General Physics
Physics 101
Test #1 – Spring 2020
Friday 2/14/20
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.

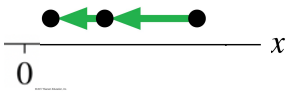
Signature:_____

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. For the following diagram, what is true?

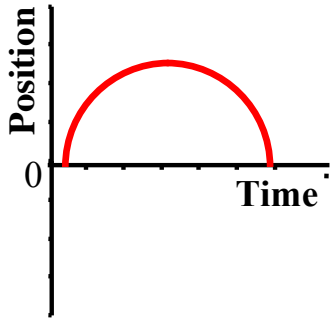
(a) Acceleration is positive
(b) Position is negative
(c) Velocity is positive
(d) Velocity is increasing

2. A sailboat is traveling west at 5.0 m/s. A sudden gust of wind gives the boat an acceleration a (0.80 m/s^2, 40^o north of east). What is the boat's x-component of the velocity (magnitude) 6.0 s later when the gust subsides?

(a) 3.7 m/s^2
(b) 1.3 m/s
(c) 8.7 m/s
(d) 1.0 m/s

3. 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) 3 m/s
(b) 7.53 m/s
(c) 200 m/s
(d) 2.63 m/s



4. Which of the following statements about this position versus time graph is false? Assume the moving object is a rigid body and only moving in one-dimension.

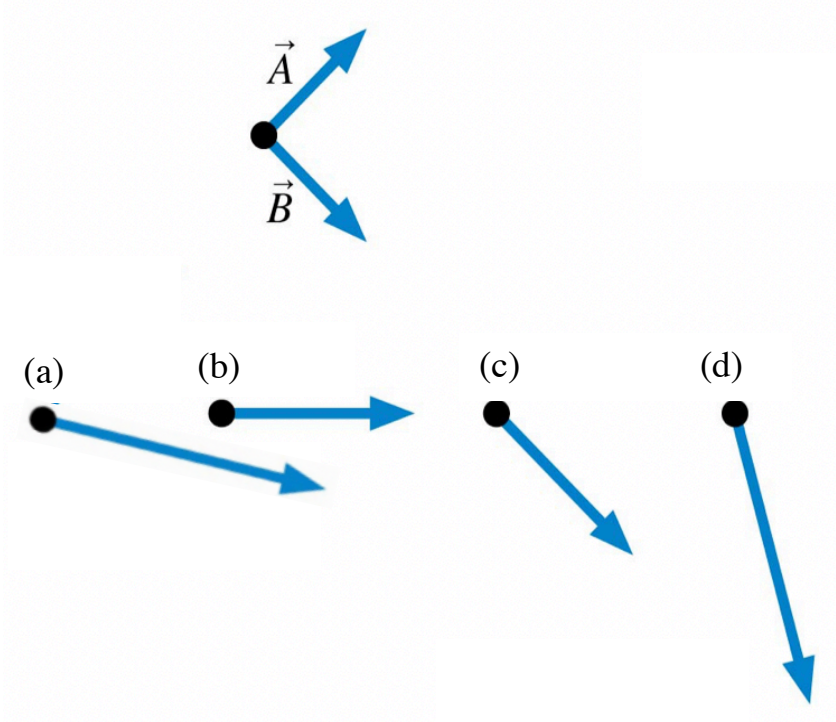
(a) The object has a zero velocity at its maximum height.

(b) The object has a negative decreasing velocity during the motion.

(c) The rise and fall time for the motion are the same.

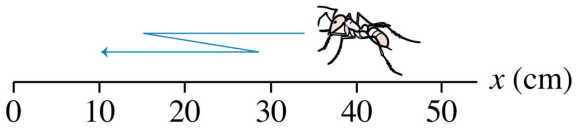
(d) The object's acceleration is never zero during the motion

5. Which of the vectors could represent $\vec{A}+2\vec{B}$?



6. A supply plane needs to drop a package of food to scientists working on a glacier in Greenland. The plane flies horizontally 100 m above the glacier at a speed of 150 m/s. How far short of the target should it drop the package?

(a) 678 m
(b) 451 m
(c) 578 m
(d) Drop directly above the scientists



7. An ant zig-zags back and forth on a picnic table as shown. What distance does the ant travel?

(a) -30 cm
(b) 50 cm
(c) 58 cm
(d) -50 cm

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

What are the combined SI base units for this equation?

(a) $\frac{m}{s^4}$

(b) $\frac{m^3}{s^4}$

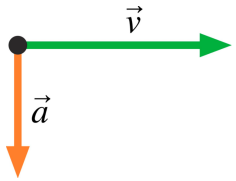
(c) $\frac{1}{m}$

(d) $\frac{1}{s^4 m}$

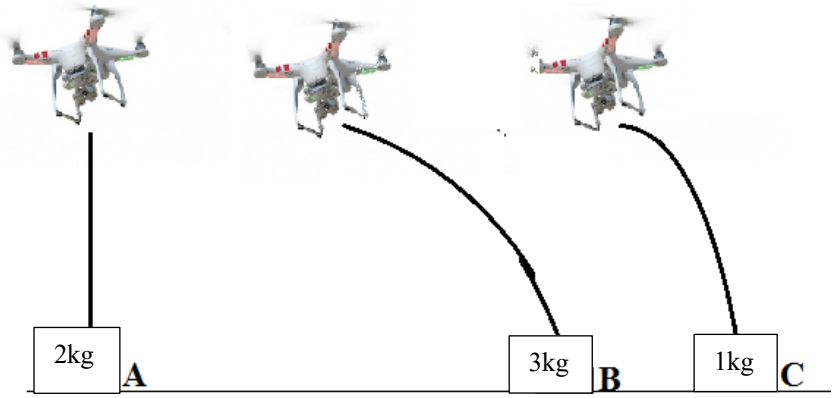
9. A speed skater moving to the left across frictionless ice at 7.9 m/s hits a 5.0 m wide patch of rough ice. She slows steadily, then continues on at 5.8 m/s. What is the magnitude of her acceleration on the rough ice?

(a) 2.877 m/s
(b) 0.88 m/s^2
(c) 0.20 m/s^2
(d) 2.9 m/s^2

10. The particle shown follows a…



(a) Parabolic trajectory
(b) Straight-line trajectory
(c) Circular trajectory
(d) Not possible to tell



11. Three delivery drones "drop" different massed packages to their waiting customers from the same height. They follow the paths shown. Rank the flight times in order of largest to smallest.

(a) B > C > A
(b) A < C < B
(c) A = B = C
(d) Need more information

12. In lab, you launched a cart up a ramp angled at 10º above the horizontal. The motion detector measures the velocity of the cart to be 1.0 m/s down the ramp, 2.0 seconds later. What was the initial speed of the cart?

(a) 20 m/s
(b) 1.7 m/s
(c) 4.4 m/s
(d) 2.4 m/s

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)**

On the Apollo 15 mission to the moon, astronaut Alan Shepard hit a golf ball with a 6 iron. The free-fall acceleration on the moon is 1/6 of its value on earth. Suppose he hit the ball on a large flat surface with a speed of 25.0 m/s at an angle of 30.0° above the horizontal: $\left(21.7\hat{i}+12.5\hat{j}\right)$ m/s.

(a) What would be the total flight time of the ball?

(b) At the ball's maximum height, explain whether the value of velocity AND acceleration are (+, 0 or -). Be sure to justify each with theory and words as needed. No calculations are required.

(c) How far did the ball travel horizontally?

(d) What is the ball's impact velocity (magnitude and direction)?
Be sure to include calculations and/or words explaining your answer.

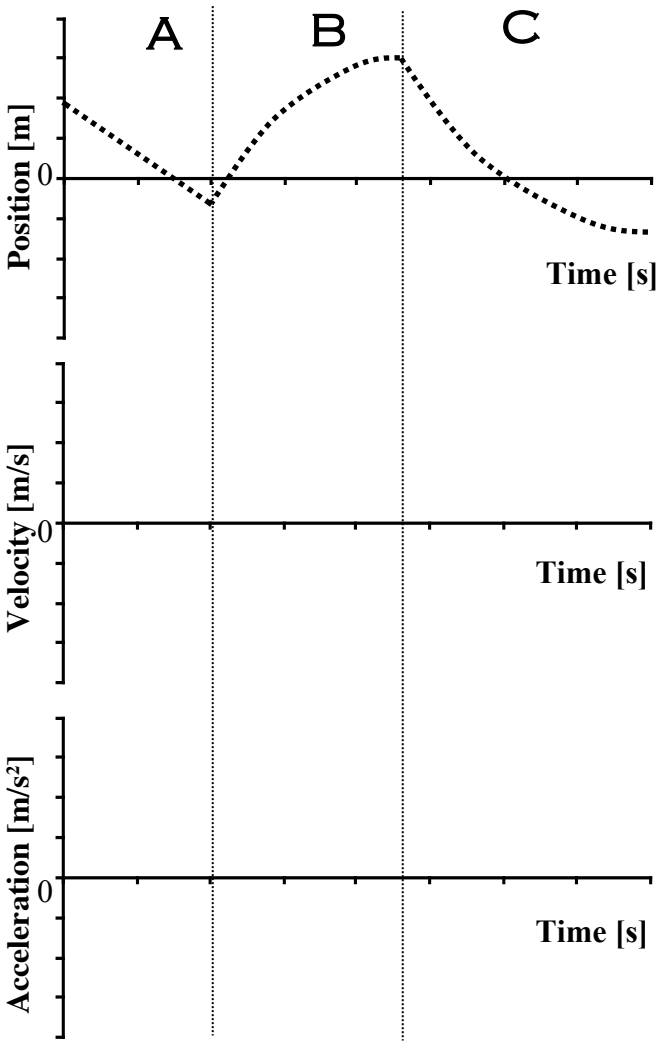
Question 2. **Grade this problem? Yes or No (circle one)**

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)**

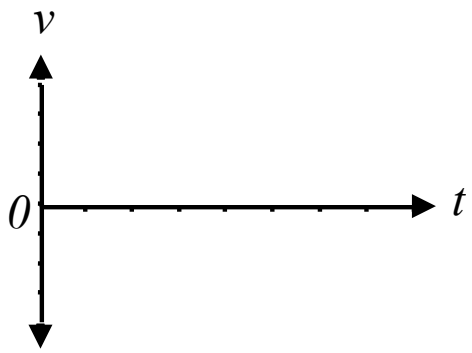
A student standing on the ground throws a ball straight up. The ball leaves the student's hand with a speed of 15.0 m/s when the hand is 2.00 m above the ground. The student catches the ball 3.12 seconds later.

(a) What maximum vertical altitude above the launch point does the ball reach?

(b) At what vertical distance above the ground does the student catch the ball?

(c) What is the velocity of the ball right before the student catches it?

(d) Sketch the velocity vs time graph for the entire motion of the ball. Please explain the shape & meaning of the graph.



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

You are driving along State Street at constant velocity and the light turns red ahead of you. It takes you 0.50 seconds to react before your car breaks with constant acceleration.

(a) Draw a full motion diagram for the motion of the car from the instant the light turns red to when you come to rest. Be sure to clearly label the start and end of the motion in question.

(b) If you travel 10 m before you start to brake, how fast were you traveling before the light turned red?

Once applying the brakes, it takes you 5.0 seconds to come to rest.
(c) What is the acceleration of the car during the braking?

(d) How far did the car travel during the 5.0 second braking experience?