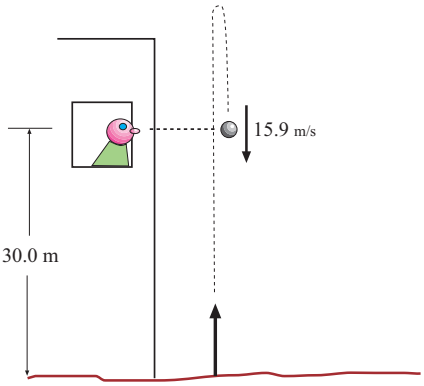
Name_____

Feb. 9, 2007

Quiz #1 — Spring 2007

Phys 2110 – Sec 2

1. A projectile is fired straight up from ground level. Your friend is observing from a point 30.0 m above ground level. Some time after the launch, your friend observes the projectile at his level going downward with a speed of $15.9\frac{\text{m}}{\text{s}}$



a) What was the initial speed of the projectile?

With the origin at the firing point, we have

$$y_i = 0 \quad y = 30.0 \text{ m} \quad v_y = -15.9\tfrac{\text{m}}{\text{s}} \quad a_y = -9.8\tfrac{\text{m}}{\text{s}^2}$$

Use $v_y^2 = v_{iy}^2 + 2a_y\Delta y$ and solve for v_{iy}:

$$v_{iy}^2 = v_y^2 - 2a_y\Delta y = (-15.9\tfrac{\text{m}}{\text{s}})^2 - 2(-9.8\tfrac{\text{m}}{\text{s}^2})(30.0 \text{ m}) = 841\ \tfrac{\text{m}^2}{\text{s}^2}$$

Then:

$$v_{iy} = 29.0\tfrac{\text{m}}{\text{s}}$$

b) How long after the launch did your friend make his observation?

We now have a so we can use $v_y = v_{iy} + a_y t$ to find t:

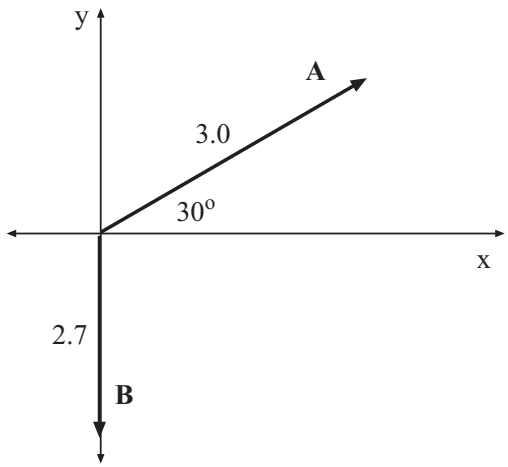
$$t = \frac{v_y - v_{iy}}{a} = \frac{(-15.9\frac{\text{m}}{\text{s}} - 29.0\frac{\text{m}}{\text{s}})}{(-9.80\frac{\text{m}}{\text{s}^2})} = 4.58 \text{ s}$$

c) What was the maximum height attained by the projectile?

At maximum height we have $v_y = 0$ but y is unknown. We can again use $v_y^2 = v_{iy}^2 + 2a_y\Delta y$ since we've got v_{iy} now.

$$\Delta y = \frac{v_y^2 - v_{iy}^2}{2a_y} = \frac{0^2 - (29.0\frac{\text{m}}{\text{s}})^2}{2(-9.8\frac{\text{m}}{\text{s}^2})} = 42.9 \text{ m}$$

2. Vector **A** has magnitude 3.0 and is directed at 30.0° from the $+x$ axis. Vector **B** has magnitude 2.7 and is directed in the $-y$ direction. Find the magnitude of $\mathbf{A} + \mathbf{B}$.



Find the components:

$$A_x = 2.60 \quad A_y = 1.50 \quad B_x = 0 \quad B_y = -2.7$$

If $\mathbf{C} = \mathbf{A} + \mathbf{B}$ then

$$C_x = A_x + B_x = -1.2 \qquad C_y = A_y + B_y = 2.60$$

and

$$C = \sqrt{C_x^2 + C_y^2} = 2.9$$

3. Convert 2.9×10^{-4} m^3 to units of cm^3.

$$(2.9 \times 10^{-4}\ \text{m}^3) = (2.9 \times 10^{-4}\ \text{m}^3)\left(\frac{100\ \text{cm}}{1\ \text{m}}\right)^3 = 2.9 \times 10^2\ \text{cm}^3$$

You must show all your work and include the right units with your answers!

$$A_x = A\cos\theta \qquad A_y = A\sin\theta \qquad A = \sqrt{A_x^2 + A_y^2} \qquad \tan\theta = A_y/A_x$$

$$v_x = v_{ix} + a_x t \qquad x = x_i + v_{ix}\Delta t + \tfrac{1}{2}a_x(\Delta t)^2 \qquad v_x^2 = v_{ix}^2 + 2a_x\Delta x \qquad x - x_i = \tfrac{1}{2}(v_{ix} + v_x)\Delta t$$

$$g = 9.80\tfrac{\text{m}}{\text{s}^2} \qquad a = g\sin\theta \qquad \mathbf{F}_{\text{net}} = m\mathbf{a}$$