PHYSICS 141
Summer 2007
Quiz 1

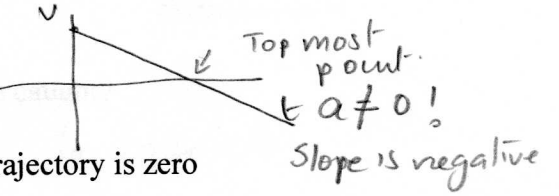
Name: Solution

The multiple choice questions are 2 points each. The problem is worth 10 points.

1. What can be said about the acceleration and velocity of the object?

   a) If the velocity is zero at some instant of time then the acceleration has to be zero at that instant of time
   b) If acceleration and velocity point in the same direction, then the object slows down
   c) If acceleration and velocity point in opposite directions, then the object speeds up.
   d) If acceleration and velocity point in the same direction, then the object speeds up.

2. An object is thrown upward from the top of a building. Which of the following is true? Assuming the regular x, and y axes,



   a) The object's speed decreases continuously.
   b) The object's velocity decreases continuously.
   c) The object's acceleration at the top most point of the trajectory is zero
   d) The distance time graph is a straight line.

3. Which of this is true?

a = Const.
x vs t → parabola
v vs t → st line
a vs t → horizontal line

   a) For a constant acceleration, the X vs t graph is a straight line.
   b) For a constant acceleration, the X vs t graph is a horizontal line.
   c) For a zero acceleration, the V vs t graph is a straight line with non zero slope.
   d) For a constant acceleration the acceleration vs t graph is a straight line of zero slope.

4. Which of this is true?

   a) Acceleration is the slope of the distance time graph
   b) Acceleration is the slope of the velocity time graph.
   c) Velocity is the slope of the acceleration time graph.
   d) Distance is the slope of the velocity time graph.

5. An object falls from rest from top of the building. Which of the following is true?

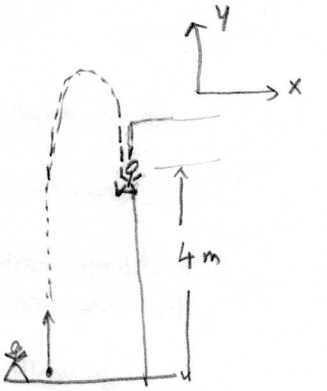
   a) The distance covered in each consecutive second decreases as the object falls down.
   b) The distance covered in each consecutive second increases as the object comes down.
   c) The distance covered in each consecutive second remains the same.

$$y_f = y_i + v_i t + \frac{1}{2} a_y t^2$$

$$= 0 + 0t + \frac{1}{2}(-9.8) t^2$$

distance increases as it is quadratic in time.

As student throws a set of keys vertically upward to her sorority sister, who is in a window 4 m above. The keys are caught 1.5 s later by the sister's outstretched hand. Write the complete equations you use while solving each part.



a) What was the initial velocity of the keys thrown?

Assume origin on the ground and axes shown.

$y_i = 0$ m $\quad y_f = 4$ m $\quad t = 1.5$ s.

Using $y_f = y_i + v_i(t) + \frac{1}{2} a_y t^2$

$4\text{m} = 0\text{m} + v_i(1.5\text{s}) + \frac{1}{2}(-9.8\text{m/s}^2)(1.5\text{s})^2$

$4 = 1.5 v_i - 11.02$

$v_i = \frac{15.025}{1.5} = 10.02$ m/s

b) What was the velocity of the keys just before they were caught?

We can use the equation $v_f = v_i + at$ to calculate the velocity.

$v_f = 10.02\text{m/s} + (-9.8\text{m/s}^2)(1.5\text{s})$

$= 10.02\text{m/s} - 14.7\text{ m/s}$

$= -4.68$ m/s

c) Were the keys caught on the way up or on the way down? Explain how you arrived at the answer.

The velocity of the keys is negative when caught. Since we have chosen +y axis as pointing up, the keys were on their way down when caught.

d) What was the maximum height reached by the object.

Method 1 $v_f^2 = v_i^2 + 2a(y_f - y_i)$

The velocity at max. ht is zero.

$0 = (10.02)^2 \frac{m^2}{s^2} + 2(-9.8)(y_f - 0)$

$y_f = 5.12$ m

Method 2 Find time taken to reach max ht.

$v_f = v_i + at$

$0 = 10.02 + (-9.8)t \Rightarrow t = 1.02$ sec

Find height using this time.

$y_f = y_i + v_i t + \frac{1}{2} a_y t^2 \Rightarrow y_f = 0 + (10.02)(1.02) + \frac{1}{2}(-9.8)(1.02)^2 = 5.12$ m

e) If the keys are not caught, then how long does it take for the keys to come down to the person throwing it?

Method 1 $y_f = 0$ when keys come down.

$y_f = y_i + v_i t + \frac{1}{2} a_y t^2$

$0 = 0 + 10.02\frac{m}{s} t + \frac{1}{2}(-9.8)t^2$

$t = \frac{2(10.02)}{9.8} = 2.04$ s.

Method 2 Time taken is twice the time taken to reach max. ht. $t = 2(1.02) = 2.04$ s.
found above.