General Physics
Physics 101
Test #1 – Spring 2015
Friday 2/13/15
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.

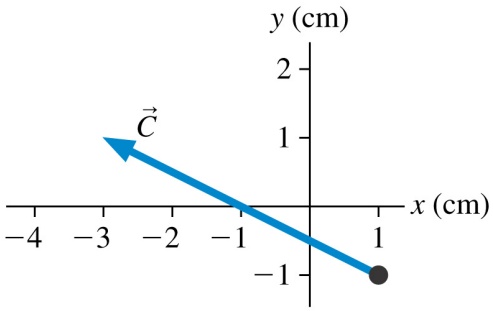
Questions:

1. In lab last week, you launched a ball a horizontal distance of 9.40 m in 1.40 seconds. The launcher was set at a launch angle of 45.0º above the horizontal and we can assume the initial and final vertical positions are 1.00 m from the floor. What is the launch velocity of the ball?

(a) 6.71 m/s^2
(b) 9.50 m/s
(c) 7.89 m/s
(d) 4.75 m/s

2. The Kessel Run involves flying a spaceship through a cluster of blackholes known as the Maw. Ignoring any alterations to the space-time continuum, the Maw has an area of 42 square parsecs. If 1 parsec is 3.085×10^{16} meters, what is the SI equivalent value of this area?

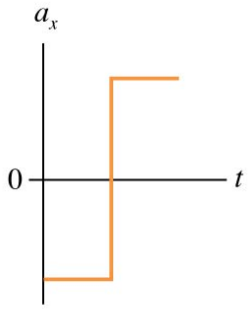
(a) 1.295 x 10^{18} m^2
(b) 9.5 x 10^{32} m^2
(c) 4.0 x 10^{34} m^2
(d) 1.3 x 10^{18} m^2

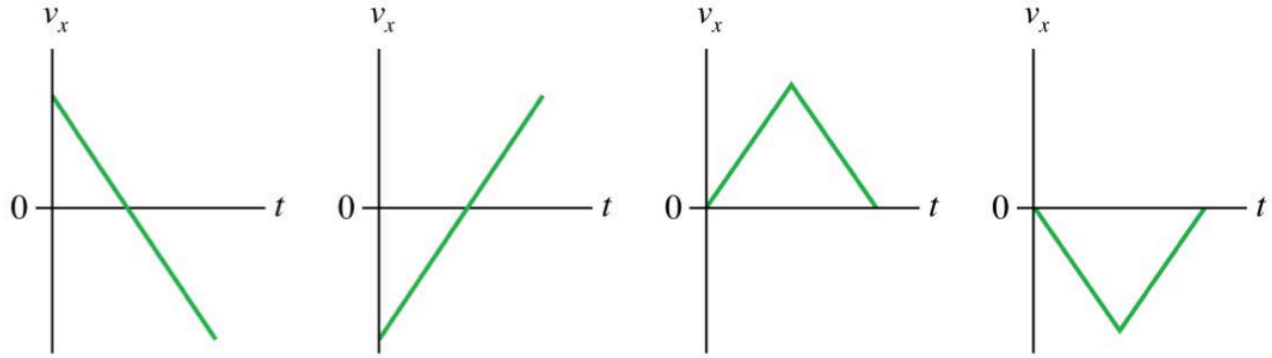


3. What are the x and y components of vector C?

(a) C_x = 4.0 cm, C_y = 2.0 cm
(b) $-3.0\hat{i} + 1.0\hat{j}$
(c) (–4.0 cm, 2.0 cm)
(d) –3.0 cm in the x-direction, 1.0 cm in the y-direction

4. Which velocity-versus-time graph could go with this acceleration graph?





5. A sailboat is traveling to the west at 10 m/s. It experiences an easterly wind that causes the sailboat to accelerate uniformily at 2.0 m/s^2, after 10 seconds, what is the displacement of the sailboat?

(a) 0.0 m
(b) 2.0 x 10^2 m
(c) -90 m
(d) 25 m

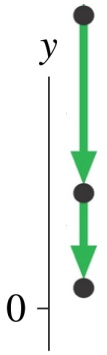
6. Which of the following statements is false?

(a) The unit "candela" is an SI base unit.

(b) In projectile motion, the velocity can be non-zero at the maximum height.

(c) Vectors can have a zero magnitude but have a non-zero component.

(d) A positive acceleration can cause an increasing or decreasing velocity.



7. For the following diagram, what is true?

(a) Acceleration is positive
(b) Position is negative
(c) Velocity is constant
(d) Velocity is increasing

8. You launch a ball of mud vertically upward and it hits the ceiling 0.500 seconds later. What is the launch velocity of the ball, if the distance from launch to the ceiling is 100 in?

(a) 8 m/s
(b) 7.53 m/s
(c) 200 m/s
(d) 2.63 m/s

9. An object moves from A to B to C.
What is the direction of the acceleration vector?

(a) South-East
(b) South-West
(c) North-East
(d) North-West

10. A projectile is fired from a cannon at a 60.0º angle with the ground and an initial velocity of 100 m/sec. Assuming no air resistance, calculate the time it will spend in the air.

(a) 8.84 s
(b) 5.10 s
(c) 20.4 s
(d) 17.7 s

11. Ball A at a constant speed on a level table 1.0 m above the floor, and ball B rolls on the level floor directly under the first ball and with the same speed and direction. When ball A rolls off the table and hits the floor,

(a) Ball B is ahead of Ball A.
(b) Ball A and Ball B collide.
(c) Ball A is ahead of Ball B.
(d) Need more information.

12. What acceleration does a rocket need to reach a speed of 200 m/s at a height of 1.0 km?

(a) 9.8 m/s
(b) 4.0×10^4 m/s^2
(c) 40 m/s^2
(d) 20 m/s^2

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.

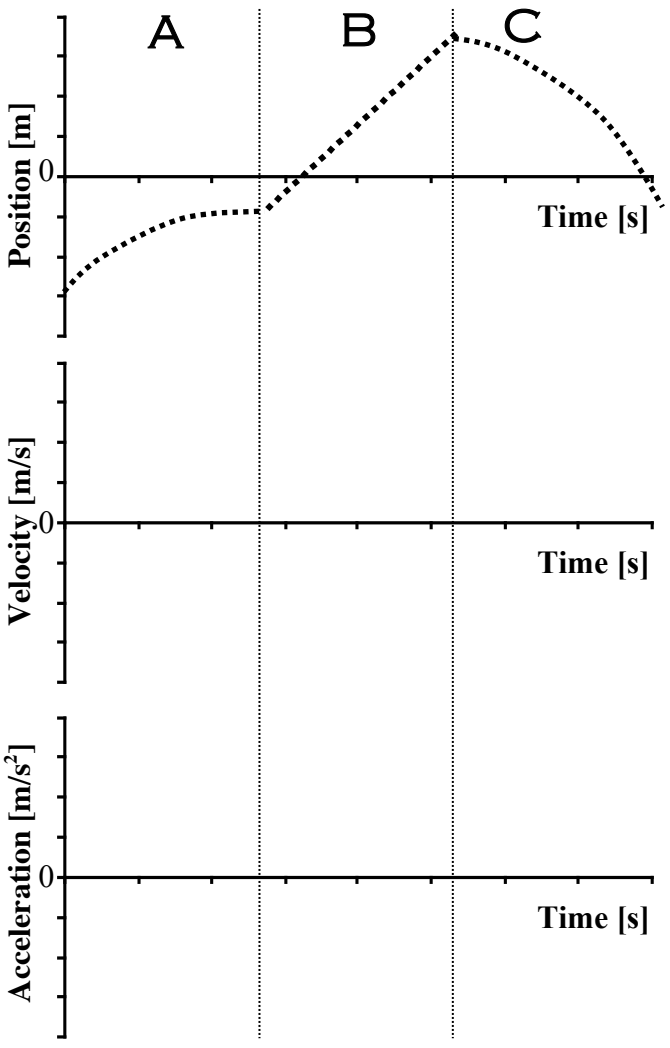
Question 1. **Grade this problem? Yes or No (circle one)**

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.



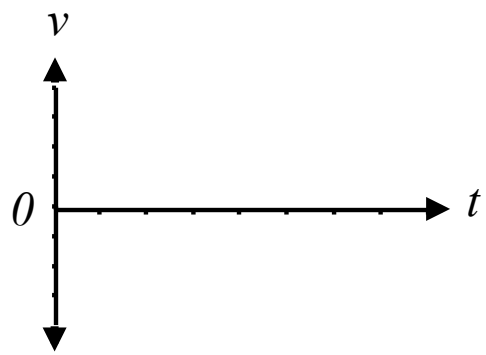
(c) In each section (A-C) describe the motion.
(x, v and a)

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

My 2.5 year old and I play a lot of cars, he likes saying "Vrroom" as we slide the cars up a ramp. We'll define down the ramp as the positive direction and the angle of the ramp as 30º with respect to the horizontal. We'll also assume my son releases the car with an initial velocity of -2.0 m/s.

(a) How far up the ramp did the car slide (magnitude)?

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



(c) How much time has elapsed from release to when the car is traveling +0.50 m/s?

(d) If my son catches the car as it comes back to the launch point, what is the total displacement of the car from release to catch?

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

A projectile is fired with an initial speed of 30 m/s at an angle of 60º above the horizontal. The object hits the ground 7.5 s later.

(a) Determine the components of the initial velocity vector and express them in $\hat{i}$ and $\hat{j}$ notation.

(b) How much higher or lower is the landing point relative to the point where the projectile was launched? Specifically state whether it is higher, lower or equal.

(c) To what maximum height above the launch point does the projectile rise?

(d) At the instant the projectile reaches its maximum height, what is the value of the acceleration at that instant? Be sure to justify your answer with words/theory.

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

In Mission Impossible Ghost Protocol, Ethan Hunt drives a BMW off a parking tower, and lands 5 stories below, approximately a 20.0 m drop. We'll assume this is a purely vertical problem and the car starts with an initial velocity of -0.50 m/s.

(a) Draw a complete motion diagram of the car's flight from the moment the car begins free-fall to right before it impacts the ground.

(b) What was the impact velocity of the car?

(c) How long did it take for the car to fall 5 parking garage stories?

(d) It takes the car 0.020 seconds to come to rest post collision with the ground. What is the acceleration (mag + dir) the car experiences during the collision?