General Physics
Physics 101
Test #1 – Fall 2012
Friday 9/28/12
Prof. Bob Ekey

Name (print):_____

I hereby declare upon my word of honor that
I have neither given nor received unauthorized
help on this work.

Signature:_____

Part I. Multiple Choice (3 pts each)

Instructions:

Please clearly circle one and only one answer for each of the following.
Show all of your work. Partial credit may be given if you include your work.

Questions:

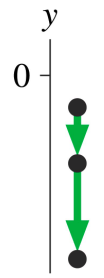
1. Standing on top of a 4.0 m "tall" tower (a.k.a. top bunk), you throw (not drop) a 1.0 kg physics text book straight down with an initial velocity of -10 m/s. What is the velocity of the book immediately before it strikes the ground?

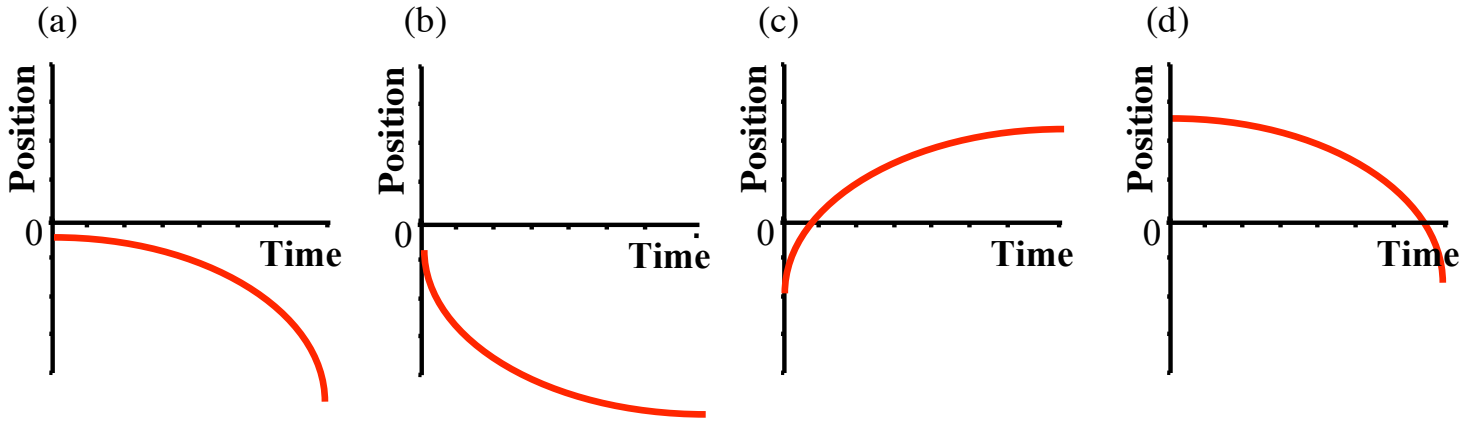
(a) 8.854 m/s
(b) 4.7 m/s
(c) -8.3 m/s
(d) -13 m/s

2. An acceleration vector is given as: $\vec{a} = (10\ \ m/s^2,\ 40°\ left\ \ of\ \ negative\ \ y-axis)$
Which of the following is a correct vector component?

(a) a_x = -7.7 m/s^2
(b) a_x = 6.4 m/s^2
(c) a_y = -7.7 m/s^2
(d) a_y = -6.4 m/s^2

3. Which of the following position versus time graphs could represent the motion diagram shown.





4. A rock is thrown from a cliff upwards at 10 m/s at an angle of 30º above the horizontal. What is the magnitude of the ball's vertical displacement after it has traveled 2.0 seconds in the air?

(a) 9.6 m
(b) 30 m
(c) 0.40 m
(d) 0.20 m

5. A student derives an equation of the form $\frac{a^2}{t}$.

What are the combined SI base units for this equation?

(a) $\frac{m}{s^3}$ (b) $\frac{m^2}{s^5}$

(c) $\frac{m^2}{s}$ (d) $\frac{m^2}{s^3}$

6. A space ship is traveling with a speed of 10.0 m/s in the negative direction. It accelerates at 100 m/s^2 for 100 ms. What is the final velocity of the space ship?

(a) 0.00 m/s
(b) -10 m/s
(c) -20 m/s
(d) 1.0 x 10^4 m/s

7. Which of the following statements are false

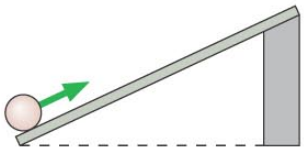
I. A vector can have a component equal zero & still have a nonzero magnitude

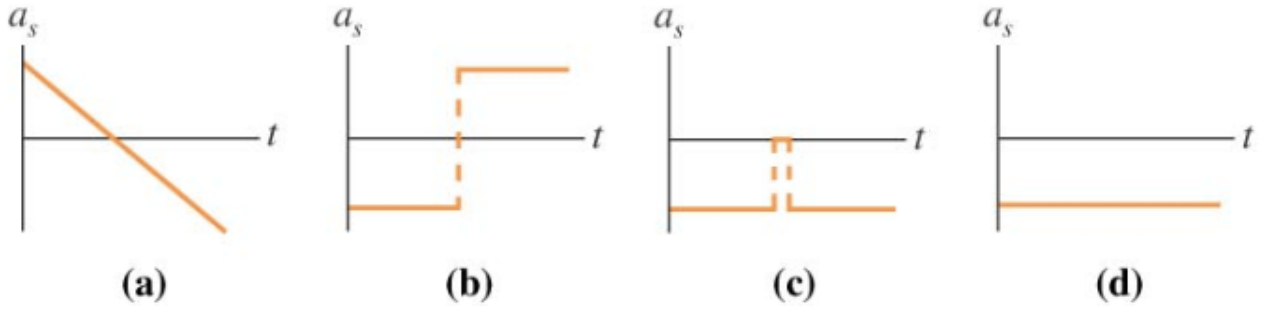
II. A vector can have a zero mag. & have one of its components be nonzero

III. Two vectors of unequal magnitudes can add to zero.

(a) I, II and III
(b) II and III
(c) III only
(d) None

8. The ball shown rolls up the frictionless ramp and back down. Which is the correct acceleration graph?



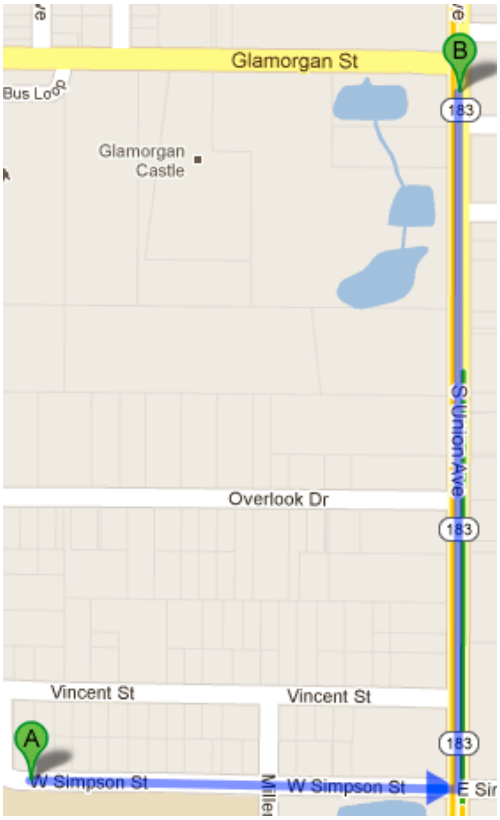


9. A balloon is flying with a speed of 2.0 m/s to the West and 1.0 m/s to the North. It experiences a steady wind that causes an acceleration of 1.0 m/s^2 to the East. If this wind acted on the balloon for 10 seconds, what is the displacement of the balloon in the East-West direction during the wind?

(a) 50 m to the East
(b) 30 m to the East
(c) 70 m to the West
(d) 60 m to the West

10. In their most recent issue, the Dynamo published a map similar to the google map shown*. It had the caption, "Map revealing distance from point A (HPCC) to point B (Physical Plant)". To verify the caption, please indicate what is physically shown in this motion?

http://umudynamo.com/wp-content/uploads/2012/09/Untitled.jpg
* They have the campus center misplaced on their map, this is more correct.

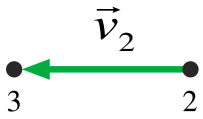


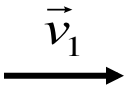
(a) The distance from B to A
(b) The displacement from A to B
(c) The distance from A to B
(d) The displacement from B to A

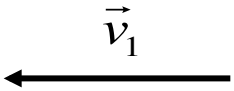
11. A bullet is fired horizontally from a gun, and falls a vertical distance of 2.0 cm while traveling 50 m horizontally. What is the flight time of the bullet?

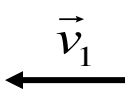
(a) 0.41 s
(b) 0.64 s
(c) 3.2 s
(d) 6.4 x 10^{-2} s

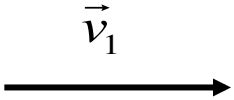
12. The figure shown shows two dots of a motion diagram and vector $\vec{v}_2$. Which of the following is a correct vector $\vec{v}_1$, if the acceleration vector points to the left?



(a) 

(b) 

(c) 

(d) 

Part II. Short answer problems (12 pts each)

Instructions:

Solve three of the following four problems. If you try to solve all four problems, please clearly indicate which problems you wish to have graded. If you do not indicate this, I will assume you want me to grade problems one, two and three.

Please show all of your work, including equations without numbers.

Please provide units with all answers.

Partial credit may be given if you include your work.

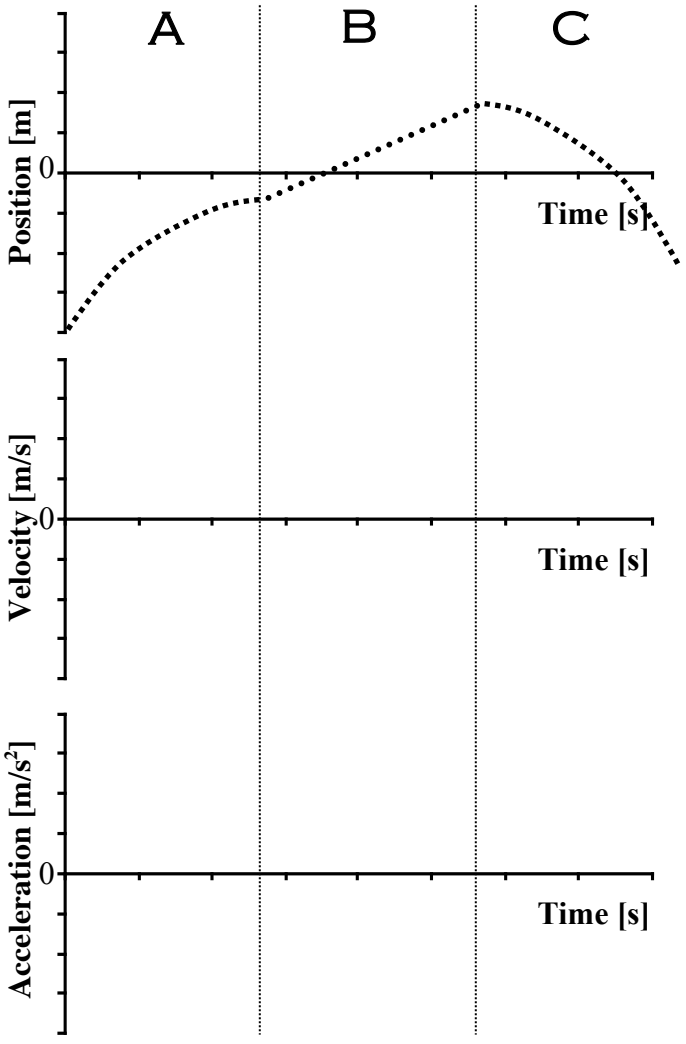
Question 1. **Grade this problem? Yes or No (circle one)**

For the following position versus time graph do the following,

(a) Sketch the velocity versus time.
What knowledge/definition are you using to make this sketch?

(b) Sketch the acceleration versus time.
What knowledge/definition are you using to make this sketch?

Note: You do not need to provide any numbers in your answers.
Note: On the velocity vs. time graph all lines should be straight - sloped or horizontal
Note: Your sketches and description will be graded independently.



(c) In each section (A-C) describe the motion.
(x, v and a)

Question 2. **Grade this problem? Yes or No (circle one)**

A cart is rolling at constant velocity of 2.0 m/s on a level table fires a ball straight up. The ball reaches 1.0 m vertically into the air, before returning to the launch altitude.

(a) What is the initial vertical velocity of the ball?

(b) What is the total flight time of the ball? Assume the ball start/stops at the same altitude.

(c) What are the components of the velocity of the ball, right before it lands? Be sure to justify your result.

(d) After the launch, if the cart accelerates in the opposite direction it is traveling, will the ball land in front of the launching tube, behind the launching tube or directly in the tube? Explain your answer with words and possibly a diagram or equation(s). No further calculations are necessary

Question 3. **Grade this problem? Yes or No (circle one)**

One game at the amusement park has you push a puck up a long, frictionless ramp. You win a stuffed animal if the puck, at its highest point comes to within 10 cm of the end of the ramp, without going off. You give the puck a push, releasing it with a speed of 5.0 m/s when it is 8.5 m from the end of the ramp. The puck's speed after traveling 3.0 m is 4.0 m/s.

(a) What is the acceleration of the puck as it goes up the ramp? Be sure to explicitly state the direction.

(b) The puck slides almost to the top and starts to slide back down, 1.0 seconds after it leaves the top of the ramp, what is the velocity of the puck?

(c) Draw a motion diagram for the puck as it moves up and down the ramp including the velocity and acceleration vectors. Indicate any point where the velocity is zero.

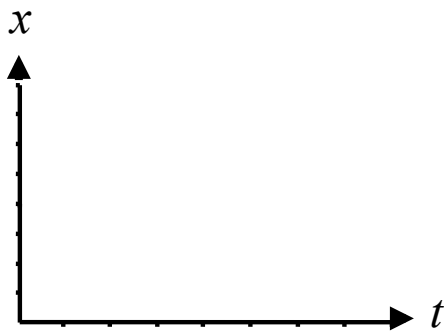
(d) What is the angle of the ramp?

Question 4. **Grade this problem? Yes or No (circle one)**

Packing to go home you placed a 50 kg wooden bookcase on a level piece of plywood that is secured to the roof of your car. You claim that you don't need to tie-down the shelf, as you know physics and you're a good driver. You drive down the street traveling at 5.0 m/s, and you spy a physics text in the road ahead. Not wanting to hit the book, you apply your brakes uniformly for 2.0 seconds.

(a) What acceleration (mag + dir) did the car experience during the stop?

(b) Sketch a position vs time plot that could represent the motion of the car as it slows. Please explain the shape & meaning of the graph.



(c) If the book was 10 m away from you when you began braking, did you hit the book? A calculation is necessary to justify your answer.

(d) Panicked, you jump out of the driver's seat, pick up the book and then get back in the driver's seat. If this took a total of 10 seconds, what is your average velocity during this rescue operation?