**Your Name:** ______________________ **PHY203 Final Exam 5/5/08**

# Part 1

# Solutions

1. 1 acre is 43560 square feet in area. How many square kilometers is that?

**a.** **$4.05x10^{-3}$ $km^2$** 43560 $ft^2$ x (1 m/ 3.281 ft)$^2$ x (1 km/ 1000m)$^2$ = $4.05x10^{-3}$ $km^2$
b. 0.47 $km^2$
c. 1.54 $km^2$
d. 4.05 $km^2$
e. None of the above

2. 1 gallon is 3.785 liters in volume. How many cubic meters is that?

a. $2.64x10^{-4}$ $m^{-3}$ 3.785 liters x (1 $m^3$/1000L) = $3.785x10^{-3}$ $m^{-3}$
**b.** **$3.785x10^{-3}$ $m^{-3}$**
c. $2.64x10^2$ $m^{-3}$
d. $3.785x10^3$ $m^{-3}$
e. None of the above

3. How many meters is 56 nanomm in correct scientific notation?

a. $5.6x10^{-13}$ m 56 nanomm x $10^{-9}$ x (1m/1000 mm) = $5.6x10^{-11}$ m
**b.** **$5.6x10^{-11}$ m**
c. $5.6x10^{-10}$ m
d. $5.6x10^{-8}$ m
e. None of the above

4. Consider two cars approaching an intersection from different directions. One car, traveling East, starts from rest a distance, d, from the intersection with an acceleration of 2.5 m/s$^2$. The other car, traveling North at a constant speed of 12 m/s, is at the same distance, d, from the intersection when the first car starts. Assuming the cars arrive at the intersection at the same time (and crash), find the time of the crash (with t=0 the time the time the first car starts moving):

a. 2.4s $x_1 = 1/2(2.5)(t)^2$ ; $x_2 = 12t$
b. 3.1s $x_1 = x_2$ :$12t = 0.5(2.5)(t)^2$
c. 4.8s $12 = 1.25t$; t=9.6s
**d.** **9.6s**
e. None of the above

5. Let **A** = -5**i** + 9**j**, **B** = 3**i** - 10**j**, **C** = -2**A** + 4**B**

Write the vector, **C**, in vector notation:

a. -22**i** - 58**j** **C** = -2(-5**i** + 9**j**) + 4(3**i** - 10**j**) **=** = 22**i** - 58**j**
b. 2**i** - 58**j**
**c.** **22i - 58j**
d. 22**i** - 22**j**
e. None of the above

6. For the above graph, find the instantaneous velocity at position B.:
**a. 0 m/s** $v_{int}$ = slope = 0
b. 1.25 m/s
c. 2.5 m/s
d. 5.0 m/s
e. None of the above

7. For the above graph, find the average velocity from A to C.:
a. -5.0 m/s $v_{iavg}$ = Dx/Dt = (-10 – (-10))/(8s) = 0
b. -2.5 m/s
c. 2.5 m/s
d. 5.0 m/s
**e. None of the above (0)**

8. For the above graph, find the average speed from A to C.:
a. -5.0 m/s $speed_{iavg}$ = Ds/Dt = (20m + 20m))/(8s) = 5.0 m/s
b. -2.5 m/s
c. 2.5 m/s
**d. 5.0 m/s**
e. None of the above

9. At t = 0, an object starts at rest from x=5m and y=5m. At t=10 sec., the particle is at x= -25m and y= 15m with a speed of 25 m/s at an angle of $30^{o}$ with respect to the x-axis. Find the average acceleration over the time interval:
a. 2.5 m/s$^2$ **D$\mathbf{a_{avg}}$** =($\mathbf{v_2}$ – $\mathbf{v_1}$ )/ Dt =((25 m/s cos($30^o$)**i** + 25m/s sin($30^o$)**j**)-(0))/10s
b. 5.0 m/s$^2$ =((21.7m/s**i** + 12.5m/s**j**)/10s
**c. 2.17 m/s$^2$ i +1.25 m/s$^2$ j** **=**2.17 m/s$^2$ **i** +1.25 m/s$^2$ **j**
d. 1.25 m/s$^2$ **i** +2.17 m/s$^2$ **j**
e. None of the above

10. Consider balls being dropped or thrown off a cliff on Planet 203X whose gravity is such that **g = 10 m/s$^2$** exactly:
A lead ball is dropped off a cliff. 1 second later an identical lead ball is thrown straight <u>down</u> from the same cliff with an initial speed of 15 m/s. If the two balls hit the ground at the base of the cliff at the same time, find the height of the cliff
a. 15m $x_1 = 1/2(10)(t)^2$ ; $x_2 = 15(t-1) + 1/2(10)(t-1)^2$
**b. 20m** $x_1 = x_2$ ; $1/2(10)(t)^2 = 15(t-1) + 1/2(10)(t-1)^2$
c. 30m $5(t)^2 = 15(t-1) + 5(t-1)^2$**;**$(t)^2 = 3(t-1) + (t^2) - 2t + 1$
d. 45m $0 = 3t - 3 - 2t + 1$; $0 = t - 2$; $t = 2.0s$
e. None of the above $H=1/2(10)(2)^2 = 20m$

11. A missile is shot from a cliff with height 500m and initial speed of 60m/s and an angle of $75^{O}$, as shown below.

a. Write the initial velocity vector, $\mathbf{v_i}$, in vector notation, using the coordinate system above.

$\mathbf{v_o}$ = 60 m/s(cos75$^o$ **i** + sin75$^o$ m/s **j**) = 15.5 m/s **i** + 58.0 m/s **j**

b. Calculate the time in sec. that it will take for the missile to reach its highest point.

0 = (58 m/s)– (9.81 m/s$^2$ ) (t)
t = 5.9s

c. Calculate the y distance above the cliff at which the missile reaches its highest point

0 = (58 m/s)$^2$– 2(9.81 m/s$^2$ ) (H)
H = 171m

d. Calculate the time in sec. that it will take for the missile to hit the ground.

0 = 250m + 58 m/s t + 1/2(-9.81 m/s$^2$ )t$^2$
solve quadratic eq.
t = 15.2s

e. Calculate the x position at which the missile will hit the ground.

D = (15.5 m/s)(15.2s) = 235m