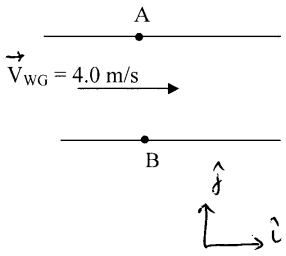
PHYS101.14
QUIZ#4- CHAPTER 4
DATE: 31/3/09

Name: Key Id#:

A 140-m wide river flows with a uniform speed of 4.0 m/s toward the East. Starting from point A it takes 20 s for a boat to cross the river with constant speed to point B. What is the velocity of the boat relative to the water?



$$\vec{V}_{BW} = \vec{V}_{BG} + \vec{V}_{GW}$$
$$= \vec{V}_{BG} - \vec{V}_{WG}$$

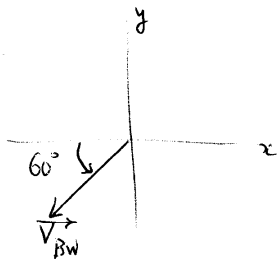
$$\vec{V}_{BG} = -\frac{140}{20}\hat{j} = -7\ m/s\ \hat{j}$$

$$\vec{V}_{WG} = 4\ m/s\ \hat{i}$$

$$\boxed{\vec{V}_{BW} = -7\hat{j} - 4\hat{i}} \quad \text{or} \quad -4\hat{i} - 7\hat{j}\ \ m/s$$

speed = 8 m/s

direction $\Rightarrow$ $\theta = \tan^{-1}\left(\frac{7}{4}\right) = 60^\circ$



PHYS101.13
QUIZ#4- CHAPTER4
DATE: 31/3/09

Name: Key Id#:

A particle starts from the origin at t = 0 with a velocity of (8j) (m/s) and moves in the xy plane with constant acceleration of (4i – 2j) (m/s^2).
When the particle reaches its maximum y coordinate, what are its (a) **position** and (b) **velocity** vectors?

$$\vec{V}_0 = 8\hat{j} \ \text{m/s}$$

$$\vec{a} = 4\hat{i} - 2\hat{j} \ \text{m/s}^2$$

$$\vec{r} = \vec{r}_0 + \vec{V}_0 t + \frac{1}{2}\vec{a}t^2 \qquad (\vec{r}_0 = 0)$$

$$= 8t\hat{j} + \frac{1}{2}(4t^2\hat{i} - 2t^2\hat{j})$$

$$\vec{r} = \underbrace{2t^2}_{r_x}\hat{i} + \underbrace{(8t - t^2)}_{r_y}\hat{j}$$

Maximum y-Coordinate $\Rightarrow V_y = 0$

$$V_y = \frac{dr_y}{dt} = 8 - 2t = 0 \Rightarrow \boxed{t = 4\,s}$$

$$\Rightarrow \vec{r} = 2(4)^2\hat{i} + (8\times 4 - (4)^2)\hat{j}$$

$$\boxed{\vec{r} = 32\hat{i} + 16\hat{j}} \ \text{m}$$

$$\vec{V} = \vec{V}_0 + \vec{a}t = 8\hat{j} + (4t\hat{i} - 2t\hat{j})$$

$t = 4s \Rightarrow \vec{V} = 8\hat{j} + 16\hat{i} - 8\hat{j} = 16\hat{i}$

$$\boxed{\vec{V} = 16\hat{i}} \ \text{m/s}$$

PHYS101.15
QUIZ#4- CHAPTER 4
DATE: 29/3/09

Name: Key Id#:

A projectile is thrown from a height H with a speed of 10.0 m/s at an angle of 30 degrees below horizontal as shown in Fig 10.
(a) Find the height H, if the horizontal distance x = 20.0 m.
(b) The velocity of the projectile just before it hits the ground.

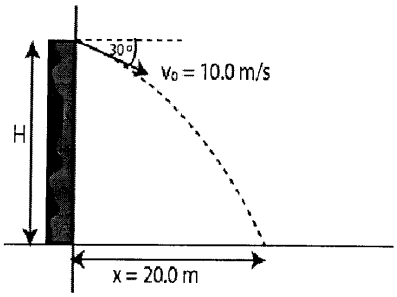


Figure 10

a) $x - x_0 = V_{0x} t = V_0 \cos\theta_0 t$

$20 = 10 \cos 30^\circ t \Rightarrow \boxed{t = 2.3\ s}$

$y - y_0 = V_{0y} t - \frac{1}{2} g t^2$

$= V_0 \sin\theta_0 t - 4.9 t^2 = -10 \sin 30^\circ \times 2.3 - 4.9 \times (2.3)^2$

$= -37.4\ m$

$\boxed{H = 37.4\ m}$

b) $\vec{V} = V_x \hat{i} + V_y \hat{j}$

$V_x = V_{0x} = V_0 \cos 30^\circ = 8.7\ m/s$

$V_y = V_{0y} - gt = -10 \sin 30^\circ - 9.8 \times 2.3 = -27.5\ m/s$

$\boxed{\vec{V} = 8.7 \hat{i} - 27.5 \hat{j}}\ m/s$