Q.1 Stationary waves are formed due to superposition of

(A) Two identical waves travelling in same directions.
(B) Two unlike waves travelling in same directions.
(C) Two identical waves travelling in opposite directions.
(D) Two unlike waves travelling in opposite directions

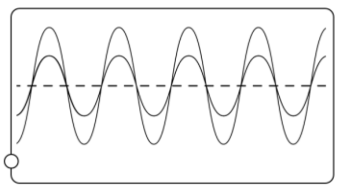
Q.2 For a string clamped at both ends, which of the following wave equation is valid for a stationary wave set up in it whose origin is at one of the ends of the string?

(A) $y = A\sin kx \sin \omega t$ **(B)** $y = A\cos kx \sin \omega t$ **(C)** $y = A\cos kx \cos \omega t$ **(D)** $y = 2A\cos kx \cos \omega t$

Q.3 The displacement equation for a particle in standing wave is represented as $y(x, t) = 0.4\sin(0.5x)\cos(30t)$, where x andy are in cm Magnitude of velocity of particle at

(A) 0.559 cm/s **(B)** 0.687 cm/s **(C)** 0.102 cm/s **(D)** 0.753 cm/s

Q.4 A standing wave is represented by $y = a\sin(0.05x)\cos(100t)$, where t is in s and x is in m, then the velocity of the constituent wave is.



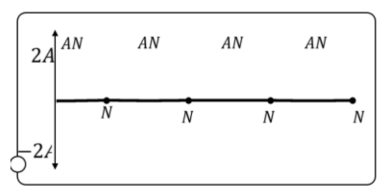
(A) 10^2 m/s **(B)** 10^5 m/s **(C)** 10^3 m/s **(D)** 2×10^3 m/s

Q.5 Two identical transverse sinusoidal waves travel in opposite directions along a string. The speed of transverse waves in the string is 0.5 cm/s. Each has an amplitude of 3.0 cm and wavelength of 6.0 cm. The equation for the resultant wave is

(A) $y = 6\sin\left(\frac{\pi t}{6}\right)\cos\left(\frac{\pi x}{3}\right)$ **(B)** $y = 6\sin\left(\frac{\pi x}{3}\right)\cos\left(\frac{\pi t}{6}\right)$

(C) Both (a) and (b) may be correct **(D)** Both (a) and (b) are wrong

Q.6 Equation of a stationary wave is given by, $y = 5\cos\left(\frac{\pi x}{25}\right)\sin(100\pi t)$ here x is in cm and t in s node will not occur at distance.

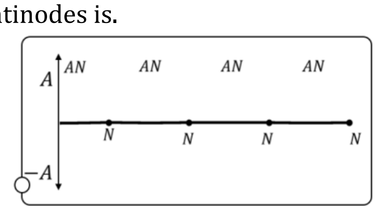


(A) 25 cm **(B)** 62.5 cm **(C)** 12.5 cm **(D)** 37.5 cm

Q.7 Vibration in a string of length 60 cm fixed at both ends is represented by the equation, $y = 4\sin\left(\frac{\pi x}{15}\right)\cos(96\pi t)$ where x and y are in cm and t in s. The number of loops formed in vibrating string will be.

(A) 4 **(B)** 3 **(C)** 6 **(D)** 5

Q.8 In a stationary wave, when particles of a string passes through their mean position then kinetic energy of these particles at antinodes is.



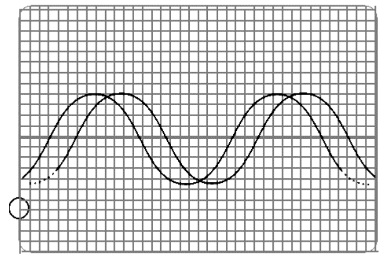
(A) Minimum **(B)** Maximum **(C)** zero **(D)** infinite

Q.9 The displacement of a particle in standing wave on a string is given by $y(x, t) = 0.4\sin(0.5x)\cos(30t)$, where x and y are in cm. Identify the incorrect option -

(A) Frequency of wave is $\frac{15}{\pi}$ Hz **(B)** Wave speed is 60 cm/s

(C) Amplitude of wave is 0.2 cm **(D)** Wave number for the wave is $0.5\ cm^{-1}$

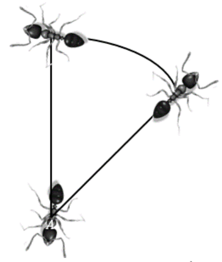
Q.10 A plane simple harmonic progressive wave given by the equation, $y = A\sin(\omega t - kx)$ of wavelength 120 cm is incident normally on a plane surface which is a perfect reflector (acts as fixed end). If a stationary wave is formed, then the ratio of amplitudes of vibrations at points 10 cm and 30 cm from the reflector is.

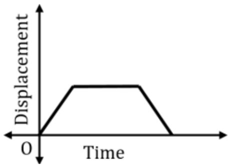


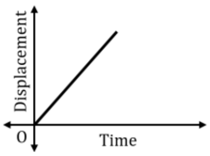
(A) 1:2 **(B)** 1: 3 **(C)** 2:1 **(D)** 3:1

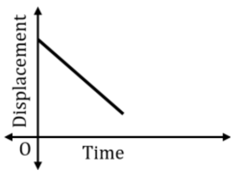
WORK SHEET

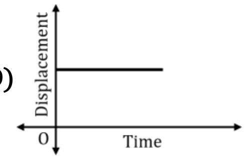
Q.1 A particle moves along the path ABCA with a constant speed starting from A. Part BC is circular with center at A. The magnitude of displacement (from A) versus time graph will be



(A) 

(B) 

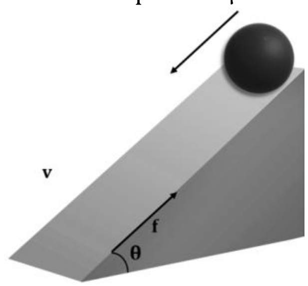
(C) 

(D) 

Q.2 The acceleration of a particle is defined by the relation, $a = -4x\left(-1 + \frac{1}{4}x^2\right)$, where x is displacement along $x-$ axis. All the quantities are in SI units. If velocity of the particle $(v) = 17$ m/s when $x = 0$, then the velocity of the particle when $x = 4$ m is

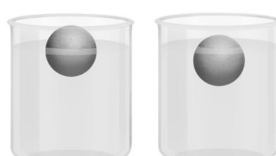
(A)12 m/s **(B)**15m/s **(C)**20m/s **(D)**25m/s

Q.3 A uniform solid sphere of radius R and mass m rolls down an inclined plane. The coefficient of friction between the sphere and the inclined plane is μ then maximum value of θ for pure rolling is



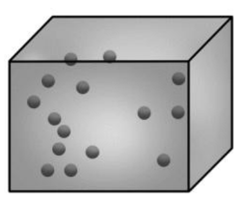
(A)$\tan^{-1}\left(\frac{3\mu}{2}\right)$ **(B)**$\tan^{-1}\left(\frac{7\mu}{2}\right)$ **(C)**$\tan^{-1}\left(\frac{5\mu}{3}\right)$ **(D)**$\tan^{-1}\left(\frac{7\mu}{3}\right)$

Q.4 Two solid bodies X and Y having same volume floats in a liquid. It is observed that X floats with 50% of its volume immersed in liquid and Y floats with 25% of its volume above the liquid level. The ratio of density of X to Y is



(A)3: 2 **(B)**2: 3 **(C)**2: 5 **(D)**5: 2

Q.5 The average velocity of molecules of a gas of molecular mass M at temperature T is



(A) 0 (B) $\sqrt{\frac{3RT}{M}}$ (C) $\sqrt{\frac{8RT}{\pi M}}$ (D) $\sqrt{\frac{2RT}{M}}$

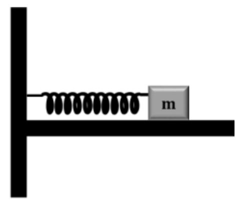
Q.6 12g He and 4g H_2 filled in a container of volume 20 L maintained at temperature 300 K. The pressure of the mixture is nearly

(A)3.225 atm **(B)**5.225atm **(C)**6.225atm **(D)**1.225atm

Q.7 The equation of motion of a particle of mass 1g is $\frac{d^2x}{dt^2} + \pi^2 x = 0$, where x is displacement (in m) from mean position. The frequency (in Hz) of oscillation is

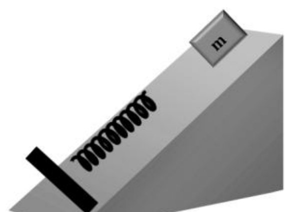
(A)0.5 **(B)**0.7 **(C)**0.8 **(D)**0.3

Q.8 In a horizontal spring mass system, mass m is released after being displaced towards right by some distance at $t = 0$ on a frictionless surface. The phase angle of the motion in radian when it passes through the equilibrium position for the first time is



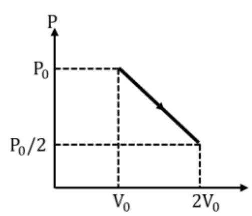
(A)$\frac{\pi}{2}$ **(B)**π **(C)**$\frac{3\pi}{2}$ **(D)**0

Q.9 A body of mass m released from a height h on a smooth inclined plane as shown in the figure. Which of the following statement can be true about the velocity v of the block knowing that the wedge is fixed?



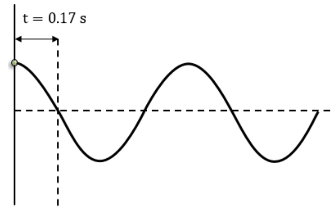
(A)V is maximum when it just touches the spring
(B)V is maximum when it compresses the spring by some amount
(C)V is maximum when the spring comes back to natural position
(D)V is zero when it just touches the spring

Q.10 An ideal monoatomic gas is at pressure P_0 and volume V_0. It is taken to final volume $2V_0$ and final pressure $\frac{P_0}{2}$ in a process which is straight line on $P - V$ diagram.



(A) Final temperature is greater than initial temperature
(B) Internal energy increases
(C) Work done by the gas is $+\frac{P_0V_0}{4}$ **(D)**Heat is absorbed by the gas

Q.11 In a sinusoidal wave, the time required for a particle to move from maximum displacement to mean position is 0.17 s. The frequency of the wave is.

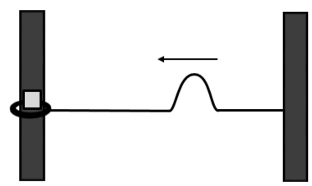


(A)1.47 Hz **(B)**2.94Hz **(C)**4.17Hz **(D)**0.92Hz

Q.12 The phase difference between two points separated by 0.8 m in a wave of frequency 120 Hz is 0.5π. The velocity of wave will be.
(A)720 m/s **(B)**384m/s **(C)**256m/s **(D)**144m/s

Q.13 When a stationary wave is formed, its frequency is
(A) Same as that of the individual waves **(B)**Twice as that of the individual waves
(C) Half as that of the individual waves **(D)**Thrice as that of the individual waves

Q.14 A pulse travelling on string fixed at one end and free at other end as shown figure. Choose an incorrect option.



(A) Point A represents node **(B)**Point B represents antinode
(C) Point B represents node **(D)**Both (a) and (b)

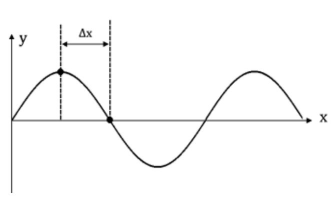
Q.15 A wave represented by the equation $y = a\cos(\omega t - kx)$ is superimposed with another wave to form a stationary wave such that the point $x = 0$ is a node. The equation of the other wave is
(A)$a\cos(\omega t - kx)$ **(B)**$-a\cos(\omega t + kx)$ **(C)**$a\sin(\omega t - kx)$ **(D)**$-a\sin(\omega t - kx$

Q.16 Standing wave is produced in 10 m long stretched string. If the string vibrates in 5 segments and wave velocity is 20 m/s, then frequency of oscillation is
(A)5 Hz **(B)**2Hz **(C)**8Hz **(D)**7Hz

Q.17 Consider the three waves, z_1, z_2 and z_3 as $z_1 = A\sin(kx - \omega t)$, $z_2 = A\sin(kx + \omega t)$ and $z_3 = A\sin(ky - \omega t)$. Which of the following represents a standing wave?
(A)$z_1 + z_2$ **(B)**$z_2 + z_3$ **(C)**$z_3 + z_1$ **(D)**$z_2 + 2z_3$

Q.18 A wave disturbance in a medium is described by $y(x,t) = 0.02\cos(10\pi x)\cos(50\pi t + \frac{\pi}{2})$, where x and y are in m and t in s. Identify the incorrect option.
(A) Node occurs at $x = 0.15$ m
(B) Antinode occurs at $x = 0.25$ m
(C) Wavelength of the constituent waves is 0.2 m
(D) Speed of the constituent waves is 5 m/s

Q.19 Equation of a progressive wave is given by $y = 0.2\cos\pi\left(0.04t + 0.02x - \frac{\pi}{6}\right)$ where distances are in cm and time in s. What will be the minimum distance between two particles having phase difference of $\frac{\pi}{2}$?



(A) 4 cm (B) 8cm (C) 25cm (D) 10cm

Q.20 A standing wave is maintained in a homogenous string of cross-sectional area s and density ρ. It is formed by the superposition of two waves travelling in opposite directions given by the equations $y_1 = a\sin(\omega t - kx)$ and $y_2 = 2a\sin(\omega t + kx)$. The total mechanical energy confined between the sections corresponding to adjacent nodes is

(A) $\frac{9}{2}\frac{\rho\omega^2a^2\pi s}{k}$ (B) $\frac{7}{2}\frac{\rho\omega^2a^2\pi s}{k}$ (C) $\frac{5}{2}\frac{\rho\omega^2a^2\pi s}{k}$ (D) $\frac{3}{2}\frac{\rho\omega^2a^2\pi s}{k}$

ANSWER KEY

Q.	1	2	3	4	5	6	7	8	9	10
Sol.	(B)	(A)	(A)	(D)	(C)	(A)	(A)	(B)	(B)	(A)
WORK SHEET										
Q.	1	2	3	4	5	6	7	8	9	10
Sol.	(A)	(B)	(B)	(B)	(A)	(C)	(A)	(B)	(B)	(D)
Q.	11	12	13	14	15	16	17	18	19	20
Sol.	(A)	(B)	(A)	(C)	(B)	(A)	(A)	(B)	(C)	(C)