Physics 123 Fall 2006 Common Hour Exam 1 (60 min.)

1. The diagram below shows 3 vectors which sum to zero, all of equal length. Which statement below is true?

   $2\mathbf{A} + 2\mathbf{B} = 2\mathbf{C}$
   $\mathbf{A} + \mathbf{B} = \mathbf{B} - \mathbf{C}$
   $\mathbf{A} - \mathbf{B} = 2\mathbf{A} - \mathbf{C}$
   $\mathbf{A} - \mathbf{B} = 2\mathbf{A} + \mathbf{C}$
   $\mathbf{A} + \mathbf{B} = \mathbf{A} - \mathbf{C}$

2. Which of the following quantities has the same dimensions as kinetic energy, $\frac{1}{2}mv^2$? Note: [a]=[g]=LT^{-2}; [h]=**L** and [v]=LT^{-1}

   mgh
   mvt
   ma
   mvx
   mgt

3. One mole of the carbon-12 isotope contains 6.022×10^{23} atoms. What volume in m^3 would be needed to store one mole of cube-shaped children's blocks 2.00 cm long on each side?

   4.8×10^{24}
   6.0×10^{23}
   1.2×10^{24}
   4.8×10^{18}
   1.2×10^{22}

4. Given that $\mathbf{A} + 2\mathbf{B} = x_1\hat{i} + y_1\hat{j}$ and $2\mathbf{A} - \mathbf{B} = x_2\hat{i} + y_2\hat{j}$, what is **A**?

   $\mathbf{A} = \frac{1}{5}(x_1 + 2x_2)\hat{i} + \frac{1}{5}(y_1 + 2y_2)\hat{j}$
   $\mathbf{A} = \frac{1}{5}(x_1 + 4x_2)\hat{i} + \frac{1}{5}(y_1 + 2y_2)\hat{j}$
   $\mathbf{A} = \frac{1}{5}(x_1 + 4x_2)\hat{i} + \frac{1}{5}(y_1 + 4y_2)\hat{j}$
   $\mathbf{A} = \frac{1}{5}(x_1 + 4x_2)\hat{i} + \frac{1}{5}(y_1 - 4y_2)\hat{j}$
   $\mathbf{A} = \frac{1}{5}(x_1 - 2x_2)\hat{i} + \frac{1}{5}(y_1 - 2y_2)\hat{j}$

5. A rocket, initially at rest, is fired vertically with an upward acceleration of 10 m/s^2. At an altitude of 0.50 km, the engine of the rocket cuts off. What is the maximum altitude it achieves?

   1.6 km
   1.0 km
   1.9 km
   2.1 km
   1.3 km

6. Two children start at one end of a street, the origin, run to the other end, then head back. On the way back Joan is ahead of Mike. Which statement is correct about the distances run and the displacements from the origin?

   Mike has run a greater distance, but his displacement is less than Joan's.
   Mike has run a greater distance and his displacement is greater than Joan's.
   Joan has run a greater distance, but her displacement is less than Mike's.
   Mike has run a shorter distance, and his displacement is less than Joan's.
   Joan has run a greater distance and her displacement is greater than Mike's.

7. An automobile manufacturer claims that its product will, starting from rest, travel 0.40 km in 9.0 s. What is the magnitude of the constant acceleration required to do this?

   9.9 m/s^2
   8.9 m/s^2
   6.6 m/s^2
   5.6 m/s^2
   4.6 m/s^2

8. A particle starts from the origin at t = 0 with a velocity of (16 $\hat{i}$ - 12 $\hat{j}$) m/s and moves in the xy plane with a constant acceleration of $\mathbf{a}$ = (3.0 $\hat{i}$ - 6.0 $\hat{j}$) m/s^2. What is the speed of the particle at t = 2.0 s?

   33 m/s
   39 m/s
   43 m/s
   46 m/s
   52 m/s

9. An airplane flies horizontally with a speed of 300 m/s at an altitude of 400 m. Assume that the ground is level. At what horizontal distance from a target must the pilot release a bomb so as to hit the target?

   1.7 km
   2.4 km
   2.7 km
   3.3 km
   3.0 km

10. A carnival Ferris wheel has a 15-m radius and completes five turns about its horizontal axis every minute. What is the acceleration of a passenger at his lowest point during the ride?

19 m/s^2 downward
14 m/s^2 downward
5.7 m/s^2 upward
4.1 m/s^2 downward
4.1 m/s^2 upward

Some possibly useful information:
$g = 9.80\ m/s^2$
1 mile = 1.609 km