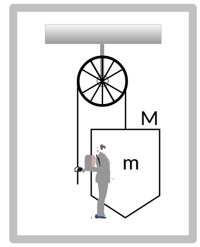
Physics Mock Test Paper – III

Sunday, September 04, 2016

1. **A man of mass *m* stands on a crate of mass *M*. He pulls on a light rope passing over a smooth light pulley. The other end of the rope is attached to the crate. For the system to be in equilibrium, the force exerted by the men on the rope will be**

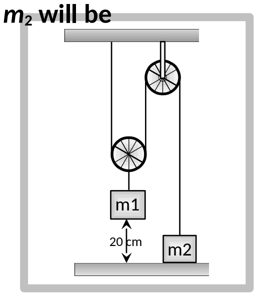


(a)$(M + m)g$
(b)
$\frac{1}{2}(M+m)g$

(c)Mg
(d)mg

2. **A 60 *kg* man stands on a spring scale in the lift. At some instant he finds, scale reading has changed from 60 *kg* to 50 *kg* for a while and then comes back to the original mark. What should we conclude**
(a)The lift was in constant motion upwards
(b)The lift was in constant motion downwards
(c)The lift while in constant motion upwards, is stopped suddenly
(d)The lift while in constant motion downwards, is suddenly stopped

3. **In the adjoining figure $m_1 = 4m_2$. The pulleys are smooth and light. At time $t = 0$, the system is at rest. If the system is released and if the acceleration of mass m_1 is a, then the acceleration of m_2 will be**



(a)g
(b)a
(c)
$\frac{a}{2}$

(d)$2a$

4. **A block of mass *M* is placed on a rough floor of a lift. The coefficient of friction between the block and the floor is μ. When the lift falls freely, the block is pulled horizontally on the floor. What will be the force of friction**
(a)μMg (b) $\mu Mg/2$ (c) $2\mu Mg$ (d) None of these

5. **The upper half of an inclined plane of inclination θ is perfectly smooth while the lower half is rough. A body starting from the rest at top comes back to rest at the bottom if the coefficient of friction for the lower half is given**
(a)$\mu = \sin\theta$ (b)$\mu = \cot\theta$ (c)$\mu = 2\cos\theta$ (d)$\mu = 2\tan\theta$

6. **An ice cream has a marked value of 700 *kcal*. How many kilowatt hour of energy will it deliver to the body as it is digested**

(a)0.81 *kWh* (b) 0.90 *kWh* (c)1.11 *kWh* (d) 0.71 *kWh*

7. **A running man has half the kinetic energy of that of a boy of half of his mass. The man speeds up by 1 *m/s* so as to have same *K.E.* as that of boy. The original speed of the man will be**

(a) $\sqrt{2}\, m/s$ (b) $(\sqrt{2}-1)\, m/s$ (c) $\frac{1}{(\sqrt{2}-1)}\, m/s$ (d) $\frac{1}{\sqrt{2}}\, m/s$

8. **From a water fall, water is falling at the rate of 100 *kg/s* on the blades of turbine. If the height of the fall is 100*m* then the power delivered to the turbine is approximately equal to**

(a)100*kW* (b)10 *kW* (c) 1*kW* (d) 1000 *kW*

9. **A big ball of mass *M*, moving with velocity *u* strikes a small ball of mass *m*, which is at rest. Finally small ball attains velocity *u* and big ball *v*. Then what is the value of *v***

(a) $\frac{M-m}{M+m}u$ (b) $\frac{m}{M+m}u$ (c) $\frac{2m}{M+m}u$ (d) $\frac{M}{M+m}u$

10. **A wooden block of mass *M* is suspended by a cord and is at rest. A bullet of mass *m*, moving with a velocity *v* pierces through the block and comes out with a velocity $v/2$ in the same direction. If there is no loss in kinetic energy, then upto what height the block will rise**

(a) $m^2v^2/2M^2g$ (b) $m^2v^2/8M^2g$ (c) $m^2v^2/4Mg$ (d) $m^2v^2/2Mg$

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Answers/solutions

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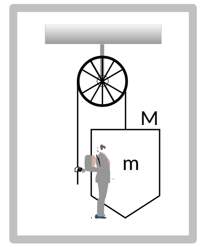
1. **A man of mass *m* stands on a crate of mass *M*. He pulls on a light rope passing over a smooth light pulley. The other end of the rope is attached to the crate. For the system to be in equilibrium, the force exerted by the men on the rope will be**



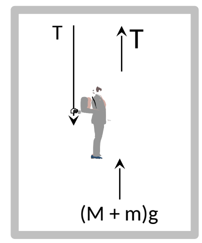
(a)$(M+m)g$
(b) $\frac{1}{2}(M+m)g$
(c)Mg
(d)mg

Ans .(b) From the free body diagram of man and crate system:

For vertical equilibrium

$$2T=(M+m)g$$

$$\therefore T=\frac{(M+m)g}{2}$$



2. **A 60 *kg* man stands on a spring scale in the lift. At some instant he finds, scale reading has changed from 60 *kg* to 50 *kg* for a while and then comes back to the original mark. What should we conclude**

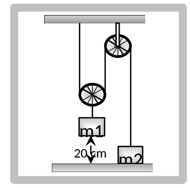
(a)The lift was in constant motion upwards
(b)The lift was in constant motion downwards
(c)The lift while in constant motion upwards, is stopped suddenly
(d)The lift while in constant motion downwards, is suddenly stopped

Ans (c) For retarding motion of a lift $R=m(g+a)$ for downward motion

$R=m(g-a)$ for upward motion

Since the weight of the body decrease for a while and then comes back to original value it means the lift was moving upward and stops suddenly.

3. In the adjoining figure $m_1 = 4m_2$. The pulleys are smooth and light. At time $t = 0$, the system is at rest. If the system is released and if the acceleration of mass m_1 is a, then the acceleration of m_2 will be



(a) g
(b) a
(c) $\frac{a}{2}$
(d) $2a$

: ANS (d) Since the mass m_2 travels double distance in comparison to mass m_1 therefore its acceleration will be double *i.e.* $2a$

4. A block of mass M is placed on a rough floor of a lift. The coefficient of friction between the block and the floor is μ. When the lift falls freely, the block is pulled horizontally on the floor. What will be the force of friction

(a) μMg (b) $\mu Mg/2$ (c) $2\mu Mg$ (d) None of these

: Ans (d) When the lift moves down ward with acceleration 'a' then effective acceleration due to gravity

$g' = g - a$

$\therefore g' = g - g = 0$ [As the lift falls freely, so $a = g$]

So force of friction $= \mu mg' = 0$

5. The upper half of an inclined plane of inclination θ is perfectly smooth while the lower half is rough. A body starting from the rest at top comes back to rest at the bottom if the coefficient of friction for the lower half is given

(a) $\mu = \sin\theta$ (b) $\mu = \cot\theta$ (c) $\mu = 2\cos\theta$ (d) $\mu = 2\tan\theta$

Ans (d) For upper half by the equation of motion $v^2 = u^2 + 2as$

$v^2 = 0^2 + 2(g\sin\theta) l/2 = gl\sin\theta$ [As $u = 0, s = l/2, a = g\sin\theta$]

For lower half

$0 = u^2 + 2g(\sin\theta - \mu\cos\theta)\, l/2$ [As $v = 0, s = l/2, a = g(\sin\theta - \mu\cos\theta)$]

$\Rightarrow 0 = gl\sin\theta + gl(\sin\theta - \mu\cos\theta)$ [As final velocity of upper half will be equal to the initial velocity of lower half]

$\Rightarrow 2\sin\theta = \mu\cos\theta \Rightarrow \mu = 2\tan\theta$

6. **An ice cream has a marked value of 700 *kcal*. How many kilowatt hour of energy will it deliver to the body as it is digested**

(a)0.81 *kWh* (b) 0.90 *kWh* (c)1.11 *kWh* (d) 0.71 *kWh*

Ans (a)700 *k cal* = $700 \times 10^3 \times 4.2\, J = \frac{700 \times 10^3 \times 4.2}{3.6 \times 10^6} = 0.81\, kWh$

[As $3.6 \times 10^6 J = 1\, kWh$]

7. **A running man has half the kinetic energy of that of a boy of half of his mass. The man speeds up by 1 *m/s* so as to have same *K.E.* as that of boy. The original speed of the man will be**

(a) $\sqrt{2}\, m/s$ (b) $(\sqrt{2} - 1) m/s$ (c) $\frac{1}{(\sqrt{2} - 1)} m/s$ (d) $\frac{1}{\sqrt{2}} m/s$

Ans (c) Let *m* = mass of the boy, *M* = mass of the man, *v* = velocity of the boy and *V* = velocity of the man

Initial kinetic energy of man $= \frac{1}{2} MV^2 = \frac{1}{2}\left[\frac{1}{2} mv^2\right] = \frac{1}{2}\left[\frac{1}{2}\left(\frac{M}{2}\right) v^2\right]$

$\left[\text{As } m = \frac{M}{2} \text{ given}\right]$

$\Rightarrow$ $V^2 = \frac{v^2}{4} \Rightarrow V = \frac{v}{2}$ .....(i)

When the man speeds up by 1 *m/s* , $\Rightarrow$ $\frac{1}{2}M(V+1)^2 = \frac{1}{2}mv^2 = \frac{1}{2}\left(\frac{M}{2}\right)v^2$

$(V+1)^2 = \frac{v^2}{2}$

$\Rightarrow$ $V + 1 = \frac{v}{\sqrt{2}}$ .....(ii)

From (i) and (ii) we get speed of the man $V = \frac{1}{\sqrt{2}-1} m/s$.

8. **From a water fall, water is falling at the rate of 100 *kg/s* on the blades of turbine. If the height of the fall is 100*m* then the power delivered to the turbine is approximately equal to**

(a) 100*kW* (b) 10 *kW* (c) 1*kW* (d) 1000 *kW*

Ans(a)

$$\text{Power} = \frac{\text{Work done}}{t} = \frac{mgh}{t} = 100 \times 10 \times 100 = 10^5 \, watt = 100 \, kW$$

$$\left[\text{As} \frac{m}{t} = 100 \frac{kg}{\sec} \text{(given)}\right]$$

9. **A big ball of mass *M*, moving with velocity *u* strikes a small ball of mass *m*, which is at rest. Finally small ball attains velocity *u* and big ball *v*. Then what is the value of *v***

(a) $\frac{M-m}{M+m}u$ (b) $\frac{m}{M+m}u$ (c) $\frac{2m}{M+m}u$ (d) $\frac{M}{M+m}u$

Ans (a)From the standard equation $v_1 = \left(\frac{m_1 - m_2}{m_1 + m_2}\right) u_1 = \left(\frac{M - m}{M + m}\right) u$.

10. A wooden block of mass *M* is suspended by a cord and is at rest. A bullet of mass *m*, moving with a velocity *v* pierces through the block and comes out with a velocity $v/2$ in the same direction. If there is no loss in kinetic energy, then upto what height the block will rise

(a) $m^2v^2/2M^2g$ (b) $m^2v^2/8M^2g$ (c) $m^2v^2/4Mg$ (d) $m^2v^2/2Mg$

Ans (b) By the conservation of momentum

Initial momentum = Final momentum

$$mv + M \times 0 = m\frac{v}{2} + M \times V \Rightarrow V = \frac{m}{2M}v$$

If block rises upto height *h* then $h = \frac{V^2}{2g} = \frac{(mv/2M)^2}{2g} = \frac{m^2v^2}{8M^2g}$.