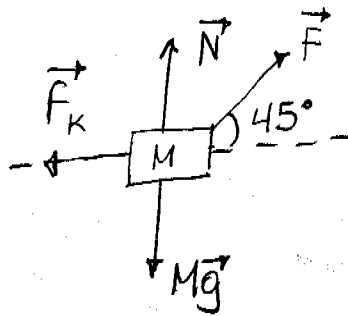
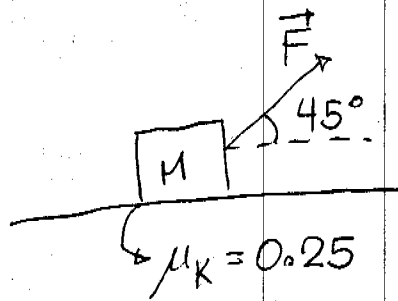


Problem 1:

$\Delta t = 10\text{ s}$
 $M = 100\text{ kg}$
 $F = 800\text{ N}$



b) $F_k = \mu_k N = 104\text{ N}$ (5)

a) $N - Mg + F \sin 45^\circ = 0$

$N = Mg - \frac{F\sqrt{2}}{2}$

$N = 414\text{ N}$ (10)

c) $F \cos 45^\circ - F_k = F_{\text{net}} = 462\text{ N}$ (10)

c) $P_i = P_f$

$P_f = (m_1 + m_2) V_f$
 $= 5\text{ kg m/s}$

$V_f = \frac{5\text{ kg m/s}}{5\text{ kg}}$

$V_f = 1\text{ m/s}$ (10)

d) $F_{\text{net}} = Ma$, $a = \frac{F_{\text{net}}}{M} = 4.62\text{ m/s}^2$

$\Delta x = v_{0x} \Delta t + \frac{1}{2} a \Delta t^2$ (10)
(from rest)

$\Delta x = \frac{1}{2} a \Delta t^2 = 231\text{ m}$

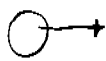
d) $K_f = \frac{1}{2} (m_1 + m_2) V_f^2$ (10)
 $= 2.5\text{ J}$

Problem 3:

Initially

$v_1 = 10\text{ m/s}$

$v_2 = -5\text{ m/s}$



$m_1 = 2\text{ kg}$

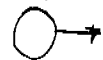
$m_2 = 3\text{ kg}$

a) $P_i = P_1 + P_2$ (5)

$= m_1 v_1 + m_2 v_2 = 5\text{ kg m/s}$

After

$v_f = ?$



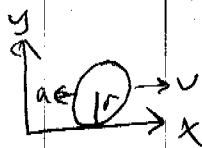
$m_1 + m_2 = 5\text{ kg}$

b) $K_i = K_1 + K_2$

$= \frac{1}{2} m_1 v_1^2 + \frac{1}{2} m_2 v_2^2$ (10)

$= 137.5\text{ J}$

Problem 2



$$\begin{aligned}r &= 0.5 \text{ m} \\m &= 2.0 \text{ kg} \\x &= 100 \text{ m}\end{aligned}$$

$$a) I = \frac{1}{2} m r^2 = \frac{1}{2} (2 \text{ kg}) (0.5 \text{ m})^2 = \frac{1}{4} \text{ kg m}^2$$

$$b) x = vt \\100 \text{ m} = v(20 \text{ s}) \\v = 5 \text{ m/s}$$

$$v = r\omega \quad \omega = \frac{5 \text{ m/s}}{0.5 \text{ m}} = 10 \frac{\text{rad}}{\text{s}}$$

$$c) \tau_{\text{angular}} = I\omega = \left(\frac{1}{4} \text{ kg m}^2 \right) \left(10 \frac{\text{rad}}{\text{s}} \right) = \frac{10}{4} \text{ kg } \frac{\text{m}}{\text{s}} \cdot \text{m}$$

d) This torque has to stop both angular + linear motion.

Angular

$$V_f^2 = V_i^2 + 2ax$$

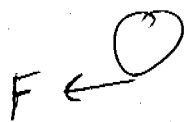
$$0 = (5 \text{ m/s})^2 + 2a(100 \text{ m})$$

$$a = \frac{-25}{200} = -\frac{1}{8} \text{ m/s}^2$$

$$\alpha = \frac{a}{r} = \frac{-\frac{1}{8} \text{ m/s}^2}{0.5 \text{ m}} = -\frac{1}{4} \frac{\text{rad}}{\text{s}^2}$$

$$\tau = I\alpha = \left(\frac{1}{4} \frac{\text{rad}}{\text{s}^2} \right) \left(\frac{1}{4} \text{ kg m}^2 \right) = \frac{1}{16} \text{ kg } \frac{\text{m}}{\text{s}^2} \cdot \text{m} = \frac{1}{16} \text{ N}\cdot\text{m}$$

Linear



$$F = ma = (2 \text{ kg}) \left(-\frac{1}{8} \text{ m/s}^2 \right) = -\frac{1}{4} \text{ kg } \frac{\text{m}}{\text{s}^2}$$

$$\tau = rF = (0.5 \text{ m}) \left(\frac{1}{4} \text{ kg } \frac{\text{m}}{\text{s}^2} \right) = \frac{1}{8} \text{ kg } \frac{\text{m}}{\text{s}^2} \cdot \text{m}$$

$$\tau_{\text{total}} = \tau_{\text{angular}} + \tau_{\text{linear}} = \left(\frac{1}{16} + \frac{1}{8} \right) \text{ N}\cdot\text{m} = \frac{3}{16} \text{ N}\cdot\text{m}$$