Phys 1010 HW 2 (23.5 points)

Due Monday Evening 9/10 at Midnight

1.) (2 pts): HOMEWORK CORRECTION ESSAY: Each week you should review both your answers and the answer key for the previous week's homework. Occasionally you will get to correct an essay from a prior week. Select one problem for which you had the wrong answer. In the text box below, 1) identify the question number you are correcting, 2) state (copy) your original wrong answer, 3) explain where your original reasoning was incorrect, the correct reasoning for the problem, and how it leads to the right answer.

2.) (1.5 pt) Are the following objects accelerating (yes/no)?

a) A car driving in a straight line at a steady 100 mph

b) A ball that I have thrown vertically upwards from my hand, at the top of its trajectory

c) A ball that I have thrown vertically upwards. Consider only the instant after it leaves my hand

d) A car crashing into a tree

e) A ball in a circular track traveling at constant speed

f) A rocket ship after lift-off, where it is traveling in a straight line at constant speed

3.) (1pt) Explain in words your answer for Question 2b:

4.) (1pt) Explain in words your answer for Question 2e:

Questions 5-11: I toss a ball vertically in the air at t=0s. It goes up for 2s and then falls back down to my hand. Answer the following questions about the ball's motion. Set the upwards direction as positive, and be careful to get the signs right for accelerations, velocities and positions.

The following equations will prove useful:
$v = v_0 + at$, $x = x_0 + v_0t + 1/2at^2$ $g = 9.8 m/s^2$

In this problem, x will describe positions in the vertical direction.

5.) (1 pt) At t = 2s, what is the velocity of the ball?

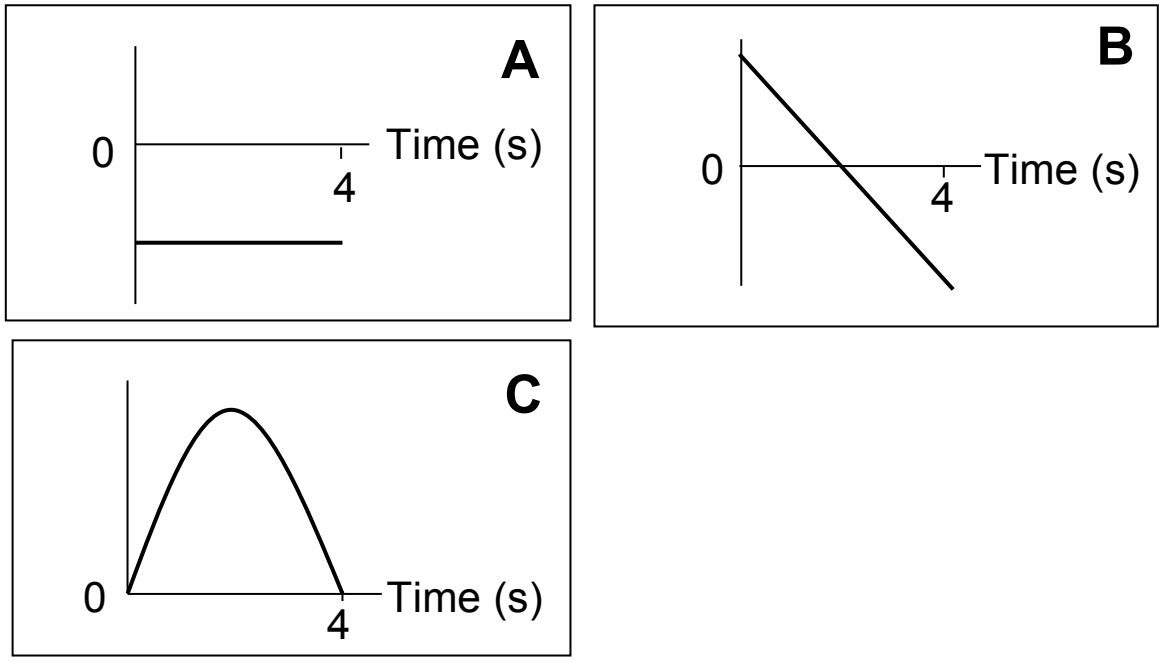
6.) (1 pt) At t = 2s, what is the acceleration of the ball? (Important: is the sign positive or negative?)

7.) (1 pt) What was the initial velocity of the ball when it left my hand?

8.) (1 pt) What is the maximum height that the ball reaches above my hand? (set $x_{0,}$ the height of my hand, to be at 0m)

9.) (1 pt) How long does it take to return to my hand from the peak?

10.) (1 pt) Match each of the following curves with the following labels:
Position vs. time
Velocity vs. time
Acceleration vs. time



11.) (2 pts) What is the velocity vs. time graph telling you – describe in words what is happening.

Questions 12-15: Stopping distance:
The Mars rover is moving along at a speed of 2 m/s (it knows how to motor!) in a straight line, and in its sights it spies a rock formation up ahead in its path, and it decides to stop precisely at the rock to investigate.

12.) (1 pt) How many of the following do you need (in addition to its velocity) to figure out whether it will stop in time at the right place:

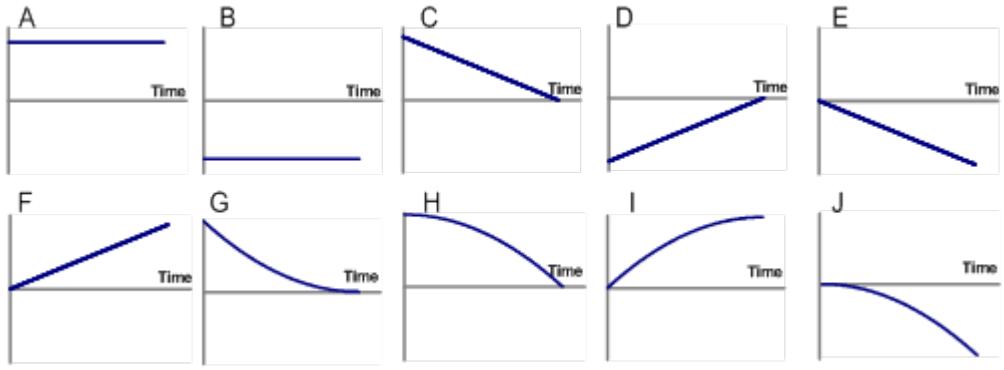
distance ($x - x_0$); time; acceleration (braking)

13.) (1 pt) If the rover doesn't brake, how long will it take to hit the rock, if the rock is 50 meters away?

14.) (1 pt) If the rover starts to decelerate (brake) at a = -0.2m/s^2, how long will it take to stop?

15.) (1 pt) Will the rover be able to stop soon enough to look at the rocks? (Why or why not?)

Questions 16-18: These questions refer to Curiosity's braking motion (in Questions 12-15 above) and the plots below.



The plots start when Curiosity starts braking (set t = 0 and x = 0), and he is travelling in the positive direction.

16.) (1 pt) Which plot best describes Curiosity's acceleration vs. time?

17.) (1 pt) Which plot best describes Curiosity's velocity vs. time?

18.) (1 pt) Which plot best describes Curiosity's position vs. time?

19.) (3 pts) Take a ruler and try the dollar bill trick we did in class. Have someone ELSE drop it between your fingers so you can measure how far it drops before you catch it. Make sure to measure the displacement (distance) in METERS! (there are 100 cm in a meter). Try catching it several times: does it always fall roughly the same distance? From this distance you should be able to calculate your reaction time…
Use the displacement formula from class:

$x - x_0$ = distance ruler fell = $v_0 t + \frac{1}{2} a t^2$

What is v_0 to begin with? [Hint: before you let it go, how fast is it moving?]

This should give you a simple formula where you can either solve for t, or just plug in different values for t and see what matches.

Hint: it will be easier if you use a = gravity = -10 m/s^2.

What did you measure for distance?

What did you calculate for time?

Does this make sense? (Remember, the Olympics disqualified folks for a reaction time faster than 0.1 s.)