

General Physics  
Physics 101  
Test #1 – Spring 2021  
Friday 2/12/21  
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. A sailboat is traveling east at 5.0 m/s. A sudden gust of wind gives the boat an acceleration  $a$  ( $0.80 \text{ m/s}^2$ ,  $40^\circ$  north of east). What is the boat's x-component of the velocity 6.0 s later when the gust subsides?

- (a)  $9.8 \text{ m/s}^2$
- (b)  $8.7 \text{ m/s}$
- (c)  $8.0 \text{ m/s}$
- (d)  $3.1 \text{ m/s}$

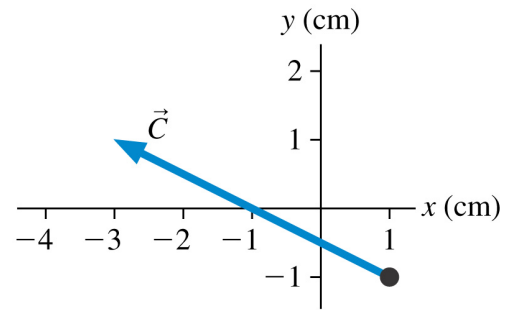
2. A student derives an equation of the form  $\frac{a}{2v^2}$ .

What are the combined SI base units for this equation?

- (a)  $\frac{1}{m}$
- (b)  $\frac{m^3}{s^5}$
- (c)  $\frac{1}{s}$
- (d)  $m$

3. A dog sled is pulled from rest across a level bit of ice with a small constant acceleration. The sled stops and they attach more dogs to the sled, which cause it to move from rest with double the original acceleration. What is a correct description of the sled's subsequent motion? Ignore friction.

- (a) The sled moves with a constant speed that is bigger than the original speed.
- (b) The sled's speed increases to a constant value greater than the original.
- (c) The sled's speed increases continually.
- (d) The final speed of the sled is the same in either situation.



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

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

5. A rifle is aimed horizontally at a target 45.0 m away. The bullet hits the target 2.3 cm below the aim point. What was the bullet's speed as it left the barrel?

- (a) 656.8 m/s
- (b)  $1.3 \times 10^3 \text{ m/s}$
- (c) 66 m/s
- (d) 0.66 km/s

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

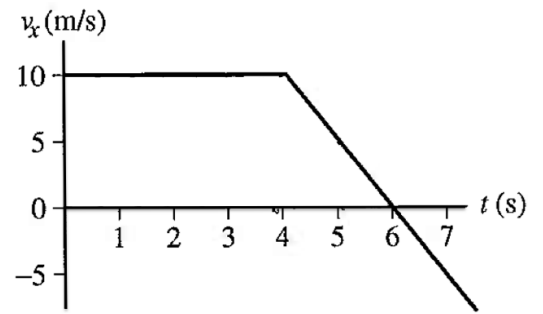


- (a) South-East
- (b) North-East
- (c) South-West
- (d) North-West

7. A student standing on the ground throws a ball straight up. The ball leaves the student's hand with a speed of 15 m/s when the hand is 2.0 m above the ground. The student moves their hand out of the way. What is the impact velocity on the ground?

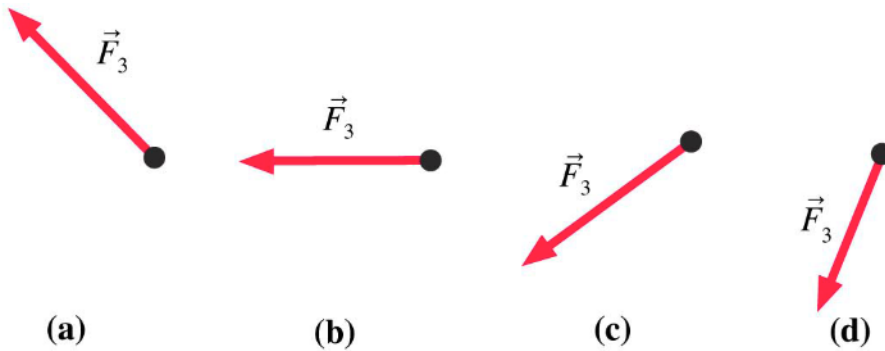
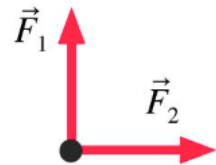
- (a) 7.4 m/s
- (b) -16 m/s
- (c)  $-2.6 \times 10^2 \text{ m/s}$
- (d) -14 m/s

8. For the following velocity versus time graph, find the object's position at 6.0 seconds. Assume the initial start position of the object is 20 m.



- (a) 70 m
- (b) 60 m
- (c) 50 m
- (d) 40 m

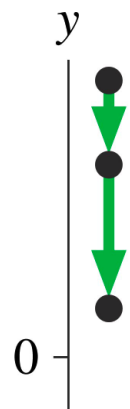
9. Two of three forces are shown. If the net force points to the right, which vector could represent the third force?



10. Which of the following are true for the motion diagram shown?

- I. The object has positive acceleration
- II. The object has an increasing velocity
- III. The object has negative position

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



11. A block sliding up a  $10^\circ$  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
12. Which of the following statements is false?
- (a) In a motion, the distance traveled can be greater than the displacement.
  - (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.

## **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?

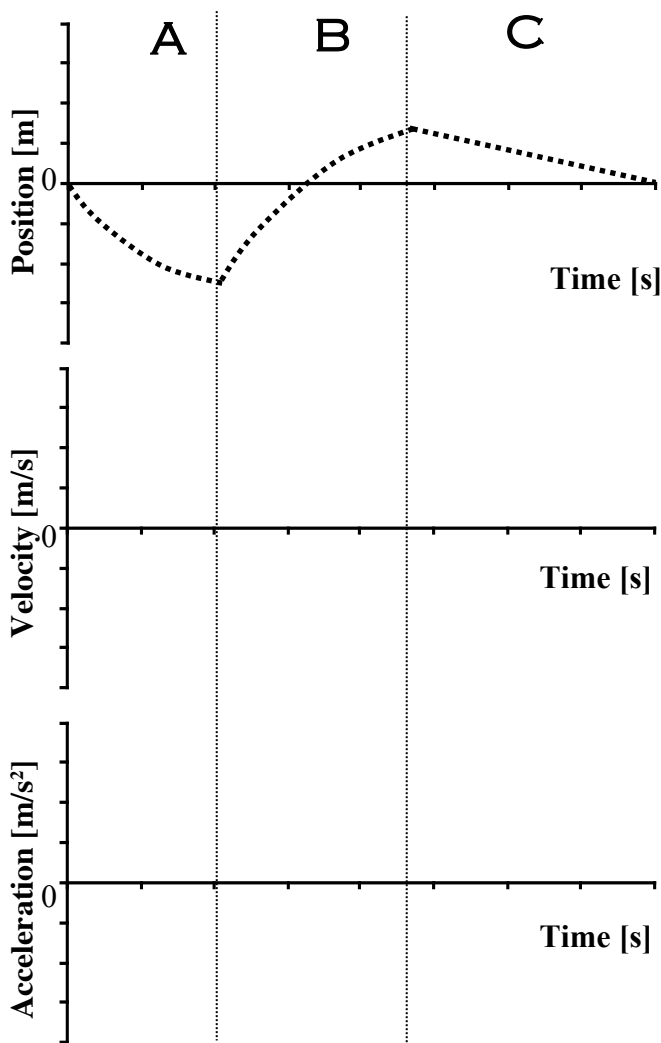
(b) Sketch the acceleration versus time.

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)**

In Ellen's Game of Games, Know or Go is a challenge round where contestants stand on a 30 ft high platform and answer questions. If they get a question wrong, they are dropped through the floor. From the front of the platform, the first 10 ft of the fall shows a glass panel, where you can see the contestants fall. Ignore air resistance.

(a) What is the velocity when the contestant's feet arrive at 10 ft of descent?

After 10 ft, it appears by lights/graphics that the contestants continue to fall, but they actually fall into a foam block pit that slows them to rest.

(b) Draw a full motion diagram for the motion of the contestant from the instant they are dropped until the moment they stop. Be sure to clearly label the start and end of the motion in question.

(c) After another 10 ft (3.0 m) the contestants are moving with half of the velocity found in (a), what is the acceleration as they slow?

(d) How long did it take to slow the contestant to half of their velocity?

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

In Ellen's Game of Games, Bukin' Blasters, contestants sit upon a large cannon that spins and bucks. As this is happening, they fire balls from the cannon in an attempt to hit a target with the ball. We will pretend there is no air resistance and ignore any impact of spinning (that's test 2). Using LoggerPro, I measured the total flight time to be 0.82s and the time to the max height to be 0.70s.

(a) What is the vertical velocity at launch?

(b) How high is the target from the launch point?

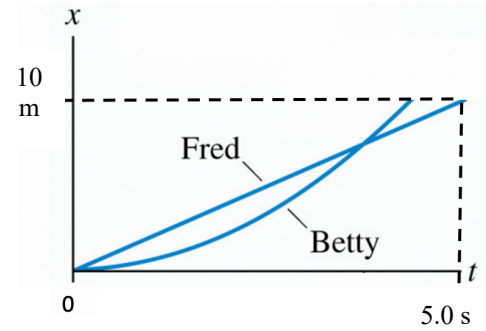
(c) If the launch angle is  $20^\circ$ , what horizontal distance did the ball travel?

(d) A second ball is fired that with the same initial velocity, but at a larger launch angle. If the ball still hits the target, is the flight time larger, smaller or the same. Please explain using words and theory.



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

In Ellen's Game of Games, Oh Ship! is a race where contestants move from a starting line to a finish point 10 m away from the start. They then discover an answer to a silly question in a multiple-choice type fashion. We will focus on two contestants, Betty and Fred, who undergo the motions shown in the graph.



(a) Based off the graph, show/explain where they have the same velocity. Please give an approximate numeric answer and provide a physical reason for your answer.

(b) From the graph, determine the velocity of Fred throughout the motion.

(c) If Betty starts from rest and she arrives at the finish line in 4.0 s, what is her acceleration?

(d) How fast is Betty traveling when she arrives at the finish?