**Your Name: _____**

**PHY203**
**Exam #1**
**Chapters 1-3**
**Thursday, 9/29/05**

# Solutions

1. Write 200 femtometers in correct SI units:
a. $2x10^{-9}$ m
b. $2x10^{-11}$ m
**c. $2x10^{-13}$ m** $200x10^{-15}$ m = $2x10^{-13}$ m
d. $2x10^{-15}$ m
e. $2x10^{-17}$ m

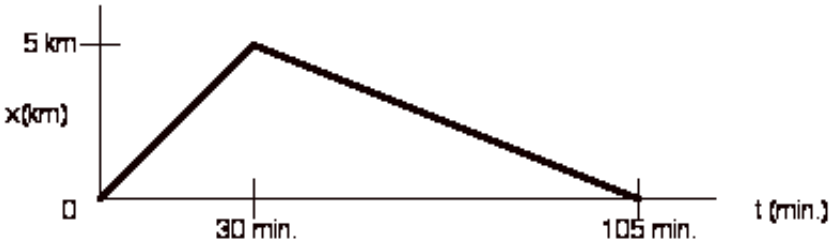
2. Convert a speed of 55 miles/hr to m/s:
a. 1.47 m/s
b. 9.5 m/s
**c. 24.6 m/s** 55 miles/hr x 1.609 km/mile x 1000 m/km /3600 sec/hr.
d. 570 m/s = 24.6 m/s
e. 1476 m/s

3. Write 0.013 gigakilograms in correct SI units:
a. $1.3x10^{6}$ kg
**b. $1.3x10^{7}$ kg** $.013x10^{9}$ kg = $1.3x10^{7}$ kg
c. $1.3x10^{9}$ kg
d. $1.3x10^{10}$ kg
e. $1.3x10^{11}$ kg

4. A football field is 100 yards long. How many centimeters is that?
a. 91,440 cm
**b. 9144 cm** 100 yards /1.0936 m/yd x 100 cm/m = 9144 cm
c. 91.4 cm
d. 10,936 cm
e. 109,360 cm

5. Convert an acceleration of 4500 $km/hr^2$ to $m/s^2$:
a. 0.015 $m/s^2$
**b. 0.35 $m/s^2$** 4500 $km/hr^2$ x 1000 m/km /$(3600\ s/hr)^2$ = 0..35 $m/s^2$
c. 1250 $m/s^2$
d. $5.8x10^{7}$ $m/s^2$

e. $3.47 \times 10^{-7}$ m/s$^2$




**For questions 6-8:**
A person's path is plotted above.

6. Find the total displacement:
a. -10,000 m
b. -5000 m
**c. 0 m** $\Delta x = x_2 - x_1 = 0\text{ m} - 0\text{ m} = 0\text{ m}$
d. 5000 m
e. 10,000 m

7. Find the total average speed:
a. 0 m/s
b. 0.8 m/s
c. 0.265 m/s
**d. 1.6 m/s** average speed = distance/time = 10,000 m/ 105 min
e. 95.2 m/s = 1.6 m/s

8. Find the total average velocity:
**a. 0 m/s** $\Delta v = (x_2 - x_1)/\Delta t = 0\text{ m} / 105\text{ min} = 0\text{ m/s}$
b. 0.8 m/s
c. 0.265 m/s
d. 1.6 m/s
e. 95.2 m/s

**For questions 9 and 10:**

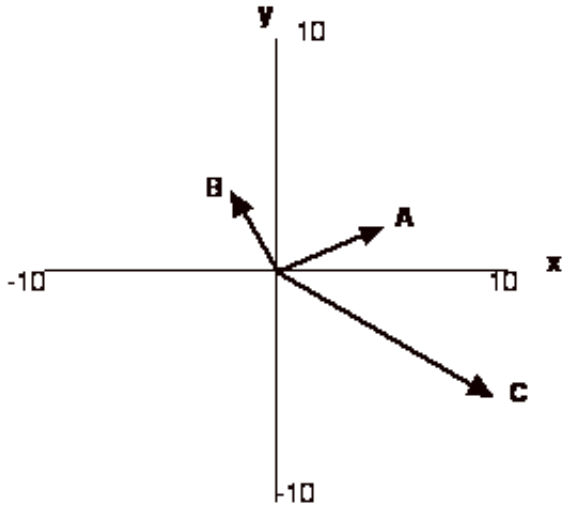
At t = 0, the speed of an object starting from the origin is 50 m/s at an angle of $30^o$ with respect to the x-axis. At t=3 sec., the particle is at x= 3m and y= -6m with a speed of 45 m/s at an angle of $45^o$ with respect to the x-axis.

9. Find the average velocity over the time interval:
a. 47.5 m/s
b. 31.7 m/s
**c. 1 m/s i –2 m/s j** $\mathbf{\Delta v} = (\mathbf{x_2} - \mathbf{x_1})/\Delta t = ((3\text{ m }\mathbf{i} - 6\text{ m }\mathbf{j}) - 0)/ 3\text{ s}$
d. -1 m/s **i** +2 m/s **j** $= 1\text{ m/s }\mathbf{i} - 2\text{ m/s }\mathbf{j}$
e. 9 m/s **i** –18 m/s **j**

10. Find the average acceleration over the time interval:
a. 47.5 m/s$^2$
b. -4.8 m/s$^2$ **i** +2.3 m/s$^2$ **j**
**c. -3.8 m/s$^2$ i +2.3 m/s$^2$ j** $\mathbf{\Delta a} = (\mathbf{v_2} - \mathbf{v_1})/\Delta t = ((3\text{ m }\mathbf{i} - 6\text{ m }\mathbf{j}) - 0)/ 3\text{ s}$
d. -4.8 m/s$^2$ **i** +3.3 m/s$^2$ **j** = ((31.8 m/s **i** –31.8 m/s **j**)-(43.3 m/s **i** –25 m/s **j**))/ 3 s

e. $-3.8\ m/s^2\ \mathbf{i} + 3.3\ m/s^2\ \mathbf{j}$ **=** $-3.8\ m/s^2\ \mathbf{i} + 2.3\ m/s^2\ \mathbf{j}$

**Your Name:** _____




11. Let **A** = 5**i** + 3**j**, **B** = -2**i** + 4**j**, **C** = **A** – 2**B**

a. Sketch and clearly label the vectors **A** and **B** on the above graph.

b. For the vector **A**, find the magnitude of the vector and the angle the vector makes with respect to the x-axis.

$A = (5^2 + 3^2)^{1/2} = 5.8$

$q = \tan^{-1}(3/5) = 31^o$

c. For the vector **B**, find the magnitude of the vector and the angle the vector makes with respect to the x-axis.

$B = ((-2)^2 + 4^2)^{1/2} = 4.47$

$q = 180^o \tan^{-1}(4/2) = 117^o$

d. Write the vector, **C**, in vector notation.

**C** = 5**i** + 3**j** + 2(-2**i** + 4**j**) **=** = 9**i** - 5**j**

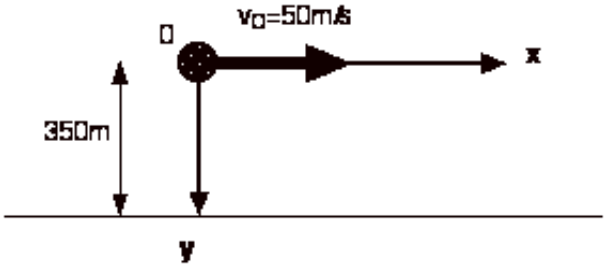
e. For the vector **C**, find the magnitude of the vector and the angle the vector makes with respect to the x-axis.

$C = (9^2 + (-5)^2)^{1/2} = 10.3$

$q = -\tan^{-1}(5/9) = -29^o$ or $331^o$

f. Sketch and clearly label the vector **C** on the above graph.

**Your Name:** _____




12. A projectile is shot in a horizontal direction from a height of 350m and initial speed of 50m/s, as shown above. (Note: Use 9.81 m/s2 for the magnitude of g, the acceleration due to gravity.)

a. Write the initial velocity vector, $\mathbf{v_O}$, in vector notation.

$\mathbf{v_O}$ = 50 m/s **i**

b. Calculate the time in sec. that it will take for the projectile to hit the ground.

$350\ m = 0 + 0 + 1/2(9.81\ m/s^2)t^2$

$t = 8.45\ s$

c. Calculate the x position at which the projectile will hit the ground (the "range").

$x = 0 + 50\ m/s\ (8.45\ s) = 422\ m$

d. Calculate the final velocity in the x-direction of the projectile just before it hits the ground (magnitude and direction-use coordinate system above).

$v_x = v_{xO} = +50\ m/s$

e. Calculate the final velocity in the y-direction of the projectile just before it hits the ground (magnitude and direction- use coordinate system above).

$v_y = 0 + (9.81\ m/s^2)(8.45\ s) = +82.9\ m/s$

f. Write the final velocity, $\mathbf{v_f}$, of the projectile just before it hits the ground in vector form and calculate the final speed.

**v** = 50 m/s **i** + 82.9 m/s **j**

$v = (50^2 + 82.9^2)^{1/2} = 96.8\ m/s$