonic wave, audible wave)

Section: Multiple Choice Questions

46. Which of the following statements is true regarding electromagnetic waves and sound waves?

(a) Both are longitudinal waves.

(b) Both can travel through a vacuum.

(c) Electromagnetic waves are transverse, while sound waves are longitudinal.

(d) Sound waves are transverse, while electromagnetic waves are longitudinal.

47. The speed of light in vacuum is approximately:

(a) 3 x 10 power 5 m/s

(b) 3 x 10 power 8 km/s

(c) 3 x 10 power 8 m/s

(d) 3 x 10 power 9 m/s

48. Which property is NOT characteristic of a LASER beam?

(a) High monochromaticity

(b) High divergence

(c) High coherence

(d) High directionality

49. Ultrasonic waves are commonly used in:

(a) Radio broadcasting

(b) SONAR systems

(c) Optical microscopes

(d) X-ray imaging

50. If the refractive index of a medium is 1.5, what is the speed of light in that medium? (Speed of light in vacuum = c)

(a) 1.5 c

(b) c / 1.5

(c) c

(d) c - 1.5

51. Total Internal Reflection (TIR) occurs when light travels from:

(a) Denser to rarer medium at an angle of incidence less than the critical angle.

(b) Rarer to denser medium at an angle of incidence greater than the critical angle.

(c) Denser to rarer medium at an angle of incidence greater than the critical angle.

(d) Rarer to denser medium at any angle of incidence.

52. Sound waves in air are best described as:

(a) Transverse and electromagnetic.

(b) Longitudinal and mechanical.

(c) Transverse and mechanical.

(d) Longitudinal and electromagnetic.

53. The approximate frequency range for human audible sound is:

(a) Below 20 Hz

(b) Above 20,000 Hz

(c) 20 Hz to 20,000 Hz

(d) 200 Hz to 2,000 Hz

54. For a wave propagating through a medium, which of the following expressions correctly relates its speed (v), frequency (f), and wavelength (lambda)?

(a) v = f times lambda

(b) f = v + lambda

(c) lambda = v - f

(d) v = f / lambda

55. The intensity of a wave is directly proportional to the:

(a) Amplitude

(b) Square of the amplitude

(c) Wavelength

(d) Frequency

56. Optical fibers primarily work on the principle of:

(a) Reflection

(b) Refraction

(c) Total Internal Reflection

(d) Diffraction

57. The persistence of sound in a large hall due to multiple reflections is known as:

(a) Echo

(b) Resonance

(c) Reverberation

(d) Diffraction

58. The critical angle for a pair of media is the angle of incidence in the denser medium for which the angle of refraction in the rarer medium is:

(a) 0 degrees

(b) 45 degrees

(c) 90 degrees

(d) 180 degrees

59. Which of the following waves requires a material medium for its propagation?

(a) Radio waves

(b) X-rays

(c) Sound waves

(d) Light waves

60. An electromagnetic wave consists of:

(a) Only an electric field oscillating perpendicular to the direction of propagation.

(b) Only a magnetic field oscillating perpendicular to the direction of propagation.

(c) Mutually perpendicular oscillating electric and magnetic fields, both perpendicular to the direction of propagation.

(d) Mutually perpendicular oscillating electric and magnetic fields, both parallel to the direction of propagation.

Answers

46. (c)

47. (c)

48. (b)

49. (b)

50. (b)

51. (c)

52. (b)

53. (c)

54. (a)

55. (b)

56. (c)

57. (c)

58. (c)

59. (c)

60. (c)

Topic: Amplitude, intensity, phase and wave equations

Section: Multiple Choice Questions

61. Which of the following correctly defines the amplitude of a wave?

(a) The total distance covered by a particle in one complete oscillation.

(b) The maximum displacement of a particle from its mean position.

(c) The distance between two consecutive crests or troughs.

(d) The number of oscillations per unit time.

62. The intensity (I) of a wave is directly proportional to which of the following?

(a) The amplitude (A) of the wave.

(b) The square of the amplitude (A^2) of the wave.

(c) The cube of the amplitude (A^3) of the wave.

(d) The square root of the amplitude (sqrt(A)) of the wave.

63. The phase of a wave at a given point and time describes:

(a) The maximum displacement of the particle at that instant.

(b) The energy carried by the wave at that point.

(c) The state of oscillation (position and direction of motion) of the particle at that point and time.

(d) The speed at which the wave travels.

64. A progressive wave is represented by the equation y(x,t) = 0.05 sin(200t - 4x) in SI units. What is the angular frequency of the wave?

(a) 0.05 rad/s

(b) 4 rad/s

(c) 200 rad/s

(d) 50 rad/s

65. For the wave given by y(x,t) = 0.05 sin(200t - 4x) in SI units, what is the wavelength of the wave?

(a) pi/2 m

(b) 2pi m

(c) 4pi m

(d) pi/4 m

66. What is the phase difference between two particles separated by a distance of lambda/4 in a progressive wave?

(a) pi/4 rad

(b) pi/2 rad

(c) pi rad

(d) 2pi rad

67. If the time period of a wave is T and its angular frequency is omega, which of the following relations is correct?

(a) T = 2pi * omega

(b) T = omega / (2pi)

(c) T = 2pi / omega

(d) T = 1 / omega

68. If the intensity of a wave at a distance r from a point source is I, what will be its intensity at a distance 2r from the same source, assuming no energy loss?

(a) I/2

(b) I/4

(c) 2I

(d) 4I

69. A sound wave is described by y(x,t) = A sin(kx - omega t). If the displacement amplitude is A and the wave number is k, what is the unit of k?

(a) m

(b) s

(c) rad/m

(d) rad/s

70. When a transverse wave reflects from a denser medium (fixed end), what is the phase change experienced by the reflected wave?

(a) 0 rad

(b) pi/2 rad

(c) pi rad

(d) 2pi rad

71. Two waves are given by y1 = A sin(kx - omega t) and y2 = A cos(kx - omega t). What is the phase difference between these two waves?

(a) 0

(b) pi/4 rad

(c) pi/2 rad

(d) pi rad

72. If the amplitude of a wave is doubled, how many times does its energy density increase?

(a) 2 times

(b) 4 times

(c) 8 times

(d) Remains unchanged

73. The equation of a wave is given by y = 0.2 sin(300t - 1.5x), where y and x are in meters and t in seconds. What is the speed of the wave?

(a) 200 m/s

(b) 1.5 m/s

(c) 300 m/s

(d) 450 m/s

74. If the maximum pressure variation in a sound wave is P_max, which quantity is proportional to the square of P_max?

(a) Amplitude of displacement

(b) Wavelength

(c) Intensity

(d) Frequency

75. Consider two waves with intensities I1 and I2, such that I1 = 16 I2. If their amplitudes are A1 and A2 respectively, what is the ratio A1/A2?

(a) 2

(b) 4

(c) 8

(d) 16

Answers

61. (b)

62. (b)

63. (c)

64. (c)

65. (a)

66. (b)

67. (c)

68. (b)

69. (c)

70. (c)

71. (c)

72. (b)

73. (a)

74. (c)

75. (b)

Topic: Reflection, refraction, Snell's law, absolute refractive index, relative refractive index, total internal reflection, critical angle, optical fiber (construction, properties and applications)

Section: Multiple Choice Questions

76. When light passes from a rarer medium to a denser medium, which of the following quantities decreases?

(a) Frequency

(b) Wavelength

(c) Speed

(d) Both (b) and (c)

77. Snell's Law states that for a given pair of media and for light of a given colour, the ratio of sine of angle of incidence to the sine of angle of refraction is a constant. This constant is known as the:

(a) Absolute refractive index

(b) Relative refractive index

(c) Critical angle

(d) Dispersion constant

78. The absolute refractive index of a medium is defined as the ratio of the speed of light in vacuum to the speed of light in that medium. If the speed of light in water is 2.25 x 10^8 m/s, what is the absolute refractive index of water? (Speed of light in vacuum = 3 x 10^8 m/s)

(a) 1.25

(b) 1.33

(c) 1.50

(d) 1.67

79. Total Internal Reflection occurs when light travels from:

(a) A rarer medium to a denser medium, and the angle of incidence is greater than the critical angle.

(b) A denser medium to a rarer medium, and the angle of incidence is greater than the critical angle.

(c) A rarer medium to a denser medium, and the angle of incidence is less than the critical angle.

(d) A denser medium to a rarer medium, and the angle of incidence is less than the critical angle.

80. The critical angle for a pair of media is the angle of incidence in the denser medium for which the angle of refraction in the rarer medium is:

(a) 0 degrees

(b) 45 degrees

(c) 90 degrees

(d) 180 degrees

81. Optical fibers work on the principle of:

(a) Refraction

(b) Reflection

(c) Total Internal Reflection

(d) Dispersion

82. An optical fiber consists of a central core and an outer cladding. For efficient light transmission, the refractive index of the core must be:

(a) Greater than the refractive index of the cladding.

(b) Less than the refractive index of the cladding.

(c) Equal to the refractive index of the cladding.

(d) Independent of the refractive index of the cladding.

83. Which of the following optical instruments commonly uses the principle of Total Internal Reflection?

(a) Simple microscope

(b) Compound microscope

(c) Periscope

(d) Prism binocular

84. If the refractive index of medium 1 with respect to medium 2 is n12, then the refractive index of medium 2 with respect to medium 1 (n21) is:

(a) n12

(b) 1/n12

(c) n12^2

(d) sqrt(n12)

85. When light passes from air into glass, which of the following remains unchanged?

(a) Speed

(b) Wavelength

(c) Frequency

(d) Amplitude

86. If the refractive index of a medium is 1.5, what is the critical angle for light passing from this medium to air? (sin 41.8 degrees approx 1/1.5)

(a) 30 degrees

(b) 41.8 degrees

(c) 45 degrees

(d) 60 degrees

87. Which of the following statements about electromagnetic waves is INCORRECT?

(a) They do not require a material medium for propagation.

(b) They are transverse in nature.

(c) Their speed in vacuum is constant for all wavelengths.

(d) They are mechanical waves.

88. A major advantage of optical fibers over metallic cables for data transmission is:

(a) Lower bandwidth

(b) Higher signal loss

(c) Immunity to electromagnetic interference

(d) Higher power consumption

89. A coin at the bottom of a tank of water (refractive index = 4/3) appears to be at a depth of 12 cm. What is the actual depth of the coin?

(a) 9 cm

(b) 12 cm

(c) 16 cm

(d) 20 cm

90. A ray of light is incident normally on a plane boundary separating two media. The angle of refraction will be:

(a) 0 degrees

(b) 45 degrees

(c) 90 degrees

(d) Dependent on the refractive indices of the media.

Answers

76. (d)

77. (b)

78. (b)

79. (b)

80. (c)

81. (c)

82. (a)

83. (d)

84. (b)

85. (c)

86. (b)

87. (d)

88. (c)

89. (c)

90. (a)

Topic: Reverberation, Reverberation time, Sabine's formula, echo, absorption coefficient

Section: Multiple Choice Questions

91. What is reverberation?

(a) The phenomenon of sound bouncing off a single surface.

(b) The persistence of sound in a large enclosure after the source has stopped.

(c) The reflection of sound from multiple surfaces in quick succession, creating a distinct repeat.

(d) The bending of sound waves around an obstacle.

92. An echo is distinguished from reverberation primarily by:

(a) The frequency of the sound wave.

(b) The time delay between the original sound and the reflected sound.

(c) The amplitude of the reflected sound.

(d) The type of surface from which sound reflects.

93. According to Sabine's formula, the reverberation time (T) of a hall is directly proportional to:

(a) The total absorbing area of the hall.

(b) The absorption coefficient of the materials in the hall.

(c) The volume of the hall.

(d) The frequency of the sound.

94. The absorption coefficient of a material is a measure of:

(a) How much sound energy is reflected by the material.

(b) How much sound energy is transmitted through the material.

(c) How much sound energy is absorbed by the material.

(d) How much sound energy is refracted by the material.

95. The SI unit of absorption coefficient is:

(a) metre squared (m^2)

(b) sabin

(c) dimensionless

(d) metre (m)

96. To reduce the reverberation time in a large auditorium, which of the following measures would be most effective?

(a) Increasing the volume of the auditorium.

(b) Decreasing the total absorbing area.

(c) Replacing hard, reflective surfaces with soft, porous materials.

(d) Increasing the intensity of the sound source.

97. Which of the following materials typically has a high absorption coefficient for sound?

(a) Concrete

(b) Polished marble

(c) Thick curtains or carpets

(d) Glass

98. For a distinct echo to be heard by a listener, the minimum time interval between the original sound and the reflected sound should be approximately:

(a) 0.01 seconds

(b) 0.1 seconds

(c) 1 second

(d) 10 seconds

99. If the reverberation time of a hall is too short, the sound inside the hall would appear:

(a) Muffled and unclear.

(b) Too loud and sustained.

(c) Dry and dull.

(d) Having a distinct echo.

100. A person shouts and hears an echo after 2 seconds. If the speed of sound in air is 340 m/s, what is the distance to the reflecting surface?

(a) 170 m

(b) 340 m

(c) 680 m

(d) 85 m

101. The primary purpose of using acoustic panels on the walls of a recording studio is to:

(a) Increase the reflection of sound.

(b) Reduce sound transmission to the outside.

(c) Control reverberation and prevent echoes.

(d) Amplify the sound within the studio.

102. How does an increase in temperature generally affect the speed of sound in air?

(a) It decreases the speed of sound.

(b) It increases the speed of sound.

(c) It has no effect on the speed of sound.

(d) It depends on the humidity, not temperature.

103. Sabine's formula for reverberation time (T) is given by:

(a) $T = 0.161 * (V / A)$

(b) $T = A / (0.161 * V)$

(c) T = 0.161 * (A / V)

(d) T = V / (0.161 * A)

Where V is volume and A is total absorption.

104. In an empty auditorium, the reverberation time is generally:

(a) Longer than when it is full.

(b) Shorter than when it is full.

(c) The same as when it is full.

(d) Dependent only on the sound source.

105. The unit of reverberation time is:

(a) Hertz (Hz)

(b) Metre (m)

(c) Second (s)

(d) Decibel (dB)

Answers

91. (b)

92. (b)

93. (c)

94. (c)

95. (c)

96. (c)

97. (c)

98. (b)

99. (c)

100. (b)

101. (c)

102. (b)

103. (a)

104. (a)

105. (c)

Topic: Summary (quick revision)

Section: Multiple Choice Questions

106. What type of wave requires a material medium for its propagation?

(a) Electromagnetic wave

(b) Mechanical wave

(c) Light wave

(d) Radio wave

107. If the frequency of a wave is doubled, and its speed remains constant, what happens to its wavelength?

(a) It doubles

(b) It becomes half

(c) It remains unchanged

(d) It quadruples

108. In a transverse wave, the particles of the medium oscillate:

(a) Parallel to the direction of wave propagation

(b) Perpendicular to the direction of wave propagation

(c) At an angle of 45 degrees to the direction of wave propagation

(d) In circles

109. The speed of all electromagnetic waves in vacuum is:

(a) Dependent on their wavelength

(b) Dependent on their frequency

(c) Constant for all, approximately 3 x 10^8 m/s

(d) Slower than sound waves

110. When a light ray passes from an optically rarer medium to an optically denser medium, it:

(a) Bends away from the normal

(b) Bends towards the normal

(c) Does not bend at all

(d) Is totally internally reflected

111. For total internal reflection to occur, the light must travel from:

(a) A rarer medium to a denser medium

(b) A denser medium to a rarer medium

(c) Any medium to vacuum

(d) Vacuum to any medium

112. Which of the following describes an ultrasonic wave?

(a) Sound wave with frequency below 20 Hz

(b) Sound wave with frequency between 20 Hz and 20,000 Hz

(c) Sound wave with frequency above 20,000 Hz

(d) Electromagnetic wave used for imaging

113. The intensity of a wave is directly proportional to the square of its:

(a) Wavelength

(b) Frequency

(c) Amplitude

(d) Speed

114. Two waves are said to be in phase if their particles at corresponding points:

(a) Have the same amplitude but different frequencies

(b) Have the same displacement and velocity at the same time

(c) Move in opposite directions

(d) Have a phase difference of 90 degrees

115. According to the law of reflection, the angle of incidence is:

(a) Greater than the angle of reflection

(b) Less than the angle of reflection

(c) Equal to the angle of reflection

(d) Independent of the angle of reflection

116. The absolute refractive index of a medium is defined as the ratio of:

(a) Speed of light in the medium to speed of light in vacuum

(b) Speed of light in vacuum to speed of light in the medium

(c) Speed of light in one medium to speed of light in another medium

(d) Wavelength of light in vacuum to wavelength of light in the medium

117. Reverberation time is the time taken for the sound intensity in a room to fall by a factor of:

(a) 100

(b) 1000

(c) 10^6

(d) 10^-6

118. For a distinct echo to be heard, the minimum distance between the source of sound and the reflecting surface at 22 degrees Celsius (speed of sound approx 344 m/s) should be approximately:

(a) 1.72 m

(b) 17.2 m

(c) 34.4 m

(d) 3.44 m

119. The principle behind the working of an optical fiber is:

(a) Refraction

(b) Diffraction

(c) Total Internal Reflection

(d) Interference

120. Which of the following is a characteristic property of LASER light?

(a) It is polychromatic

(b) It is highly divergent

(c) It is incoherent

(d) It is highly monochromatic

Answers

106. (b)

107. (b)

108. (b)

109. (c)

110. (b)

111. (b)

112. (c)

113. (c)

114. (b)

115. (c)

116. (b)

117. (c)

118. (b)

119. (c)

120. (d)

Topic: Introduction and basics

Section: Multiple Choice Questions

1. What is the primary characteristic of a wave?

(a) It transfers matter from one point to another.

(b) It transfers energy without transferring matter.

(c) It causes permanent displacement of a medium.

(d) It requires a vacuum to propagate efficiently.

2. Which of the following is an example of a longitudinal wave?

(a) Light waves

(b) Water waves on the surface

(c) Sound waves in air

(d) Radio waves

3. The distance between two consecutive crests or troughs of a wave is called its:

(a) Amplitude

(b) Frequency

(c) Wavelength

(d) Period

4. If the frequency of a wave is 100 Hz and its wavelength is 2 meters, what is its speed?

(a) 50 m/s

(b) 100 m/s

(c) 200 m/s

(d) 0.02 m/s

5. The maximum displacement of particles of the medium from their equilibrium position during wave propagation is known as the wave's:

(a) Wavelength

(b) Frequency

(c) Amplitude

(d) Speed

6. Which type of wave can travel through a vacuum?

(a) Sound waves

(b) Water waves

(c) Electromagnetic waves

(d) Seismic waves

7. The time taken for one complete oscillation of a particle in a medium transmitting a wave is called the:

(a) Frequency

(b) Period

(c) Wavelength

(d) Amplitude

8. When a wave travels from a rarer medium to a denser medium, which of the following quantities remains constant?

(a) Wavelength

(b) Speed

(c) Frequency

(d) Amplitude

9. Sound waves propagate fastest in which of the following media at a given temperature?

(a) Air

(b) Water

(c) Steel

(d) Vacuum

10. Which of the following statements about electromagnetic waves is true?

(a) They are longitudinal waves.

(b) They require a material medium to travel.

(c) They travel at different speeds in a vacuum depending on their frequency.

(d) They consist of oscillating electric and magnetic fields perpendicular to each other and to the direction of propagation.

11. The phenomenon where two or more waves overlap to form a resultant wave of greater, smaller, or the same amplitude is called:

(a) Diffraction

(b) Refraction

(c) Interference

(d) Polarization

12. The loudness of a sound is primarily determined by its:

(a) Frequency

(b) Wavelength

(c) Amplitude

(d) Speed

13. Which part of the electromagnetic spectrum has wavelengths longer than visible light but shorter than radio waves?

(a) Ultraviolet

(b) X-rays

(c) Infrared

(d) Gamma rays

14. A wave travels 150 meters in 5 seconds. Its speed is:

(a) 750 m/s

(b) 30 m/s

(c) 150 m/s

(d) 5 m/s

15. The relationship between the speed of light (c), its frequency (f), and its wavelength (lambda) is given by:

(a) f = c * lambda

(b) lambda = c * f

(c) c = f / lambda

(d) c = f * lambda

Answers

1. (b)

2. (c)

3. (c)

4. (c)

5. (c)

6. (c)

7. (b)

8. (c)

9. (c)

10. (d)

11. (c)

12. (c)

13. (c)

14. (b)

15. (d)

Topic: Modes of heat transfer

16. Which mode of heat transfer involves the transfer of energy through direct contact and vibration of particles without any actual movement of the material itself?

(a) Convection

(b) Conduction

(c) Radiation

(d) Absorption

17. Heat from the Sun reaches the Earth predominantly through which mode of heat transfer?

(a) Conduction

(b) Convection

(c) Radiation

(d) Diffusion

18. In which mode of heat transfer does the bulk movement of fluid (liquid or gas) play a significant role?

(a) Conduction

(b) Convection

(c) Radiation

(d) Evaporation

19. A metal spoon placed in a hot cup of tea quickly becomes warm. This is an example of heat transfer primarily by:

(a) Convection

(b) Radiation

(c) Conduction

(d) Condensation

20. Which of the following statements is true regarding the specific heat capacity of a substance?

(a) It is the amount of heat required to raise the temperature of 1 kg of a substance by 1 degree Celsius.

(b) It is the amount of heat required to melt 1 kg of a substance.

(c) It is the amount of heat absorbed during a phase change.

(d) It is the rate at which heat is transferred.

21. What is the equivalent temperature of 27 degrees Celsius on the Kelvin scale?

(a) 27 K

(b) 273 K

(c) 300 K

(d) 327 K

22. Which of the following materials is generally considered the best conductor of heat?

(a) Wood

(b) Air

(c) Copper

(d) Water

23. The gaps left between railway tracks are primarily to account for:

(a) Thermal expansion

(b) Thermal conductivity

(c) Specific heat capacity

(d) Convection currents

24. A person feels warmer when standing near a bonfire. The primary mode of heat transfer responsible for this feeling is:

(a) Conduction

(b) Convection from the flames

(c) Radiation

(d) Convection from the surrounding air

25. Why do cooking utensils often have wooden or plastic handles?

(a) To make them lighter

(b) To make them aesthetically pleasing

(c) Because wood and plastic are poor conductors of heat

(d) Because wood and plastic are good conductors of heat

26. On a cold winter day, why do two thin blankets keep us warmer than one thick blanket of the same material?

(a) Two blankets have a higher specific heat capacity.

(b) The air trapped between the two thin blankets acts as an insulator.

(c) The surface area for heat radiation is increased.

(d) Two blankets absorb more heat from the environment.

27. Water has a very high specific heat capacity. This property makes it suitable for which of the following applications?

(a) As a good electrical conductor

(b) As a coolant in engines

(c) As a material for cooking utensils

(d) As a good thermal insulator

28. The process of heat transfer that does not require any material medium is:

(a) Conduction

(b) Convection

(c) Radiation

(d) Both conduction and convection

29. If 0 degrees Celsius is equivalent to 32 degrees Fahrenheit, then what is 100 degrees Celsius equivalent to in Fahrenheit?

(a) 180 degrees F

(b) 212 degrees F

(c) 273 degrees F

(d) 373 degrees F

30. Which of the following scenarios primarily demonstrates convection?

(a) Heating a solid metal rod at one end.

(b) Feeling the warmth of a light bulb from a distance.

(c) Boiling water in a pot, where hot water rises and cold water sinks.

(d) Sunlight passing through a window and warming a room.

Answers

16. (b)

17. (c)

18. (b)

19. (c)

20. (a)

21. (c)

22. (c)

23. (a)

24. (c)

25. (c)

26. (b)

27. (b)

28. (c)

29. (b)

30. (c)