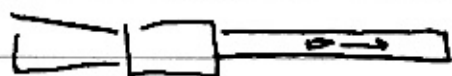


Exam 3 Spring '06

1

1



$$\Delta(MV) = 0.02 \times 500 = 10 \text{ Ns}$$

$$F \Delta t = \Delta(MV) \Rightarrow \Delta t = \Delta(MV) / F = 10 / 2009 \approx 0.005$$

2

$$P_I = P_F \Rightarrow 0.02 \times 500 = (M_b + M_{blk}) V_F$$

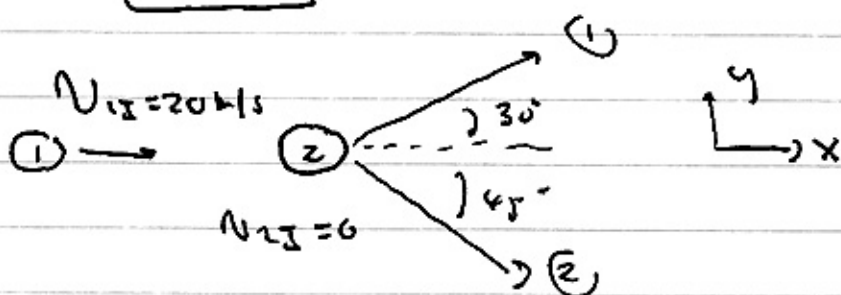
$$10 \text{ Ns} = (0.02 + 2) V_F$$

$$V_F = \frac{10 \text{ Ns}}{2.02} = 4.95 \text{ m/s}$$

3

$$\begin{aligned} M_1 V_{1I} + M_2 V_{2I} &= M_1 V_{1F} + M_2 V_{2F} \\ V_{1I} + V_{1F} &= V_{2I} + V_{2F} \\ V_{2F} &= V_{1I} + V_{1F} \\ V_{1I} + 0 &= V_{1F} + V_{1I} + V_{1F} \\ \boxed{V_{1F} = 0} \end{aligned}$$

4



$$x: M_1 V_{1I} = M_1 V_{1F} \cos 30^\circ + M_2 V_{2F} \cos 45^\circ$$

$$y: 0 = M_1 V_{1F} \sin 30^\circ - M_2 V_{2F} \sin 45^\circ$$

$$M_1 / M_2 = 2$$

$$x \Rightarrow V_{1F} \cos 30^\circ = (V_{1I} - 0.5 V_{2F} \cos 45^\circ) / \cos 30^\circ$$

$$0 = \cancel{2} (V_{1I} - 0.5 V_{2F} \cos 45^\circ) \frac{\sin 30^\circ}{\cos 30^\circ} - 0.5 V_{2F} \sin 45^\circ$$

$$0 = V_{1I} \tan 30^\circ - 0.5 [\cos 45^\circ \tan 30^\circ + \sin 45^\circ] V_{2F}$$

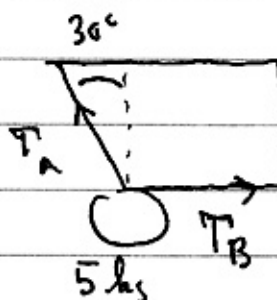
(4) cont:

$$0 = 20 \times 0.577 - 0.5 [0.707 \times 0.577 + 0.707] U_{2F}$$

$$0 = 11.54 - 0.557 U_{2F}$$

$$U_{2F} = 20.7 \text{ mph}$$

(5)



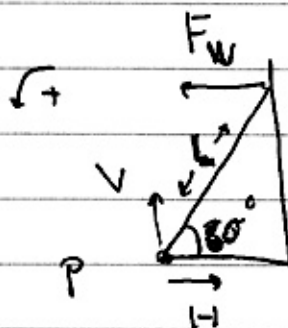
$$x: T_A \sin 30 - T_B = 0$$

$$y: T_A \cos 30 - 5 \times 9.8 = 0$$

$$T_A = \frac{5 \times 9.8}{\cos 30} = 56.6 \text{ N}$$

$$T_B = T_A \sin 30 = 56.6 \times 0.5 \text{ N} = \boxed{28.3 \text{ N}}$$

(6)



$$\tau: F_W L \sin \theta - M L g \frac{L}{2} \cos \theta = 0$$

$$x: H - F_W = 0$$

$$y: V - M L g = 0$$

$$\tau \Rightarrow F_W = M L g \frac{1}{2} \frac{1}{\tan \theta} = 50 \times 9.8 \times 0.5 \frac{1}{1.73} \text{ N}$$

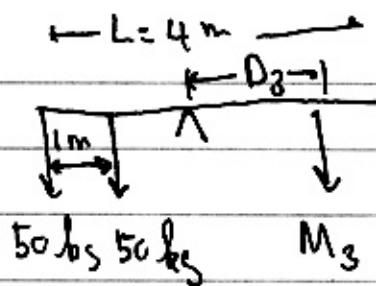
$$F_W = 141.6 \text{ N}$$

$$x: H = F_W = 141.6 \text{ N}$$

$$y: V = M L g = 490 \text{ N}$$

$$\frac{H}{V} \leq \mu_s \Rightarrow \frac{141.6}{490} \leq \mu_s \Rightarrow \boxed{0.289} \leq \mu_s$$

(7)

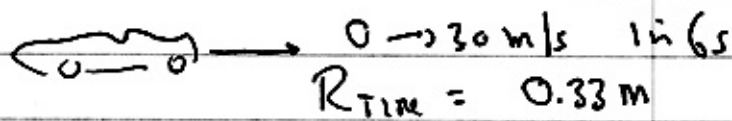


$$2 \times 50 + 1 \times 50 = D_3 \times 100$$

$$150 = D_3 \times 100$$

$$D_3 = 1.5\text{ m}$$

(8)



$$a = \frac{30\text{ m/s}}{6\text{ s}} = 5\text{ m/s}^2$$

$$X_F - X_I = \frac{1}{2} (0 + 30) \times 6\text{ m} = 90\text{ m}$$

$$\theta = \frac{s}{R} = \frac{90}{0.33}\text{ rad} = 272.7\text{ rad}$$

$$\# \text{ of revolutions} = \frac{\theta}{2\pi} = 43.4\text{ revolutions}$$