

General Physics
Physics 101
Test #1 – Spring 2014
Friday 2/14/14
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. The rockets on a spaceship fire for 1.0 second, causing it to accelerate at -10 m/s^2 . If the final velocity of the spaceship is -10 m/s , what was its initial velocity?

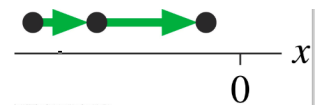
- (a) 0.0 m/s
- (b) -20 m/s
- (c) -10 m/s
- (d) 20 m/s

2. A cart that is rolling at constant velocity on a level table fires a ball straight-up. When the ball comes back down, where will it land?

- (a) Behind the launching tube
- (b) In front of the launching tube
- (c) Directly in the launching tube
- (d) Not enough information to tell

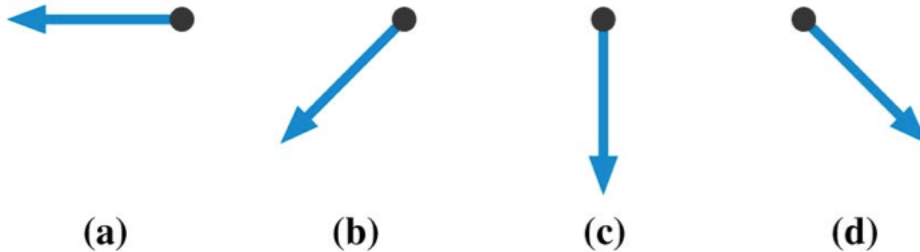
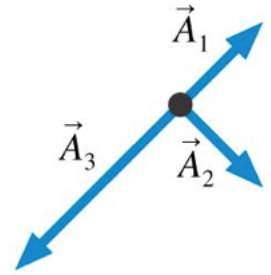
3. Which of the following are false for the motion diagram shown?

- I. The object has positive acceleration
- II. The object has negative velocity
- III. The object is moving away from the origin



- (a) I, II and III
- (b) II and III
- (c) I only
- (d) I and II

4. For the vectors shown, which of the following vectors represents $\vec{A}_1 + \vec{A}_2 + \vec{A}_3$?



5. You would like to stick a wet spit wad on the ceiling, so you toss it straight-up with a speed of 10.0 m/s and it takes 100 ms for the spit wad to hit the ceiling. What is the displacement of the spit wad from launch to hitting the ceiling?

- (a) 51.0 cm
- (b) 95.1 cm
- (c) 1.05 m
- (d) 100 ms

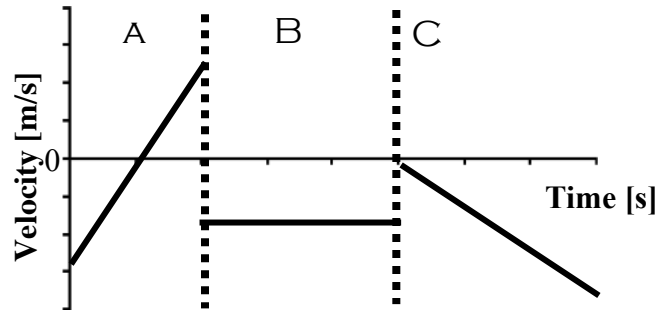
6. The volume of a sphere is calculated as 1 in^3 . What is the volume in cm^3 ?

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

7. A ball thrown horizontally at 25 m/s travels a horizontal distance of 50 m before hitting the ground. From what height was the ball thrown?

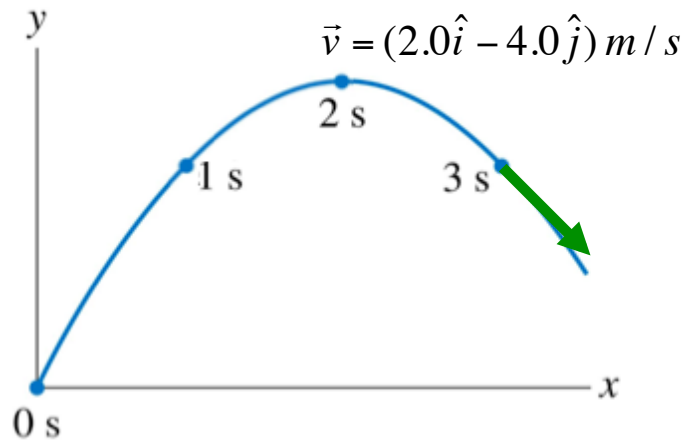
- (a) 2.0 m
- (b) 9.8 m
- (c) 1.2 m
- (d) 20 m

8. For the following velocity vs. time graph, what is false? Ignore the transitions between sections.



- (a) The cart has a negative decreasing then positive increasing velocity in A.
- (b) The cart has a negative decreasing velocity in C.
- (c) The cart is not accelerating in B.
- (d) The magnitude of the acceleration in A is the largest.

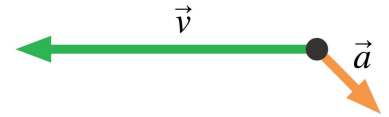
9. A physics student on the planet Exidar throws a ball, and it follows the parabolic trajectory shown. The velocity vector for $t=3$ seconds is also shown. From this information, what is the velocity at 1 s?



- (a) $(2.0\hat{i} + 2.0\hat{j})$
- (b) 4.0 m/s horizontally and 2.0 m/s vertically
- (c) 2.8 m/s, 45° above the horizontal
- (d) $(2.0\frac{m}{s}, 4.0\frac{m}{s})$

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

- (a) $a_x = -6.4\text{ m/s}^2$
- (b) $a_x = 7.7\text{ m/s}$
- (c) $a_y = 7.7\text{ m/s}^2$
- (d) $a_y = -6.4\text{ m/s}^2$



11. The acceleration shown will cause the particle to

- (a) Curve downward and speed up
- (b) Move to the right and down
- (c) Decrease speed and curve downward
- (d) Slow down and curve upward

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

- (a) 20 m/s^2
- (b) 10 m/s^2
- (c) 9.8 m/s^2
- (d) $2.0 \times 10^4 \text{ m/s}^2$

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)

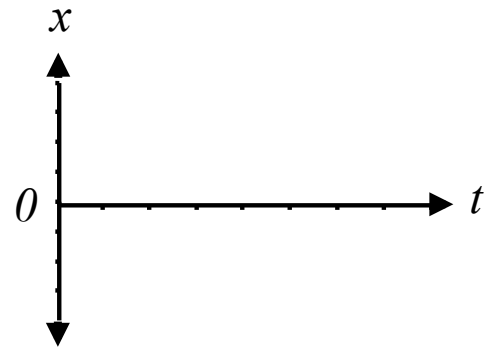
A velociraptor spots you 40 meters away and attacks, accelerating from rest at -4.0 m/s^2 up to its top speed of 25 m/s .



xkcd.com

(a) How long has the velociraptor traveled before it reaches its top speed?

(b) Sketch a position vs time plot that could represent the motion of the velociraptor while it accelerates to its top speed. Please explain the shape & meaning of the graph.



(c) How far has the velociraptor traveled at the moment he reaches his top speed?

(d) If you were careless enough to just stand still and let the velociraptor arrive at your location; how long did it take to travel the 40 m distance between you and him? Please run appropriately if you are ever in this situation.

Question 2.

Grade this problem? Yes or No (circle one)

A student is asleep on the top bunk, which is 2.20 m from the floor.

(a) If he rolls off the bed with an initial horizontal velocity of 1.10 m/s, how long did it take him to reach the floor?

(b) What is his vertical velocity at the moment prior to impact?

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

(d) The student collides with the floor immediately coming to rest (no sliding) and awakes wondering what just happened. Using the definitions of acceleration and velocity, explain the direction of the acceleration experienced by the student as he hits the ground. Be as specific as possible about the direction.

Question 3. **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?

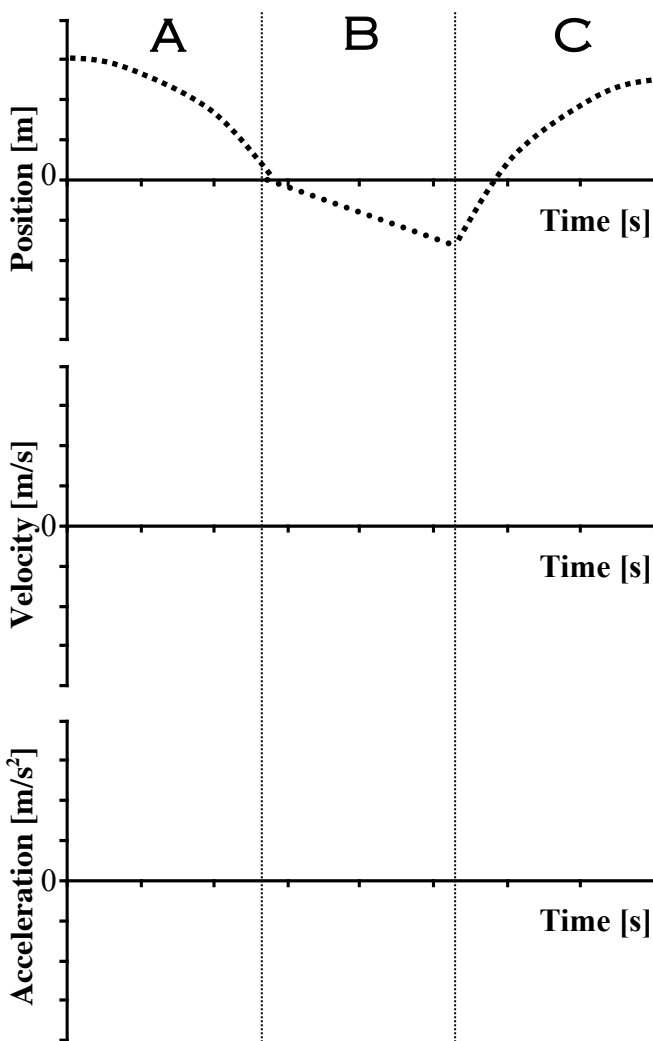
(b) Sketch the acceleration versus time.

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 4.

Grade this problem? Yes or No (circle one)

At the arcade you are launching a puck up a long ramp, trying to win “tickets”, which coincidentally have no cash value. Of course, it is well oiled, which means you can ignore friction. We’ll define up the ramp as the positive direction and the angle of the ramp is 30° with respect to the horizontal.

(a) You launch the puck with a speed of 4.9 m/s, what is the puck’s maximum displacement from the launch point?

(b) How far away from the launch point is the puck 1.5 seconds after launch?

The puck returns to the launch point.

(c) If the entire trip up and down the ramp took 2.0 seconds, what is the average velocity of the puck during its motion?

(d) Draw a full motion diagram for the motion of the puck as it travels up and down the ramp. Be sure to clearly label the start and end of the motion in question.