



# PHYSICS

## BOOKS - NCERT FINGERTIPS PHYSICS (HINGLISH)

### PRACTICE PAPERS

#### Practice Paper 1

1. If 'S' is stress and 'Y' is young's modulus of material of a wire, the energy stored in the wire

per unit volume is

A.  $\frac{S}{2Y}$

B.  $\frac{2Y}{S^2}$

C.  $\frac{S^2}{2Y}$

D.  $2S^2Y$

**Answer: C**



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2. A tank full of water has a small hole at the bottom. If one-fourth of the tank is emptied in

$t_1$  seconds and the remaining three-fourths of the tank is emptied in  $t_2$  seconds. Then the ratio

$\frac{t_1}{t_2}$  is

A.  $\sqrt{3}$

B.  $\sqrt{2}$

C.  $\frac{2 - \sqrt{2}}{\sqrt{2}}$

D.  $\frac{2 - \sqrt{3}}{\sqrt{3}}$

**Answer: D**



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3. Find the moment of inertia of a uniform square plate of mass  $m$  and edge  $a$  about one of its diagonals.

A.  $\frac{Ml^2}{6}$

B.  $\frac{Ml^2}{12}$

C.  $\frac{Ml^2}{3}$

D.  $\frac{Ml^2}{4}$

**Answer: B**

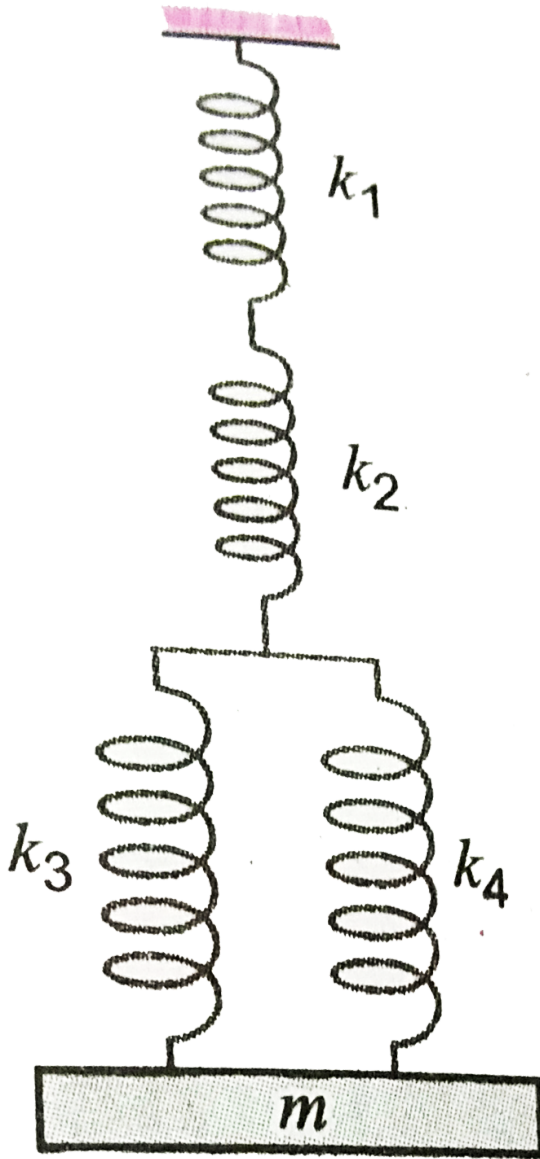


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4. A system of springs with their spring constants are as shown in figure. What is the

frequency of oscillations of the mass  $m$  ?



- A.  $\frac{1}{2\pi} \sqrt{\frac{k_1 k_2 (k_3 + k_4)}{[(k_1 + k_2) + (k_3 + k_4) + k_1 k_4] m}}$
- B.  $\frac{1}{2\pi} \sqrt{\frac{k_1 k_2 (k_3 + k_4)}{[(k_1 + k_2) + (k_3 + k_4) + k_1 k_2] m}}$
- C.  $\frac{1}{2\pi} \sqrt{\frac{k_1 k_2 (k_3 + k_4)}{[(k_1 + k_2) + (k_3 + k_4) + k_1 k_2] m}}$
- D.  $\frac{1}{2\pi} \sqrt{\frac{(k_1 + k_2)(k_3 + k_4) + k_1 k_2}{k_1 k_2 (k_3 + k_4) m}}$

**Answer: C**



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5. A closed organ pipe and an open organ pipe of some length produce *2beats* when they are set up into vibration simultaneously in their

fundamental mode . The length of the open organ pipe is now halved and of the closed organ pipe is doubled , the number of beats produced will be

A. 7

B. 4

C. 8

D. 2

**Answer: A**



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6. A force of  $7\hat{i} + 6\hat{k}$  newton makes a body move on a rough plane with a velocity of  $3\hat{j} + 4\hat{k}ms^{-1}$ . Calculate the power in watt.

A. 24

B. 34

C. 21

D. 45

**Answer: A**



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7. Three samples of the same gas A,B and C ( $\gamma = 3/2$ ) have initially equal volume. Now the volume of each sample is doubled. The process is adiabatic for A. Isobaric for B and isothermal for C. If the final pressures are equal for all three samples, find the ratio of their initial pressures

A.  $2 : 1 : \sqrt{2}$

B.  $2\sqrt{2} : 1 : 2$

C.  $\sqrt{2} : 1 : 2$

D.  $\sqrt{2} : 2 : 1$

**Answer: B**



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8. The temperature of equal masses of three different liquids A, B and C are  $12^{\circ}C$ ,  $19^{\circ}C$  and  $28^{\circ}C$  respectively. The temperature when A and B are mixed is  $16^{\circ}C$  and when B and C are mixed it is  $23^{\circ}C$ . What should be the temperature when A and C are mixed?

A.  $18.2^{\circ}C$

B.  $22^{\circ}C$

C.  $20.2^{\circ}C$

D.  $24.2^{\circ}C$

**Answer: C**

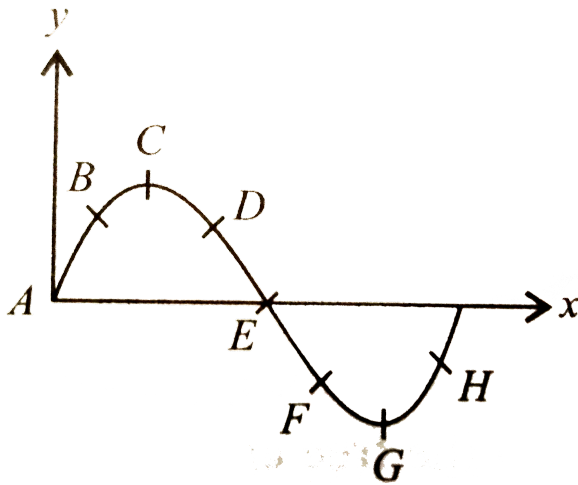


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9. A transverse wave is travelling along a string from left to right. The figure below represents the shape of the string at a given instant. At this instant, among the following, choose the wrong



statement.



A. Points D, E, F have upward positive velocity.

B. Points A, B and H have downward negative velocity  
velocity

C. Point C and G have zero velocity.

D. Points A and E have minimum velocity.

**Answer: D**



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10. The ratio of energy required to raise a satellite to a height  $h$  above the earth surface to that required to put it into the orbit is

A.  $R : h$

B.  $h : R$

C.  $R : 2h$

D.  $2h : R$

**Answer: D**

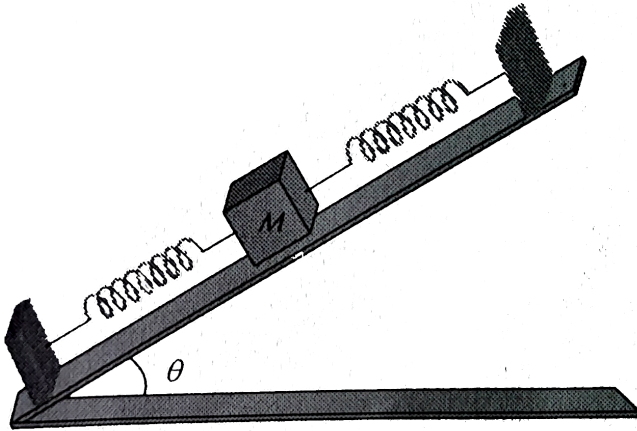


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**11.** On a smooth inclined plane, a body of mass  $M$  is attached between two springs. The other ends of the springs are fixed to firm supports. If each spring has force constant  $K$ , the period of oscillation of the body (assuming the springs as

massless)

is



- A.  $2\pi\sqrt{\frac{M}{2k}}$
- B.  $2\pi\sqrt{\frac{2M}{k}}$
- C.  $2\pi\sqrt{\frac{Mg \sin \theta}{2k}}$
- D.  $2\pi\sqrt{\frac{2Mg}{k}}$

**Answer: A**

12. The relation between internal energy  $U$ , pressure  $P$  and volume  $V$  of a gas in an adiabatic process is

$U = a + bPV$  where  $a$  and  $b$  are constants.

What is the effective value of adiabatic constant

$\gamma$ ?

A.  $\frac{a}{b}$

B.  $\frac{b + 1}{b}$

C.  $\frac{a + 1}{a}$

D.  $\frac{b}{a}$

**Answer: B**



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**13.** The speed of sound through oxygen gas at T K is  $vm s^{-1}$ . As the temperature becomes 2T and oxygen gas dissociated into atomic oxygen, the speed of sound

A. remains the same

B. become 2v

C. become  $\sqrt{2}v$

D. none of these

**Answer: D**



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**14.** A ball of mass  $m$  moving with a speed  $2v_0$  collides head-on with an identical ball at rest. If  $e$  is the coefficient of restitution, then what will be the ratio of velocity of two balls after collision?

A.  $\frac{1 - e}{1 + e}$

B.  $\frac{e - 1}{e + 1}$

C.  $\frac{1 + e}{1 - e}$

D.  $\frac{e + 1}{e - 1}$

**Answer: A**



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**15.** A uniform rope of length 12 m and mass 6 kg hangs vertically from a rigid support. A block of mass 2 kg is attached to the free end of the



rope. A transverse pulse of wavelength 0.06 m is produced at the lower end of the rope. What is the wavelength of the pulse when it reaches the top of the rope?

A. 0.06 m

B. 0.03 m

C. 0.12 m

D. 0.09 m

**Answer: C**



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16. There is some change in length when a  $33000N$  tensile force is applied on a steel rod of area of cross-section  $10^{-3}m^2$ . The change in temperature of the steel rod when heated is  $(Y = 3 \times 10^{11}N/m^2, \alpha = 1.1 \times 10^{-5}/^{\circ}C)$

A.  $20^{\circ}C$

B.  $15^{\circ}C$

C.  $10^{\circ}C$

D.  $0^{\circ}C$

**Answer: C**



17. Two identical containers A and B with frictionless pistons contain the same ideal gas at the same temperature and the same velocity  $V$ . The mass of the gas in A is  $m_A$ , and that in B is  $m_B$ . The gas in each cylinder is now allowed to expand isothermally to the same final volume  $2V$ . The changes in the pressure in A and B are found to be  $\Delta P$  and  $1.5\Delta P$  respectively. Then

A.  $4m_A = 9m_B$

B.  $3m_A = 3m_B$

C.  $3m_A = 2m_B$

D.  $9m_A = 4m_B$

**Answer: C**



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**18.** A stone tied at the end of a string 80 cm long is whirled in a horizontal circle with a constant speed. If the stone makes 25 revolutions in 14 s,

what is the magnitude of acceleration of the stone ?

A.  $90ms^{-2}$

B.  $100ms^{-2}$

C.  $110ms^{-2}$

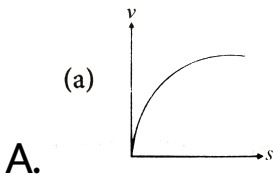
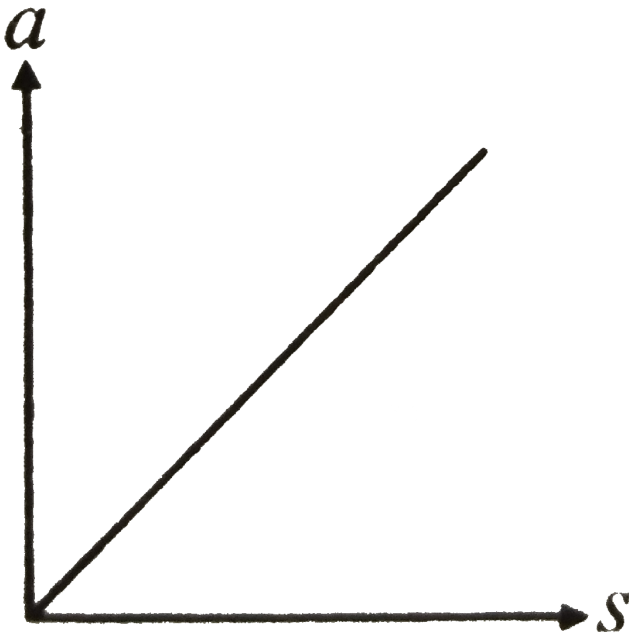
D.  $120ms^{-2}$

**Answer: B**

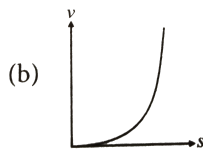


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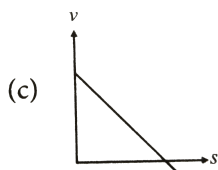
19. Acceleration ( $a$ )-displacement( $s$ ) graph of a particle moving in a straight line is shown here. The initial velocity of the particle is zero. The  $v$ - $s$  graph of the particle would be



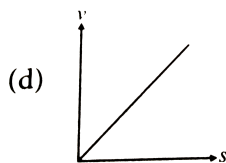
B.



C.



D.



**Answer: D**



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**20.** A  $4m$  long ladder weighing  $25kg$  rests with its upper end against a smooth wall and lower

end on rough ground. What should be the minimum coefficient of friction between the ground and the ladder for it to be inclined at  $60^\circ$  with the horizontal without slipping?

$$(Take\ g = 10\ m / s^2)$$

A. 0.19

B. 0.29

C. 0.39

D. 0.49

**Answer: B**

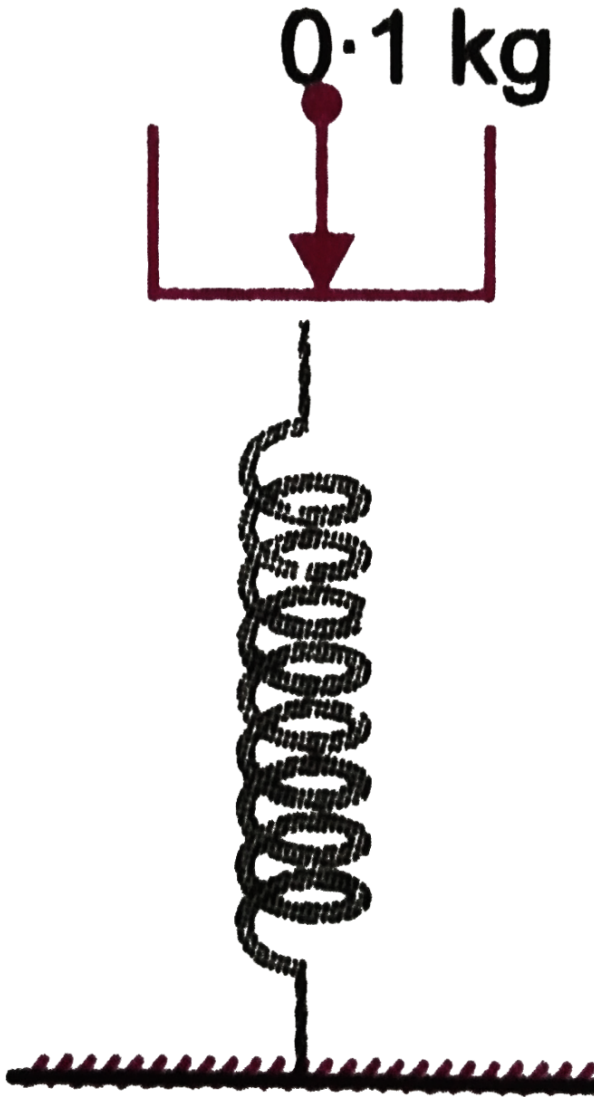


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**21.** A massless platform is kept on a light elastic spring as shown in figure. When a small stone of mass  $0.1 \text{ kg}$  is dropped on the pan from a height of  $0.24 \text{ m}$ , the spring compresses by  $0.01 \text{ m}$ . From what height should the stone be dropped to

cause a compression of 0.04m in the spring ?



A. 0.96 m

B. 2.96 m

C. 3.96 m

D. 0.48 m

**Answer: C**



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**22.** A particle moves in the x-y plane with velocity  $v_x = 8t - 2$  and  $v_y = 2$ . If it passes through the point  $x = 14$  and  $y = 4$  at  $t = 2s$ , the equation of the path is

A.  $x = y^3 - y^2 + 2$

B.  $x = y^2 - y + 2$

C.  $x = y^2 - 3y + 2$

D.  $x = y^3 - 2y^2 + 2$

**Answer: B**



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**23.** Two bodies of masses  $10kg$  and  $2kg$  are moving with velocities

$(2\hat{i} - 7\hat{j} + 3\hat{k})$  and  $(-10\hat{i} + 35\hat{j} - 3\hat{k})m/s$

respectively. Calculate the velocity of their centre of mass.

A.  $2\hat{i}ms^{-1}$

B.  $2\hat{k}ms^{-1}$

C.  $(2\hat{j} + 2\hat{k})ms^{-1}$

D.  $(2\hat{i} + 2\hat{j} + 2\hat{k})ms^{-1}$

**Answer: B**



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24. A satellite is launched into a circular orbit of radius  $R$  around the earth. A second satellite is launched into an orbit of radius  $(1.01) R$ . The period of the second satellite is larger than the first one by approximately

A. 0.7 %

B. 1.0 %

C. 1.5 %

D. 3.0 %

**Answer: D**



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25. Two men with weights in the ratio 4:3 run up a staircase in time in the ratio 12:11. The ratio of power of the first to that of second is

A.  $\frac{4}{3}$

B.  $\frac{12}{11}$

C.  $\frac{48}{33}$

D.  $\frac{11}{9}$

**Answer: D**



26. An object is kept on a smooth inclined plane of height 1 unit and length  $l$  units. The horizontal acceleration to be imparted to the inclined plane so that the object is stationary relative to the incline is

A.  $g\sqrt{l^2 - 1}$

B.  $g(l^2 - 1)$

C.  $\frac{g}{\sqrt{l^2 - 1}}$

D.  $\frac{g}{l^2 - 1}$



**Answer: C**



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**27.** A force  $F$  is given by  $F = at + bt^2$ , where  $t$  is time. What are the dimensions of  $a$  and  $b$ ?

A.  $[MLT^{-3}]$  and  $[MLT^{-4}]$

B.  $[MLT^{-4}]$  and  $[MLT^{-3}]$

C.  $[MLT^{-1}]$  and  $[MLT^{-2}]$

D.  $[MLT^{-2}]$  and  $[MLT^0]$

**Answer: A**



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**28.** The speed of a projectile when it is at its greatest height is  $\sqrt{2/5}$  times its speed at half the maximum height. The angle of projection is

A.  $30^\circ$

B.  $60^\circ$

C.  $45^\circ$

D.  $0^\circ$

**Answer: B**



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**29.** A ball of mass  $M$  is thrown vertically upwards. Another ball of mass  $2M$  is thrown at an angle  $\theta$  with the vertical. Both of them stay in air for the same period of time. The heights attained by the two are in the ratio

A. 1 : 2

B. 2 : 1

C. 1 : 1

D. 1 :  $\cos \theta$

**Answer: C**



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**30.** On a two lane road , car (A) is travelling with a speed of  $36kmh^{-1}$ . The car  $B$  and  $C$  approach car (A) in opposite directions with a speed of  $54kmh^{-1}$  each . At a certain instant , when the distance (AB) is equal to (AC), both

being  $1\text{km}$ , ( $B$ ) decides  $\rightarrow$  overtake A before C does , What minimum acceleration of car (B) is required to avoid an accident.

A.  $9.8\text{m.s}^{-2}$

B.  $10\text{m.s}^{-2}$

C.  $1\text{m.s}^{-2}$

D.  $2.0\text{m.s}^{-2}$

**Answer: C**



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31. If the vectors

$\vec{A} = 2\hat{i} + 4\hat{j}$  and  $\vec{B} = 5\hat{i} - p\hat{j}$  are parallel to

each other, the magnitude of  $\vec{B}$  is

A.  $5\sqrt{5}$

B. 10

C. 15

D.  $2\sqrt{5}$

**Answer: A**



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32. The force on a particle of mass  $10g$  is  $(\hat{i}10 + \hat{j}5)$  N. If it starts from rest, what would be its position at time  $t = 5s$ ?

A.  $12500\hat{i} + 6250\hat{j}m$

B.  $6250\hat{i} + 12500\hat{j}m$

C.  $12500\hat{i} + 12500\hat{j}m$

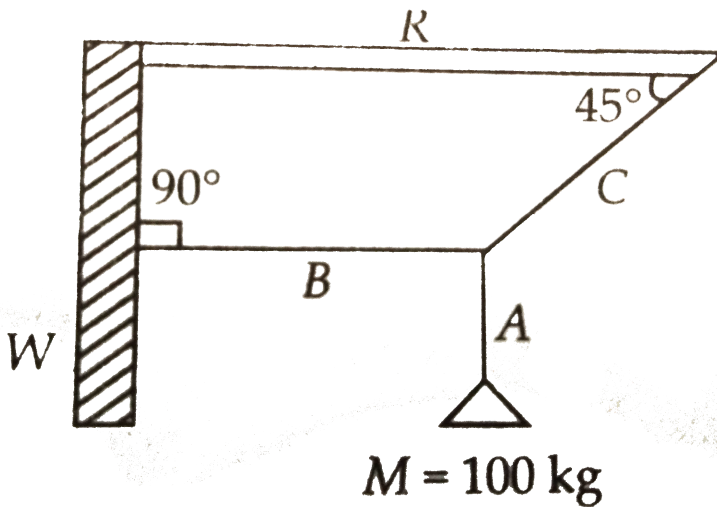
D.  $6250\hat{i} + 6250\hat{j}m$

**Answer: A**



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33. A mass  $M$  of 100 kg is suspended with the use of strings  $A$ ,  $B$  and  $C$  as shown in the figure, where  $W$  is the vertical wall and  $R$  is a rigid horizontal rod. The tension in the string  $B$  is



A. 100g N



B. zero

C.  $100\sqrt{2}gN$

D.  $\frac{100}{\sqrt{2}}gN$

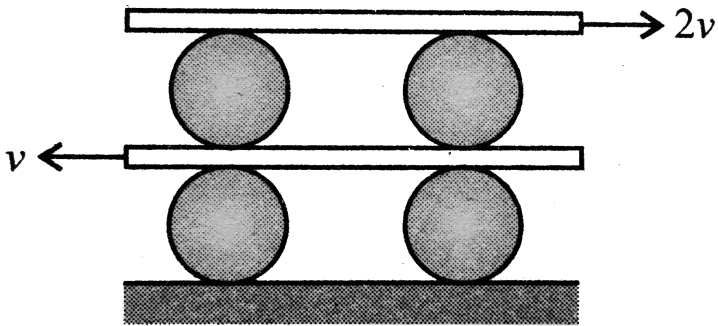
**Answer: A**



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**34.** A system of identical cylinders and plates is shown in Fig. All the cylinders are identical and there is no slipping at any contact. The velocity of lower and upper plates are  $V$  and  $2V$ ,

respectively, as shown in Fig. Then the ratio of angular speeds of the upper cylinders to lower cylinders is



A. 1:3

B. 3:1

C. 1:2

D. 2:1

**Answer: B**



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**35.** Two springs A and B are identical except that A is stiffer than B i.e.,  $k_A > k_B$ . If the two springs are stretched by the same force, then

A. more work is done on B i.e.,  $W_B > W_A$

B. more work is done on A i.e.,  $W_A > W_B$

C. work done on A and B are equal

D. work done depends upon the way in which they are stretched

**Answer: A**



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**36.** A body of mass  $3kg$  is under a force , which causes a displacement in it is given by  $S = \frac{t^3}{3}$  (in metres). Find the work done by the force in first 2 seconds.

A. 2J

B. 3.8 J

C. 5.2 J

D. 2.6 J

**Answer: D**



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**37.** A ball is dropped on to a horizontal plate from a height  $h = 9$  m above it. If the coefficient of restitution is  $e=1/2$ , the total distance travelled before the ball comes to rest is

A. 10 m

B. 15 m

C. 20 m

D. 25 m

**Answer: B**



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**38.** A rigid body rotates about a fixed axis with variable angular velocity equal to  $(a - bt)$  at time  $t$  where  $a$  and  $b$  are constants. The angle

through which it rotates before it comes to rest

is

A.  $\frac{a^2}{b}$

B.  $\frac{a^2}{2b}$

C.  $\frac{a^2}{4b}$

D.  $\frac{a^2}{2b^2}$

**Answer: B**



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**39.** Water rises in a capillary tube to a height of 2.0cm. In another capillary tube whose radius is one third of it, how much the water will rise?

A. 5 cm

B. 3 cm

C. 6 cm

D. 9 cm

**Answer: C**

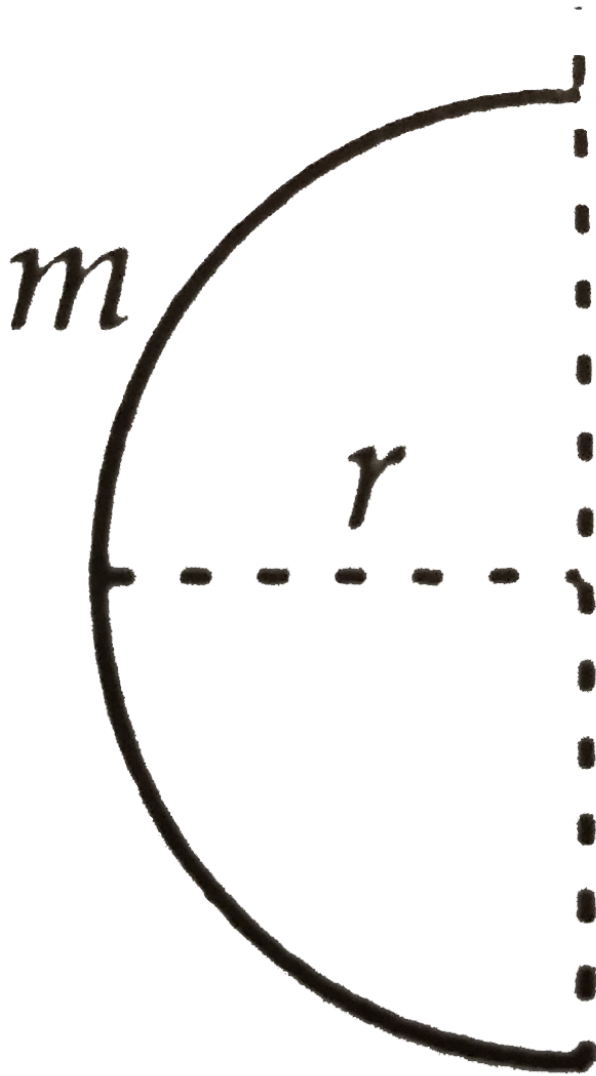


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**40.** A thin wire of length  $l$  and mass  $m$  is bent in the form of a semicircle as shown in the figure. Its moment of inertia about an axis joining its

free ends will be



A.  $ml^2$

B. *zero*

C.  $\frac{ml^2}{\pi^2}$

D.  $\frac{ml^2}{2\pi^2}$

**Answer: D**



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41. The radii of two planets are respectively  $R_1$  and  $R_2$  and their densities are respectively

$\rho_1$  and  $\rho_2$ . The ratio of the accelerations due to gravity at their surface is

A.  $\frac{R_1 \rho_2}{R_2 \rho_1}$

B.  $\frac{R_1 \rho_1}{R_2 \rho_2}$

C.  $\frac{\rho_1 R_2^2}{\rho_2 R_1^2}$

D.  $\frac{R_1 R_2}{\rho_1 \rho_2}$

**Answer: B**



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42. The work done in increasing the size of a rectangular soap film with dimensions 8 cm x 3.75 cm to 10 cm x 6 cm is  $2 \times 10^{-4} J$ . The surface tension of the film in ( $Nm^{-1}$ ) is

A.  $1.65 \times 10^{-2}$

B.  $3.3 \times 10^{-2}$

C.  $6.6 \times 10^{-2}$

D.  $8.25 \times 10^{-2}$

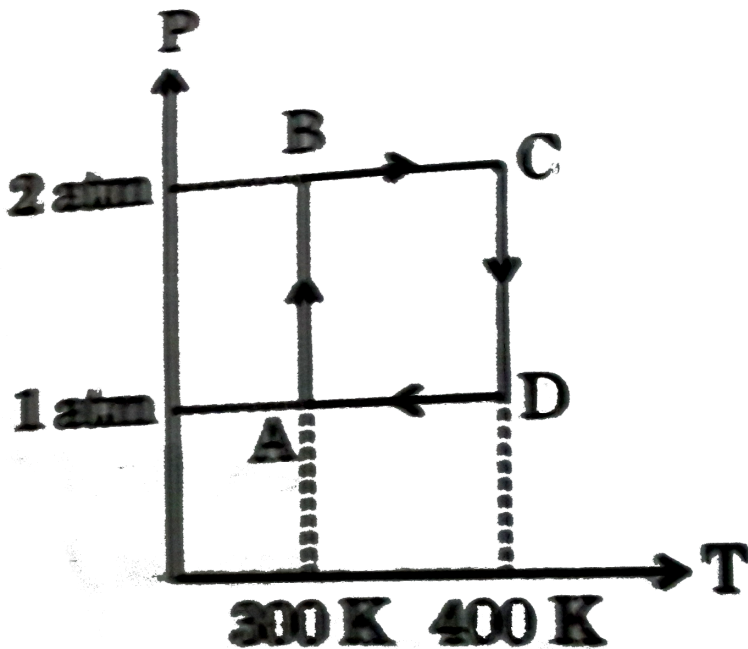
**Answer: B**



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43. Two moles of Helium gas undergo a reversible cyclic process as shown in figure.

Assuming gas to be ideal, what is the net work involved in the cyclic process ?



A.  $200R \ln 2$

B.  $100R \ln 2$

C.  $300R \ln 2$

D.  $400R \ln 2$

**Answer: A**



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**44.** An object of mass  $0.2\text{kg}$  executes SHM along the X-axis with frequency of  $(25/\pi)\text{Hz}$ . At the

point  $X = 0.4\text{m}$  the object has  $KE 0.5\text{J}$  and  $PE 0.4\text{J}$ . The amplitude of oscillation is-

A. 0.06 m

B. 0.04 m

C. 0.05 m

D. 0.25 m

**Answer: A**



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45. The second overtone of an open organ pipe has the same frequency as the first overtone of a closed pipe  $L$  metre long. The length of the open pipe will be

A. 8 m

B. 4 m

C. 2 m

D. 1 m

**Answer: B**



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**46.** When a body is suspended from two light springs separately, the periods of vertical oscillations are  $T_1$  and  $T_2$ . When the same body is suspended from the two spring connected in series, the period will be

A.  $T = T_1 + T_2$

B.  $\frac{1}{T} = \frac{1}{T_1} + \frac{1}{T_2}$

C.  $T^2 = T_1^2 + T_2^2$

D.  $\frac{1}{T^2} = \frac{1}{T_1^2} + \frac{1}{T_2^2}$

**Answer: C**



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**47.** Fifty-six tuning forks are arranged in order of increasing frequencies so that each fork gives 4 beats per second with the next one. The last fork gives the octave of the first. Find the frequency of the first.

A. 138 Hz

B. 144 Hz

C. 132 Hz

D. 276 Hz

**Answer: B**



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**48.** The height of the water in a tank is  $H$ . The range of the liquid emerging out from a hole in the wall of the tank at a depth  $\frac{3H}{4}$  from the upper surface of water, will be

A.  $H$

B.  $\frac{H}{2}$

C.  $\frac{3H}{2}$

D.  $\frac{\sqrt{3}H}{2}$

**Answer: D**



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**49.** A vehicle of mass  $M$  is moving on a rough horizontal road with a momentum  $P$  If the coefficient of friction between the tyres and the road is  $\mu$  is then the stopping distance is .

A.  $\frac{p}{2\mu mg}$

B.  $\frac{p^2}{2\mu mg}$

C.  $\frac{p}{2\mu m^2 g}$

D.  $\frac{p^2}{2\mu m^2 g}$

**Answer: C**



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**50.** Time taken by a 836 W heater to heat one litre of water from  $10^\circ C \rightarrow 40^\circ C$  is

A. 50 s

B. 100 s

C. 150 s

D. 200 s

**Answer: C**



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**Practice Paper 2**

1. Four particles of masses  $m$ ,  $2m$ ,  $3m$  and  $4m$  are arranged at the corners of a parallelogram with each side equal to  $a$  and one of the angle between two adjacent sides is  $60^\circ$ . The parallelogram lies in the  $x$ - $y$  plane with mass  $m$  at the origin and  $4m$  on the  $x$ -axis. The centre of mass of the arrangement will be located at

A.  $\left( \frac{\sqrt{3}}{2}a, 0.95a \right)$

B.  $\left( 0.95a, \frac{\sqrt{3}}{4}a \right)$

C.  $\left( \frac{3a}{4}, \frac{a}{2} \right)$

D.  $\left( \frac{a}{2}, \frac{3a}{4} \right)$



**Answer: B**



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2. A body is moving under the action of two force  $\vec{F}_1 = 2\hat{i} - 5\hat{j}$ ,  $\vec{F}_2 = 3\hat{i} - 4\hat{j}$ . Its velocity will become uniform under a third force  $\vec{F}_3$  given by.

A.  $5\hat{i} - 9\hat{j}$

B.  $-5\hat{i} - 9\hat{j}$

C.  $5\hat{i} + 9\hat{j}$

D.  $-5\hat{i} + 9\hat{j}$

**Answer: D**



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3. A particle of mass 0.1 kg is held between two rigid supports by two springs of force constant  $8Nm^{-1}$  and  $2Nm^{-1}$ . If the particle is displaced along the direction of length of the springs, its frequency of vibration is

A.  $\frac{5}{\pi}$  Hz

B.  $\frac{8}{\pi}$  Hz

C.  $\frac{2}{\pi}$  Hz

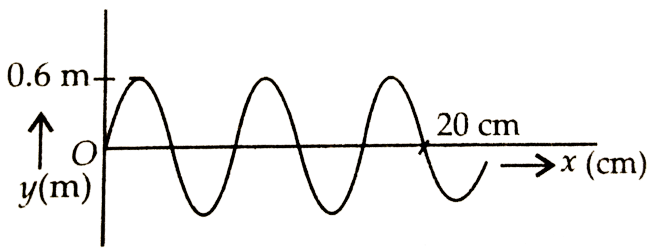
D.  $\frac{1}{\pi}$  Hz

**Answer: A**



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4. What is the wavelength of wave shown in given figure ?



A. 0.6 m

B. 0.3 m

C. 0.08 m

D. 4 cm

**Answer: C**



**Watch Video Solution**

5. A gas under constant pressure of  $4.5 \times 10^5 Pa$  when subjected to  $800kJ$  of heat, changes the volume from  $0.5m^3 \rightarrow 2.0m^3$ . The change in internal energy of the gas is

A.  $6.75 \times 10^5 J$

B.  $5.25 \times 10^5 J$

C.  $3.25 \times 10^5 J$

D.  $1.25 \times 10^5 J$

**Answer: D**



**Watch Video Solution**

6. A wave is represented by the equation

$$y = 0.1 \sin(100\pi t - kx)$$

If wave velocity is  $100\text{ms}^{-1}$ , its wave number is equal to

A.  $1\text{m}^{-1}$

B.  $2\text{m}^{-1}$

C.  $\pi\text{m}^{-1}$

D.  $2\pi\text{m}^{-1}$

**Answer: C**



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7. A sound source is moving towards a stationary observer with  $1/10$  of the speed of sound. The ratio of apparent to real frequency is

A.  $\frac{10}{9}$

B.  $\left(\frac{10}{9}\right)^2$

C.  $\left(\frac{11}{10}\right)^2$

D.  $\frac{11}{10}$

**Answer: A**



8. If  $E$ ,  $M$ ,  $J$ , and  $G$ , respectively, denote energy, mass, angular momentum, and gravitational constant, then  $EJ^2 / M^5 G^2$  has the dimensions of

A. length

B. mass

C. time

D. angle



**Answer: D**



**Watch Video Solution**

**9.** Two cars travelling towards each other on a straight road at velocity  $10m/s$  and  $12m/s$  respectively. When they are 150 metre apart, both drivers apply their brakes and each car decelerates at  $2m/s^2$  until it stops. How far apart will they be when they have both come to a stop?

A. 89 m

B. 98 m

C. 108 m

D. 150 m

**Answer: A**



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**10.** A particle is projected vertically upwards and it reaches the maximum height  $H$  in time  $T$  seconds. The height of the particle at any time  $t$  will be-

A.  $g(t - T)^2$

B.  $H - \frac{1}{2}g(t - T)^2$

C.  $\frac{1}{2}g(t - T)^2$

D.  $H - g(t - T)^2$

**Answer: B**



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**11.** If a body placed at the origin is acted upon by a force  $\vec{F} = (\hat{i} + \hat{j} + \sqrt{2}\hat{k})$ , then which of the following statements are correct?

Magnitude of  $\vec{F}$  is  $(2 + \sqrt{2})$

Magnitude of  $\vec{F}$  is 2.

$\vec{F}$  makes an angle of  $45^\circ$  with the Z-axis

$\vec{F}$  makes an angle of  $30^\circ$  with the Z-axis.

Select the correct answer using the codes given below

A. 1 and 3

B. 2 and 3

C. 1 and 4

D. 2 and 4

**Answer: B**



12. A particle is projected from the ground with an initial speed  $v$  at an angle  $\theta$  with horizontal. The average velocity of the particle between its point of projection and highest point of trajectory is [*EAM2013*]

A.  $u \cos \theta$

B.  $\frac{u}{2} \sqrt{1 + \cos^2 \theta}$

C.  $\frac{u}{2} \sqrt{1 + 2 \cos^2 \theta}$

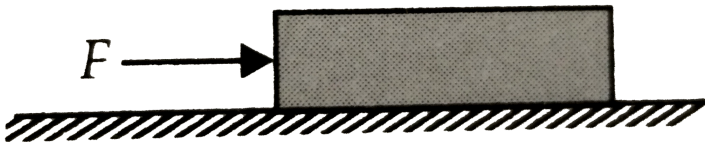
D.  $\frac{u}{2} \sqrt{1 + 3 \cos^2 \theta}$

Answer: D



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13. A block of mass 2 kg is placed on the floor. The coefficient of static friction is 0.4. A force  $F$  of 3 N is applied on the block as shown in figure. The force of friction between the block and the floor is (Take  $g = 10\text{m.s}^{-2}$ )



A. 3 N

B. 8 N

C. 4 N

D. 6 N

**Answer: A**



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**14.** A block released from rest from the top of a smooth inclined plane of angle  $\theta_1$  reaches the bottom in time  $t_1$ . The same block released from rest from the top of another smooth inclined

plane of angle  $\theta_2$  reaches the bottom in time  $t_2$

If the two inclined planes have the same height,

the relation between  $t_1$  and  $t_2$  is

A.  $\frac{t_2}{t_1} = \left( \frac{\sin \theta_1}{\sin \theta_2} \right)^{1/2}$

B.  $\frac{t_2}{t_1} = 1$

C.  $\frac{t_2}{t_1} = \frac{\sin \theta_1}{\sin \theta_2}$

D.  $\frac{t_2}{t_1} = \frac{\sin^2 \theta_1}{\sin^2 \theta_2}$

**Answer: C**



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15. A ball , moving with a speed of  $10\sqrt{3}m / s$  , strikes an identical stationary ball such that after the collision , the direction of each ball makes an angle of  $30^\circ$  with the original line of motion. The speeds of two balla after the collision are , respectively.

A.  $3ms^{-1}$  ,  $3ms^{-1}$

B.  $3\sqrt{3}ms^{-1}$  ,  $3\sqrt{3}ms^{-1}$

C.  $3\sqrt{3}ms^{-1}$  ,  $3ms^{-1}$

D.  $3ms^{-1}$  ,  $3\sqrt{3}ms^{-1}$

**Answer: B**



**Watch Video Solution**

**16.** A force  $F$  is related to the position of a particle by the relation  $F = (10x^2)N$ . Find the work done by the force when the particle moves from  $x = 2m \rightarrow x = 4m$ .

A.  $\frac{56}{3}$  J

B. 560 J

C.  $\frac{560}{3}$  J

D.  $\frac{3}{560}$  J

**Answer: C**



**Watch Video Solution**

17. Two particles of masses 1 kg and 3 kg have position vectors

$$2\hat{i} + 3\hat{j} + 4\hat{k} \text{ and } -2\hat{i} + 3\hat{j} - 4\hat{k}$$

respectively. The centre of mass has a position vector

A.  $\hat{i} - 3\hat{j} - 2\hat{k}$

B.  $-\hat{i} - 3\hat{j} - 2\hat{k}$

C.  $-\hat{i} + 3\hat{j} + 2\hat{k}$

D.  $-\hat{i} + 3\hat{j} - 2\hat{k}$

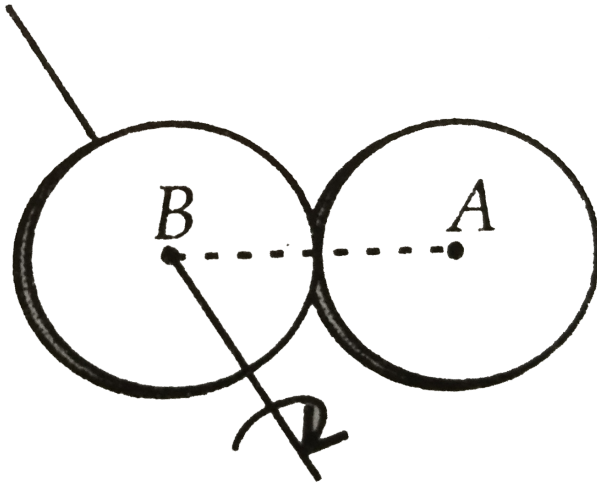
**Answer: D**



**Watch Video Solution**

**18.** Two thin discs each of mass  $M$  and radius  $r$  metre are attached to form a rigid body as shown in figure. The rotational inertia of this body about an axis perpendicular to the plane

of disc B and passing through its centre is



A.  $2Mr^2$

B.  $3Mr^2$

C.  $4Mr^2$

D.  $5Mr^2$

**Answer: D**



**Watch Video Solution**

**19.** Two satellites are revolving around the earth in circular orbits of same radii. Mass of one satellite is 100 times that of the other. Then their periods of revolutions are in the ratio

A. 1 : 1

B. 10 : 1

C. 100 : 1

D. 1 : 100

**Answer: A**



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**20.** The increase in length of a wire on stretching is 0.025%. If its Poisson's ratio is 0.4, then the percentage decrease in diameter is

A. 0.01 %

B. 0.02 %

C. 0.03 %

D. 0.04 %

**Answer: A**



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**21.** A planet is revolving in an elliptical orbit around the sun. Its closest distance from the sun is  $r$  and the farthest distance is  $R$ . If the velocity of the planet nearest to the sun be  $v$  and that farthest away from the sun be  $V$ . then  $v/V$  is



A.  $R^2 / r^2$

B.  $r^2 / R^2$

C.  $R / r$

D.  $r / R$

**Answer: C**



**Watch Video Solution**

**22.** A block of wood weighs 12 kg and has a relative density 0.6. It is to be in water with 0.9 of its volume immersed. What weight of a metal

is needed if the metal is on the top of wood ?

[Relative density of metal = 14]

A. 2 kg

B. 4 kg

C. 6 kg

D. 8 kg

**Answer: C**



**Watch Video Solution**

23. The mean distance between the atoms of iron is  $3 \times 10^{-10}$  m and interatomic force constant for iron is  $7N/m$ . The Young's modulus of elasticity for iron is

- A.  $2.33 \times 10^5 Nm^{-2}$
- B.  $23.3 \times 10^{10} Nm^{-2}$
- C.  $2.33 \times 10^9 Nm^{-2}$
- D.  $2.33 \times 10^{10} Nm^{-2}$

**Answer: D**



**Watch Video Solution**

24. An ice cube of mass  $0.1 \text{ kg}$  at  $0^\circ \text{C}$  is placed in an isolated container which is at  $227^\circ \text{C}$ . The specific heat  $s$  of the container varies with temperature  $T$  according to the empirical relation

$$s = A + BT, \quad \text{where}$$

$$A = 100 \text{ cal/kg.K} \text{ and } B = 2 \times 10^{-2} \text{ cal/kg.K}^2$$

. If the final temperature of the container is  $27^\circ \text{C}$ , determine the mass of the container.

(Latent heat of fusion for water =  $8 \times 10^4 \text{ cal/kg}$ , specific heat of water =  $10^3 \text{ cal/kg.K}$ ).

A.  $0.495 \text{ kg}$

B. 0.595 kg

C. 0.695 kg

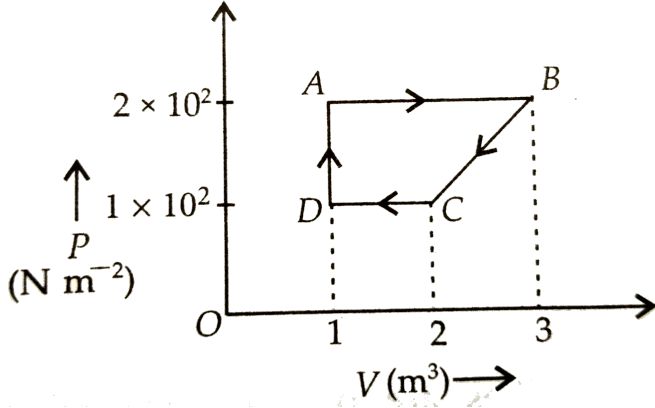
D. 0.795 kg

**Answer: A**



**Watch Video Solution**

**25.** A cyclic process is shown in the figure. Work done during the cyclic process ABCDA is



A. 1600 J

B. 150 J

C. 600 J

D. 900 J

**Answer: B**



**Watch Video Solution**

26. One mole of an ideal monoatomic gas at temperature  $T_0$  expands slowly according to the law  $\frac{p}{V} = \text{constant}$ . If the final temperature is  $2T_0$ , heat supplied to the gas is

A.  $2RT_0$

B.  $RT_0$

C.  $\frac{3}{2}RT_0$

D.  $\frac{1}{2}RT_0$

**Answer: A**



**Watch Video Solution**

27. A simple pendulum has time period ( $T_1$ ). The point of suspension is now moved upward according to the relation  $y = Kt^2$ , ( $K = 1m/s^2$ ) where ( $y$ ) is the vertical displacement. The time period now becomes ( $T_2$ ). The ratio of  $\frac{T_1^2}{T_2^2}$  is ( $g = 10m/s^2$ ).

A.  $6/5$

B.  $5/6$

C. 1



D.  $4/5$

**Answer: A**



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**28.** A stone is thrown horizontally with velocity  $u$ . The velocity of the stone  $0.5$  s later is  $3u/2$ .

The value of  $u$  is

A.  $2.2ms^{-1}$

B.  $3.3ms^{-1}$

C.  $4.4ms^{-1}$

D.  $1.1ms^{-1}$

**Answer: C**



**Watch Video Solution**

29. The dimension of the quantity  $\frac{1}{\epsilon_0} \frac{e^2}{hc}$  is (e charge of electron, h Planck's constant and c=velocity of light)

A.  $[M^{-1}L^{-3}T^2A]$

B.  $[M^0L^0T^0A^0]$

C.  $[ML^3T^{-4}A^{-2}]$

D.  $[M^{-1}L^{-3}T^4A^2]$

**Answer: B**



**Watch Video Solution**

**30.** A projectile is thrown with an initial velocity of  $(a\hat{i} + b\hat{j})ms^{-1}$ . If the range of the projectile is twice the maximum height reached by it, then

A.  $b = \frac{a}{2}$

B.  $b = a$

C.  $b = 2a$

D.  $b=4a$

**Answer: C**



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**31.** A uniform wire of length 20 m and weighing 5 kg hangs vertically. If  $g = 10ms^{-2}$ , then the speed of transverse waves in the middle of the wire is

A.  $10ms^{-1}$

B.  $10\sqrt{2}ms^{-1}$

C.  $4ms^{-1}$

D.  $2ms^{-1}$

**Answer: A**



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**32.** The velocity of a body moving in a vertical circle of radius  $r$  is  $\sqrt{7gr}$  at the lowest point of the circle. What is the ratio of maximum and minimum radius  $r$  is tension?

A. 4:1

B.  $\sqrt{7}:1$

C. 3:1

D. 2:1

**Answer: A**

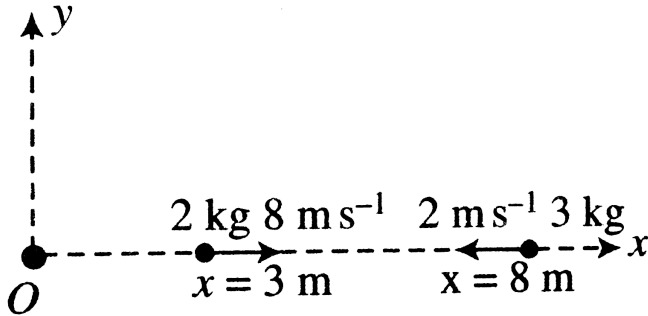


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**33.** Figure shows position and velocities of two particles moving under mutual gravitational attraction in space at time  $t = 0$ . The position

of centre of mass after one second is

'\*'  $m$ . Fill '\*'.



A.  $x=4 \text{ m}$

B.  $x=6 \text{ m}$

C.  $x=8 \text{ m}$

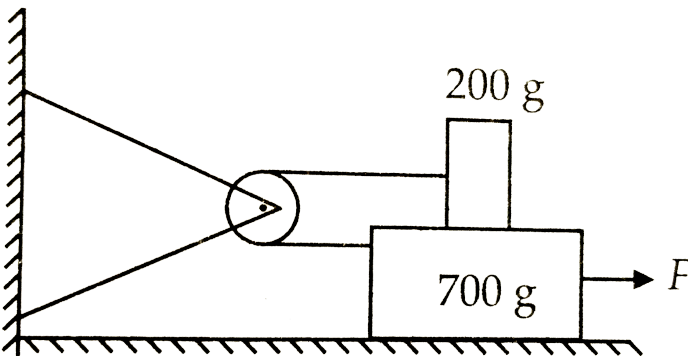
D.  $x=10 \text{ m}$

**Answer: D**



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34. How large must  $F$  be in the figure shown to give the 700 g block an acceleration of  $30\text{cm s}^{-2}$  ? The coefficient of friction between all surfaces is 0.15.



A. 2.18 N

B. 3.18 N



C. 4N

D. 6N

**Answer: A**



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**35.** The radii of the two columns in a U-tube are  $r_1$  and  $r_2$  ( $r_2 > r_1$ ). When a liquid of density  $\rho$  (angle of contact is  $0^\circ$ ) is filled in it, the level difference of liquid in two arms is  $h$ . The surface tension of

liquid is

( $g$  = acceleration due to gravity)

A.  $\frac{\rho g h r_1 r_2}{2(r_2 - r_1)}$

B.  $\frac{\rho g h (r_2 - r_1)}{2r_1 r_2}$

C.  $\frac{2(r_2 - r_1)}{\rho g h r_1 r_2}$

D.  $\frac{\rho g h}{2(r_2 - r_1)}$

**Answer: A**



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36. The angle subtended by vector

$\vec{A} = 4\hat{i} + 3\hat{j} + 12\hat{k}$  with the x-axis is :

A.  $\sin^{-1}\left(\frac{3}{13}\right)$

B.  $\sin^{-1}\left(\frac{4}{13}\right)$

C.  $\cos^{-1}\left(\frac{4}{13}\right)$

D.  $\cos^{-1}\left(\frac{3}{13}\right)$

**Answer: C**



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37. A solid cylinder rolls without slipping down a  $30^\circ$  slope. The minimum coefficient of friction needed to prevent slipping, will be

A. 0.192

B. 0.18

C. 0.15

D. 0.2

**Answer: A**



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38. The equation of state for 5 g of oxygen at a pressure  $P$  and temperature  $T$ , when occupying a volume  $V$ , will be

A.  $PV = \left(\frac{5}{32}\right)RT$

B.  $PV=5RT$

C.  $PV = \left(\frac{5}{2}\right)RT$

D.  $PV = \left(\frac{5}{16}\right)RT$

**Answer: A**



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**39.** A weightless spring of length 60 cm and force constant  $100Nm^{-1}$  is kept straight and unstretched on a smooth horizontal table and its ends are rigidly fixed. A mass of 0.25 kg is attached at the middle of the spring and is slightly displaced along the length. The time period of the oscillation of the mass is

A.  $\frac{\pi}{20}$  s

B.  $\frac{\pi}{10}$  s

C.  $\frac{\pi}{5}$  s

D.  $\frac{\pi}{\sqrt{200}}$  s

**Answer: A**



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**40.** A particle is executing simple harmonic motion of amplitude 5 cm and period 6 s. How long will it take to move from one end of its path on one side of mean position to a position 2.5 cm on the same side of the mean position ?

A. 1 s

B. 1.5 s

C. 3 s

D. 3.5 s

**Answer: A**

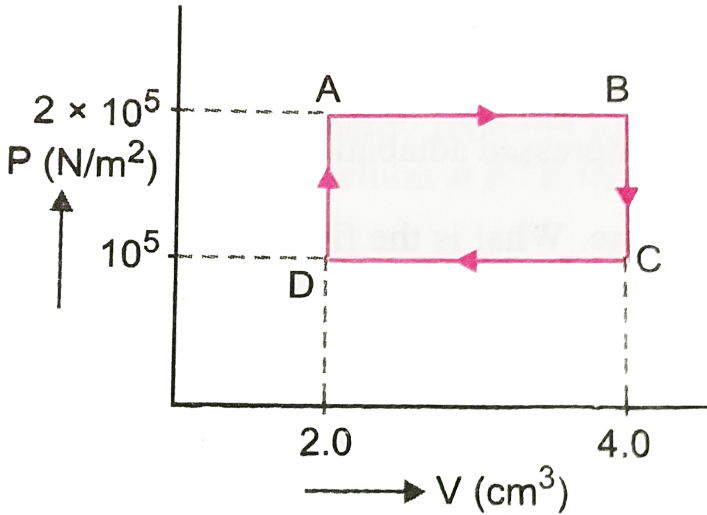


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**41.** The  $P - V$  diagram of a gas undergoing a cyclic process ABCDA is shown in (figure). Where  $P$  is in  $N/m^2$  and  $V$  is in  $cm^3$ . Identify the



incorrect statement



A. 0.4 J of work is done by the gas from A to

B

B. 0.2 of work is done on the gas from C to D

C. No work is done by the gas from B to C

D. Work is done by the gas from B to C and  
on the gas from D to A

**Answer: D**



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**42.** Three stars  $A, B, C$  have surface temperatures  $T_A, T_B$  and  $T_C$ . A appears bluish, B appears reddish and C appears yellowish. We can conclude that

A.  $T_A > T_C > T_B$

B.  $T_A > T_B > T_C$

C.  $T_B > T_C > T_A$

D.  $T_C > T_B > T_A$

**Answer: A**



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**43.** A body of mass  $m$  accelerates uniformly from rest to  $v_1$  in time  $t_1$ . As a function of time  $t$ , the instantaneous power delivered to the body is

A.  $\frac{mv_1 t}{t_1}$

B.  $\frac{mv_1^2 t}{t_1}$

C.  $\frac{mv_1 t^2}{t_1}$

D.  $\frac{mv_1^2 t}{t_1^2}$

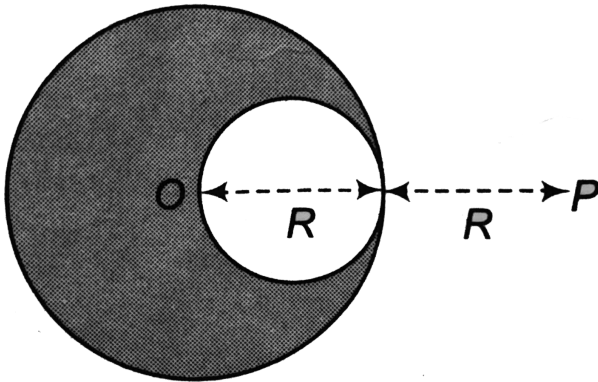
**Answer: D**



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**44.** A solid sphere of uniform density and radius  $R$  applies a gravitational force of attraction equal to  $F_1$  on a particle placed at  $P$ , distance  $2R$  from the centre  $O$  of the sphere. A spherical

cavity of radius  $R/2$  is now made in the sphere as shown in figure. The particle with cavity now applies a gravitational force  $F_2$  on same particle placed at  $P$ . The ratio  $F_2 / F_1$  will be



A.  $1/2$

B.  $7/9$

C.  $3$

D. 7

**Answer: B**



**Watch Video Solution**

**45.** A metal wire of length  $L_1$  and area of cross section  $A$  is attached to a rigid support. Another metal wire of length  $L_2$  and of the same cross sectional area is attached to the free end of the first wire. A body of mass  $M$  is then suspended from the free end of the second wire, if  $Y_1$  and  $Y_2$  are the Young's moduli of the wires

respectively the effective force constant of the system of two wires is

A.  $\frac{Y_1 Y_2 A}{2(Y_1 L_2 + Y_2 L_1)}$

B.  $\frac{Y_1 Y_2 A}{(L_1 L_2)^{1/2}}$

C.  $\frac{Y_1 Y_2 A}{(Y_1 L_2 + Y_2 L_1)}$

D.  $\frac{(Y_1 Y_2)^{1/2} A}{(L_1 L_2)^{1/2}}$

**Answer: C**



**Watch Video Solution**

46. The average degrees of freedom per molecule for a gas are 6. The gas performs  $25J$  of work when it expands at constant pressure.

The heat absorbed by gas is

A. 75 J

B. 100 J

C. 150 J

D. 125 J

**Answer: B**



**Watch Video Solution**



47. A thin circular ring of mass  $M$  and radius  $r$  is rotating about its axis with a constant angular velocity  $\omega$ . Two objects, each of mass  $m$ , are attached gently to the opposite ends of a diameter of the ring. The wheel now rotates with an angular velocity  $\omega =$

A.  $\frac{\omega M}{M + m}$

B.  $\frac{\omega(M - 2m)}{M + 2m}$

C.  $\frac{\omega M}{M + 2m}$

D.  $\frac{\omega(M + 2m)}{M}$

**Answer: C**



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**48.** A bus is moving with a speed of  $10ms^{-1}$  on a straight road. A scooterist wishes to overtake the bus in  $10s$ . If the bus is at a distance of  $1km$  from the scooterist with what speed should the scooterist chase the bus ?

A.  $10ms^{-1}$

B.  $20ms^{-1}$

C.  $50\text{m.s}^{-1}$

D.  $30\text{m.s}^{-1}$

**Answer: B**



**Watch Video Solution**

**49.** A particle  $A$  is projected vertically upwards. Another identical particle  $B$  is projected at an angle of  $45^\circ$ . Both reach the same height. The ratio of the initial kinetic energy of  $A$  to that of  $B$  is —

A.  $1/4$

B.  $1/3$

C.  $1/2$

D. 1

**Answer: C**



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**50.** A car is initially at rest, 330 m away from a stationary observer. It begins to move towards the observer with an acceleration of  $1.1ms^{-2}$

sounding its horn continuously. 20 s later, the driver stops sounding the horn. The velocity of sound in air is  $330\text{ms}^{-1}$ . The observer will hear the sound of the horn for a duration of

A. 20 s

B. 21 s

C.  $20\frac{2}{3}$  s

D.  $19\frac{1}{3}$  s

**Answer: D**



**Watch Video Solution**

1. A spherical soap bubble of radius 1 cm is formed inside another of radius 3 cm the radius of single soap bubble which maintains the same pressure difference as inside the smaller and outside the larger soap bubble is \_\_\_ cm

A.  $0.75\text{cm}$

B.  $0.75\text{m}$

C.  $7.5\text{cm}$

D.  $7.5\text{m}$

**Answer: A**



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2. A spherical metal ball of mass  $m$  and radius ( $r$ ) is falling through a viscous medium. The value of its terminal velocity is proportional to

A.  $1/r$  only

B.  $m/r$

C.  $(m/r)^{1/2}$

D.  $m$  only

**Answer: B**



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3. A vessel contains a mixture consisting of  $m_1 = 7g$  of nitrogen ( $M_1 = 28$ ) and  $m_2 = 11g$  of carbon dioxide ( $M_2 = 44$ ) at temperature  $T = 300K$  and pressure  $p_0 = 1 \text{ atm}$ . Find the density of the mixture.

A. 1.446 g per litre

B. 2.567 g per litre



C. 3.752 g per litre

D. 4.572 g per litre

**Answer: A**



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4. Two thermally insulated vessel 1 and 2 are filled with air at temperature  $(T_1, T_2)$ , volume  $(V_1, V_2)$  and pressure  $(P_1, P_2)$  respectively. If the valve joining the two vessels

is opened, the temperature inside the vessel at equilibrium will be

A.  $T_1 + T_2$

B.  $\frac{(T_1 + T_2)}{2}$

C.  $\frac{T_1 T_2 (P_1 V_1 + P_2 V_2)}{P_1 V_1 T_2 + P_2 V_2 T_1}$

D.  $T_1 T_2 (P_1 V_1 + P_2 V_2)$

**Answer: C**



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5. A steel metre scale is to be ruled so that the millimetre intervals are accurate to within about  $5 \times 10^{-5}$  mm at a certain temperature. What is the maximum temperature variation allowable during the ruling ? Given  $\alpha$  for steel  $= 1.1 \times 10^{-5} .^{\circ} C^{-1}$ .

A.  $8^{\circ} C$

B.  $9^{\circ} C$

C.  $4.5^{\circ} C$

D.  $10^{\circ} C$

**Answer: C**



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6. What is the relationship between time of flight  $T$  and horizontal range  $R$ ?

(where  $\theta$  is angle of projection with the horizontal)

A.  $R = \frac{gT}{\tan \theta}$

B.  $R = \frac{gT^2}{2 \tan \theta}$

C.  $R = \frac{gT^2}{\tan \theta}$

$$D. R = \frac{gT}{2 \tan \theta}$$

**Answer: B**



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7. The disc of a siren revolves 600 times in one minute and it is in unison with a tuning fork of frequency 480 Hz. The number of holes in the disc is

A. 24

B. 38

C. 48

D. 56

**Answer: C**



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**8. Which of the following is dimensionless?**

A. Force/acceleration

B. Velocity/acceleration

C. Volume/area

## D. Energy/work

**Answer: D**



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**9.** Given

$\vec{F} = (4\hat{i} - 10\hat{j})$  and  $\vec{r} = (5\hat{i} - 3\hat{j})$ . then

torque  $\vec{\tau}$  is

A.  $-62\hat{j}$

B.  $62\hat{k}$

C.  $38\hat{i}$

D.  $-38\hat{k}$

**Answer: D**



**Watch Video Solution**

**10.** A man throws balls with the same speed vertically upwards one after the other at an interval of 2s. What should be the speed of the throw so that more than two balls are in the sky at any time ? (Given  $g = 9.8m / s^2$ )

A. Only with speed  $19.6ms^{-1}$



B. More than  $19.6ms^{-1}$

C. At least  $9.8ms^{-1}$

D. Any speed less than  $19.6ms^{-1}$

**Answer: B**



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**11. In uniform circular motion**

A. both the angular velocity and the angular momentum vary

B. the velocity varies but the momentum remains constant

C. magnitude of both the velocity and the momentum stay constant

D. the momentum varies but the velocity remains constant

**Answer: C**



**Watch Video Solution**

12. A ball is rolled off along the edge of the table (horizontal) with velocity  $4\text{ms}^{-1}$ . It hits the ground after time  $0.4\text{ s}$ . Which one of the following statements are wrong? ( $g = 10\text{ms}^{-2}$ ).

A. The height of the table is  $0.8\text{ m}$ .

B. It hits the ground at angle of  $60^\circ$  with the vertical

C. It covers a horizontal distance  $1.6\text{ m}$  from the table

D. It hits the ground with vertical velocity

$$4ms^{-1}$$

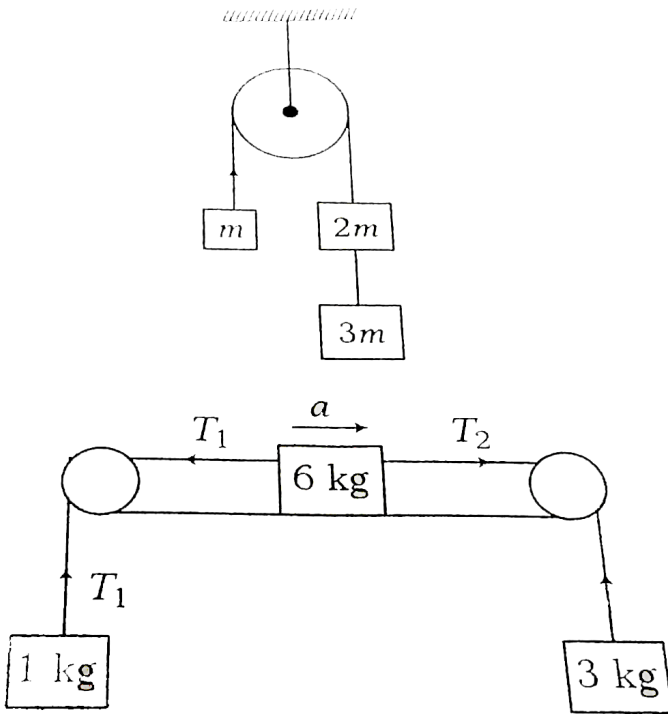
**Answer: B**



**Watch Video Solution**

**13.** Three masses of 1kg, 6 kg and 3 kg are connected to each other with threads and are placed on a table as shown in figure. What is the acceleration with which the system is moving? (

Take  $g = ms^{-2}$ )



A.  $6ms^{-2}$

B.  $2ms^{-2}$

C.  $1ms^{-2}$

D.  $4ms^{-2}$

**Answer: B**



**Watch Video Solution**

14. A liquid of density  $\rho$  flows along a horizontal pipe of uniform cross-section  $A$  with a velocity  $v$  through a right angled bend as shown in fig. What force has to be exerted at the bend to hold the pipe in equilibrium ? .

A.  $2a\rho v^2$

B.  $a\rho v^2 / \sqrt{2}$

C.  $\sqrt{2}a\rho v^2$

D.  $a\rho v^2$

**Answer: C**



**Watch Video Solution**

**15.** A chain of uniform mass  $m$  and length  $L$  is held on a frictionless table in such a way that its  $\frac{1}{n}$ th part is hanging below the edge of table.

The work done to pull the hanging part of chain

is : —

A.  $\sqrt{n}$

B.  $n$

C.  $n^{-3}$

D.  $n^{-2}$

**Answer: D**



**Watch Video Solution**

**16.** For the same total mass, which of the following will have the largest moment of inertia about an axis passing through the centre



of mass and perpendicular to the plane of the body

A. A disc of radius  $a$

B. A ring of radius  $a$

C. A square lamina of side  $a$

D. Four identical rods forming square of side

$a$

**Answer: D**



**Watch Video Solution**

17. Kepler's second law is based on

- A. Newton's first law
- B. Newton's second law
- C. special theory of relativity
- D. conservation of angular momentum.

**Answer: D**



**Watch Video Solution**

18. A spaceship is launched into a circular orbit close to the Earth's surface. What additional velocity has to be imparted to the spaceship to overcome the gravitational pull?

A.  $11.2\text{km s}^{-1}$

B.  $8\text{km s}^{-1}$

C.  $3.2\text{km s}^{-1}$

D.  $1.5\text{km s}^{-1}$

**Answer: C**



**Watch Video Solution**

19. A hole is drilled in a copper sheet. The diameter of the hole is  $4.24\text{cm}$  at  $27.0^\circ\text{C}$ . What is the change in the diameter of the hole when the sheet is heated to  $227^\circ\text{C}$ ?  $\alpha$  for copper  $= 1.70 \times 10^{-5}\text{K}^{-1}$

A.  $1.44 \times 10^{-2}\text{cm}$

B.  $2.44 \times 10^{-3}\text{cm}$

C.  $1.44 \times 10^{-2}\text{mm}$

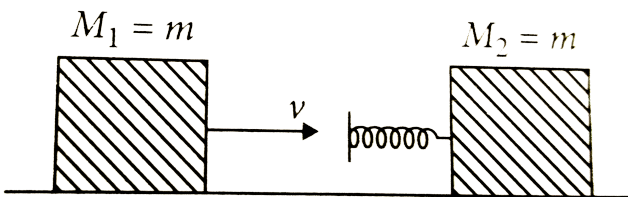
D.  $2.44 \times 10^{-3}\text{mm}$

**Answer: A**



**Watch Video Solution**

20. Two blocks  $M_1$  and  $M_2$  having equal masses are to move on a horizontal frictionless surface.  $M_2$  is attached to a massless spring as shown in figure. Initially  $M_2$  is at rest and  $M_1$  is moving toward  $M_2$  with speed  $v$  and collides head-on with  $M_2$ .



A. While spring is fully compressed, all the kinetic energy of  $M_1$  is stored as potential energy of spring

B. While spring is fully compressed, the system's momentum is not conserved, though final momentum is equal to initial momentum.

C. If spring is massless, the final state of the  $M_2$  is state of rest.

D. If the surface on which blocks are moving has friction, then collision cannot be elastic

**Answer: D**

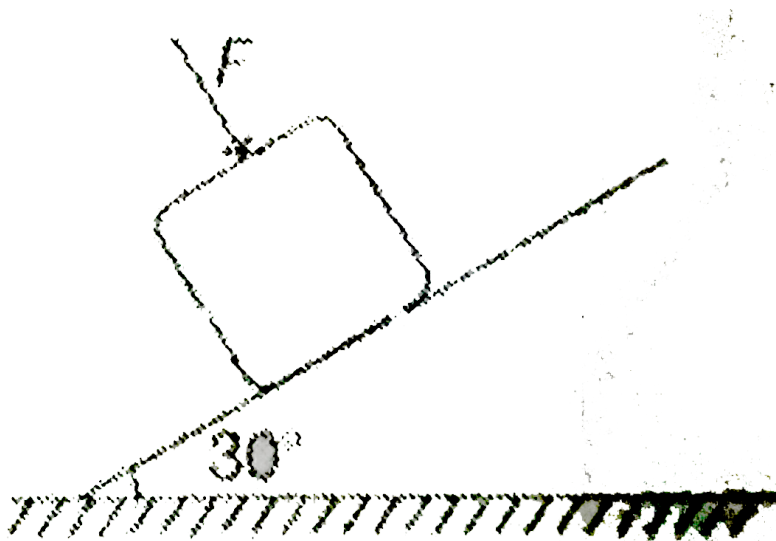


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**21.** A block of mass  $m=2\text{kg}$  is resting on a rough inclined plane of inclination  $30^\circ$  as shown in figure. The coefficient of friction between the block and the plane is

$\mu = 0.5$ . What minimum force  $F$  should be applied perpendicular to the plane on the block, so that blocks does not slip on the plane?

$(g = 10m / s^2)$



A. 2.68 N

B. zero

C. 4.34 N



D. 6.24 N

**Answer: A**



**Watch Video Solution**

**22.** The density of a solid ball is to be determined in an experiment. The diameter of the ball is measured with a screw gauge, whose pitch is  $0.5\text{mm}$  and there are 50 divisions on the circular scale. The reading on the main scale is  $2.5\text{mm}$  and that on circular scale is 20 divisions. if the measured mass of the ball has a

relative error of 2%, the relative percentage error in the density is

A. 0.9%

B. 2.4%

C. 3.1%

D. 4.2%

**Answer: C**



**Watch Video Solution**

23. A floor-mat of mass  $M$  made up of extensible material, is rolled along its length so as to form a cylinder of radius  $R$  and kept on a rough horizontal surface. If the mat is now unrolled, without sliding, to a radius  $\frac{R}{2}$ , the decrease in potential energy is

A.  $\frac{1}{2}MgR$

B.  $\frac{7}{8}MgR$

C.  $\frac{5}{8}MgR$

D.  $\frac{3}{4}MgR$

**Answer: B**



**Watch Video Solution**

**24.** A liquid of density  $\rho_0$  is filled in a wide tank to a height  $h$ . A solid rod of length  $L$ , cross-section  $A$  and density  $\rho$  is suspended freely in the tank. The lower end of the rod touches the base of the tank and  $h=L/n$  (where  $n > 1$ ). Then the angle of inclination  $\theta$  of the rod with the horizontal in equilibrium position is

$$\text{A. } \sin^{-1} \left( \sqrt{\frac{\rho_0}{\rho}} \right)$$

B.  $\sin^{-1} \left( n \sqrt{\frac{\rho_0}{\rho}} \right)$

C.  $\sin^{-1} \left( \frac{1}{n} \sqrt{\frac{\rho_0}{\rho}} \right)$

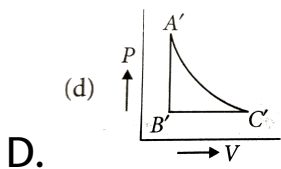
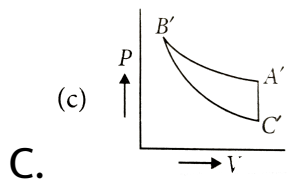
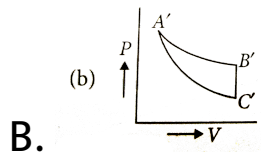
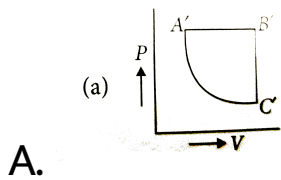
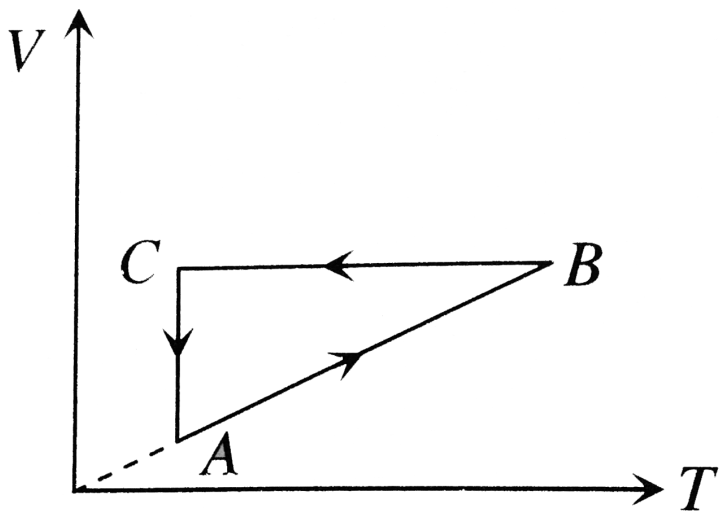
D.  $\sin^{-1} \left( \frac{1}{n} \sqrt{\frac{\rho}{\rho_0}} \right)$

**Answer: C**



**Watch Video Solution**

**25.** A cyclic process  $ABCA$  is shown in the  $V - T$  diagram process on the  $P - V$



**Answer: A**



**Watch Video Solution**

**26.** Two pendulums differ in lengths by  $22m$ . They oscillate at the same place so that one of them makes 30 oscillations and the other makes 36 oscillations during the same time. The length ( in  $cm$  ) of the pendulum are :

A. 72 and 50

B. 60 and 38

C. 50 and 28

D. 80 and 58

**Answer: A**



**Watch Video Solution**

27. A body of mass  $30\text{kg}$  starts running rest along a circular path of radius  $6\text{m}$  with constant tangential acceleration of magnitude  $2\text{m/s}^2$ .

After 2sec from start he feels that his shoes started slipping on ground. The friction



coefficient between his shoes and ground is : (

Take  $g = 10m / s^2$ )

A.  $\frac{1}{2}$

B.  $\frac{1}{3}$

C.  $\frac{1}{4}$

D.  $\frac{1}{5}$

**Answer: B**



**Watch Video Solution**

28. A long glass tube is held vertically in water . A tuning fork is struck and held over the tube . Strong resonances are observed at two successive lengths  $0.50m$  and  $0.84m$  above the surface of water . If the velocity of sound is  $340m / s$ , then the frequency of the tuning fork is

A. 128 Hz

B. 256 Hz

C. 384 Hz

D. 500 Hz

**Answer: D**



**Watch Video Solution**

**29.** A particle executes linear simple harmonic motion with an amplitude of 2 cm . When the particle is at 1 cm from the mean position the magnitude of its velocity is equal to that of its acceleration. Then its time period in seconds is

A.  $\frac{1}{2\pi\sqrt{3}}$

B.  $2\pi\sqrt{3}$

C.  $\frac{2\pi}{\sqrt{3}}$

D.  $\frac{\sqrt{3}}{2\pi}$

**Answer: C**



**Watch Video Solution**

**30.** A body of mass  $m$  thrown horizontally with velocity  $v$ , from the top of tower of height  $h$  touches the level ground at a distance of 250m from the foot of the tower. A body of mass  $2m$  thrown horizontally with velocity  $v/2$ , from the

top of tower of height  $4h$  will touch the level ground at a distance  $x$  from the foot of tower.

The value of  $x$  is

A. 250 m

B. 500 m

C. 125 m

D.  $250\sqrt{2}$  m

**Answer: A**



**Watch Video Solution**

**31.** The Poisson's ratio of a material is 0.4. If a force is applied to a wire of this material, there is a decrease of cross-sectional area by 2%. The percentage increase in its length is

A. 3 %

B. 2.5 %

C. 1 %

D. 0.5 %

**Answer: B**



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**32.** A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle. The motion of the particle takes place in a plane. It follows that

- A. its velocity is constant
- B. its acceleration is constant
- C. its kinetic energy is constant
- D. it moves in a straight line.

**Answer: C**



**Watch Video Solution**

**33.** The maximum velocity of a particle executing simple harmonic motion is  $v$ . If the amplitude is doubled and the time period of oscillation decreased to  $1/3$  of its original value the maximum velocity becomes

A.  $18v$

B.  $12v$



C. 6v

D. 3v

**Answer: C**



**Watch Video Solution**

**34.** A particle moves in x-y plane according to the equations  $x = 4t^2 + 5t + 16$  and  $y = 5t$  where x, y are in metre and t is in second. The acceleration of the particle is

A.  $8ms^{-2}$

B.  $12ms^{-2}$

C.  $14ms^{-2}$

D.  $16ms^{-2}$

**Answer: A**



**Watch Video Solution**

**35.** Two stars of masses  $m_1$  and  $m_2$  distance  $r$  apart, revolve about their centre of mass. The period of revolution is :

A.  $2\pi \sqrt{\frac{r^3}{2G(m_1 + m_2)}}$

B.  $2\pi \sqrt{\frac{r^3(m_1 + m_2)}{2G(m_1 m_2)}}$

C.  $2\pi \sqrt{\frac{2r^3}{G(m_1 + m_2)}}$

D.  $2\pi \sqrt{\frac{r^3}{G(m_1 + m_2)}}$

**Answer: D**



**Watch Video Solution**

**36.** Two projectiles A and B thrown with speeds in the ratio  $1 : \sqrt{2}$  acquired the same heights. If

A is thrown at an angle of  $45^\circ$  with the horizontal, the angle of projection of B will be

A.  $0^\circ$

B.  $60^\circ$

C.  $30^\circ$

D.  $45^\circ$

**Answer: C**



**Watch Video Solution**

37. A body executes simple harmonic motion. At a displacement  $x$ , its potential energy is  $U_1$ . At a displacement  $y$ , its potential energy is  $U_2$ . What is the potential energy of the body at a displacement  $(x + y)$ ?

A.  $U_1 + U_2$

B.  $(\sqrt{U_1} + \sqrt{U_2})^2$

C.  $\sqrt{U_1^2 + U_2^2}$

D.  $\sqrt{U_1 U_2}$

**Answer: B**



**38.** The pressure on the top surface of an aeroplane wing is  $0.8 \times 10^5$  Pa and the pressure on the bottom surface is  $0.75 \times 10^5$  Pa. If the area of each surface is  $50m^2$ , the dynamic lift on the wing is

A.  $0.5 \times 10^4$  N

B.  $0.25 \times 10^4$  N

C.  $5 \times 10^4$  N

D.  $25 \times 10^4$  N

**Answer: D**



**Watch Video Solution**

**39.** If pressure of  $CO_2$  (real gas ) in a container is given by  $P = \frac{RT}{2V - b} - \frac{a}{4b^2}$ , then mass of the gas in container is

A. 11g

B. 22g

C. 33g

D. 44g

**Answer: B**



**Watch Video Solution**

**40.** A body is thrown up with a velocity  $100ms^{-1}$ . It travels 5 m in the last second of upward journey if the same body thrown up with velocity  $200ms^{-1}$ , how much distance (in metre) will it travel in the last second of its upward journey? ( $g = 10ms^{-2}$ )

A. 5m



B. 10 m

C. 15 m

D. 20 m

**Answer: A**



**Watch Video Solution**

**41.** A machine gun is mounted on a 2000kg car on a horizontal frictionless surface. At some instant the gun fires bullets of mass 10gm with a velocity of  $500 \frac{m}{sec}$  with respect to the car. The

number of bullets fired per second is ten. The average thrust on the system is

A.  $0.025ms^{-2}$

B.  $0.25ms^{-2}$

C.  $0.5ms^{-2}$

D.  $500ms^{-2}$

**Answer: A**



**Watch Video Solution**

42. The radius of gyration of a solid sphere of radius  $R$  about a certain axis is also equal to  $R$ . If  $r$  is the distance between the axis and the centre of the sphere, then  $r$  is equal to

A.  $R$

B.  $0.5R$

C.  $\sqrt{0.6}R$

D.  $\sqrt{0.3}R$

**Answer: C**



**Watch Video Solution**

**43.** A cylindrical drum, open at the top, contains 30 litres of water. It drains out through a small opening at the bottom. 10 litres of water comes out in time  $t_1$ , the next 10 litres in a further time  $t_2$  and the last 10 litres in a further time  $t_3$ . Then,

A.  $t_1 < t_2 < t_3$

B.  $t_1 > t_2 > t_3$

C.  $t_1 = t_2 = t_3$

D.  $t_1 > t_2 = t_3$

**Answer: A**



**Watch Video Solution**

**44.** A body of mass 5 kg starts from the origin with an initial velocity  $\vec{u} = (30\hat{i} + 40\hat{j})\text{ms}^{-1}$ . If a constant force  $(-6\hat{i} - 5\hat{j})\text{N}$  acts on the body, the time in which the y-component of the velocity becomes zero is.

A. 5 s

B. 20 s

C. 40 s

D. 80 s

**Answer: C**



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**45.** One mole of gas of specific heat ratio 1.5 being initially at temperature 290 K is adiabatically compressed to increase its pressure 8 times. The temperature of the gas after compression will be

A. 580 K

B. 870 K

C.  $270\sqrt{2}$  K

D. 1160 K

**Answer: A**



**Watch Video Solution**

**46.** A man goes at the top of a smooth inclined plane. He releases a bag to fall freely and himself slides down on inclined plane to reach

the bottom. If  $u_1$  and  $u_2$  are the respective velocities of the man and bag at the bottom of inclined plane, then

A.  $u_1 > u_2$

B.  $u_1 < u_2$

C.  $u_1 = u_2$

D.  $u_1$  and  $u_2$  cannot be compared

**Answer: C**



**Watch Video Solution**



47. A Carnot refrigerator extracts heat from water at  $0^{\circ}C$  and rejects it to room at  $24.4^{\circ}C$ .

The work required by the refrigerator for every 1 kg of water converted into ice is

(Latent heat of ice =  $336 \text{ kJ kg}^{-1}$ )

A. 24.4 kJ

B. 30 kJ

C. 336 kJ

D. 11.2 kJ

**Answer: B**



**48.** A bullet is fired normally towards an immovable wooden block. If it loses 25 % of its kinetic energy in penetrating through the block at thickness  $x$ , the distance penetrated by the bullet into the block is

A.  $4x$

B.  $6x$

C.  $8x$

D.  $2x$

**Answer: A**



**Watch Video Solution**

**49.** Two identical flutes produce fundamental notes of frequency  $300\text{Hz}$  at  $27^\circ\text{C}$ . If the temperature of air in one flute is increased to  $31^\circ\text{C}$ , the number of the beats heard per second will be

A. 3

B. 2

C. 1

D. 4

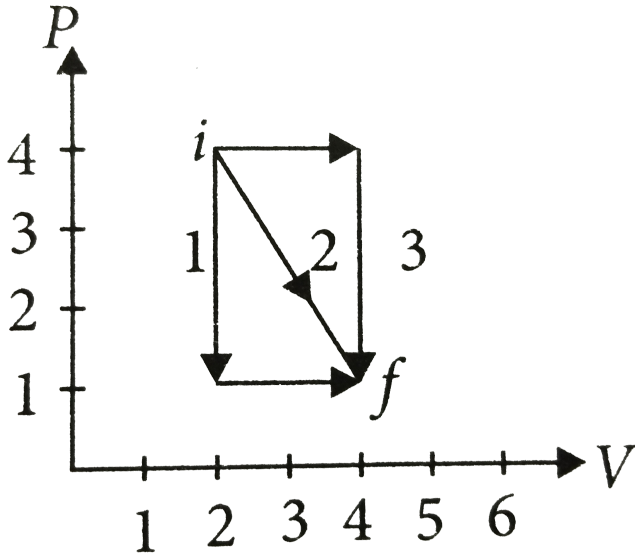
**Answer: B**



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50. A gas expands from  $i$  to  $f$  along the three paths indicated. The work done along the three paths denoted by  $W_1$ ,  $W_2$  and  $W_3$  have the

relationship



A.  $W_1 < W_2 < W_3$

B.  $W_2 < W_1 = W_3$

C.  $W_2 < W_1 < W_3$

D.  $W_1 > W_2 > W_3$

**Answer: A**



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