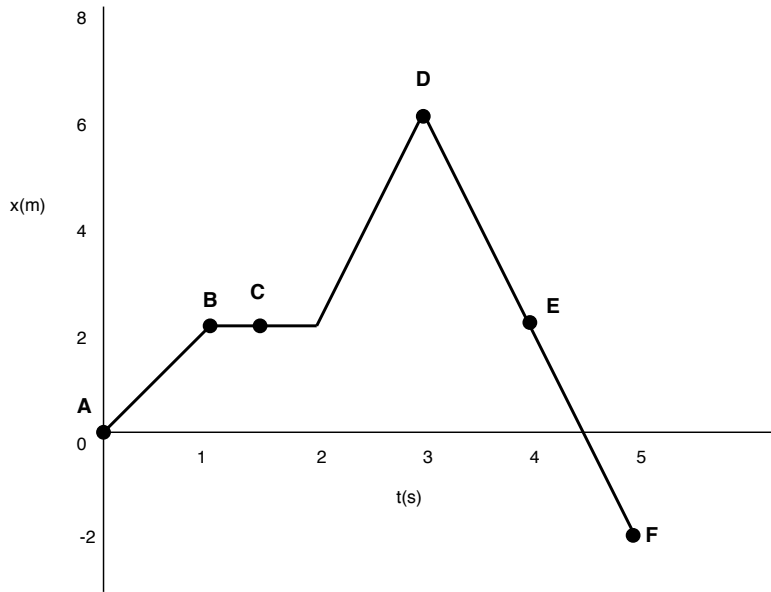


Your Name: \_\_\_\_\_

**PHY203**  
**Exam #1**  
**Chapters 1-3**  
**Mon., 2/18/13**

# Solutions



1. The plot above depicts the position vs. time for the one dimensional motion of a toy car:

a. Find the average velocity (magnitude and sign) from point B to point F.

$$v_{iavg} = \Delta x / \Delta t = (-2\text{m} - 2\text{m}) / (4\text{s}) = -1 \text{ m/s} \quad \mathbf{5}$$

b. Find the average speed (magnitude and sign) from point A to point E.

$$\text{speed}_{iavg} = \Delta s / \Delta t = (2\text{m} + 4\text{m} + 4\text{m}) / (4\text{s}) = 2.5 \text{ m/s} \quad \mathbf{5}$$

c. Find the instantaneous velocity (magnitude and sign) at point C.

$$v_{int} = \text{slope} = 0 \quad \mathbf{5}$$

d. Find the instantaneous velocity (magnitude and sign) at point E.

$$v_{int} = \text{slope} = (-8\text{m}) / 2\text{s} = -4 \text{ m/s} \quad \mathbf{5}$$

2. A car accelerates from rest to 60.0 miles per hour in 30.0 seconds.

a. Find the speed after 30.0 s in m/s.

$$(60 \text{ mph})\left(0.447 \frac{\text{m/s}}{\text{mph}}\right) = 26.8 \text{ m/s} \quad \mathbf{5}$$

b. Assuming constant acceleration, you want to find the acceleration over the 30.0 second interval. Which of the three kinematic equations is the best choice (A,B, or C)? Briefly explain why (Hint: consider what you know about the initial and final parameters.)

**B:** We know  $v$ ,  $v_0$ , and  $t$ ; want to find  $a$ . **5**

c. Use the equation you chose in part b. to find the acceleration over the 30.0 second interval.

$$\begin{aligned} 26.8 \text{ m/s} &= 0 + a(30.0 \text{ s}) \\ a &= 26.8/30 = 0.894 \text{ m/s}^2 \end{aligned} \quad \mathbf{5}$$



3. A ball is thrown straight up in the air at an initial speed of  $v_0=20.0$  m/s. (Ignore air resistance.)

a. At the highest point the ball reaches, find the acceleration of the ball (magnitude and sign) using the coordinate system given above.

-9.81 m/s<sup>2</sup>

**5**

b. At the highest point the ball reaches, find the velocity of the ball (magnitude and sign) using the coordinate system given above.

0

**5**

c. To find the height of the ball at its highest point, which of the kinematic equations will work best? (Pick A,B, or C.) Briefly explain why.

**C:** We know  $v$ ,  $v_0$ , and  $a$ ; want to find  $H$ .

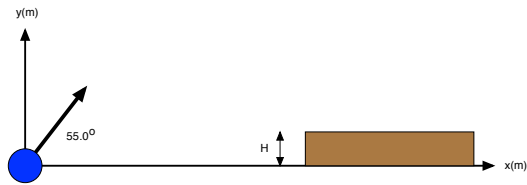
**5**

d. Use that equation to find the height of the ball at its highest point.

$$0 = (20.0 \text{ m/s})^2 + 2(-9.81 \text{ m/s}^2)(\Delta x)$$

$$\Delta x = H = 20.4 \text{ m}$$

**10**



4. A ball is thrown into the air at an initial speed of 20.0 m/s and an angle of  $55.0^\circ$  with respect to the horizontal direction and lands on a ledge with a height of  $H=5.00$  m. (Ignore air resistance.)

- a. Sketch the path of the ball on the figure above. **5**  
 b. Find the x- and y-components of the initial velocity of the ball.

$$v_{x0} = (20.0 \text{ m/s})(\cos 55^\circ) = 11.5 \text{ m/s} \quad \mathbf{5}$$

$$v_{y0} = (20.0 \text{ m/s})(\sin 55^\circ) = 16.4 \text{ m/s} \quad \mathbf{5}$$

b. At the highest point the ball reaches, find the acceleration of the ball and express it in vector notation using the above coordinate system:

$$\mathbf{a} = ( 0 \mathbf{i} + -9.81 \mathbf{j} ) \text{ m/s}^2 \quad \mathbf{5}$$

c. At the highest point the ball reaches, find the velocity of the ball and express it in vector notation using the above coordinate system. (Hint: consider both x- and y-directions):

$$\mathbf{v} = ( 11.5 \mathbf{i} + 0 \mathbf{j} ) \text{ m/s} \quad \mathbf{5}$$

d. Find the time it takes the ball to reach its highest point.

Use kinematic eq. B:

$$0 = 16.4 \text{ m/s} + (-9.81 \text{ m/s}^2)(t) \quad \mathbf{5}$$

$$t = 1.67 \text{ s}$$

e. Find the time it takes the ball to hit the ledge.

Use kinematic eq. A: **10**

$$5.00 \text{ m} = 0 + (16.4 \text{ m/s})t + 1/2(-9.81 \text{ m/s}^2)t^2$$

Solve quadratic eq.; longer time is correct:  
 $t = 3.00 \text{ s}$