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بارم هر سوال ۲/۸۰ می باشد.

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2/49 $a = k/x$, $v\,dv = \frac{k}{x}\,dx$

$$\int_0^v v\,dv = k\int_{x_1}^{x} \frac{dx}{x} \; ; \quad \frac{v^2}{2} = k \ln \frac{x}{x_1}$$

Thus $\frac{(600)^2}{2} = k \ln \frac{750}{7.5}$, $k = \frac{0.36}{2(4.605)} = 0.0391\ (km/s)^2$

at $x = 375\ mm$, $a = \frac{0.0391}{375(10^{-6})} = \underline{104.2\ km/s^2}$

$$V = \sqrt{2kln\frac{x}{x_1}} = \sqrt{2 * 0.0391ln\frac{375}{7.5}} = 0.305km/s$$

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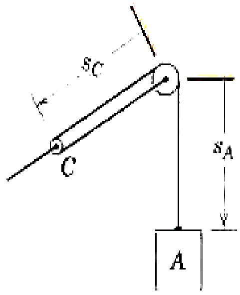
$$0 = 2a_C + a_A$$



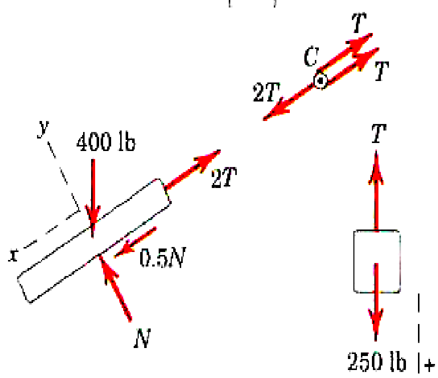
2 $[\Sigma F_y = 0]$ $\quad N - 400 \cos 30° = 0 \quad N = 346$ lb

and its equation of motion in the x-direction gives

$[\Sigma F_x = ma_x]$ $\quad 0.5(346) - 2T + 400 \sin 30° = \dfrac{400}{32.2} a_C$

For the block in the positive downward direction, we have

3 $[+\downarrow \Sigma F = ma]$ $\quad 250 - T = \dfrac{250}{32.2} a_A$



Solving the three equations in a_C, a_A, and T gives us

$$a_A = 5.83 \text{ ft/sec}^2 \qquad a_C = -2.92 \text{ ft/sec}^2 \qquad T = 205 \text{ lb}$$

4 For the 20-ft drop with constant acceleration, the block acquires a velocity

$[v^2 = 2ax]$ $\quad v_A = \sqrt{2(5.83)(20)} = 15.27$ ft/sec $\qquad$ *Ans.*

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4/10 For system, $\Delta T + \Delta V_g = 0$

$$\Delta T = 3\left(\frac{1}{2} m v^2\right) - 0 = \frac{3}{2} m v^2$$

$$\Delta V_g = 0 - mg\frac{b}{\sqrt{2}} - mg\frac{2b}{\sqrt{2}} = -\frac{3b}{\sqrt{2}} mg$$

Thus $\frac{3}{2} m v^2 - \frac{3b}{\sqrt{2}} mg = 0$, $v^2 = bg\sqrt{2}$

$$\underline{v = \sqrt{bg\sqrt{2}}}$$

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Solution: First we must do a velocity analysis to find the angular velocity of BCD

$$\mathbf{v}_B = \mathbf{v}_A + \boldsymbol{\omega}_{AB} \times \mathbf{r}_{B/A} = 0 + (2\ \text{rad/s})\mathbf{k} \times (0.32\ \text{m})\mathbf{i} = (0.64\ \text{m/s})\mathbf{j}$$

$$\mathbf{v}_C = \mathbf{v}_B + \boldsymbol{\omega}_{BCD} \times \mathbf{r}_{C/B} = (0.64\ \text{m/s})\mathbf{j} + \omega_{BCD}\mathbf{k} \times (0.24\mathbf{i} + 0.48\mathbf{j})\ \text{m}$$

$$= (-0.48\ \text{m})\omega_{BCD}\mathbf{i} + (0.64\ \text{m/s} + \{0.24\ \text{m}\}\omega_{BCD})\mathbf{j}$$

Since C cannot move in the **j** direction we know

$$0.64\ \text{m/s} + \{0.24\ \text{m}\}\omega_{BCD} = 0 \Rightarrow \omega_{BCD} = -2.67\ \text{rad/s}$$

Now we do the acceleration analysis

$$\mathbf{a}_B = \mathbf{a}_A + \boldsymbol{\alpha}_{AB} \times \mathbf{r}_{B/A} - \omega_{AB}{}^2\mathbf{r}_{B/A}$$

$$= 0 + (8\ \text{rad/s}^2)\mathbf{k} \times (0.32\ \text{m})\mathbf{i} - (2\ \text{rad/s})^2(0.32\ \text{m})\mathbf{i}$$

$$= (-1.28\mathbf{i} + 2.56\mathbf{j})\ \text{m/s}^2$$

$$\mathbf{a}_C = \mathbf{a}_B + \boldsymbol{\alpha}_{BC} \times \mathbf{r}_{C/B} - \omega_{BC}{}^2\mathbf{r}_{C/B}$$

$$= (-1.28\mathbf{i} + 2.56\mathbf{j})\ \text{m/s}^2 + \alpha_{BCD}\mathbf{k} \times (0.24\mathbf{i} + 0.48\mathbf{j})\ \text{m}$$

$$- (-2.67\ \text{rad/s})^2(0.24\mathbf{i} + 0.48\mathbf{j})\ \text{m}$$

$$= (-2.99\ \text{m/s}^2 - \{0.48\ \text{m}\}\alpha_{BCD})\mathbf{i}$$

$$+ (-0.853\ \text{m/s}^2 + \{0.24\ \text{m}\}\alpha_{BCD})\mathbf{j}$$

Since C cannot move in the **j** direction we know

$$-0.853\ \text{m/s}^2 + \{0.24\ \text{m}\}\alpha_{BCD} = 0 \Rightarrow \alpha_{BCD} = 3.56\ \text{rad/s}^2$$

Now we can find the acceleration of point D

$$\mathbf{a}_D = \mathbf{a}_B + \boldsymbol{\alpha}_{BCD} \times \mathbf{r}_{D/B} - \omega_{BCD}{}^2\mathbf{r}_{D/B}$$

$$= (-1.28\mathbf{i} + 2.56\mathbf{j})\ \text{m/s}^2 + (3.56\ \text{rad/s}^2)\mathbf{k} \times (0.4\mathbf{i} + 0.8\mathbf{j})\ \text{m}$$

$$- (-2.67\ \text{rad/s})^2(0.4\mathbf{i} + 0.8\mathbf{j})\ \text{m}$$

$$\boxed{\mathbf{a}_D = (-.697\mathbf{i} - 1.71\mathbf{j})\ \text{m/s}^2}$$