PHYSICS

BOOKS - MTG PHYSICS (ENGLISH)

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. $\dfrac{S}{2Y}$

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

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

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 momentof 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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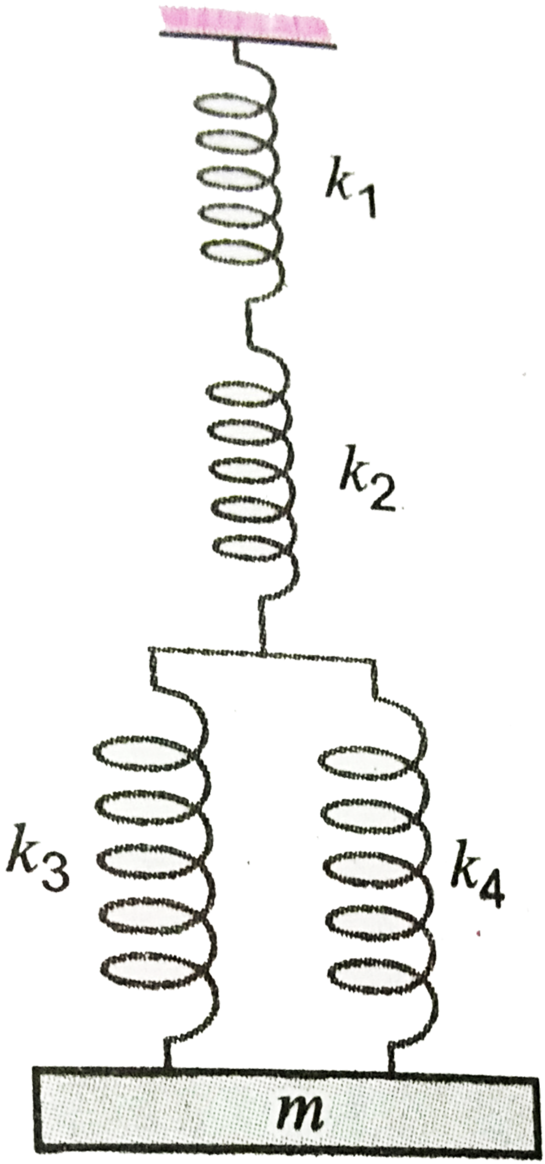
4. A system of springs with their spring constants are as shown in figure. What is the frequency of oscillations of the mass m ?



A. $\dfrac{1}{2\pi}\sqrt{\dfrac{k_1k_2(k_3+k_4)}{[(k_1+k_2)+(k_3+k_4)+k_1k_4]m}}$

B. $\dfrac{1}{2\pi}\sqrt{\dfrac{k_1k_2(k_3+k_4)}{[(k_1+k_2)+(k_3+k_4)+k_1k_2]m}}$

C. $\dfrac{1}{2\pi}\sqrt{\dfrac{k_1k_2(k_3+k_4)}{[(k_1+k_2)+(k_3+k_4)+k_1k_2]m}}$

D. $\dfrac{1}{2\pi}\sqrt{\dfrac{(k_1+k_2)(k_3+k_4)+k_1k_2}{k_1k_2(k_3+k_4)m}}$

Answer: C

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5. A closed organ pipe and an open organ pipe of some length produce $2 beats$ 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

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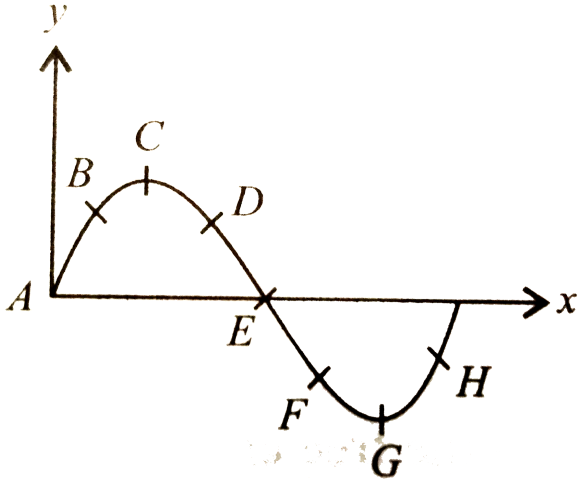
9. A transverse wave is travelling along a string from left to right. The figure below represents the shape of the string at a given instant. At this instant, among the following, choose the wrong statement.



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

B. Points A, B and H have downward negative

velocity

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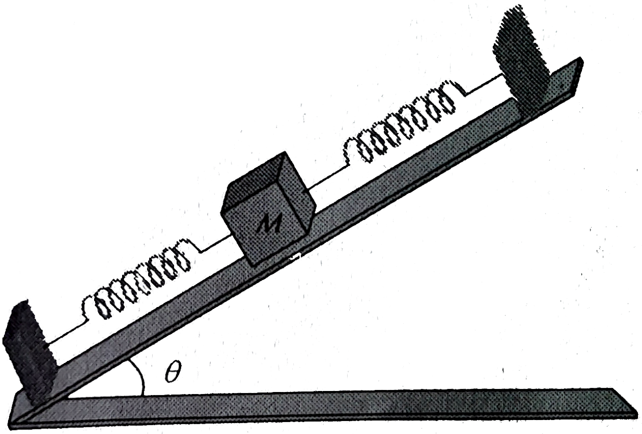
11. On a smooth inclined plane, a body of mass M is attached between two springs. The other ends of the springs are fixed to firm supports. If each spring has force constant K , the period of oscillation of the body (assuming the springs as massless) is



A. 1. $2\pi\sqrt{\frac{M}{2k}}$

B. 2. $2\pi\sqrt{\frac{2M}{k}}$

C. 3. $2\pi\sqrt{\frac{Mg\sin\theta}{2k}}$

D. 4. $2\pi\sqrt{\frac{2Mg}{k}}$

Answer: A

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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 γ ?

A. 1. $\frac{a}{b}$

B. 2. $\frac{b+1}{b}$

C. 3. $\frac{a+1}{a}$

D. 4. $\frac{b}{a}$

Answer: B

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

A. 1. remains the same

B. 2. become 2v

C. 3. become $\sqrt{2}v$

D. 4. 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. $\dfrac{1-e}{1+e}$

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

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

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

Answer: A

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15. A uniform rope of length 12 mm 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 $33000 N$ 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

$$\left(Y = 3 \times 10^{11} N / m^2, \alpha = 1.1 \times 10^{-5 / \circ} C\right)$$

a) 20 degree C b) 15 degree C c) 10 degree C d) 0 degree C

A. $20^{\circ} C$

B. $15^{\circ} C$

C. $10^{\circ} C$

D. $0^{\circ} C$

Answer: C

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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 ΔP 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 14 revolutions in 25 s, what is the magnitude of acceleration of the stone ?

A. 1. $9.0ms^{-2}$

B. 2. $12.0ms^{-2}$

C. 3. $11ms^{-2}$

D. 4. $9.9ms^{-2}$

Answer: B

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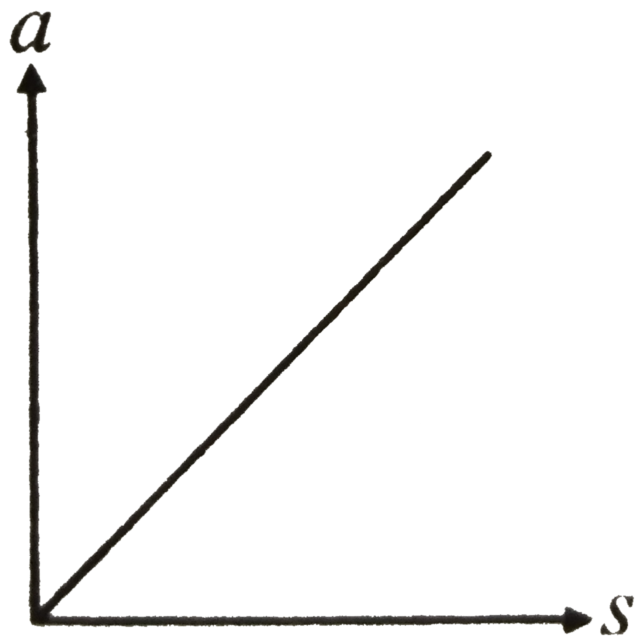
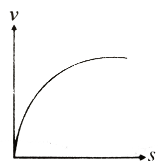
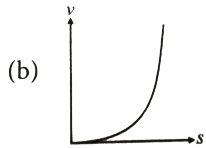
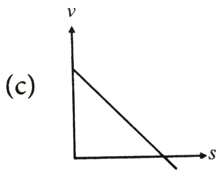
19. Acceleration (a)-displacement(s) graph of a particle moving in a straight line is shown here. The initial velocity of the particle is zero. The v-s graph of the particle would be

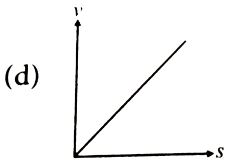


A. (a)



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° with the horizontal without slipping? $(Take g = 10m / s^2)$

A. a. 0.19

B. b. 0.29

C. c. 0.39

D. d. 0.49

Answer: B

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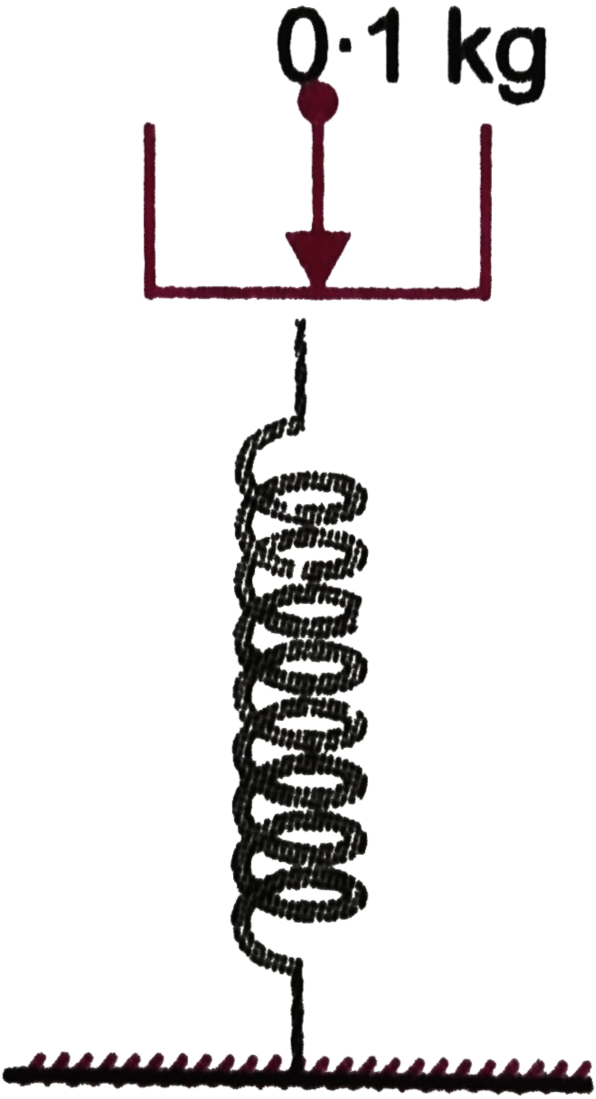
21. A massless platform is kept on a light elastic spring as shown in figure. When a small stone of mass 0.1 kg is dropped on the pan from a height of 0.24 m, the spring compresses by 0.01m. From what height should the stone be droppped to cause a compression of 0.04m in the spring ?



A. A. 0.96 m

B. B. 2.96 m

C. C. 3.96 m

D. 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. 1. $x = y^3 - y^2 + 2$

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

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

D. 4. $x = y^3 - 2y^2 + 2$

Answer: B

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23. Two bodies of masses $10kg$ and $2kg$ are moving with velocities $\left(2\hat{i} - 7\hat{j} + 3\hat{k}\right)$ and $\left(-10\hat{i} + 35\hat{j} - 3\hat{k}\right)m/s$

respectively. Calculate the velocity of their centre of mass.

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

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

C. 3. $\left(2\hat{j}+2\hat{k}\right)ms^{-1}$

D. 4. $\left(2\hat{i}+2\hat{j}+2\hat{k}\right)ms^{-1}$

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. A. $0.7\,\%$

B. B. $1.0\,\%$

C. C. $1.5\,\%$

D. 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

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

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

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°

B. 60°

C. 45°

D. 0°

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 θ 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 $36kmh^{-1}$. Tho 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 $1km, (B) decides \rightarrow overtake$ A before C does , What minimum accelration of car (B) is required to avoid and accident.

A. $9.8ms^{-2}$

B. $10ms^{-2}$

C. $1ms^{-2}$

D. $2.0ms^{-2}$

Answer: C

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31. If the vectors $\overrightarrow{A} = 2\hat{i} + 4\hat{j}$ and $\overrightarrow{B} = 5\hat{i} - p\hat{j}$ are parallel to each other, the magnitude of $\overrightarrow{B}$ 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 $\left(\hat{i}10+\hat{j}5\right)$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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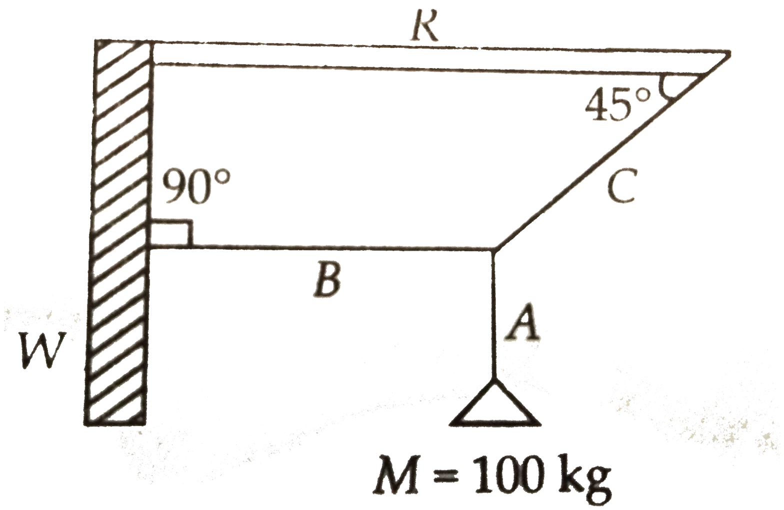
33. A mass M of 100 kg is suspended with the use of strings A, B 90 and C as shown in the figure, where W is the vertical wall and R is a rigid horizontal rod. The tension in the string B is



A. 100g N

B. zero

C. $100\sqrt{2}gN$

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

Answer: A

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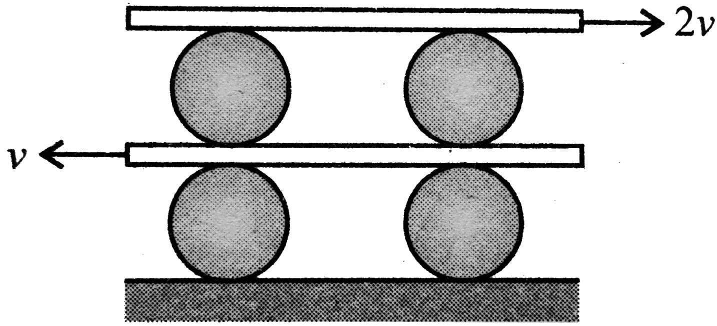
34. A system of identical cylinders and plates is shown in Fig. All the cylinders are identical and there is no slipping at any contact. The velocity of lower and upper plates are V and $2V$, respectively, as shown in Fig. Then the ratio of angular speeds of the upper cylinders to lower cylinders is



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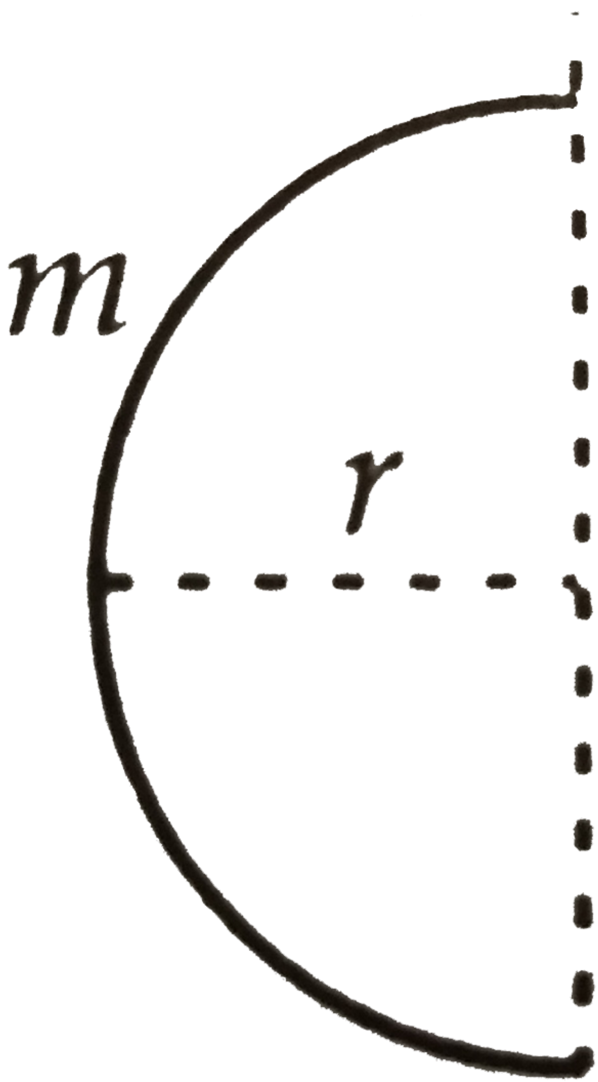
40. A thin wire of length l and mass m is bent in the form of a semicircle as shown in the figure. Its moment of inertia about an axis joining its free ends will be



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

ρ_1 and ρ_2.The ratio of the accelerations due to gravity at their surface is

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

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

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

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

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. 1.65×10^{-2}

B. 3.3×10^{-2}

C. 6.6×10^{-2}

D. 8.25×10^{-2}

Answer: B

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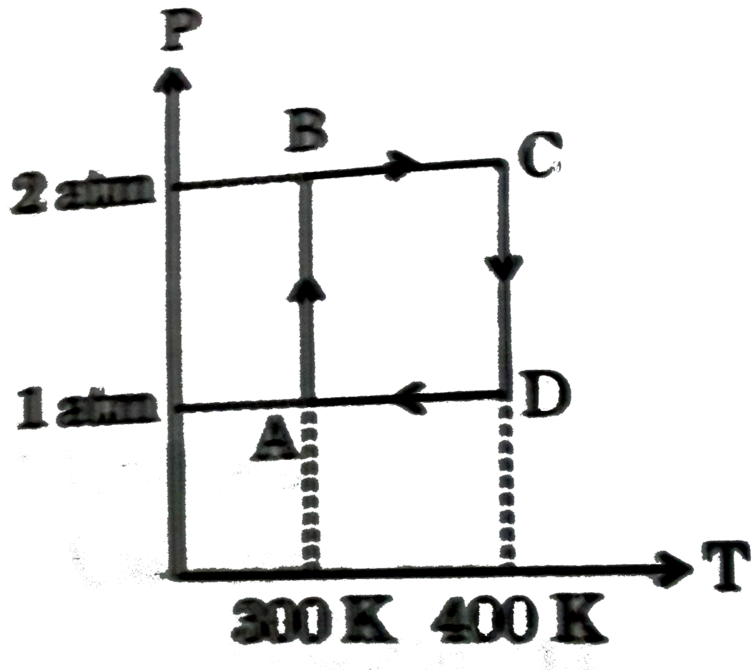
43. Two moles of Helium gas undergo a reversible cyclic process as shown in figure. Assuming gas to be ideal, what is the net work involved in the cyclic process ?



A. 200R ln2

B. 100R ln2

C. 300R ln2

D. 400R ln2

Answer: A

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44. An object of mass $0.2kg$ executes SHm along the X-axis with frequency of $(25/\pi)Hz$. At the point $X = 0.4m$ the object has $KE0.5J$ and $PE0.4J$. The amplitude of oscilation 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. L/2

B. 4L

C. L

D. 2L

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

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 μ 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°. The parallelogram lies in the x-y plane with mass m at the origin and 4 m 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 $\overrightarrow{F_1 = 2\hat{i} - 5\hat{j}}$, $\overrightarrow{F_2 = 3\hat{i} - 4\hat{j}}$. Its velocity will become uniform under a third force $\overrightarrow{F_3}$ 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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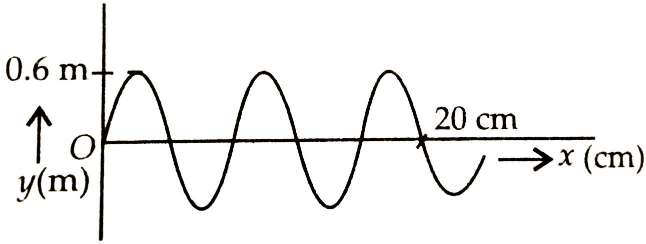
4. What is the wavelength of wave shown in given figure ?



A. 0.6 m

B. 0.3 m

C. 0.08 m

D. 4 cm

Answer: C

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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

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6. A wave is represented by the equation

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

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

A. $1m^{-1}$

B. $2m^{-1}$

C. πm^{-1}

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

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

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

Watch Video Solution

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

Watch Video Solution

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

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

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

$\overrightarrow{F}$ makes an angle of 45° with the Z-axis

$\overrightarrow{F}$ makes an angle of 30° 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

Watch Video Solution

12. A particle is projected from the ground with an initial speed v at an angle θ 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. $\frac{u}{2}\sqrt{1+\cos^2\theta}$

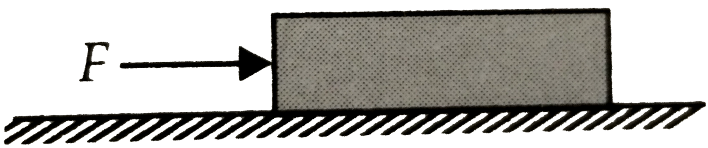
C. $\frac{u}{2}\sqrt{1+2\cos^2\theta}$

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

Answer: D

Watch Video Solution

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 $g = 10 ms^{-2}$)



A. 3 N

B. 8 N

C. 4 N

D. 6 N

Answer: A

Watch Video Solution

14. A block released from rest from the top of a smooth inclined plane of angle θ_1 reaches the bottom in time t_1. The same block released from rest from the top of another smooth inclined plane of angle θ_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

Watch Video Solution

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° 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. $\dfrac{3}{560}$ J

Answer: C

Watch Video Solution

17. Two particles of masses 1 kg and 3 kg have position vectors $2\hat{i} + 3\hat{j} + 4\hat{k}$ 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. $-\hat{i}-3\hat{j}-2\hat{k}$

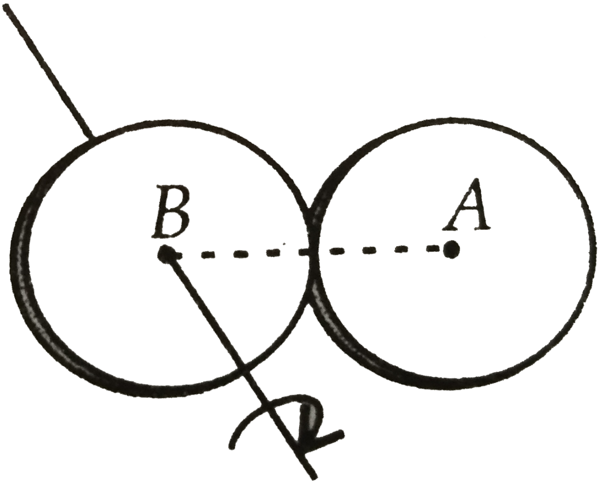
C. $-\hat{i}+3\hat{j}+2\hat{k}$

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

Watch Video Solution

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

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23. The mean distance between the atoms of iron is 3×10^{-10} m and interatomic fore 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 kg at $0^{\circ} C$ is placed in an isolated container which is at $227^{\circ} C$. The specific heat s of the container varies with temperature T according to the empirical relation $s = A + BT$, where $A = 100 cal / kg.\ K$ and $B = 2 \times 10^{-2} cal / kg.\ K^2$. If the final temperature of the container is $27^{\circ} C$, determine the mass of the container.

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

A. 0.495 kg

B. 0.595 kg

C. 0.695 kg

D. 0.795 kg

Answer: A

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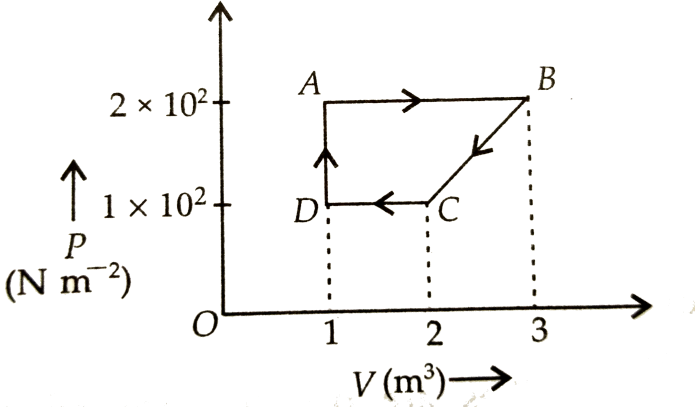
25. A cyclic process is shown in the figure. Work done during the cyclic process ABCDA is



A. 1600 J

B. 150 J

C. 600 J

D. 900 J

Answer: B

Watch Video Solution

26. One mole of an ideal monatomic gas at temperature T_0 expands slowly according to the law $\frac{P}{V} = cons\tan t$.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 $y = Kt^2, \left(K = 1m / s^2\right)$ where (y) is the vertical displacement. The time period now becomes (T_2). The ratio of $\frac{T_1^2}{T_2^2}$ is $\left(g = 10m / s^2\right)$.

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 $\frac{1}{\varepsilon_0}\frac{e^2}{hc}$ 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. $\left[M^{-1}L^{-3}T^{4}A^{2}\right]$

Answer: B

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30. A projectile is thrown with an initial velocity of $\left(a\hat{i}+b\hat{j}\right)ms^{-1}$. 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

Watch Video Solution

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

Watch Video Solution

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 tension?

A. $4:1$

B. $\sqrt{7}:1$

C. $3:1$

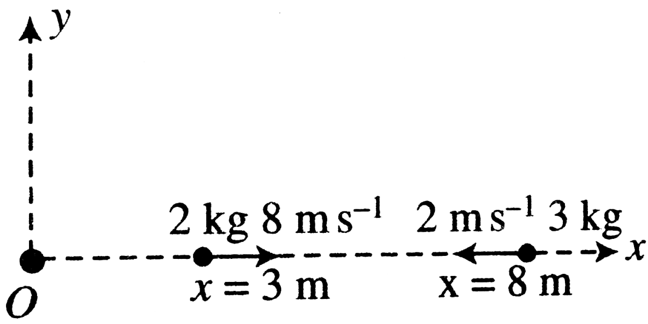
D. $2:1$

Answer: A

Watch Video Solution

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 m

B. x=6 m

C. x=8 m

D. x=10 m

Answer: D

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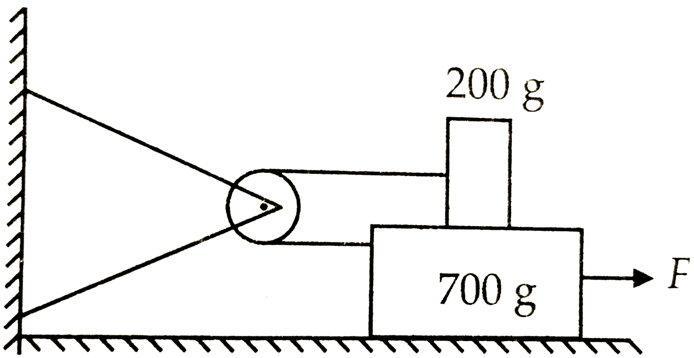
34. How large must F be in the figure shown to give the 700 g block an acceleration of $30 cm s^{-2}$? The coefficient of friction between all surfaces is 0. 15.



A. 2.18 N

B. 3.18 N

C. 4N

D. 6N

Answer: A

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35. The radii of the two columne is U-tube are r_1 and $r_2(> r_1)$. When a liquid of density ρ (angle of contact is 0°)) is filled in it, the level different of liquid in two arms is h. The surface tension of liquid is

($g =$ acceleration due to gravity)

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

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

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

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

Answer: A

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36. The angle subtended by vector $\overrightarrow{A} = 4\hat{i} + 3\hat{j} + 12\hat{k}$ 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

Watch Video Solution

37. A solid cylinder rolls without slipping down a 30° 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 $100 Nm^{-1}$ 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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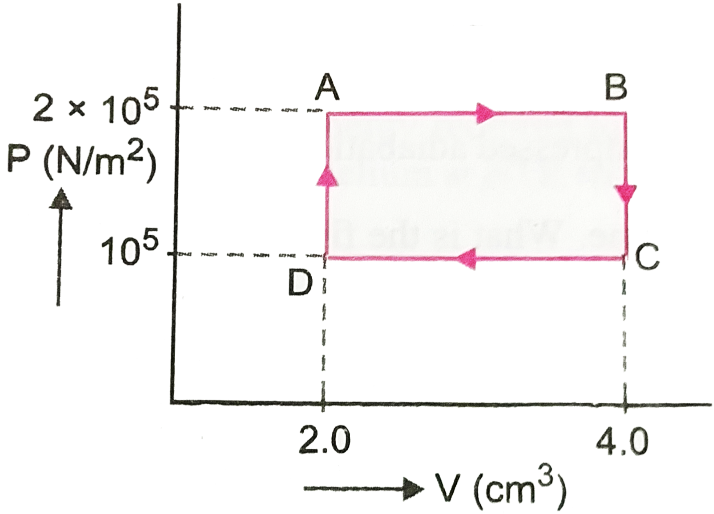
41. The $P-V$ diagram of a gas undergoing a cyclic process ABCDA is shown in (figure). Where P is in N/m^2 and V is in cm^3. Identify the incorrect statement



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 appaears 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. $\dfrac{mv_1t}{t_1}$

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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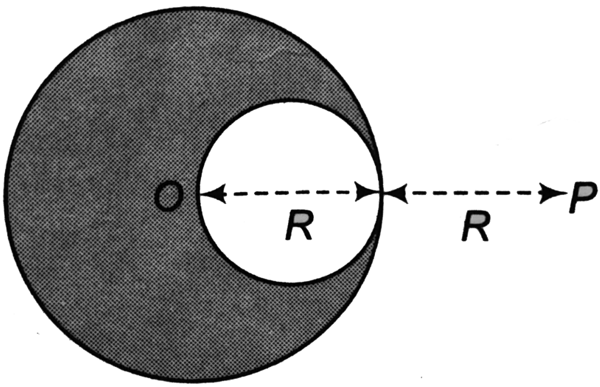
44. A solid sphere of uniform density and radius R applies a gravitational force of attraction equal to F_1 on a particle placed at P, distance $2R$ from the centre O of the sphere. A spherical cavity of radius $R/2$ is now made in the sphere as shown in figure. The particle with cavity now applies a gravitational force F_2 on same particle placed at P. The radio F_2/F_1 will be



A. $1/2$

B. $7/9$

C. 3

D. 7

Answer: B

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45. A metal wire of length L_1 and area of cross section A is ttached 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. $\dfrac{Y_1 Y_2 A}{2(Y_1 L_2 + Y_2 L_1)}$

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

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

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

Answer: C

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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

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47. A thin circular ring of mass M and radius r is rotating about its axis with a constant angular velocity ω, 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. $\dfrac{\omega M}{M+m}$

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

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

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

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 $100s$. If the bus is at a distance of $1km$ from the scooterist with what speed should the scooterist chase the bus ?

A. a. $10ms^{-1}$

B. b. $20ms^{-1}$

C. c. $50ms^{-1}$

D. d. $30ms^{-1}$

Answer: B

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49. A particle A is projected verically upwards. Another indentical particle B is projected at an angle of 45°. 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 $1.1 ms^{-2}$

sounding its horn continuously. 20 s later, the driver stops sounding the horn. The velocity of sound in air is $330ms^{-1}$. 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

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Practice Paper 3

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. $0.75cm$

B. $0.75m$

C. $7.5cm$

D. $7.5m$

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 mixtrue 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 $p_0 = 1$ 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 $(T_1T_2), volume(V_1V_2)$ and pressure (P_1P_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. $\dfrac{(T_1 + T_2)}{2}$

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

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 5×10^{-5}mm at a certain temperature. What is the maximum temperature variation allowable during the ruling ? Given α 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 θ 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. $R = \dfrac{gT}{2\tan\theta}$

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 $\overrightarrow{F} = \left(4\hat{i} - 10\hat{j}\right)$ and $\overrightarrow{r} = \left(5\hat{i} - 3\hat{j}\right)$. then torque $\overrightarrow{\tau}$ is

A. 1. $-62\hat{j}$

B. 2. $62\hat{k}$

C. 3. $38\hat{i}$

D. $4. -38\hat{k}$

Answer: D

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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 $g = 9.8 m / s^2$)

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

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

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

A. The height of the table is 0.8 m.

B. It hits the ground at angle of 60° with the vertical

C. It covers a horizontal distance 1.6 m from the table

D. It hits the ground with vertical velocity $4ms^{-1}$

Answer: B

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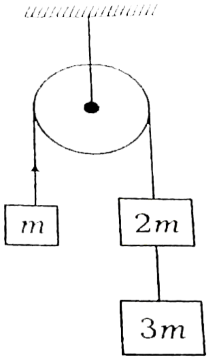
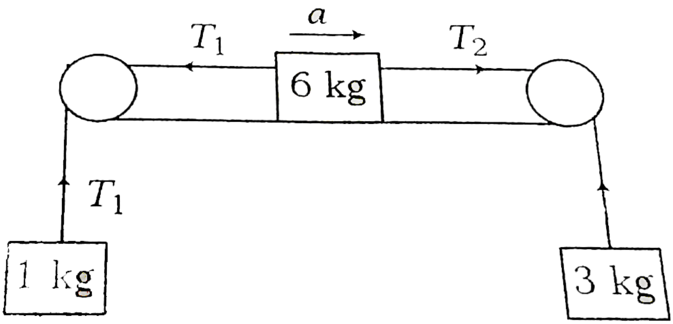
13. Three masses of 1kg, 6 kg and 3 kg are connected to each other with theads and are placed on a table as shown in figure. What is the acceleration with which the system is moving? (

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





A. $6ms^{-2}$

B. $2ms^{-2}$

C. $1ms^{-2}$

D. $4ms^{-2}$

Answer: B

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14. A liquid of density ρ 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

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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

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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

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

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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. $11.2kms^{-1}$

B. $8kms^{-1}$

C. $3.2kms^{-1}$

D. $1.5kms^{-1}$

Answer: C

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19. A hole is drilled in a copper sheet. The diameter of the hole is $4.24cm$ at $27.0^\circ C$. What is the change in the diameter of the hole when the sheet is heated to 227^0C? α for copper $= 1.70 \times 10^{-5} K^{-1}$

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

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

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

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

Answer: A

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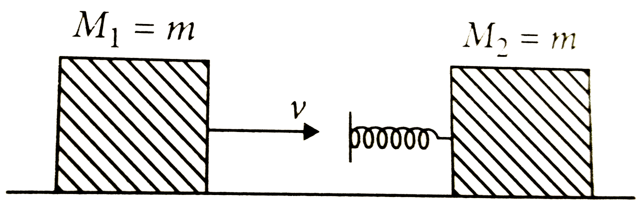
20. Two blocks M_1 and M_2 having equal masses are to move on a horizontal frictionless surface. M_2 is attached to a massless spring as shown in figure. Initially M_2 is at rest and M_1 is moving toward M_2 with speed v and collides head-on with M_2.



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.

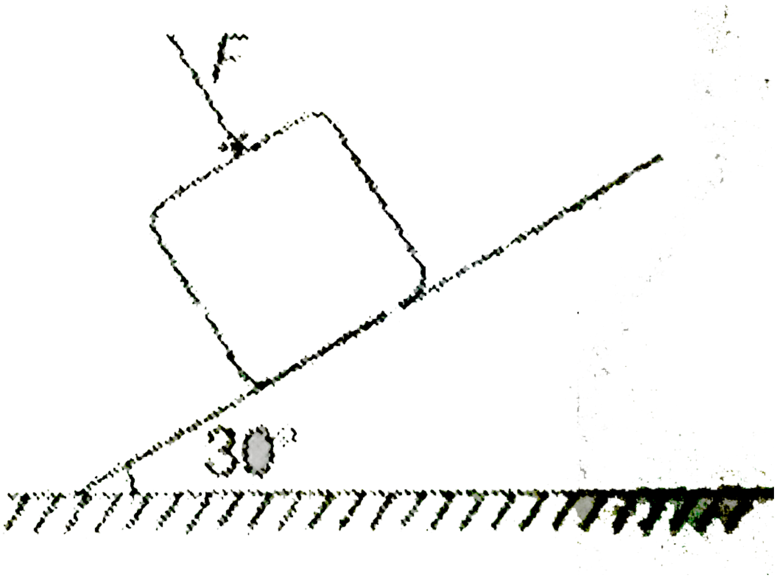
C. If spring is massless, the final state of the M_2 is state of rest.

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

Answer: D

Watch Video Solution

21. A block of mass m=2kg is resting on a rough inclined plane of inclination of 30° 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 $0.5mm$ and there are 50 divisions on the circular scale. The reading on the main scale is $2.5mm$ 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. 1. $\frac{1}{2}MgR$

B. 2. $\frac{7}{8}MgR$

C. 3. $\frac{5}{8}MgR$

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

Answer: B

Watch Video Solution

24. A liquid of density ρ_0 is filled in a wide tank to a height h. A solid rod of length L, cross-section A and density ρ is suspended freely in the tank. The lower end of the rod touches the base of the tank and h=L/n (where n gt 1). Then the angle of inclination θ of the rod with the horizontal in equilibrium position is

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

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

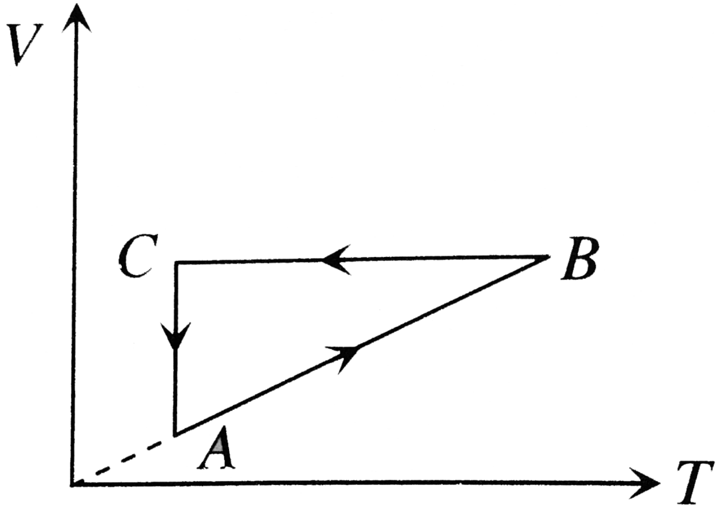
C. $\sin^{-1}\left(\frac{1}{n}\sqrt{\frac{\rho_0}{\rho}}\right)$

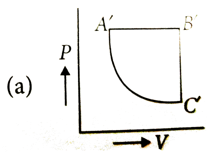
D. $\sin^{-1}\left(\frac{1}{n}\sqrt{\frac{\rho}{\rho_0}}\right)$

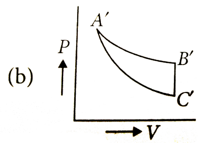
Answer: C

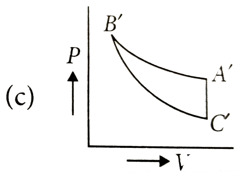
Watch Video Solution

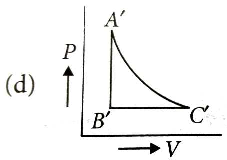
25. A cyclic process $ABCA$ is shown in the $V-T$ diagram process on the $P-V$



A. 

B. 

C. 

D. 

Answer: A

Watch Video Solution

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

A. 1. 72 and 50

B. 2. 60 and 38

C. 3. 50 and 28

D. 4. 80 and 58

Answer: A

Watch Video Solution

27. A body of mass $30kg$ starts running rest along a ciruclar path of radius $6m$ with constant tangential acceleration of magnitude $2m/s^2$. After $2\sec$ 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. $\dfrac{1}{2\pi\sqrt{3}}$

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

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

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

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

Watch Video Solution

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. $2\pi\sqrt{\frac{r^3(m_1+m_2)}{2G(m_1m_2)}}$

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° with the horizontal, the angle of projection of B will be

A. 0°

B. 60°

C. 30°

D. 45°

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. $\left(\sqrt{U}_1 + \sqrt{U}_2\right)^2$

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

D. $\sqrt{U_1 U_2}$

Answer: B

Watch Video Solution

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

A. 0.5×10^4 N

B. 0.25×10^4 N

C. 5×10^4 N

D. 25×10^4 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

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 harizontal 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. $550N$

B. $50N$

C. $250N$

D. $300N$

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 10litres 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 stJrls from the origin with an initial velocity $\bar{u} = \left(30\hat{i} + 40\hat{j}\right)ms^{-1}$ .If a constant force $\left(-6\hat{i} - 5\hat{j}\right)N$ acts on the body, the time in velocity, which the y-component of the velocity becomes zero is.

A. 5 s

B. 20 s

C. 40 s

D. 80 s

Answer: C

Watch Video Solution

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=$336 kJkg^{-1}$) a) 24.4kJ b) 30 kJ c) 336 kJ d) 27.55 kJ

A. 24.4kJ

B. 30 kJ

C. 336 kJ

D. 11.2 kJ

Answer: B

Watch Video Solution

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 $300Hz$ at $27^\circ C$. If the temperature of air in one flute is increased to $31^\circ C$, the number of the beats heard per second will be

A. 3

B. 2

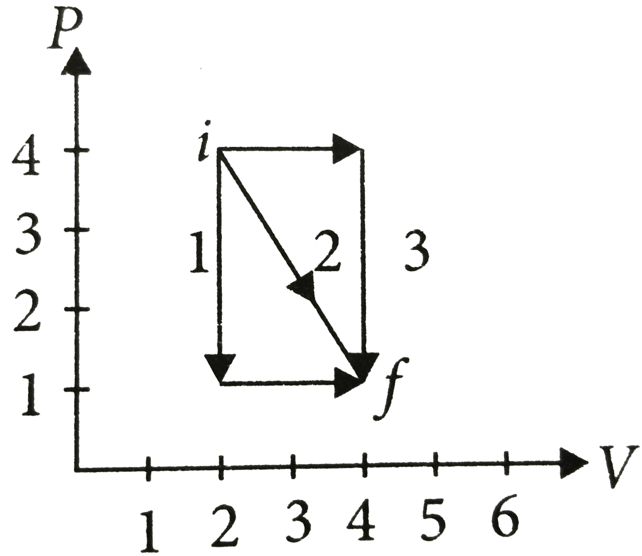
C. 1

D. 4

Answer: B

Watch Video Solution

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

Watch Video Solution

Others

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

Watch Video Solution

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. $\dfrac{2-\sqrt{2}}{\sqrt{2}}$

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

Answer: D

Watch Video Solution

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

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

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

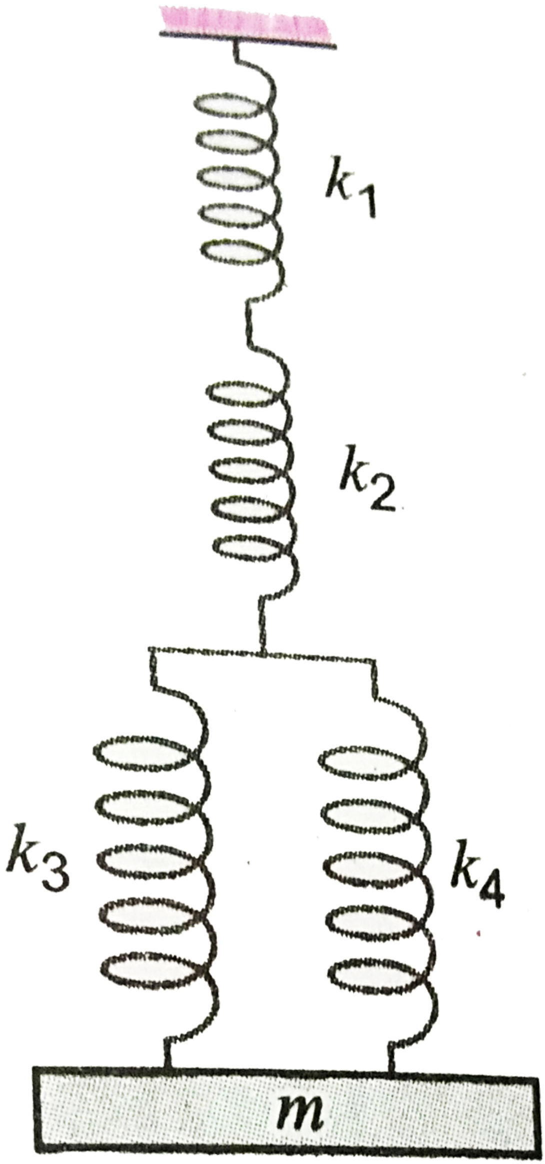
C. $\frac{Ml^2}{3}$

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

Answer: B

Watch Video Solution

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. $\frac{1}{2\pi}\sqrt{\frac{k_1k_2(k_3+k_4)}{[(k_1+k_2)+(k_3+k_4)+k_1k_4]m}}$

B. $\frac{1}{2\pi}\sqrt{\frac{k_1k_2(k_3+k_4)}{[(k_1+k_2)+(k_3+k_4)+k_1k_2]m}}$

C. $\frac{1}{2\pi}\sqrt{\frac{k_1k_2(k_3+k_4)}{[(k_1+k_2)+(k_3+k_4)+k_1k_2]m}}$

D. $\frac{1}{2\pi}\sqrt{\frac{(k_1+k_2)(k_3+k_4)+k_1k_2}{k_1k_2(k_3+k_4)m}}$

Answer: C

Watch Video Solution

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

A. 7

B. 4

C. 8

D. 2

Answer: A

Watch Video Solution

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

A. 24

B. 34

C. 21

D. 45

Answer: A

Watch Video Solution

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

Watch Video Solution

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. $22^{\circ} C$

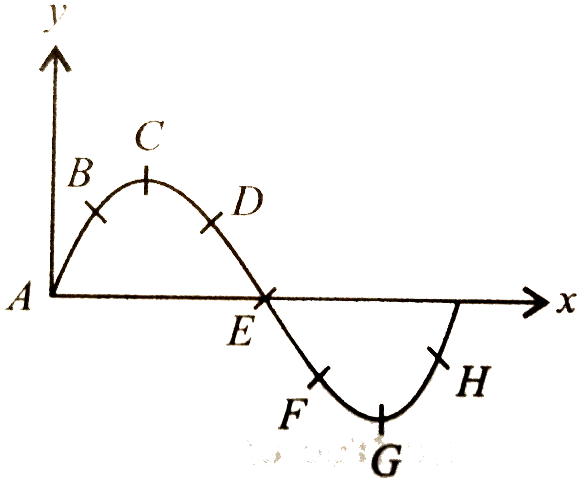
C. $20.2^{\circ} C$

D. $24.2^{\circ} C$

Answer: C

Watch Video Solution

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

C. Point C and G have zero velocity.

D. Points A and E have minimum velocity.

Answer: D

Watch Video Solution

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. $h : R$

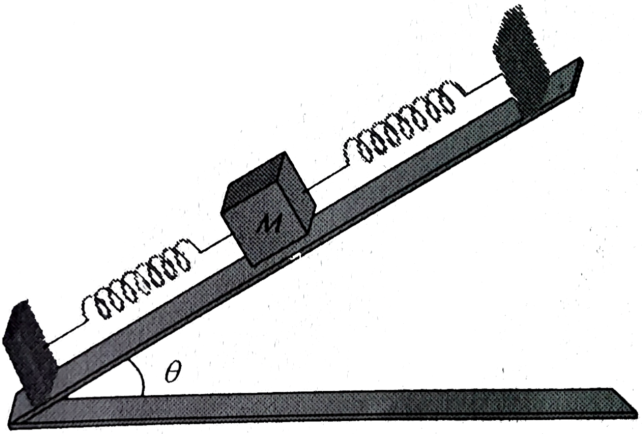
C. $R : 2h$

D. $2h : R$

Answer: D

Watch Video Solution

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. 1. $2\pi\sqrt{\frac{M}{2k}}$

B. 2. $2\pi\sqrt{\frac{2M}{k}}$

C. 3. $2\pi\sqrt{\frac{Mg\sin\theta}{2k}}$

D. 4. $2\pi\sqrt{\frac{2Mg}{k}}$

Answer: A

Watch Video Solution

Watch Video Solution

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 γ ?

A. 1. $\frac{a}{b}$

B. 2. $\frac{b+1}{b}$

C. 3. $\frac{a+1}{a}$

D. 4. $\frac{b}{a}$

Answer: B

Watch Video Solution

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

A. 1. remains the same

B. 2. become 2v

C. 3. become $\sqrt{2}v$

D. 4. none of these

Answer: D

Watch Video Solution

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. $\dfrac{1-e}{1+e}$

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

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

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

Answer: A

Watch Video Solution

15. A uniform rope of length 12 mm 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

Watch Video Solution

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

$\left(Y = 3 \times 10^{11} N/m^2, \alpha = 1.1 \times 10^{-5/\circ} C\right)$

a) 20 degree C b) 15 degree C c) 10 degree C d) 0 degree C

A. $20^\circ C$

B. $15^\circ C$

C. $10^\circ C$

D. $0^\circ C$

Answer: C

Watch Video Solution

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 ΔP 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

Watch Video Solution

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 14 revolutions in 25 s, what is the magnitude of acceleration of the stone ?

A. 1. $9.0ms^{-2}$

B. 2. $12.0ms^{-2}$

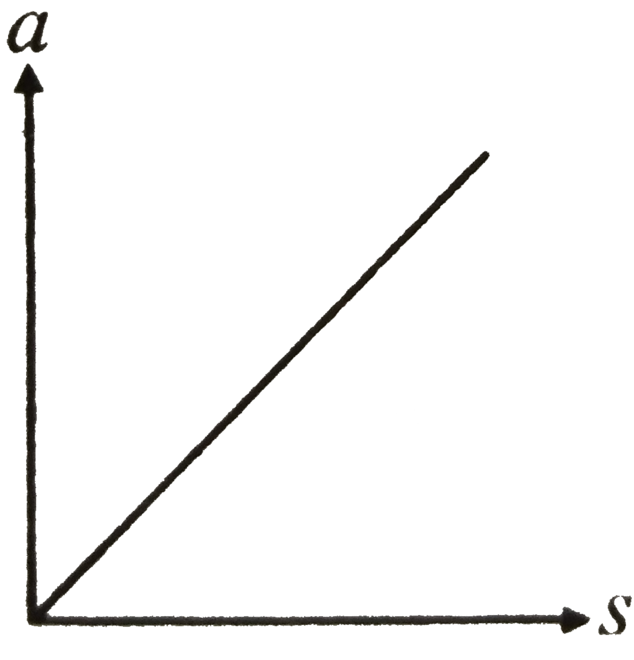
C. 3. $11ms^{-2}$

D. 4. $9.9ms^{-2}$

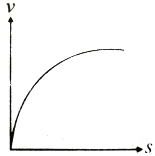
Answer: B

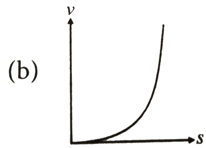
Watch Video Solution

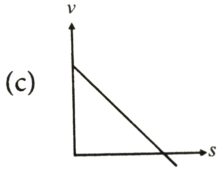
19. Acceleration (a)-displacement(s) graph of a particle moving in a straight line is shown here. The initial velocity of the particle is zero. The v-s graph of the particle would be

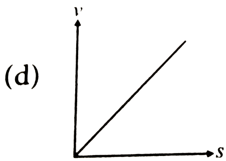


A. (a)



B. 

C. 

D. 

Answer: D

Watch Video Solution

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° with the horizontal without slipping? $(Take g = 10 m / s^{2})$

A. a. 0.19

B. b. 0.29

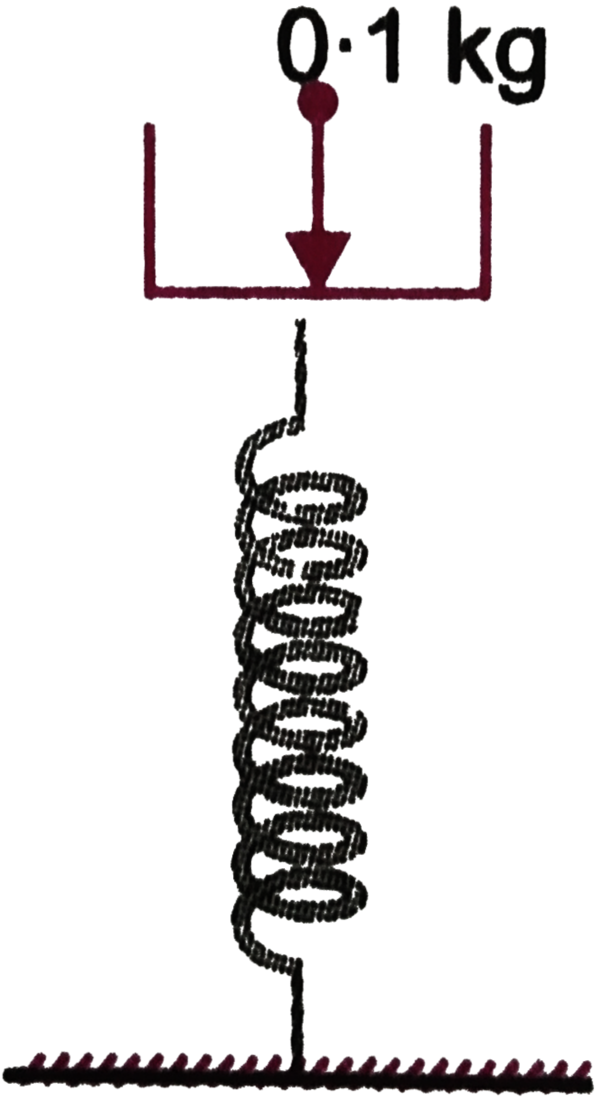
C. c. 0.39

D. d. 0.49

Answer: B

Watch Video Solution

21. A massless platform is kept on a light elastic spring as shown in figure. When a small stone of mass 0.1 kg is dropped on the pan from a height of 0.24 m, the spring compresses by 0.01m. From what height should the stone be droppped to cause a compression of 0.04m in the spring ?



A. A. 0.96 m

B. B. 2.96 m

C. C. 3.96 m

D. D. 0.48 m

Answer: C

Watch Video Solution

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

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

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

D. 4. $x = y^3 - 2y^2 + 2$

Answer: B

Watch Video Solution

23. Two bodies of masses $10kg$ and $2kg$ are moving with velocities $\left(2\hat{i} - 7\hat{j} + 3\hat{k}\right)$ and $\left(-10\hat{i} + 35\hat{j} - 3\hat{k}\right)m/s$

respectively. Calculate the velocity of their centre of mass.

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

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

C. 3. $\left(2\hat{j}+2\hat{k}\right)ms^{-1}$

D. 4. $\left(2\hat{i}+2\hat{j}+2\hat{k}\right)ms^{-1}$

Answer: B

Watch Video Solution

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. A. $0.7\,\%$

B. B. $1.0\,\%$

C. C. $1.5\,\%$

D. D. $3.0\,\%$

Answer: D

Watch Video Solution

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

Watch Video Solution

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

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

Answer: C

Watch Video Solution

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

Watch Video Solution

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°

B. 60°

C. 45°

D. 0°

Answer: B

Watch Video Solution

29. A ball of mass M is thrown vertically upwards. Another ball of mass 2M is thrown at an angle θ 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

Watch Video Solution

30. On a two lane road , car (A) is travelling with a speed of $36kmh^{-1}$. Tho 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 $1km, (B) decides \rightarrow overtake$ A before C does , What minimum accelration of car (B) is required to avoid and accident.

A. $9.8ms^{-2}$

B. $10ms^{-2}$

C. $1ms^{-2}$

D. $2.0ms^{-2}$

Answer: C

Watch Video Solution

31. If the vectors $\overrightarrow{A} = 2\hat{i} + 4\hat{j}$ and $\overrightarrow{B} = 5\hat{i} - p\hat{j}$ are parallel to each other, the magnitude of $\overrightarrow{B}$ is

A. $5\sqrt{5}$

B. 10

C. 15

D. $2\sqrt{5}$

Answer: A

Watch Video Solution

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

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

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

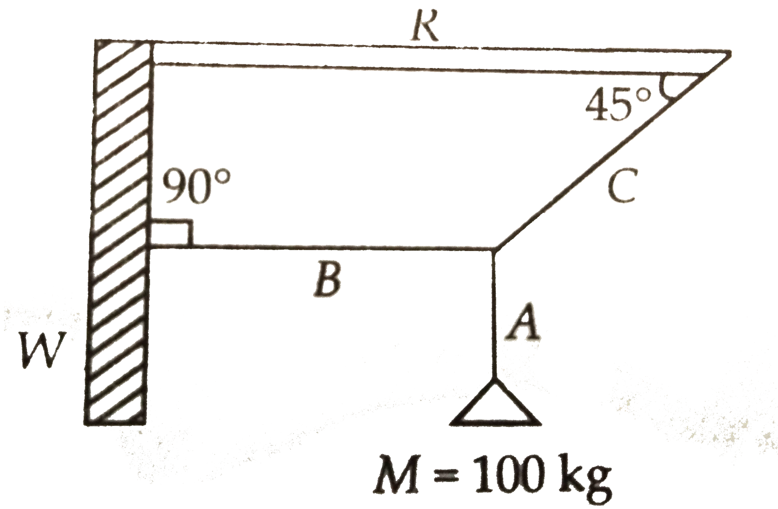
C. $12500\hat{i} + 12500\hat{j}m$

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

Answer: A

Watch Video Solution

33. A mass M of 100 kg is suspended with the use of strings A, B 90 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

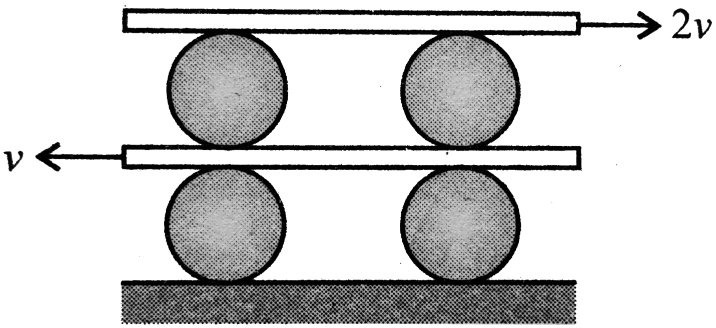
C. $100\sqrt{2}gN$

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

Answer: A

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

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

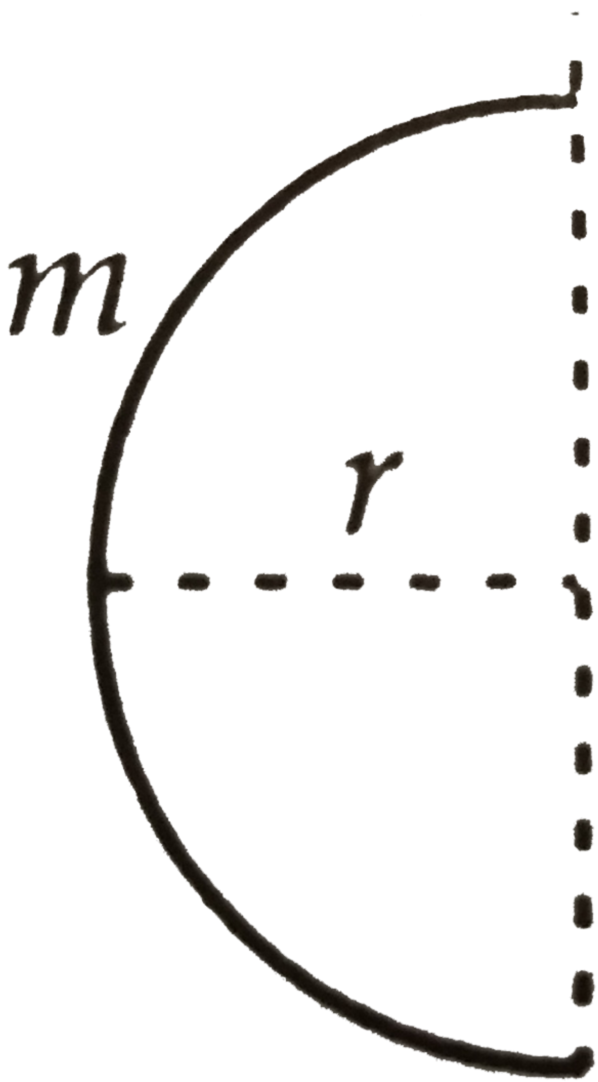
C. 6 cm

D. 9 cm

Answer: C

Watch Video Solution

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

Watch Video Solution

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

ρ_1 and ρ_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

Watch Video Solution

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. 1.65×10^{-2}

B. 3.3×10^{-2}

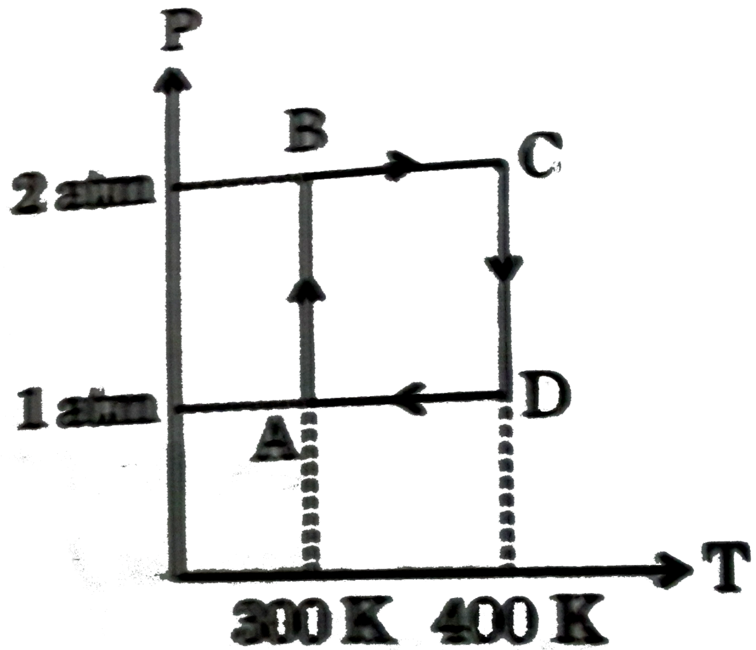
C. 6.6×10^{-2}

D. 8.25×10^{-2}

Answer: B

Watch Video Solution

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 ln2

B. 100R ln2

C. 300R ln2

D. 400R ln2

Answer: A

Watch Video Solution

44. An object of mass $0.2kg$ executes SHm along the X-axis with frequency of $(25/\pi)Hz$. At the point $X = 0.4m$ the object has $KE0.5J$ and $PE0.4J$. The amplitude of oscilation is-

A. 0.06 m

B. 0.04 m

C. 0.05 m

D. 0.25 m

Answer: A

Watch Video Solution

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. L/2

B. 4L

C. L

D. 2L

Answer: B

Watch Video Solution

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

Answer: C

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

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 μ 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

Watch Video Solution

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

Watch Video Solution

51. 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°. The parallelogram lies in the x-y plane with mass m at the origin and 4 m 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

Watch Video Solution

52. A body is moving under the action of two force $\overrightarrow{F_1 = 2\hat{i} - 5\hat{j}}$, $\overrightarrow{F_2 = 3\hat{i} - 4\hat{j}}$. Its velocity will become uniform under a third force $\overrightarrow{F_3}$ 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

Watch Video Solution

53. A particle of mass 0.1 kg is held between two rigid supports by two springs of force constant $8 Nm^{-1}$ and $2 Nm^{-1}$. 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

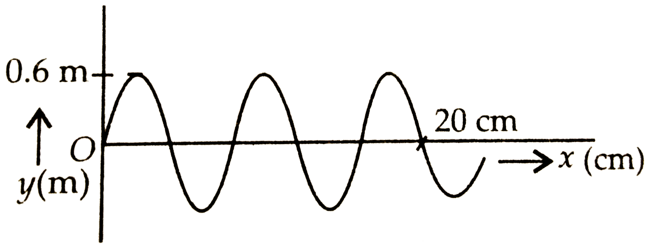
C. $\frac{2}{\pi}$ Hz

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

Answer: A

Watch Video Solution

54. 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

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

56. A wave is represented by the equation

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

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

A. $1m^{-1}$

B. $2m^{-1}$

C. πm^{-1}

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

Answer: C

Watch Video Solution

57. 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

Watch Video Solution

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

A. length

B. mass

C. time

D. angle

Answer: D

Watch Video Solution

59. 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

Watch Video Solution

60. 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

Watch Video Solution

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

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

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

$\overrightarrow{F}$ makes an angle of 45° with the Z-axis

$\overrightarrow{F}$ makes an angle of 30° 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

Watch Video Solution

62. A particle is projected from the ground with an initial speed v at an angle θ with horizontal. The average velocity of the particle between its point of projection and highest point of trajectory is $[EAM 2013]$

A. $u \cos \theta$

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

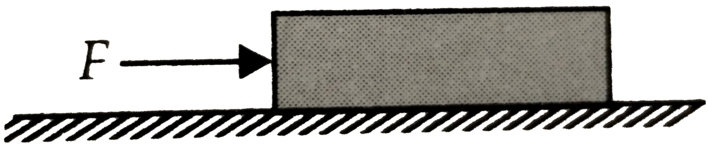
C. $\frac{u}{2} \sqrt{1+2\cos^2 \theta}$

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

Answer: D

Watch Video Solution

63. 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 $g = 10 ms^{-2}$)



A. 3 N

B. 8 N

C. 4 N

D. 6 N

Answer: A

Watch Video Solution

64. A block released from rest from the top of a smooth inclined plane of angle θ_1 reaches the bottom in time t_1. The same block released from rest from the top of another smooth inclined plane of angle θ_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. $\dfrac{t_2}{t_1} = \left(\dfrac{\sin\theta_1}{\sin\theta_2}\right)^{1/2}$

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

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

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

Answer: C

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65. 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° 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

66. 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

67. Two particles of masses 1 kg and 3 kg have position vectors $2\hat{i}+3\hat{j}+4\hat{k}$ 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. $-\hat{i}-3\hat{j}-2\hat{k}$

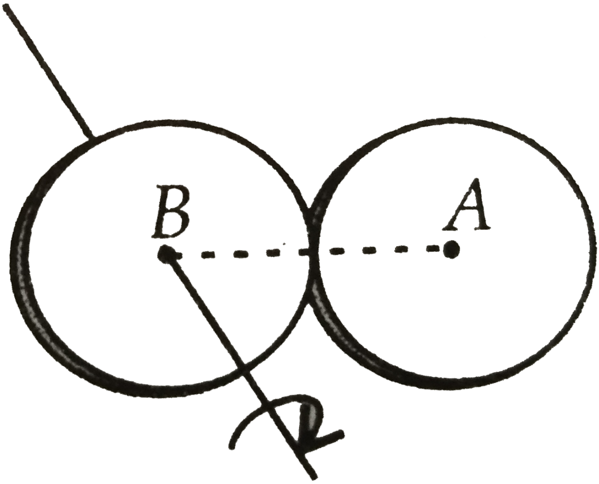
C. $-\hat{i}+3\hat{j}+2\hat{k}$

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

Answer: D

Watch Video Solution

68. 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

69. 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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70. 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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71. 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

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72. 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

73. The mean distance between the atoms of iron is 3×10^{-10} m and interatomic fore 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

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74. An ice cube of mass 0.1 kg at $0^{\circ} C$ is placed in an isolated container which is at $227^{\circ} C$. The specific heat s of the container varies with temperature T according to the empirical relation $s = A + BT$, where $A = 100 cal / kg. K$ and $B = 2 \times 10^{-2} cal / kg. K^{2}$. If the final temperature of the container is $27^{\circ} C$, determine the mass of the container.

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

A. 0.495 kg

B. 0.595 kg

C. 0.695 kg

D. 0.795 kg

Answer: A

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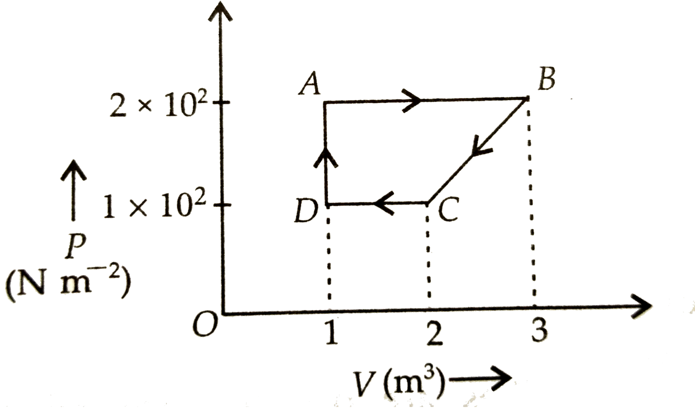
75. A cyclic process is shown in the figure. Work done during the cyclic process ABCDA is



A. 1600 J

B. 150 J

C. 600 J

D. 900 J

Answer: B

Watch Video Solution

76. One mole of an ideal monatomic gas at temperature T_0 expands slowly according to the law $\frac{P}{V} = cons\tan t$.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

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

A. $6/5$

B. $5/6$

C. 1

D. $4/5$

Answer: A

Watch Video Solution

78. 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

79. The dimension of the quantity $\frac{1}{\varepsilon_0}\frac{e^2}{hc}$ 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. $\left[M^{-1}L^{-3}T^{4}A^{2}\right]$

Answer: B

Watch Video Solution

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

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

B. $b=a$

C. $b = 2a$

D. b=4a

Answer: C

Watch Video Solution

81. 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

Watch Video Solution

82. 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 tension?

A. $4 : 1$

B. $\sqrt{7} : 1$

C. $3 : 1$

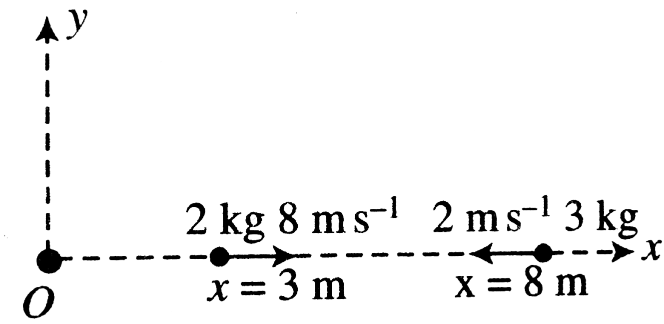
D. $2 : 1$

Answer: A

Watch Video Solution

83. 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 m

B. x=6 m

C. x=8 m

D. x=10 m

Answer: D

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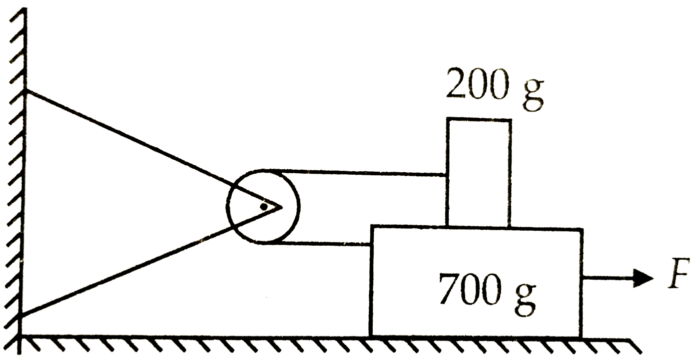
84. How large must F be in the figure shown to give the 700 g block an acceleration of $30cms^{-2}$? The coefficient of friction between all surfaces is 0. 15.



A. 2.18 N

B. 3.18 N

C. 4N

D. 6N

Answer: A

Watch Video Solution

85. The radii of the two columne is U-tube are r_1 and $r_2(> r_1)$. When a liquid of density ρ (angle of contact is 0°)) is filled in it, the level different of liquid in two arms is h. The surface tension of liquid is

$(g =$ acceleration due to gravity)

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

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

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

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

Answer: A

Watch Video Solution

86. 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

Watch Video Solution

87. A solid cylinder rolls without slipping down a 30° 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

Watch Video Solution

88. 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

Watch Video Solution

89. 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

Watch Video Solution

90. 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

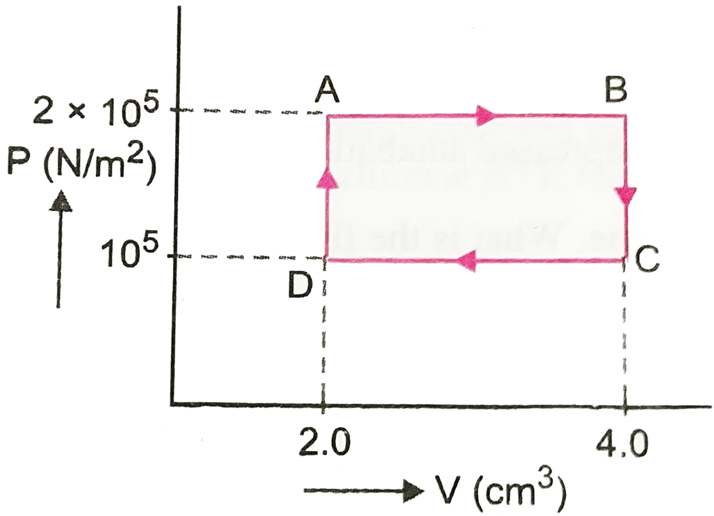
C. 3 s

D. 3.5 s

Answer: A

Watch Video Solution

91. 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

Watch Video Solution

92. Three stars A, B, C have surface temperatures T_A, T_B and T_C. A appaears 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

Watch Video Solution

93. 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. $\frac{mv_1t}{t_1}$

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

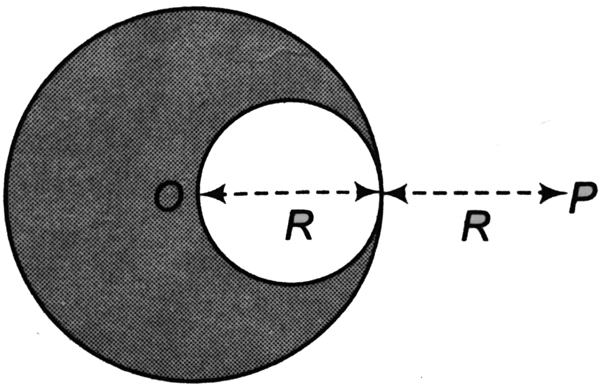
C. $\frac{mv_1 t^2}{t_1}$

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

Answer: D

Watch Video Solution

94. 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 radio F_2/F_1 will be



A. $1/2$

B. $7/9$

C. 3

D. 7

Answer: B

Watch Video Solution

95. A metal wire of length L_1 and area of cross section A is ttached 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. $\dfrac{Y_1 Y_2 A}{2(Y_1 L_2 + Y_2 L_1)}$

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

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

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

Answer: C

Watch Video Solution

96. 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

97. A thin circular ring of mass M and radius r is rotating about its axis with a constant angular velocity ω, 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. $\dfrac{\omega M}{M+m}$

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

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

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

Answer: C

Watch Video Solution

98. A bus is moving with a speed of $10ms^{-1}$ on a straight road. A scooterist wishes to overtake the bus in $100s$. If the bus is at a distance of $1km$ from the scooterist with what speed should the scooterist chase the bus ?

A. a. $10ms^{-1}$

B. b. $20ms^{-1}$

C. c. $50ms^{-1}$

D. d. $30ms^{-1}$

Answer: B

Watch Video Solution

99. A particle A is projected verically upwards. Another indentical particle B is projected at an angle of 45°. 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

Watch Video Solution

100. 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 $330 ms^{-1}$. 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

101. 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. $0.75cm$

B. $0.75m$

C. $7.5cm$

D. $7.5m$

Answer: A

Watch Video Solution

102. 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

Watch Video Solution

103. A vessel contains a mixtrue 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 $p_0 = 1$ 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

Watch Video Solution

104. 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. $\dfrac{(T_1 + T_2)}{2}$

C. $\dfrac{T_1T_2(P_1V_1 + P_2V_2)}{P_1V_1T_2 + P_2V_2T_1}$

D. $T_1T_2(P_1V_1 + P_2V_2)$

Answer: C

Watch Video Solution

105. A steel metre scale is to be ruled so that the millimetre intervals are accurate to within about 5×10^{-5}mm at a certain temperature. What is the maximum temperature variation allowable during the ruling ? Given α 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

Watch Video Solution

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

(where θ is angle of projection with the horizontal)

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

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

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

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

Answer: B

Watch Video Solution

107. 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

Watch Video Solution

108. Which of the following is dimensionless?

A. Force/acceleration

B. Velocity/acceleration

C. Volume/area

D. Energy/work

Answer: D

Watch Video Solution

109. Given $\overrightarrow{F} = \left(4\hat{i} - 10\hat{j}\right)$ and $\overrightarrow{r} = \left(5\hat{i} - 3\hat{j}\right)$. then torque $\overrightarrow{\tau}$ is

A. 1. $-62\hat{j}$

B. 2. $62\hat{k}$

C. 3. $38\hat{i}$

D. 4. $-38\hat{k}$

Answer: D

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110. 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 $g = 9.8 m / s^2$)

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

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

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

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

Answer: B

Watch Video Solution

111. 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

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

A. The height of the table is 0.8 m.

B. It hits the ground at angle of 60° with the vertical

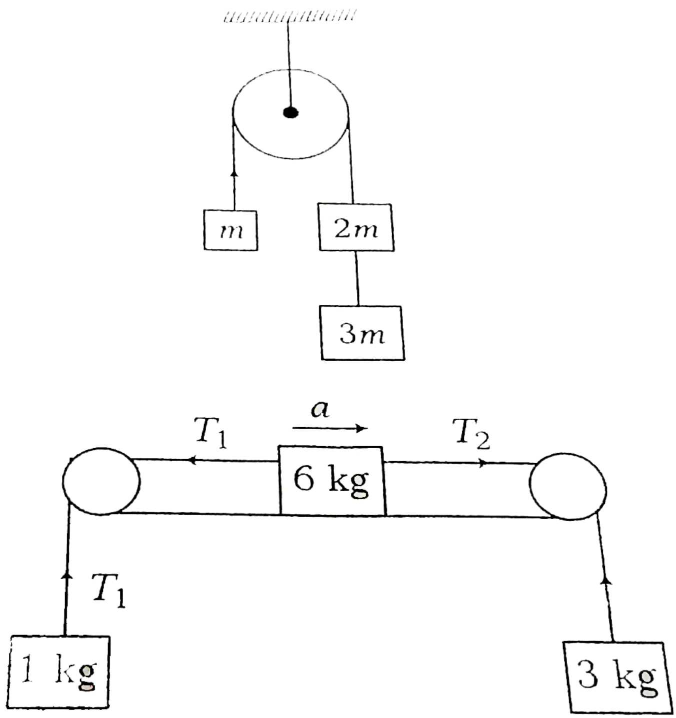
C. It covers a horizontal distance 1.6 m from the table

D. It hits the ground with vertical velocity $4ms^{-1}$

Answer: B

Watch Video Solution

113. Three masses of 1kg, 6 kg and 3 kg are connected to each other with theads 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

114. A liquid of density ρ 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

115. 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

116. 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

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

117. 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

118. 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. $11.2kms^{-1}$

B. $8kms^{-1}$

C. $3.2kms^{-1}$

D. $1.5kms^{-1}$

Answer: C

Watch Video Solution

119. A hole is drilled in a copper sheet. The diameter of the hole is $4.24cm$ at $27.0^{\circ}C$. What is the change in the diameter of the hole when the sheet is heated to $227^{0}C$? α for copper

$= 1.70 \times 10^{-5} K^{-1}$

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

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

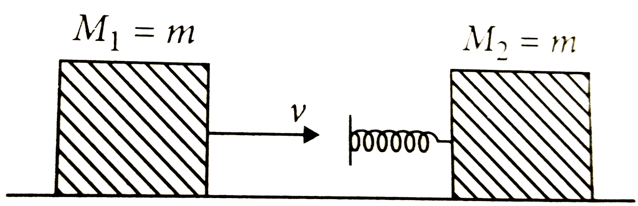
C. $1.44 \times 10^{-2} mm$

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

Answer: A

Watch Video Solution

120. 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.

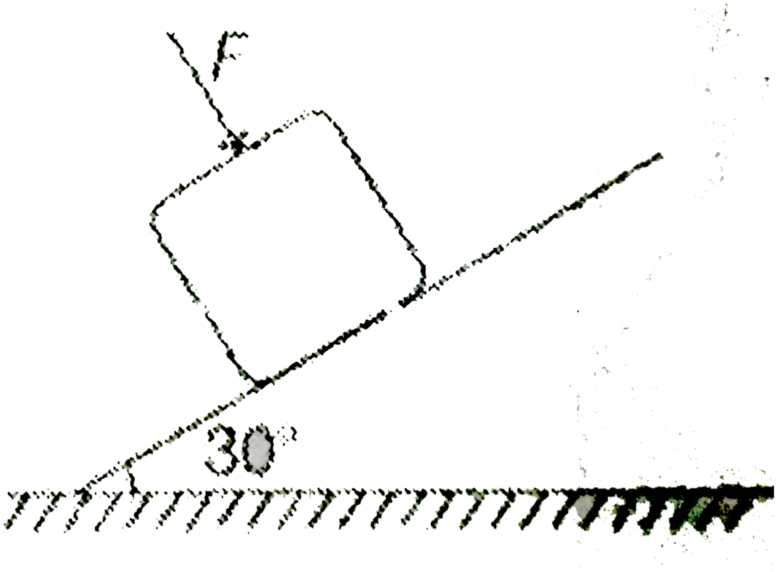
C. If spring is massless, the final state of the M_2 is state of rest.

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

Answer: D

Watch Video Solution

121. A block of mass m=2kg is resting on a rough inclined plane of inclination of 30° 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

122. 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 $0.5mm$ and there are 50 divisions on the circular scale. The reading on the main scale is $2.5mm$ 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

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

B. 2. $\frac{7}{8}MgR$

C. 3. $\frac{5}{8}MgR$

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

Answer: B

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124. A liquid of density ρ_0 is filled in a wide tank to a height h. A solid rod of length L, cross-section A and density ρ is suspended freely in the tank. The lower end of the rod touches the base of the tank and h=L/n (where n gt 1). Then the angle of inclination θ of the rod with the horizontal in equilibrium position is

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

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

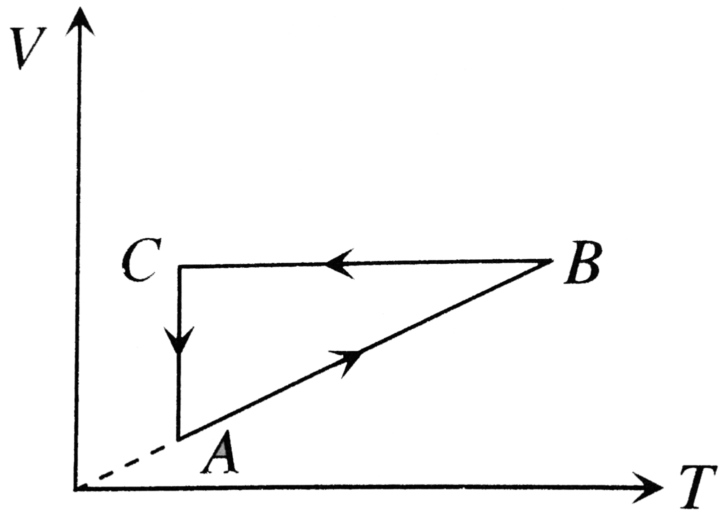
C. $\sin^{-1}\left(\frac{1}{n}\sqrt{\frac{\rho_0}{\rho}}\right)$

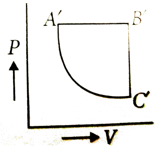
D. $\sin^{-1}\left(\frac{1}{n}\sqrt{\frac{\rho}{\rho_0}}\right)$

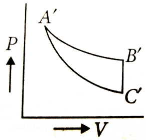
Answer: C

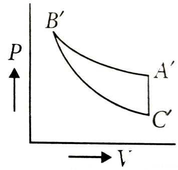
Watch Video Solution

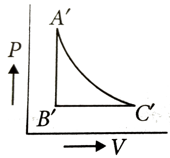
125. A cyclic process $ABCA$ is shown in the $V-T$ diagram process on the $P-V$



A. (a) 

B. (b) 

C. (c) 

D. (d) 

Answer: A

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

A. 1. 72 and 50

B. 2. 60 and 38

C. 3. 50 and 28

D. 4. 80 and 58

Answer: A

Watch Video Solution

127. A body of mass $30kg$ starts running rest along a ciruclar path of radius $6m$ with constant tangential acceleration of magnitude $2m/s^2$. After $2\sec$ 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

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128. 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

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129. 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

130. 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

131. 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

Watch Video Solution

132. 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

133. 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

134. 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

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

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

B. $2\pi\sqrt{\dfrac{r^3(m_1+m_2)}{2G(m_1m_2)}}$

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

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

Answer: D

Watch Video Solution

136. 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° with the horizontal, the angle of projection of B will be

A. 0°

B. 60°

C. 30°

D. 45°

Answer: C

Watch Video Solution

137. 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. $\left(\sqrt{U}_1 + \sqrt{U}_2\right)^2$

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

D. $\sqrt{U_1 U_2}$

Answer: B

Watch Video Solution

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

A. 0.5×10^4 N

B. 0.25×10^4 N

C. 5×10^4 N

D. 25×10^4 N

Answer: D

Watch Video Solution

139. 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

A. 11g

B. 22g

C. 33g

D. 44g

Answer: B

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

A. 5m

B. 10 m

C. 15 m

D. 20 m

Answer: A

Watch Video Solution

141. A machine gun is mounted on a 2000kg car on a harizontal 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. $550N$

B. $50N$

C. $250N$

D. $300N$

Answer: A

Watch Video Solution

142. 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

143. 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 10litres 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

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

A. 5 s

B. 20 s

C. 40 s

D. 80 s

Answer: C

Watch Video Solution

145. 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

146. 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

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147. 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=$336 kJkg^{-1}$) a) 24.4kJ b) 30 kJ

c) 336 kJ d) 27.55 kJ

A. 24.4kJ

B. 30 kJ

C. 336 kJ

D. 11.2 kJ

Answer: B

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148. 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

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

A. 3

B. 2

C. 1

D. 4

Answer: B

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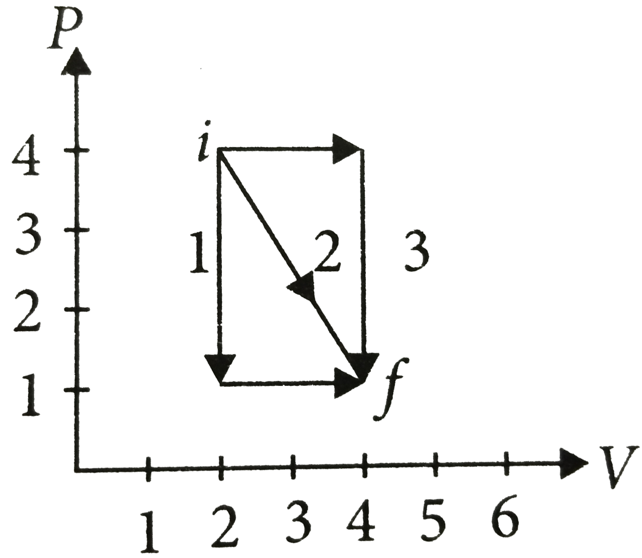
150. A gas expands from i to f along the three paths indicated. The work done along the three paths denoted by W_1, W_2 and W_3 have the relationship



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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