Your Name: _____ **PHY203**

Exam #1
Chapters 1-3
Fri., 2/18/11

Solutions

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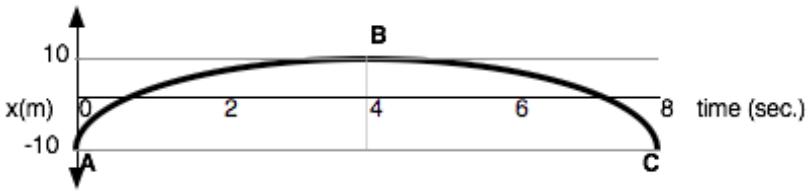


1. For the above graph, find the instantaneous velocity at position B.:

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

2. 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)

3. 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

4. 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. 3.47x10^{-7} m/s^2

5. A car is traveling a constant speed of 25 m/s starting at x = 0 and t = 0. Find the final position at t = 30 s.

a. 0.075 km x = (25 m/s)(30 s)
b. 0.15 km
c. 0.75 km
d. 1.5 km

e. 7.5 km

6. A car accelerates from rest at x = 0 and t = 0 with a constant acceleration of 1.5 m/s^2. Find the final position at t = 30 s.

a. 0.00225 km x = 1/2(1.5 m/s^2)(30 s)^2
b. 0.0675 km
c. 0.675 km
d. 1.35 km
e. 6.75 km

7. A car passes a point at x = 0 and t = 0 with an initial speed of 25 m/s and an acceleration of 1.5 m/s^2. Find the final position at t = 30 s.

a. 0.772 km x = (25 m/s)(30 s) + 1/2(1.5 m/s^2)(30 s)^2
b. 1.425 km
c. 2.1 km
d. 7.72 km
e. 14.25 km

8. A car passes a point at x =0 and t = 0 with an initial speed of 25 m/s and a negative acceleration of -1.5 m/s^2. Find the final position at t = 30 s.

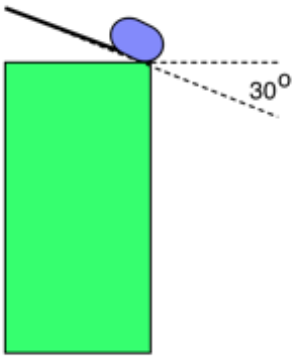
a. -1.425 km x = (25 m/s)(30 s) + 1/2(-1.5 m/s^2)(30 s)^2
b. -0.075 km
c. +0.075 km
d. +0.75 km
e. +1.425 km

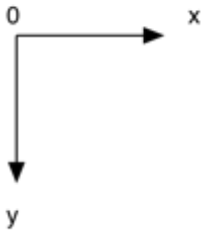
9. Find the magnitude of the vector **B** = 5**i** - 6**j** and the angle that vector **B** makes with the positive x-axis (measured in a counterclockwise direction from the positive x-axis):

a. 3.3, 310^o B = ((5)^2 + (-6)^2)$^{1/2}$ = 7.8
b. 3.3, 320^o
c. 7.8, 310^o q = 360^o - tan^{-1}(6/5) = 309.8^o
d. 7.8, 320^o
e. None of the above

10. 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





11. A block of ice slides down a roof and falls off a building. Just as it leaves the roof, its speed is 8.0 m/s

making an angle of 30^o below the horizontal. After leaving the roof, it takes 1.5 s to reach the ground. (Use g = 9.81 m/s^2.) **Show your work**.

a. Find the initial x and y components of the velocity of the block of ice using the coordinate system given in the figure *and* write the initial velocity, $\mathbf{v}_i$, in vector form.

$$\mathbf{v_i} = 8 \text{ m/s}(\cos 30^o\, \mathbf{i} + \sin 30^o \text{ m/s } \mathbf{j}) = 6.9 \text{ m/s } \mathbf{i} + 4.0 \text{ m/s } \mathbf{j}$$

b. Find how far from the building the block hits the ground.

x = (6.9 m/s)(1.5 s) = 10.4 m

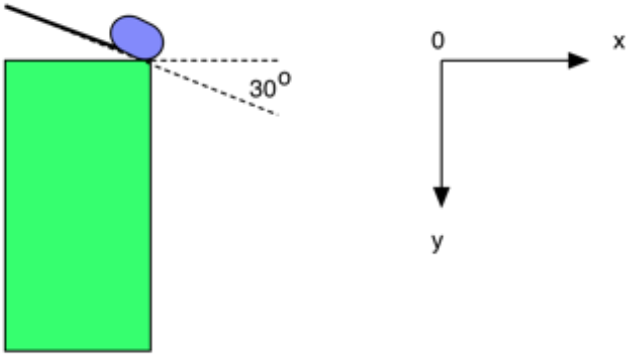
c. Find the height of the building.

$$H = y = 0 + 4.0 \text{ m/s}(1.5 \text{ s}) + 1/2(9.81 \text{m/s}^2)(1.5 \text{ s})^2$$
$$= 17 \text{ m}$$

d. Find the x and y components of the velocity of the block of ice just before it hits the ground using the coordinate system given in the figure *and* write the velocity, **v**, in vector form.

$$v_x = 6.9 \text{ m/s no change; } v_y = (4.0 \text{ m/s}) + (9.81 \text{m/s}^2)(1.5 \text{ s}) = 18.7 \text{ m/s}$$

$$\mathbf{v} = 6.9 \text{ m/s } \mathbf{i} + 18.7 \text{ m/s } \mathbf{j}$$



11. A block of ice slides down a roof and falls off a building. Just as it leaves the roof, its speed is 12.0 m/s making an angle of 30^o below the horizontal. After leaving the roof, it takes 1.5 s to reach the ground. (Use g = 9.81 m/s^2.) **Show your work**.

a. Find the initial x and y components of the velocity of the block of ice using the coordinate system given in the figure *and* write the initial velocity, $\mathbf{v}_i$, in vector form.

$$\mathbf{v_i} = 12 \text{ m/s}(\cos 30^o\, \mathbf{i} + \sin 30^o \text{ m/s } \mathbf{j}) = 10.4 \text{ m/s } \mathbf{i} + 6.0 \text{ m/s } \mathbf{j}$$

b. Find how far from the building the block hits the ground.

x = (10.4 m/s)(1.5 s) = 15.6 m

c. Find the height of the building.

$H = y = 0 + 6.0\ m/s(1.5\ s) + 1/2(9.81 m/s^2)(1.5\ s)^2$
$= 20\ m$

d. Find the x and y components of the velocity of the block of ice just before it hits the ground using the coordinate system given in the figure *and* write the velocity, **v**, in vector form.

$v_x = 10.4\ m/s$ no change; $v_y = (6.0\ m/s) + (9.81 m/s^2)(1.5\ s) = 20.7\ m/s$

$\mathbf{v} = 10.4\ m/s\ \mathbf{i} + 20.7\ m/s\ \mathbf{j}$