

General Physics
Physics 101
Test #1 – Spring 2012
Friday 2/10/12
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: _____

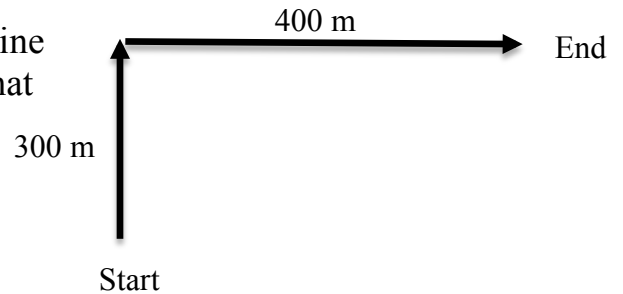
Part I. Multiple Choice (3 pts each)

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. In the middle of a field, you walk in a straight line 300 m to the north and then 400 m to the east. What total distance did you travel?

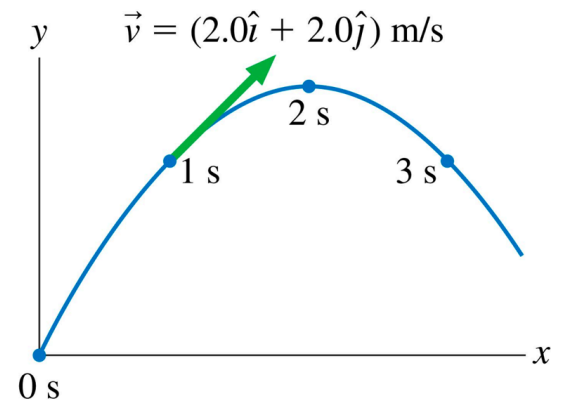


- (a) 100 m
- (b) 500 m
- (c) 700 m
- (d) 220 m

2. You throw a ball straight-up with a velocity of 19.8 m/s, and after the up-down motion you catch the ball at the same height above the ground. How long was the ball in the air?

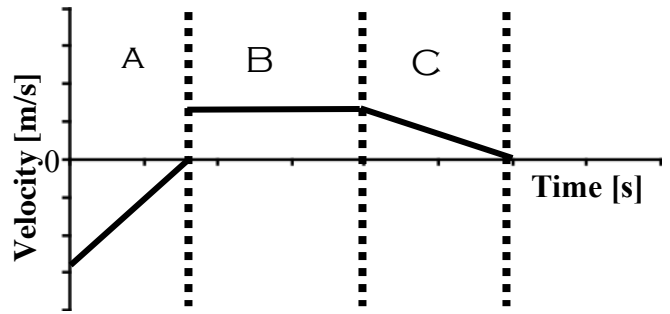
- (a) 1 s
- (b) 0.495 s
- (c) 4.04 s
- (d) 0.990 s

3. A physics student on the planet Exidor throws a ball, and it follows the parabolic trajectory shown. The velocity vector for $t=1$ second is also shown. From this information, what is the launch velocity?



- (a) $\vec{v} = (2.0\hat{i} + 2.8\hat{j}) \text{ m/s}$
- (b) $\vec{v} = (4.0\hat{i} + 2.0\hat{j}) \text{ m/s}$
- (c) $\vec{v} = 2.8 \text{ m/s}^2$
- (d) $\vec{v} = (2.0\hat{i} + 4.0\hat{j}) \text{ m/s}$

4. For the following velocity vs. time graph, which statement is false?



- (a) The object has a negative decreasing velocity in A.
- (b) The magnitude of acceleration in A is greater than the acceleration in C.
- (c) The velocity in B is zero.
- (d) The object is moving in the negative direction in A.

5. Your rocket sled is sliding backwards on a frozen lake with a velocity of -10 m/s , so you fire the rocket and you accelerate at 2.0 m/s^2 . After 10 seconds, what is the total displacement of the your sled?

- (a) 0.0 m
- (b) 90 m
- (c) $2.0 \times 10^2 \text{ m}$
- (d) 200.0 m

6. Which of the following statements is false?

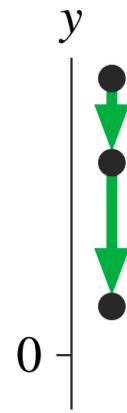
- (a) A negative acceleration can cause an increasing or decreasing velocity.
- (b) In projectile motion, the velocity can be non-zero at the maximum height.
- (c) The unit “candela” is an SI base unit.
- (d) Vectors of non-equal magnitude can add to zero.

7. The volume of a sphere is calculated as 1 in^3 . What is the volume in cm^3 ?

- (a) 0.394 cm^3
- (b) 0.06 cm^3
- (c) 16.4 cm^3
- (d) $2 \times 10^1 \text{ cm}^3$

8. For the following diagram, what is false.

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



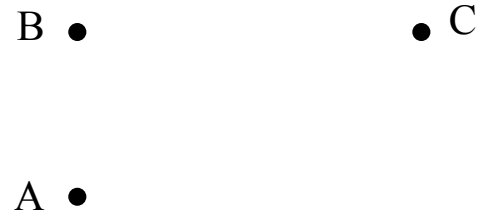
9. A block sliding up a 10° incline takes 3.3 s to stop. What was the initial velocity of the block? Ignore friction.

- (a) 32 m/s
- (b) 5.6 m/s
- (c) 1.9 m/s
- (d) 18 m/s

10. In lab yesterday, a group “accidentally” hit the bowling ball down the stairs. It was traveling at an initial horizontal velocity of 4.0 m/s, and landed on the stairs 2.0 m below the floor. What horizontal distance did the ball travel?

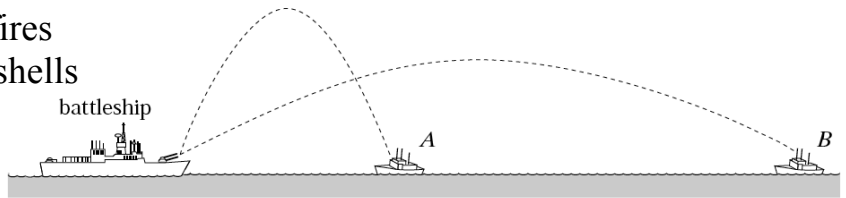
- (a) 1.63 s
- (b) 2.6 m
- (c) 41 cm
- (d) 1.6 m

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



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

12. A battleship simultaneously fires two shells at enemy ships. If the shells follow the parabolic trajectories shown, which ship gets hit last?



- (a) A
- (b) both at the same time
- (c) B
- (d) need more information

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)

A 20 g ice cube slides down a frictionless ramp that is tilted at an angle of 20° with respect to the horizontal. The block slides 3.0 m down the ramp, and then slides across the dirty floor, which slows it down to a stop.

(a) Draw a motion diagram for the motion along the ramp and floor including the velocity and acceleration vectors and labeled starting and ending position.

(b) Calculate the velocity of the ice-cube at the bottom of the ramp. Explicitly state the direction it is traveling.

Now consider the motion along the floor.

(c) What acceleration (mag + dir) will bring the cube to rest after 2.0 s on the floor?

(d) How far has the cube traveled after 1.0 s on the floor?

Question 2. **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?

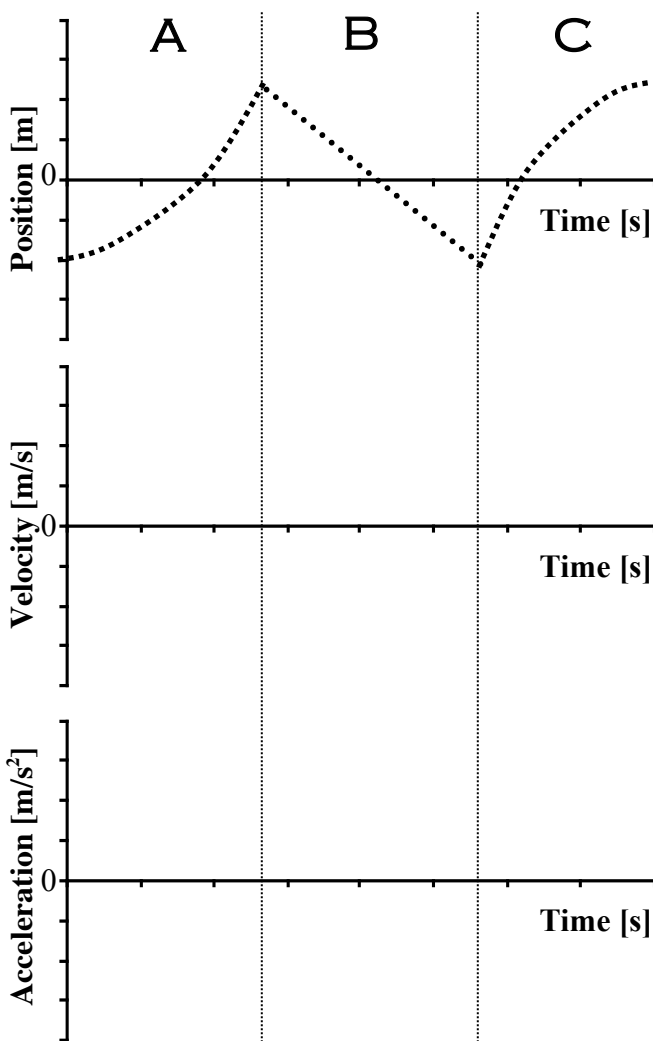
(b) Sketch the acceleration versus time.

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

Recently the MythBusters™ had an accident...

“The cannonball was supposed to land harmlessly in a nearby hill -- but something went wrong ... and the ball, traveling at about 1000 ft/s, went over the hill bordering Camp Parks Military Firing Reservation, and into the neighboring town of Dublin, crashing through two separate houses before finally coming to rest ... inside someone's minivan.” http://www.starpulse.com/news/TMZ/2011/12/07/mythbusters_experiment_goes_wrong_can

We'll assume the ball fell a vertical distance of 30 m before initial impact, and assume $v_x = 300$ m/s and $v_y = 20$ m/s.

(a) What is the y velocity component of the cannon ball just prior to impact?

(b) Determine the flight time of the ball from launch to initial impact.

(c) What is the magnitude of the velocity just prior to impact?

(d) At the top of ball's motion, what is magnitude of the velocity?
Words explaining your answer are required, but calculations are not.

Question 4.

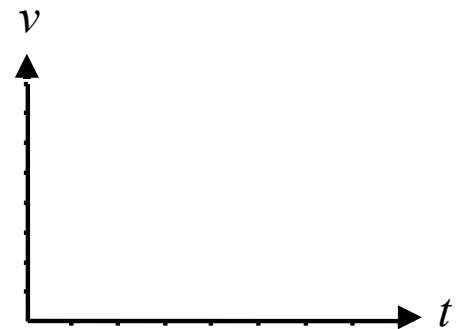
Grade this problem? Yes or No (circle one)

A bullet with a speed of 400 m/s strikes a block of wood and penetrates a distance of 12 cm before coming to rest. Assume the block is brought to rest at a uniform rate.

(a) What is the acceleration (magnitude and direction) of the bullet in the block?

(b) How long does it take before the bullet comes to rest in the block?

(c) Sketch a velocity vs time plot that could represent the motion of the bullet in the block. Please explain the shape & meaning of the graph.



(d) How far into the block is the bullet when it has a velocity of 200 m/s?