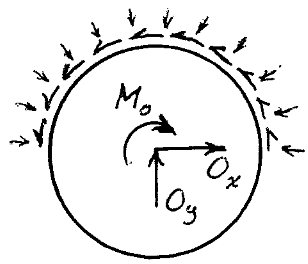
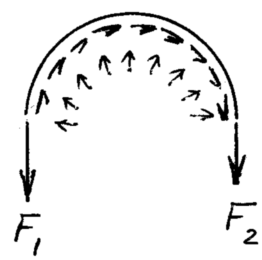
#29



Pulley FBD



Belt FBD

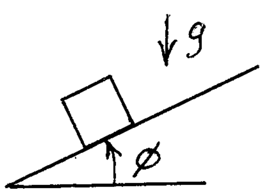
$$F_1 = F_2 e^{\mu_s \theta}$$

$$3000 = 450 e^{\mu_s \pi}$$

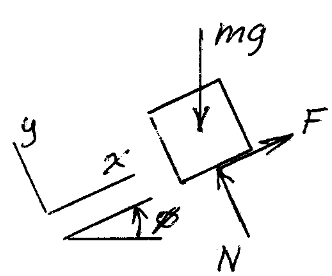
$$\mu_s \pi = \ln \frac{3000}{450} = 1.897$$

$$\mu_s = 0.604 \longleftarrow \text{Ans.}$$

#30



$\mu_s = 0.25$



$$F = \mu_s N = 0.25 N \quad (1)$$

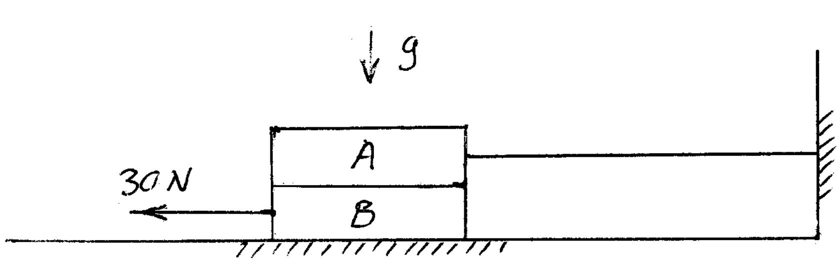
$$\Sigma F_x = 0 \implies -mg\sin\phi + F = 0 \quad (2)$$

$$\Sigma F_y = 0 \implies N - mg\cos\phi = 0 \quad (3)$$

$$(3) \rightarrow (1) \rightarrow (2) \implies -mg\sin\phi + 0.25\, mg\cos\phi = 0$$

$$\tan\phi = 0.25 \longleftarrow \text{Ans.}$$

#31

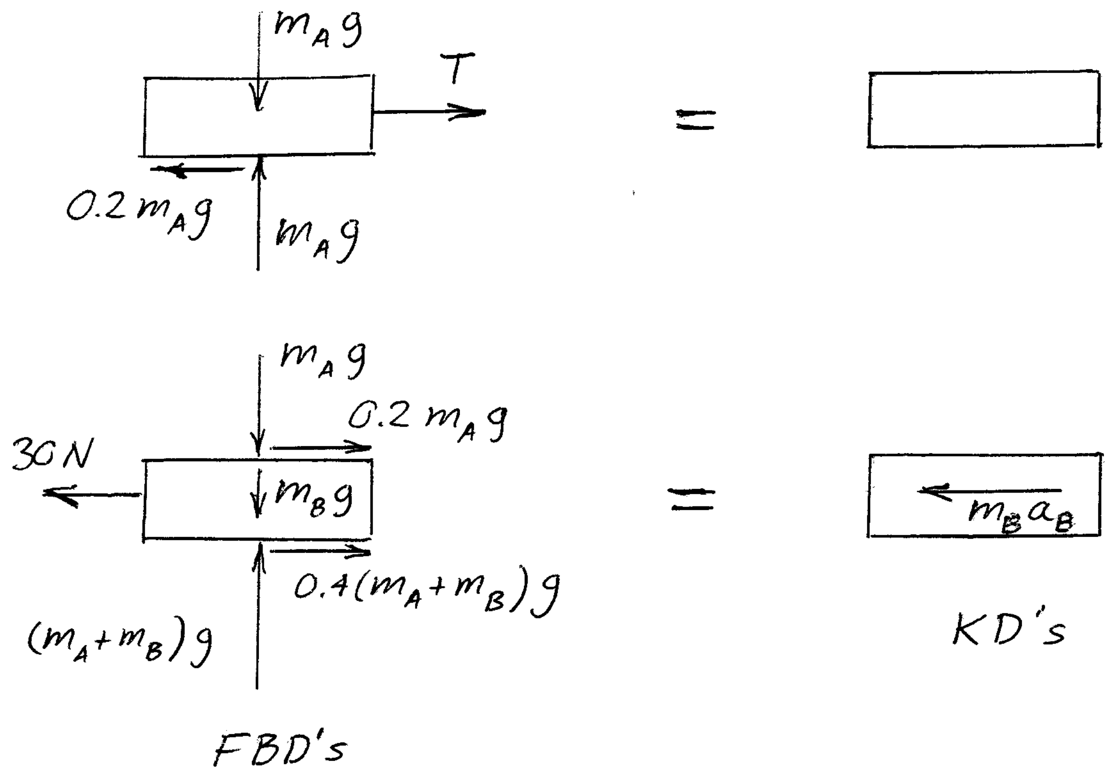


$m_A = 2$ kg

$m_B = 2$ kg

$\mu_k = 0.2$ between A and B

$\mu_k = 0.4$ between B and ground

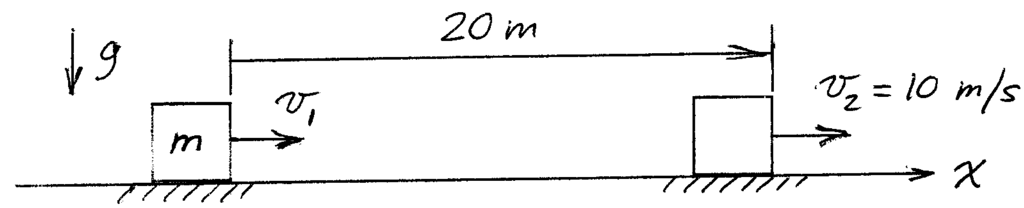


$$m_B : \leftarrow \sum F = m_B a_B \Rightarrow 30 - 0.2 m_A g - 0.4(m_A + m_B)g = m_B a_B$$

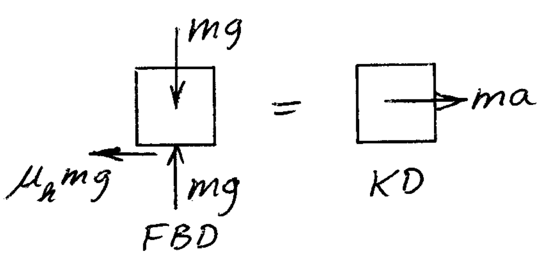
$$2 a_B = 30 - [(0.2)(2) + (0.4)(4)]9.81$$

$$a_B = 5.19 \ m/s^2 \leftarrow \text{Ans.}$$

#32



$$m = 2 \text{ kg} \qquad \mu_k = 0.2$$



$$\sum F_x = ma \Rightarrow -\mu_k mg = ma$$

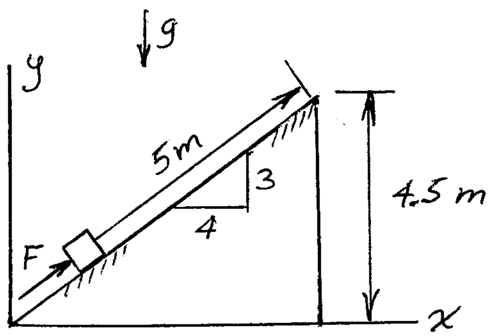
$$a = -\mu_k g$$

$$v \, dv = a \, dx \Rightarrow v_2^2 - v_1^2 = 2a \Delta x$$

$$v_1^2 = 100 + (2)(0.2)(9.81)(20)$$

$$v_1 = 13.36 \ m/s \leftarrow \text{Ans.}$$

33

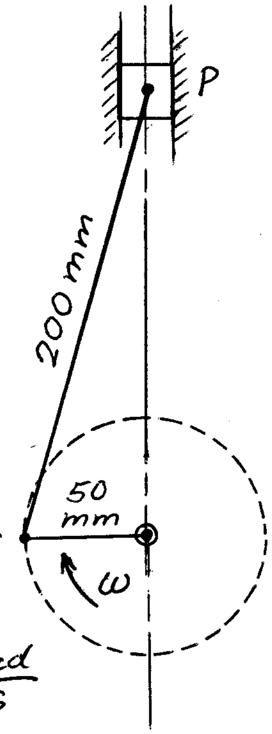


$$U_{1\to2} = \Delta T + \Delta V_g = \frac{1}{2}mv_2^2 + mg\Delta y$$

$$5F = \frac{1}{2}(2)(8)^2 + (2)(9.81)(3)$$

$$F = 24.6\ N \leftarrow \text{Ans}$$

34



$\omega = 377 \frac{rad}{s}$

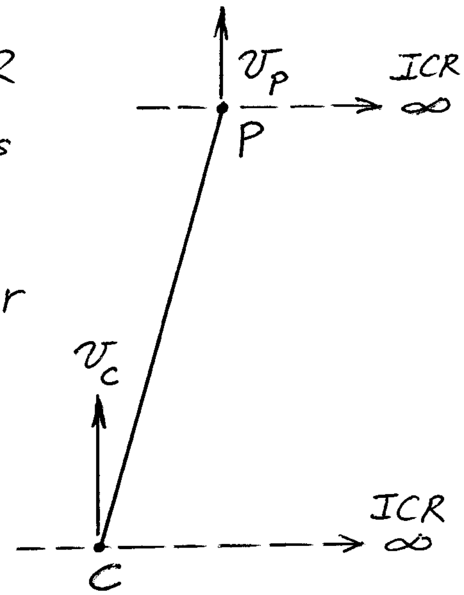
Determine ICR for connecting rod CP. It is at infinity. Therefore,

$$v_P = v_C = \omega r$$

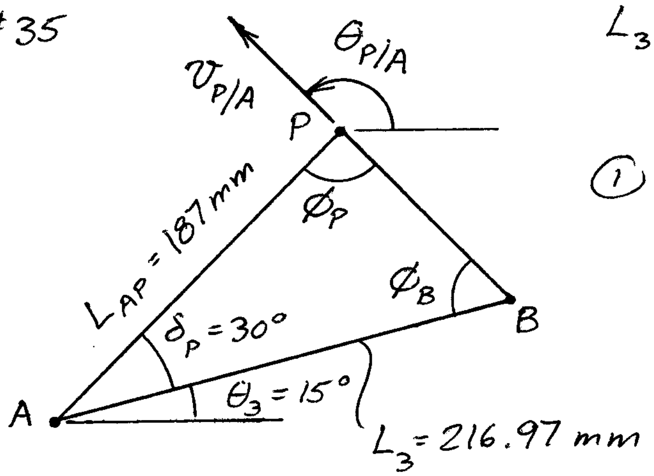
$$= (377)(50)$$

$$= 18,850 \frac{mm}{s}$$

Ans.



35



$$L_3 \cos \delta_P = 216.97 \cos 30° = 187.90$$

$$\simeq L_{AP} \quad (1)$$

(1) ⟹ ΔAPB is a right triangle and $\phi_P = 90°$ & $\phi_B = 60°$.

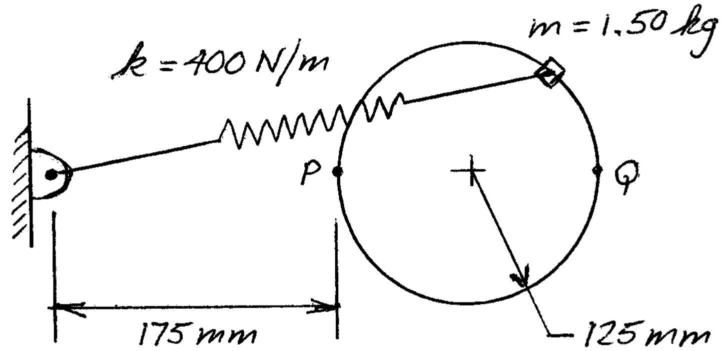
Thus,

$$\theta_{P/A} = (90° - \phi_B) + 15° + 90°$$

$$= 30° + 15° + 90°$$

$$= 135° \leftarrow \text{Ans.}$$

#36



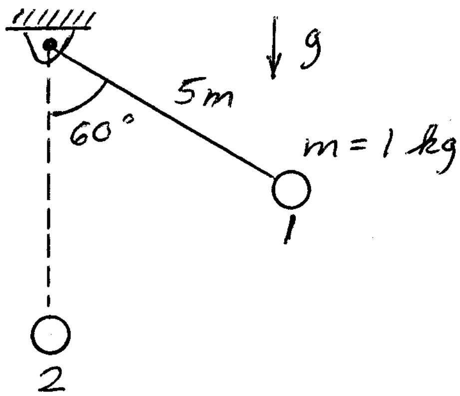
$v_Q = 2 \text{ m/s}$

$T_Q = \frac{1}{2} m v_Q^2$

$= \frac{1}{2}(1.5)(2)^2$

$= 3 \text{ N}\cdot\text{m or J}$ ← Ans.

#37



$0 = \Delta T + \Delta V_g$

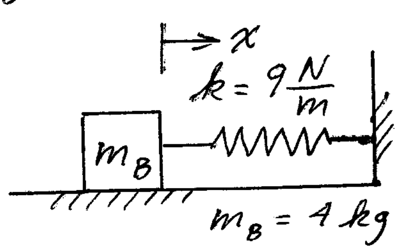
$0 = \frac{1}{2} m v_2^2 - mg5(1 - \cos 60°)$

$v_2^2 = (2)(9.81)(5)(1 - \cos 60°)$

$= 49.05$

$v_2 = 7.00 \text{ m/s}$ ← Ans.

#38



When $x = 0$, spring is undeformed.

$v_1 = 6 \text{ m/s}$ when $x_1 = 0$.

Let F = spring force acting on m_B

$F = m_B a \Longrightarrow$ max. acceleration occurs when $|F| = F_{max}$. F_{max} occurs when $x_2 = x_{max}$. x_{max} occurs when $v_2 = 0$.

$0 = \Delta T + \Delta V_e \Longrightarrow \frac{1}{2} m_B v_1^2 = \frac{1}{2} k x_{max}^2 \Rightarrow \frac{1}{2}(4)(6)^2 = \frac{1}{2}(9) x_{max}^2$

$x_{max} = 4 \text{ m}$

$F_{max} = k x_{max} = m_B a_{max} \Longrightarrow a_{max} = \frac{(9)(4)}{4} = 9 \frac{\text{m}}{\text{s}^2}$ ← Ans.