LOM SOLUTION

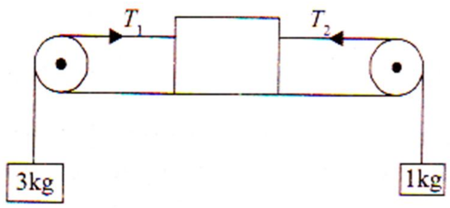
1. (c)

$T = mg = 10\ (9.8) = 98\ N$

3. (b)

Here $T_1 - T_2 = 6a$

$T_2 - 1g = 1a$ and $3g - T_1 = 3a$



Addition of the above three equations give

$10a = 3g - 1g = 2g$

4. (b)

Three force of 100 N acts on both the boats

$\therefore$ $250\ a_1 = 100$ and $500\ a_2 = 100$

Or $a_1 = 0.4\,ms^{-2}$

And $a_2 = 0.2\,ms^{-2}$

Then relative acceleration

$= a_1 + a_2 = 0.6\,ms^{-2}$

Using $S = ut + 1/2\,at^2$, we get

$$100 = (1/2) \times 0.6 \times t^2$$

Or $t = 18.3$ s.

5. (c)

Acceleration of mass m is

$a = \sqrt{a_x^2 + a_y^2}$

Various force equations are

$$2T - N = Ma_x$$

$$N = ma_x$$

And $mg - \mu N - T = ma_y$

Solving $a_x = \dfrac{2mg}{M + 5m + 2\mu m}$

And $a_y = \dfrac{4mg}{M + 5m + 2\mu m}$

$\therefore$ $a = \sqrt{a_x^2 + a_y^2}$

$$= \frac{2\sqrt{5}mg}{M + 5m + 2\mu m}$$

6. (b)

For equilibrium

$$T = m_1 a \quad \ldots \text{(i)}$$

And $T = m_2 g + \mu m_2 a \quad \ldots \text{(ii)}$

From (i) and (ii)

$$m_1 a = m_2 g + \mu m_2 a$$

Or $\mu = \dfrac{m_1 a - m_2 g}{m_2 a}$

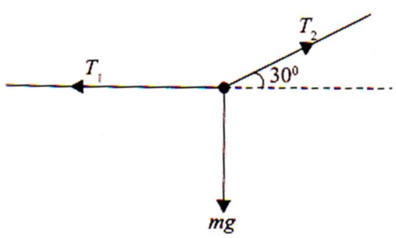
$$= \frac{m_1\left(\frac{g}{7}\right) - m_2 g}{m_2\left(\frac{g}{7}\right)} = \frac{m_1 - 7m_2}{m_2}$$

7. (a)

Here $T_1 = T_2 \ \cos 30 \ T_2 \dfrac{\sqrt{3}}{2}$

i.e., $T_2 = \dfrac{2}{\sqrt{3}} T_1$

also $Mg = T_2 \sin 30^0 = \dfrac{T_2}{2}$



i.e., $Mg = \dfrac{2}{\sqrt{3}} \dfrac{T_1}{2} = \dfrac{T_1}{\sqrt{3}}$

i.e., $T_1 = \sqrt{3}\, Mg$

8. (a)

9. (b)

Impulse = Ft = change in momentum

$= m\upsilon - (-m\upsilon)$

$= 2m\upsilon = 2 \times 0.01 \times 5$

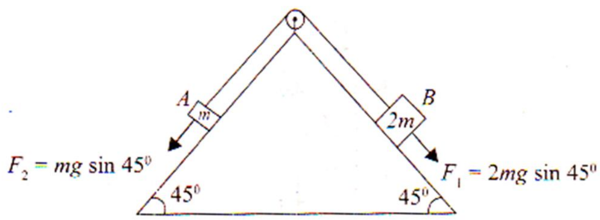
= 0.1

$\therefore \ F = \dfrac{0.1}{0.01} = 10\,N$

10. (a)

f_{max} for $A = \mu_1\left(mg\cos 45^0\right)$

$= \dfrac{2}{3}\dfrac{mg}{\sqrt{2}} = \dfrac{\sqrt{2}}{3} mg$



Also f_{max} for $B = \mu_2 (2mg \cos 45)$

$= 1/3\left(2mg\sqrt{2}\right) = \frac{\sqrt{2}}{3} mg$

Total frictional force

$= \frac{\sqrt{2}}{3} mg + \frac{\sqrt{2}}{3} mg = \frac{2\sqrt{2}}{3} mg$

But pulling force

$= F_1 - F_2 = \frac{2mg}{\sqrt{2}} - \frac{mg}{\sqrt{2}} = \frac{mg}{\sqrt{2}}$

$\therefore$ system can be accelerate.

11. (a, c)

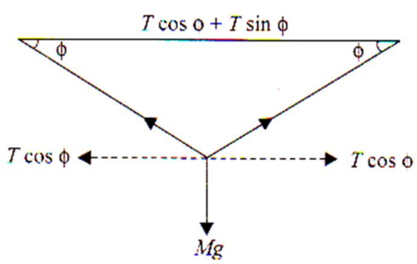
$a = mg - T$

$T = 3$ solving $a = \frac{g}{4}$

$\therefore$ $T = \frac{3}{4} g$ and $F_{clamp} = \sqrt{2}\ \frac{3}{4} g$

18. (d)

$2T \sin \phi = Mg$



$T = \frac{Mg}{2\sin\phi} = \frac{900}{2\sin 10}$

$T = \frac{450}{0.1736} = 2580\,\text{N}$

19. (a)

$\sin\phi = \frac{Mg}{2T} = \frac{900}{2 \times 25000} = .018$

Or $\phi = 1^0$

20. $a_{rel} = a_A - a_B = 2ms^{-2}$ $s = \frac{1}{2} a_{rd}\, t_2$ $t = \sqrt{\frac{4 \times 2}{2}} = 2s$