

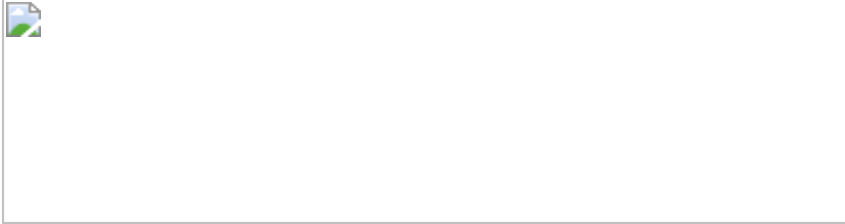
Your Name: _____

PHY203
Final Exam
5/5/08

Part 1

Solutions

- 1 acre is 43560 square feet in area. How many square kilometers is that?
 - $4.05 \times 10^{-3} \text{ km}^2$** $43560 \text{ ft}^2 \times (1 \text{ m} / 3.281 \text{ ft})^2 \times (1 \text{ km} / 1000 \text{ m})^2 = 4.05 \times 10^{-3} \text{ km}^2$
 - 0.47 km^2
 - 1.54 km^2
 - 4.05 km^2
 - None of the above
- 1 gallon is 3.785 liters in volume. How many cubic meters is that?
 - $2.64 \times 10^{-4} \text{ m}^{-3}$ $3.785 \text{ liters} \times (1 \text{ m}^3 / 1000 \text{ L}) = 3.785 \times 10^{-3} \text{ m}^{-3}$
 - $3.785 \times 10^{-3} \text{ m}^{-3}$**
 - $2.64 \times 10^2 \text{ m}^{-3}$
 - $3.785 \times 10^3 \text{ m}^{-3}$
 - None of the above
- How many meters is 56 nanommm in correct scientific notation?
 - $5.6 \times 10^{-13} \text{ m}$ $56 \text{ nanommm} \times 10^{-9} \times (1 \text{ m} / 1000 \text{ mm}) = 5.6 \times 10^{-11} \text{ m}$
 - $5.6 \times 10^{-11} \text{ m}$**
 - $5.6 \times 10^{-10} \text{ m}$
 - $5.6 \times 10^{-8} \text{ m}$
 - None of the above
- 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):
 - 2.4 s $x_1 = 1/2(2.5)(t)^2$; $x_2 = 12t$
 - 3.1 s $x_1 = x_2 : 12t = 0.5(2.5)(t)^2$
 - 4.8 s $12 = 1.25t$; $t=9.6 \text{ s}$
 - 9.6 s**
 - None of the above
- Let $\mathbf{A} = -5\mathbf{i} + 9\mathbf{j}$, $\mathbf{B} = 3\mathbf{i} - 10\mathbf{j}$, $\mathbf{C} = -2\mathbf{A} + 4\mathbf{B}$
Write the vector, \mathbf{C} , in vector notation:
 - $-22\mathbf{i} - 58\mathbf{j}$ $\mathbf{C} = -2(-5\mathbf{i} + 9\mathbf{j}) + 4(3\mathbf{i} - 10\mathbf{j}) = 22\mathbf{i} - 58\mathbf{j}$
 - $2\mathbf{i} - 58\mathbf{j}$
 - $22\mathbf{i} - 58\mathbf{j}$**
 - $22\mathbf{i} - 22\mathbf{j}$
 - None of the above



6. For the above graph, find the instantaneous velocity at position B.:

- a. **0 m/s** $v_{\text{int}} = \text{slope} = 0$
 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 $v_{\text{avg}} = \Delta x / \Delta t = (-10 - (-10)) / (8\text{s}) = 0$
 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 $\text{speed}_{\text{avg}} = \Delta s / \Delta t = (20\text{m} + 20\text{m}) / (8\text{s}) = 5.0 \text{ m/s}$
 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 $x=5\text{m}$ and $y=5\text{m}$. At $t=10 \text{ sec.}$, the particle is at $x= -25\text{m}$ and $y= 15\text{m}$ with a speed of 25 m/s at an angle of 30° with respect to the x -axis. Find the average acceleration over the time interval:

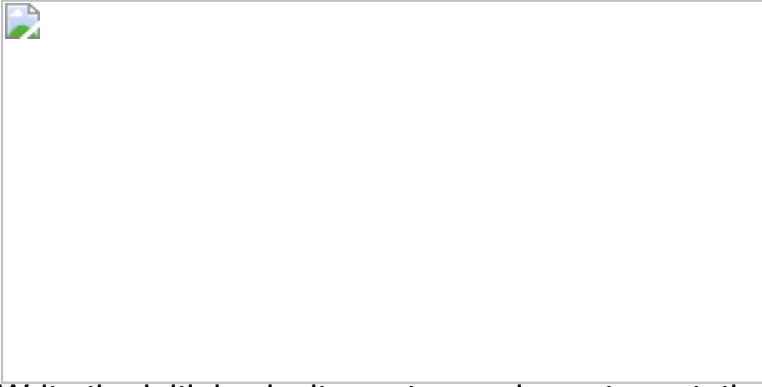
- a. 2.5 m/s^2 $\mathbf{D}\mathbf{a}_{\text{avg}} = (\mathbf{v}_2 - \mathbf{v}_1) / \Delta t = ((25 \text{ m/s} \cos(30^\circ)\mathbf{i} + 25\text{m/s} \sin(30^\circ)\mathbf{j}) - (0)) / 10\text{s}$
 b. 5.0 m/s^2 $= ((21.7\text{m/s}\mathbf{i} + 12.5\text{m/s}\mathbf{j}) / 10\text{s})$
 c. **$2.17 \text{ m/s}^2 \mathbf{i} + 1.25 \text{ m/s}^2 \mathbf{j}$** $= 2.17 \text{ m/s}^2 \mathbf{i} + 1.25 \text{ m/s}^2 \mathbf{j}$
 d. $1.25 \text{ m/s}^2 \mathbf{i} + 2.17 \text{ m/s}^2 \mathbf{j}$
 e. None of the above

10. Consider balls being dropped or thrown off a cliff on Planet 203X whose gravity is such that $\mathbf{g} = 10 \text{ m/s}^2$ exactly:

A lead ball is dropped off a cliff. 1 second later an identical lead ball is thrown straight down 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 $0 = 3t - 3 - 2t + 1$; $0 = t - 2$; $t = 2.0\text{s}$
 e. None of the above $H = 1/2(10)(2)^2 = 20\text{m}$

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



- a. Write the initial velocity vector, \mathbf{v}_i , in vector notation, using the coordinate system above.

$$\mathbf{v}_0 = 60 \text{ m/s}(\cos 75^\circ \mathbf{i} + \sin 75^\circ \mathbf{j}) = 15.5 \text{ m/s } \mathbf{i} + 58.0 \text{ m/s } \mathbf{j}$$

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

$$0 = (58 \text{ m/s}) - (9.81 \text{ m/s}^2)(t)$$

$$t = 5.9 \text{ s}$$

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

$$0 = (58 \text{ m/s})^2 - 2(9.81 \text{ m/s}^2)(H)$$

$$H = 171 \text{ m}$$

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

$$0 = 250 \text{ m} + 58 \text{ m/s } t + \frac{1}{2}(-9.81 \text{ m/s}^2)t^2$$

solve quadratic eq.

$$t = 15.2 \text{ s}$$

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

$$D = (15.5 \text{ m/s})(15.2 \text{ s}) = 235 \text{ m}$$