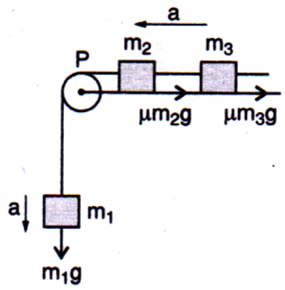
WEEKLY TEST TYM -1 TEST - 18 Balliwala
SOLUTION Date 25-08-2019

[PHYSICS]

1. Force of friction on mass $m_2 = \mu m_2 g$
Force of friction on mass $m_3 = \mu m_3 g$
Let a be common acceleration of the system



$\therefore \quad a = \dfrac{m_1 g - m_2 g - \mu m_3 g}{m_1 + m_2 + m_3}$

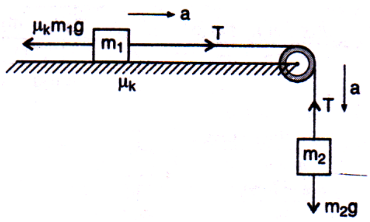
Here, $m_1 = m_2 = m_3 = m$

$\therefore \quad a = \dfrac{mg - \mu mg - \mu mg}{m + m + m}$

$= \dfrac{mg - 2\mu mg}{3m}$

$= \dfrac{g(1 - 2\mu)}{3}$

2. For motion of mass m_1,



$T - \mu_k m_1 g = m_1 a$ ......(i)
$m_2 g - T = m_2 a$ ....(ii)
Adding eqns. (i) and (ii), we get

$a = \dfrac{m_2 g - \mu_k m_1 g}{m_1 + m_2}$ ....(iii)

Putting eqn. (iii), in eqn. (ii), we get

$m_2 g - T = m_2 \left[\dfrac{m_2 g - \mu_k m_1 g}{m_1 + m_2}\right]$

or $\quad T = \left[\dfrac{m_1 m_2 g(1 + \mu_k)}{m_1 + m_2}\right]$

3. Force of friction, $f = \mu mg$

$\therefore \quad a = \dfrac{f}{m} = \dfrac{\mu mg}{m} = \mu g = 0.5 \times 10 = 5 ms^{-2}$

Using, $v^2 - u^2 = 2aS$
$0^2 - 2^2 = 2(-5) \times S$
$S = 0.4$ m

4. $R = mg \cos\alpha$
Force of friction $= \mu R = \mu mg \cos\alpha$
Force on the body along the direction of motion
$= mg \sin\alpha - \mu mg \cos\alpha$

$\therefore \quad a = \dfrac{\text{force}}{\text{mass}} = g(\sin\alpha - \mu \cos\alpha)$

5. Ball bearing are helpful in converting the sliding friction into rolling friction. Remember rolling friction is negligble as compared to sliding friction.

6. When the cube is to be moved up, the minimum force needed is given by :
$F = mg\sin\theta + \mu R = mg\sin\theta + \mu mg\cos\theta$

$$= 10\sin\theta + 0.6 \times 10\cos\theta = 10 \times \frac{3}{5} + 0.6 \times 10 \times \frac{4}{5}$$

= 10.8 N

7. $\mu_s > \mu_k > \mu_r$. Rolling friction is always less than sliding friction, that is why it is easy to move heavy load from one place to another by rolling it over the surface instead of sliding it over the same surface. Moreover, it is quite obvious that static friction is always greater than kinetic friction

8. Given u = V, final velocity = 0
Using v = u + at

$\therefore$ 0 = V – at or $-a = \frac{0-V}{t} = -\frac{V}{t}$

f = μR = μmg (f is the force of friction)

$\therefore$ Retardation, a = μg

$\therefore$ $t = \frac{V}{a} = \frac{V}{\mu g}$

10. $x = 3t - 4t^2 + t^3$

$$\frac{dx}{dt} = 3 - 8t + 3t^2 \text{ and } a = \frac{d^2x}{dt^2} = -8 + 6t$$

Now, $W = \int F dx \int ma dx = \int ma \frac{dx}{dt} dt$

$$= \int_0^4 \frac{3}{1000} \times (-8 + 6t)(3 - 8t + 3t^2) dt$$

On integrating, we get W = 530 mJ

11. When the body is rest, force of friction between the body and the floor = applied force = 2.8 N.

12. Kinetic friction is constant, hence frictional force will remain same = (10 N)

13. Given that; $a = 70\text{km/h} = 70 \times \frac{5}{18} = \frac{175}{9}\text{m/s}$

Final velocity = 0

Now, $\mu = \frac{F}{R} = \frac{(m-a)}{mg} = -\frac{a}{g}$ or $-a = \mu g$

$\therefore$ Retardation = 0.2 × 9.8 = 1.96 m/s^2

Using, $v^2 = u^2 + 2as$, we get

$$0 = \left(\frac{175}{9}\right)^2 + 2(-1.96)s$$

Solving, we get; s = 96.45 m

14.

[CHEMISTRY]

26. (c) Boyle's law is $V \propto \frac{1}{P}$ at constant T

27. (d) According to Boyle's law $V \propto \frac{1}{P}$

$V = \frac{\text{Constant}}{P}$ **;** VP = Constant.

28. (a) At constant $T, P_1V_1 = P_2V_2$

$1 \times 20 = P_2 \times 50$ **;** $P_2 = \frac{20}{50} \times 1$

29. (b,c)According to Boyle's Law PV = constant, at constant temperature either P increases or V increases both (*b*) & (*c*) may be correct.