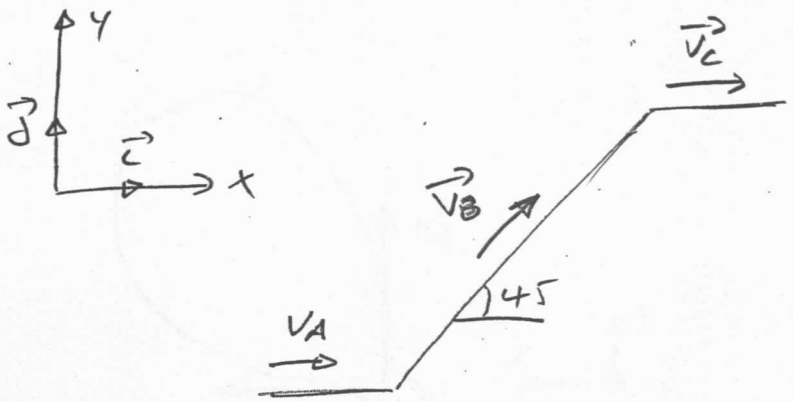
2HW
SS 2009/2010

12-73



$$\vec{V_A} = 20\,\vec{i}$$

$$\vec{V_B} = \frac{30}{\sqrt{2}}(\vec{i}+\vec{j})$$

$$\vec{V_C} = 40\,\vec{i}$$

$$\vec{a}_{AB} = \frac{\Delta\vec{V}}{\Delta t} = \frac{\vec{V_B}-\vec{V_A}}{\Delta t}$$

$$\vec{a}_{AB} = \frac{(\frac{30}{\sqrt{2}}-20)\vec{i} + \frac{30}{\sqrt{2}}\vec{j}}{3} = 0.404\vec{i} + 7.07\vec{j}$$

$$\vec{a}_{AC} = \frac{\vec{V_C}-\vec{V_A}}{\Delta t} = \frac{40\vec{i}-20\vec{i}}{8} = 2.5\,\vec{i}$$

* 12-76 II

$$y = x - \frac{x^2}{400} \qquad v_x = 2\,m/s = const.$$

Determine v_y and a_y when $x = 20\,m$

$$v_y = \frac{dy}{dt} = \dot{x} - \frac{2x}{400}\dot{x} = \dot{x}(1-\frac{x}{200}) \qquad \text{but } \dot{x} = v_x$$

$$v_y = 2 - \frac{x}{100}$$

When $x = 20\,m \rightarrow v_x = 2 \quad v_y = 2 - \frac{20}{100} = 1.8\,m/s$

$$v = \sqrt{v_x^2 + v_y^2} = \sqrt{2^2 + 1.8^2} = 2.69\,m/s$$

$$a_x = \dot{v}_x = 0 \qquad \text{since } v_x = const$$

$$a_y = \dot{v}_y = 0 - \frac{1}{100}\dot{x} = 0 - \frac{2}{100} = -0.02$$

$$a = \sqrt{a_x^2 + a_y^2} = 0.02\,m/s^2$$

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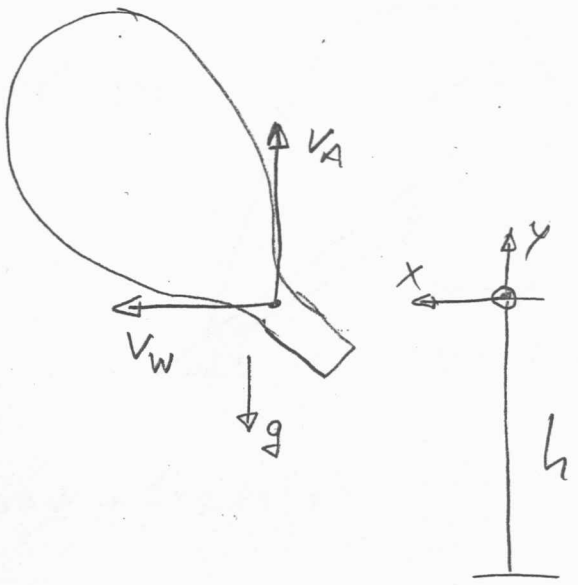
12-82



$V_A = 12 \text{ km/h}$
$= 3.33\overline{3} \text{ m/s}$

$V_W = 20 \text{ km/h}$
$= 5.55 \text{ m/s}$

↑: $v_y^2 = v_{oy}^2 + 2a_c(y - y_o)$
$= (3.33)^2 + 2(-9.81)(-50 - 0)$

↳ $v_y = 31.5 \text{ m/s}$

$v_y = v_{oy} + a_c t$
$-31.5 = 3.33 - 9.81 t$
↳ $t = 3.55 \text{ s}$

$v = v_x^2 + v_y^2 = \sqrt{31.5^2 + 5.55^2}$
$v = 32 \text{ m/s}$

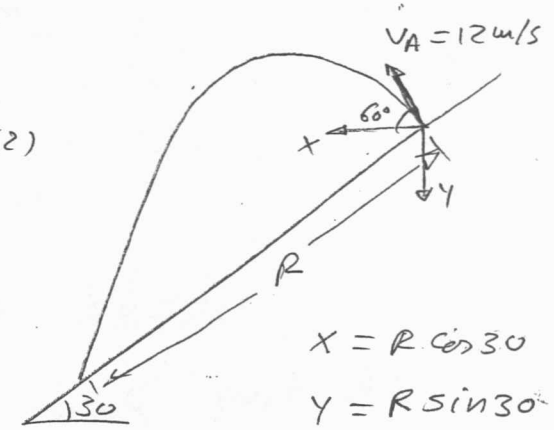
12-91

$\rightarrow: R\cos 30 = V_A \cos 60\, t$ (1)

$\downarrow: R\sin 30 = -V_A \sin 60\, t + \frac{1}{2}(9.81)t^2$ (2)

$V_A = 12$

(1) $R = \frac{12\cos 60}{\cos 30}\, t$ (3)



$x = R\cos 30$

$y = R\sin 30$

(3) into (2)

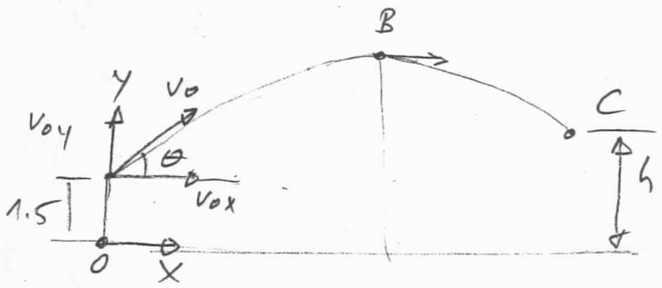
$\frac{12\cos 60}{\cos 30} \cdot \sin 30\, t = -12\sin 60\, t + \frac{1}{2}(9.81)t^2$

$\Rightarrow t = \frac{2}{9.81}(12)\left[\frac{\cos 60 \sin 30}{\cos 30} + \sin 60\right] = 2.825\ s$

$R = \frac{12\cos 60}{\cos 30}(2.825) = 19.572\ m$

12-92

$V_0 = 15 \text{ m/s}$



at B $V_y = 0$

$$V_y^2 = V_{0y}^2 + 2a_c(y - y_0)$$

$$0 = (15\sin\theta)^2 + 2(-9.81)(6 - 1.5)$$

$$\Rightarrow \sin^2\theta = \frac{88.29}{15^2} \quad \Rightarrow \quad \theta = 38.786°$$

$\rightarrow$ $x = x_0 + V_{0x}t$ to reach point C

$$18 = 0 + 15\cos(38.786)\,t$$

$$\hookrightarrow t = \frac{18}{15\cos 38.786} = 1.54 \text{ s}$$

$\uparrow$ $y = y_0 + V_{0y}t + \frac{1}{2}gt^2$

$$y = 1.5 + 15\sin(38.786)(1.54) - \frac{1}{2}(9.81)(1.54)^2$$

$$y = 4.363 \text{ m}$$