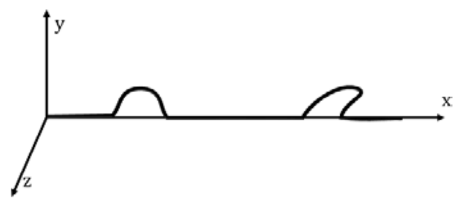
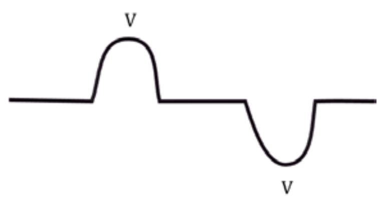
Q.1 For a transverse wave
Statement 1: Total average energy density is the sum of average K.E density and average P.E density
Statement 2: Average K.E density is equal to the average P.E density
(A) Statement 1 is correct and Statement 2 is incorrect.
(B) Statement 2 is correct and Statement 1 is incorrect.
(C) Both the Statements are correct.
(D) Both the Statements are incorrect.

Q.2 Two pulses are propagating on a stretched string as shown in figure. The plane of propagation of pulses are perpendicular to each other. When the two pulses overlaps the resultant displacement of any particle Is.



(A) Algebraic sum of the individual displacement due to each wave pulse
(B) Vector sum of the individual displacement due to each wave pulse
(C) Independent of the individual displacement due to each wave pulse
(D) None of these

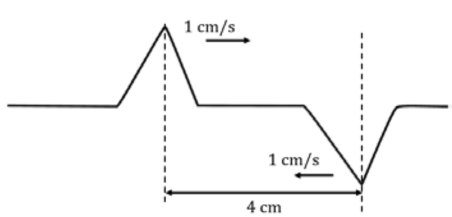
Q.3 Two wave pulses approaching each other are identical in shape except that one is inverted with respect to the other. At some instant the resultant displacement of particles from their mean position becomes zero. Then, at that instant velocity of the particles is.



(A) Zero **(B)**Non−Zero
(C) Depends on distance between the pulses **(D)**None of these

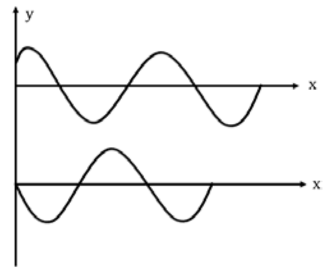
Q.4 Two waves generated from a coherent source and an incoherent source respectively, are propagating on a stretched string. Statement 1: The resultant wave can be obtained by using the principle of superposition of waves. Statement 2: Principle of superposition of waves is not applicable on the wave obtained from incoherent sources.
(A) Statement 1 is true, statement 2 is false **(B)**Statement 1 is false, statement 2 is true
(C) Both the statements are true. **(D)**Both the statements are false

Q.5 Two identical triangular wave pulses whose centres are initially 4 cm apart, have been shown in figure given below. The speed of each pulse is 1 cm/s. After 2 second, the shape of resultant wave-pulse will be



(A) Triangular **(B)**Rectangular **(C)**Straight line **(D)**None of these

Q.6 On the superposition of the two waves represented by equation $y_1 = A\sin(\omega t - kx)$ and $y_2 = A\sin\left(\omega t + kx + \frac{\pi}{4}\right)$, the resultant amplitude of oscillation will be:



(A) $A\sqrt{2}$ **(B)** $A\sqrt{2+\sqrt{2}}$ **(C)** $A\sqrt{2+\sqrt{3}}$ **(D)** $A\sqrt{1+\sqrt{2}}$

Q.7 Two waves represented by equation, $y_1 = 2\sin(\pi t - 0.1x)$ and $y_2 = 2\sin(\pi t - 0.1x + \phi)$ are superimposed. If the resultant wave has a maximum amplitude equal to 4 cm, the value of ϕ is :

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

Q.8 Two waves are passing simultaneously through a string.
The equation of the waves are given by, $y_1 = A_1 \sin k(x - vt)$ and $y_2 = A_2 \sin k(x - vt + x_0)$ where the wave number $k = 6.28\ \text{cm}^{-1}$ and $x_0 = 1.50$ cm The amplitudes are $A_1 = 5.0$ mm and $A_2 = 4.0$ mm Find the phase difference between the waves and the amplitude of the resulting wave.

(A) 2πguj1 mm **(B)** 3πguj1 mm **(C)** π guj 2 mm **(D)** π guj 0.5 mm

Q.9 Two waves represented by equation $y_1 = A\sin(\omega t - kx + \phi_1)$ and $y_2 = A\sin(\omega t - kx + \phi_2)$ Are superimposed such that the amplitude of resultant wave is A. Find the phase difference between them. Given: $(\phi_1 > \phi_2)$

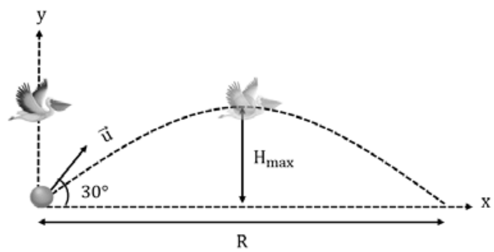
(A) 90° **(B)** 120° **(C)** 60° **(D)** 135°

Q.10 Two waves of equal amplitude (A), frequency (f) and intensity (I) propagate along the same direction in a medium. The intensity of resultant wave will be:

(A) 0 **(B)** 2I **(C)** 4I **(D)** Between 0 and 4I

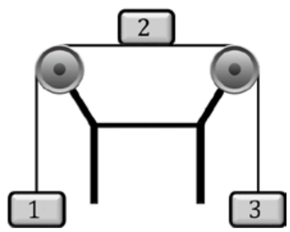
WORK SHEET

Q.1 A ball is thrown from a point on a ground at some angle of projection. At the same time, a bird starts from a point directly above this point of projection at a height h, horizontally with speed ‘u’. Given that during its flight, the ball just touches the bird at only one point. Find the distance on the ground from the point of projection where the ball strikes.



(A) $2u\sqrt{\frac{2h}{g}}$ **(B)** $2u\sqrt{\frac{h}{g}}$ **(C)** $u\sqrt{\frac{h}{g}}$ **(D)** $u\sqrt{\frac{h}{2g}}$

Q.2 In the figure given below, blocks 1 and 3 are connected by a belt and block 2 rests on the horizontal portion of the belt. When the three blocks are released from rest, they accelerate with a magnitude of $0.5\ m/s^2$. Block 1 has mass m, block 2 has mass 2m and block 3 has the same mass 2m. What is the coefficient of kinetic friction between block 2 and the belt? [Take $g = 9.81\ m/s^2$ and assume the mass of the belt to be negligible]

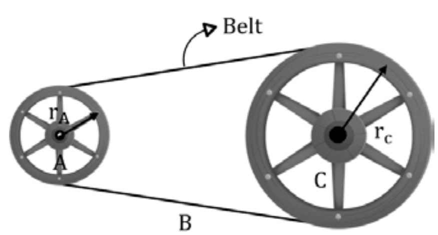


(A) 0.25 **(B)** 0.37 **(C)** 0.45 **(D)** 0.67

Q.3 A force $\vec{F} = (cx - 3.00\,x2)\hat{i}$ acts on a particle as the particle moves along x − axis, with $\vec{F}$ in Newton’s, x in meters and c is a constant. At $x = 0$, the particle’s kinetic energy is 20.0 J and at $x = 3.00$ m, it is 11.00 J. Then, the value of c is

(A) 1 N/m **(B)** 2N/m **(C)** 3N/m **(D)** 4N/m

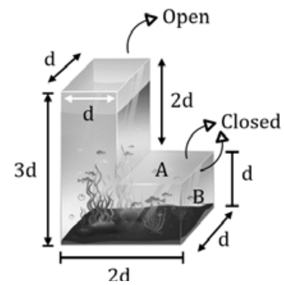
Q.4 Wheel A of radius $r_A = 10$ cm is coupled by belt B to a wheel C of radius $r_C = 25$ cm. The angular speed of the wheel A is increased from rest at a constant rate of $1.6\ rad/s^2$. Find the time needed for wheel C to reach an angular speed of 100 rev/min, assuming that the belt does not slip.



(A) 4 second **(B)** 9second **(C)** 16second **(D)** 25second

Q.5 The L-shaped fish tank shown in the figure is filled with water and is open at the top. If $d = 5.0$ m, what is the ratio of force exerted by the water on face A and face B? (Take $g = 10\ m/s^2$) and neglect atmospheric pressure)

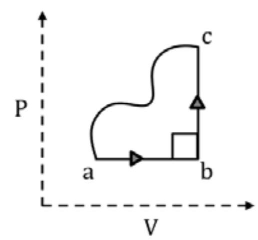
(A) 4: 5 **(B)** 5: 4 **(C)** 3: 5 **(D)** 5: 3



Q.6 An object of mass 8 kg falls through a height of 60 m and by means of mechanical linkage, rotates a paddle wheel that stirs 0.8 kg of water. Determine the change in temperature of water if initial temperature was 15°C. Assume no heat is lost to surroundings, specific heat of water, c = 4190 J/kg°C).

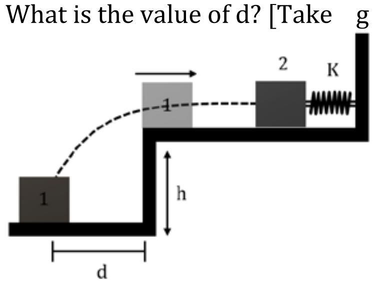
(A) 0.5°C **(B)** 1.4°C **(C)** 2.1°C **(D)** 3.6°C

Q.7 A figure show a closed cycle for a gas. The change in internal energy along the path cais −160 J. The energy transferred to the gas as heat is 200 J along path ab and 40 J along path bc. What is the ratio of work done by the gas along the path abcand ab?



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

Q.8 A block 1 of mass 0.2 kg sliding to the right over a frictionless elevated surface as shown in the image. The speed of block 1is 8.00 m/s. The block undergoes an elastic collision with stationary block 2, which is attached to a spring of spring constant 1208.5 N/m. After the collision, block 2 oscillates in SHM with a period, block 2 oscillates in SHM with a period of 0.140 s, and block 1 Slides off the opposite end of the elevated surface landing at distance d from the base of that surface after falling through height ($h = 4.90$ m), What is the value of d? [Take $g = 9.8\ m/s^2$]



(A) 4 m **(B)** 3m **(C)** 2m **(D)** 1m

Q.9 A 150 g block oscillates in SHM on the end of a spring with $k = 1500$ N/m, according to the relation $x = x_0 \cos(\omega t + \phi)$. How long does the block take to move from the position $+0.800\ x_0$ to $+\ 0.600\ x_0$?

(A) 2 ms **(B)** 0.3ms **(C)** 4ms **(D)** 3ms

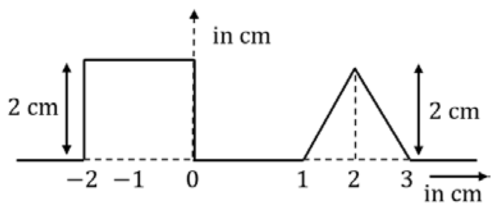
Q.10 A long taut string is connected to a harmonic oscillator of frequency f at one end. The oscillator oscillates with an amplitude a_0 and delivers power P_0 to the string. Due to dissipation of energy, the amplitude of wave goes on decreasing with distancex from the oscillator as $a = a_0 e^{-kx}$. In what length of the string does $\left(\frac{3}{4}\right)^{th}$ of the energy supplied by the oscillator get dissipated?

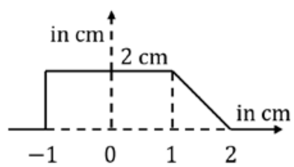
(A)$\frac{\ln 2}{k}$ **(B)**$\frac{2\ln 2}{k}$ **(C)**$\frac{\ln 2}{2k}$ **(D)**$\frac{1}{k}$

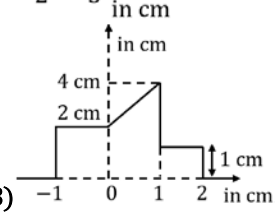
Q.11 Two sinusoidal wave each of amplitude 2A, travel in the same direction in a medium. If the phase difference between the two waves is 120°, then find the resultant amplitude of the superimposed wave.

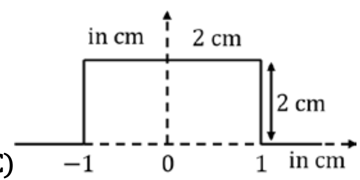
(A)$3\sqrt{2}$A **(B)**2A **(C)**$\sqrt{2}$A **(D)**3A

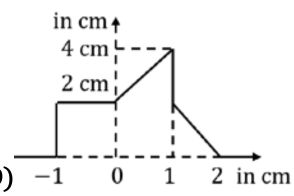
Q.12 The figure shows at time $t = 0$ sec, a rectangular and triangular pulse on a uniform wire. They are approaching each other. The pulse speeds are 0.5 cm/s each. The resultant pulse at $t = 2$ sec is



(A)


(B)


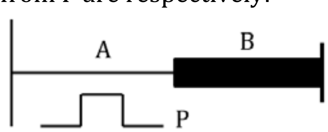
(C)


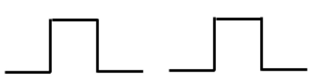
(D)


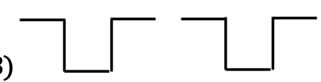
Q.13 Ratio of maximum to minimum intensity during interference of two waves is 25 : 1. The amplitude ratio of these two waves is

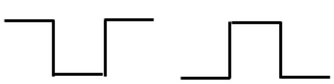
(A)$\frac{2}{3}$ **(B)**$\frac{3}{2}$ **(C)**$\frac{4}{5}$ **(D)**$\frac{5}{4}$

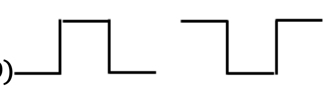
Q.14 P is the junction of two wires A and B. B is made of steel and is thicker, while A is made of aluminum and is thinner as shown in the figure. If a wave pulse as shown in the figure approaches P, the reflected and transmitted wave from P are respectively:



(A)


(B)


(C)


(D)


Q.15 A harmonic wave is travelling on string 1. At the junction with string 2, it is partly reflected and partly transmitted. The linear mass density of string 2 is 9 times that of string 1, and that the boundary between the two strings is at $x = 0$. If the expression for the incident wave is

$y_i = (3\text{ cm})\cos[(3.14\text{ cm}^{-1})x - (314\text{ rad s}^{-1})t]$.What is the expression for the transmitted waves?

(A)$y_t = (3\text{ cm})\cos[(3.14\text{ cm}^{-1})x - (314\text{rads}^{-1})t)]$

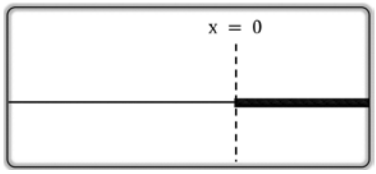
(B)$y_t = (1.5\text{ cm})\cos[(3\text{ cm}^{-1})x - (9.42\text{rads}^{-1})t)]$

(C) $y_t = (3\text{ cm})\cos[(9.42\text{ cm}^{-1})x - (3.14\text{rads}^{-1})t)]$

(D) $y_t = (1.5\text{ cm})\cos[(9.42\text{ cm}^{-1})x - (314\text{rads}^{-1})t)]$

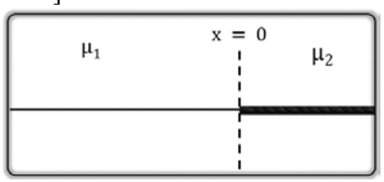
Q.16 Two strings are attached to each other as shown in the figure. The linear mass density of the second string is 16 times that of the first string and the boundary between the two strings is at $x = 0$.

The incident wave is given by $y = 0.01\cos(20x - 100t)$. Then, the ratio of amplitude of reflected wave to amplitude of transmitted wave is:[Assume, tension in both the strings is same]



(A) 2: 3 **(B)** 3: 2 **(C)** 5: 9 **(D)** 9: 5

Q.17 The pulse shown in figure has a speed 8 cm/s. The linear mass density of right string is 4 times that of the left string. What is ratio of the heights of the transmitted pulse and the reflected pulse?[Assume tension to be same]



(A) 4 **(B)** 1 **(C)** 2 **(D)** 6

Q.18 Two strings 1 and 2 make a junction of partly reflected and partly transmitted waves. The linear mass density of string 2 is four times that of string 1, and the boundary between the two strings is at $x = 0$. The expression for the incident wave is $y_i = A_i\cos(k_1x - \omega_1t)$. Which of the following relations is correct, if average power carried by the incident wave, transmitted wave and reflected wave are P_i , P_t & P_r respectively? [Assume tension in string 1 and 2 to be the same]

(A) $P_i = P_t - P_r$ **(B)** $P_i = \frac{P_i}{P_r}$ **(C)** $P_i = P_t \times P_r$ **(D)** $P_i = P_t + P_r$

Q.19 Two superimposing waves are represented by the equations $x_1 = 5\sin 2\pi(20t - 0.1x)$ and $x_1 = 10\sin 2\pi(20t - 0.2x)$ where x and amplitude of each wave are given in meters and t is in seconds.If the ratio of maximum intensity to minimum intensity is x: 1, thenx is

(A) $x = 9$ **(B)** $x = 9.0$ **(C)** $x = 9.00$

Q.20 The initial pressure, volume and temperature of an ideal gas are 1 atm, 200 L and 300 K respectively. The volume and pressure of the ideal gas are adiabatically changed to 74.3 L and 4 atm respectively. Then: [Take $R = 0.082\text{ L atm K}^{-1}\text{mol}^{-1}$]

(A) Gas is monoatomic **(B)** O Gas is diatomic

(C) Final temperature is 446 K **(D)** Gas has 8.13 moles

ANSWER KEY

Q.	1	2	3	4	5	6	7	8	9	10
Sol.	(C)	(B)	(B)	(A)	(C)	(B)	(B)	(B)	(B)	(D)
WORK SHEET										
Q.	1	2	3	4	5	6	7	8	9	10

Sol.	(A)	(B)	(C)	(D)	(A)	(B)	(A)	(A)	(D)	(A)
Q.	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Sol.	(B)	(D)	(B)	(C)	(D)	(B)	(C)	(D)	(A,B,C)	(B,C,D)