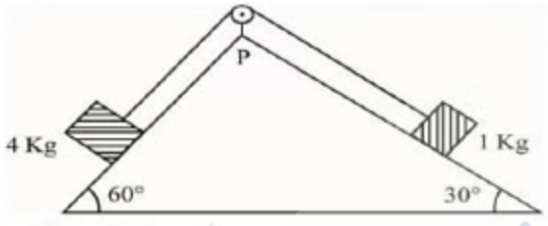
Guaranteed JEE Mains Questions You Can't Afford to Miss

Laws of Motion

Question 1: The maximum vertical height to which a man can throw a ball is 136 meters. What is the maximum horizontal distance up to which he can throw the same ball? **[24 Jan 2023 - Shift I]**

(a) 272 m
(b) 68 m
(c) 192 m
(d) 136 m
Click for Answer

Question 2: As per the given figure, a weightless pulley P is attached to a double-inclined frictionless surface. The tension in the string (massless) will be.



[24 Jan 2023 - Shift II]

(a) $(4\sqrt{3}+1)$, N
(b) $4(\sqrt{3}+1)$, N
(c) $(4\sqrt{3}-1)$, N
(d) $4(\sqrt{3}-1)$, N
Click for Answer

Question 3: A body of mass 1000 kg is moving horizontally with a velocity of 6 m/s. If 200 kg extra mass is added, the final velocity (in m/s) is: **[27 Jan 2024 - Shift 1]**

(a) 6
(b) 2
(c) 3
(d) 5
Click for Answer

Question 4: A heavy iron bar of weight $12\,\mathrm{kg}$ is having its one end on the ground and the other on the shoulder of a man. The rod makes an $angle 60^\circ$ with the horizontal, the weight experienced by the man is: **[27-Jan-2024 Shift 2]**

$(a) 6\,\mathrm{kg}$

$(b) 12\,\mathrm{kg}$

$(c) 3\,\mathrm{kg}$

$(d) 6\sqrt{3}\,\mathrm{kg}$

Click for Answer

Question 5: Given below are two statements:

Statement (I): The limiting force of static friction depends on the area of contact and is independent of materials.

Statement (II): The limiting force of kinetic friction is independent of the area of contact and depends on materials.

In the light of the above statements, choose the most appropriate answer from the options given below: **[27-Jan-2024 Shift 2]**

(a) Statement I is correct but Statement II is incorrect

(b) Statement I is incorrect but Statement II is correct

(c) Both Statement I and Statement II are incorrect

(d) Both Statement I and Statement II are correct

Click for Answer

Question 6:

A stone of mass 900 g is tied to a string and moved in a vertical circle of radius 1 m making 10 rpm. The tension in the string, when the stone is at the lowest point, is (if $\pi^2 = 9.8 and g = 9.8\,\mathrm{m/s^2}$) **[29-Jan-2024 Shift 2]**

(a) $97\,\mathrm{N}$

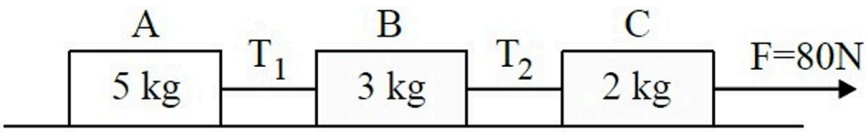
(b) $9.8\,\mathrm{N}$

(c) $8.82\,\mathrm{N}$

(d) $17.8\,\mathrm{N}$

Click for Answer

Question 7: Three blocks A, B, and C are pulled on a horizontal smooth surface by a force of 80 N as shown in the figure. The tensions T1 and T2 in the string are respectively: **[30-Jan-2024 Shift 2]**



(a) 40 N, 64 N
(b) 60 N, 80 N
(c) 88 N, 96 N
(d) 80 N, 100 N
Click for Answer

Question 8: A block of mass m is placed on a surface having a vertical cross section given by $y = \frac{x^2}{4}$. If the coefficient of friction is 0.5, the maximum height above the ground at which the block can be placed without slipping is: **[30-Jan-2024 Shift 2]**

(a) ¼ m
(b) ½ m
(c) ⅛ m
(d) ⅓ m
Click for Answer

Question 9: A block of mass m slides down the plane inclined at an angle30 with an acceleration g/4 . The value of the coefficient of kinetic friction will be:

[29-Jan-2023 Shift 1]

(a) $\frac{2\sqrt{3}+1}{2}$
(b) $\frac{1}{2\sqrt{3}}$
(c) $\frac{\sqrt{3}}{2}$
(d) $\frac{2\sqrt{3}-1}{2}$
Click for Answer

Question 10: A cricket player catches a ball of mass 120 g moving with 25 m/s speed. If the catching process is completed in 0.1 s, then the magnitude of force exerted by the ball on the hand of the player will be (in SI unit): **[1-Feb-2024 Shift 2]**

(a) 24 N
(b) 12 N
(c) 25 N
(d) 30 N
Click for Answer

Solution 1:

Correct Answer is Option (a)

Max vertical height

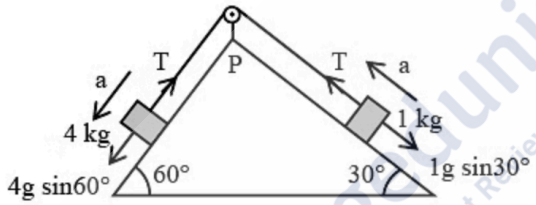
$$H = \frac{v^2}{2g} = 136\,m$$

Max horizontal distance

$$R = \frac{v^2}{g} \Rightarrow R = 2 \times 136 = 272\ m$$

Solution 2:

Correct Answer is Option (b)



$$4g\frac{\sqrt{3}}{2} - T = 4a \qquad \ldots (1)$$

$$T - \frac{g}{2} = 1a \qquad \ldots (2)$$

$$2\sqrt{3}g - T = 4\left(T - \frac{g}{2}\right) \Rightarrow 5T = (2\sqrt{3}+2)g$$

$$T = \frac{10}{5}\left(2\sqrt{3}+2\right) \Rightarrow T = 4\left(\sqrt{3}+1\right)N$$

Solution 3:

Correct answer is Option (d)

Momentum will remain conserved:

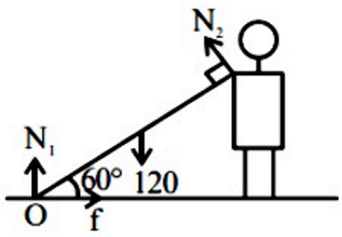
1000 $\times 6$ = $1200 \times v$

Solving for v :

$$v = \frac{1000 \times 6}{1200} = 5\,m/s$$

So, the final velocity $v = 5\,m/s.$

Solution 4:



Torque about O = 0

$$120\left(\frac{L}{2}\cos 60^{\circ}\right) - N_2 L = 0$$

$$N_2 = 30N$$

Solution 5:

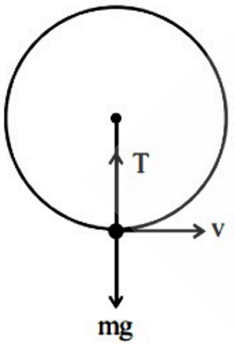
Correct answer is Option (b)

The coefficient of friction depends on the surface in contact, so it depends on the material of the object. Therefore, Statement I is incorrect, while Statement II is correct.

Solution 6:

Correct answer is Option (b)

Given that



$$m = 900\,gm = \frac{900}{1000}kg = \frac{9}{10}kg$$

$$r = 1m$$

$$\omega = \frac{2\pi N}{60} = \frac{2\pi(10)}{60} = \frac{\pi}{3}\,rad/\,sec$$

$$T - mg = mr\omega^2$$

$$T = mg + mr\omega^2$$

$$= \frac{9}{10}\times 9.8 + \frac{9}{10}\times 1\left(\frac{\pi}{3}\right)^2$$

$$= 8.82 + \frac{9}{10}\times\frac{\pi^2}{9}$$

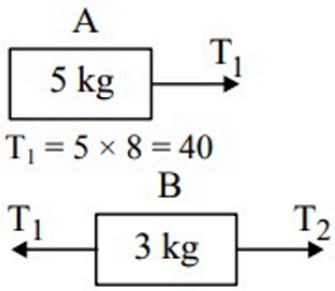
$$= 8.82 + 0.98$$

$$= 9.80N$$

Solution 7:

Correct answer is Option (a)

$$a_A = a_B = a_C = \frac{F}{5+3+2} = \frac{80}{10} = 8 m/s^2$$



$T_1 = 5 \times 8 = 40$

$T_2 - T_1 = 3 \times 8 \Rightarrow T_2 = 64$

Solution 8:

Correct answer is Option (a)

$$\frac{dy}{dx} = \tan\theta = \frac{x}{2} = \mu = \frac{1}{2}$$

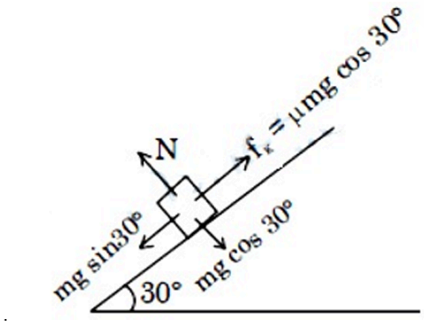
$$x = 1, y = 1/4$$

Solution 9:

Correct answer is Option (b)

$$Mg\sin 30^\circ - \mu mg\cos 30^\circ = ma$$

$$\frac{g}{2} - \frac{\sqrt{3}}{2} \cdot \mu g = \frac{g}{4}$$



$$\frac{\sqrt{3}}{2}\mu = \frac{1}{4}$$

$$\mu = \frac{1}{2\sqrt{3}}$$

Solution 10:

Correct answer is Option (d)

$$F_{av} = \frac{\Delta p}{\Delta t}$$

$$= \frac{0.12 \times 25}{0.1} = 30N$$