Q1. 21 January Shift 1

A 4 kg mass moves under the influence of a force $\vec{F} = \left(4t^3\hat{i} - 3t\hat{j}\right)$N where t is the time in second. If mass starts from origin at $t = 0$, the velocity and position after $t = 2$ s will be:

(1) $\vec{v} = 4\hat{i} - \frac{3}{2}\hat{j}$ $\vec{r} = \frac{6}{5}\hat{i} - \hat{j}$

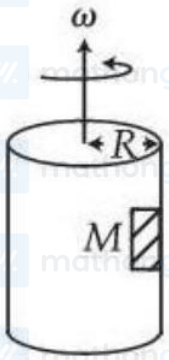
(2) $\vec{v} = 3\hat{i} + \frac{3}{2}\hat{j}$ $\vec{r} = \frac{6}{5}\hat{i} + \hat{j}$

(3) $\vec{v} = 4\hat{i} - \frac{3}{2}\hat{j}$ $\vec{r} = \frac{8}{5}\hat{i} - \hat{j}$

(4) $\vec{v} = 4\hat{i} + \frac{5}{2}\hat{j}$ $\vec{r} = \frac{8}{5}\hat{i} + 2\hat{j}$

Q2. 21 January Shift 2

A large drum having radius R is spinning around its axis with angular velocity ω, as shown in figure. The minimum value of ω so that a body of mass M remains stuck to the inner wall of the drum, taking the coefficient of friction between the drum surface and mass M as μ, is :



(1) $\sqrt{\frac{\mu g}{R}}$ (2) $\sqrt{\frac{g}{2\mu R}}$ (3) $\sqrt{\frac{2g}{\mu R}}$ (4) $\sqrt{\frac{g}{\mu R}}$

Q3. 23 January Shift 2

A block is sliding down on an inclined plane of slope θ and at an instant $t = 0$ this block is given an upward momentum so that it starts moving up on the inclined surface with velocity u. The distance (S) travelled by the block before its velocity become zero, is ____.

(g = gravitational acceleration)

(1) $\frac{2u^2}{\cos\theta}$ (2) $\frac{u^2}{4g\sin\theta}$ (3) $\frac{u^2}{2g\cos\theta}$ (4) $\frac{u^2}{\sqrt{2}g\cos\theta}$

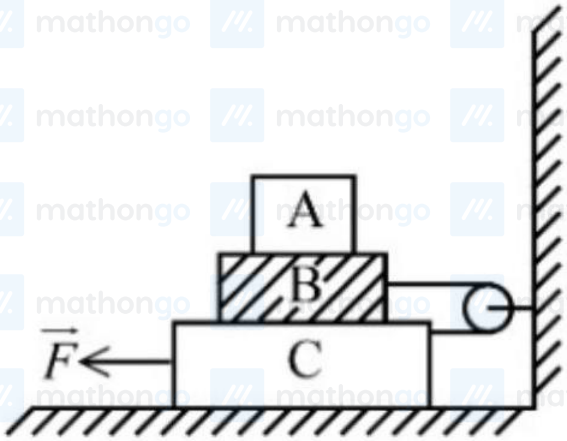
Q4. 24 January Shift 1

A spring of force constant 15 N/m is cut into two pieces. If the ratio of their length is 1 : 3, then the force constant of smaller piece is ____ N/m.

(1) 60 (2) 15 (3) 20 (4) 45

Q5. 24 January Shift 1

In the given figure the blocks A, B and C weigh 4 kg, 6 kg and 8 kg respectively. The co-efficient of sliding friction between any two surfaces is 0.5. The force $\vec{F}$ required to slide the block C with constant speed is ____ N.
(Use $g = 10\ \text{m/s}^2$)



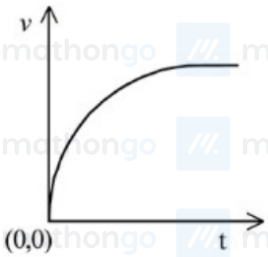
Q6. 24 January Shift 2

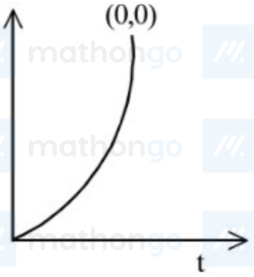
A flexible chain of mass m hangs between two fixed points at the same level. The inclination of the chain with the horizontal at the two points of support is 30°. Considering the equilibrium of each half of the chain, the tension of the chain at the lowest point is ____.

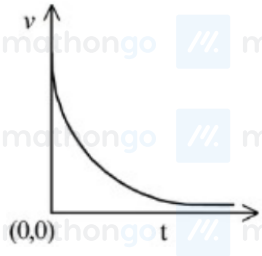
(1) $\frac{\sqrt{3}}{2}$mg (2) mg (3) $\frac{1}{2}m$ g (4) $\sqrt{3}$mg

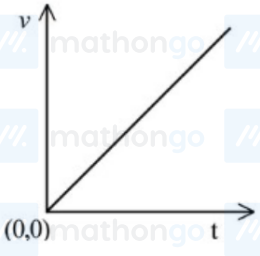
Q7. 28 January Shift 1

A particle of mass m falls from rest through a resistive medium having resistive force, $F = -kv$, where v is the velocity of the particle and k is a constant. Which of the following graphs represents velocity (v) versus time (t)?

(1)


(2)


(3)


(4)


Q8. 28 January Shift 1

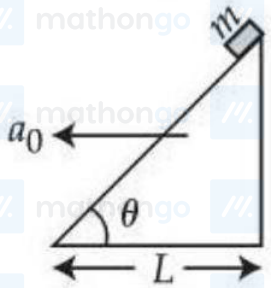
A block of mass 5 kg is moving on an inclined plane which makes an angle of 30° with the horizontal. Friction coefficient between the block and inclined plane surface is $\frac{\sqrt{3}}{2}$. The force to be applied on the block so that the block will move down without acceleration is ____ N.

$\left(g = 10\ \text{m/s}^2\right)$.

(1) 25 (2) 7.5 (3) 12.5 (4) 15

Q9. 28 January Shift 2

A small block of mass m slides down from the top of a frictionless inclined surface, while the inclined plane is moving towards left with constant acceleration a_0. The angle between the inclined plane and ground is θ and its base length is L. Assuming that initially the small block is at the top of the inclined plane, the time it takes to reach the lowest point of the inclined plane is ____.



(1) $\sqrt{\frac{2L}{g\sin\theta - a_0\cos\theta}}$ (2) $\sqrt{\frac{4L}{g\cos^2\theta - a_0\sin\theta\cos\theta}}$

(3) $\sqrt{\frac{2L}{g\sin 2\theta - a_0(1+\cos 2\theta)}}$ (4) $\sqrt{\frac{4L}{g\sin 2\theta - a_0(1+\cos 2\theta)}}$

ANSWER KEYS

1. (3) **2.** (4) **3.** (2) **4.** (1) **5.** 210 **6.** (1) **7.** (1) **8.** (3)
9. (4)