

General Physics
Physics 101
Test #1 – Spring 2018
Friday 2/9/18
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.

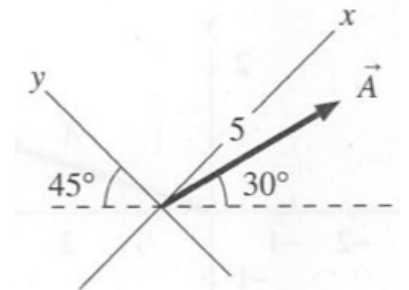
Questions:

1. In Star Wars: The Last Jedi, Po Dameron is in an X-wing with BB-8™ cruising at max speed and he engages a thruster rocket, which causes the X-wing to increase speed uniformly. Looking at Wookipedia, the X-wing max speed is 300 m/s, which the booster improves upon. If the X-wing travels 5.0 km towards a Dreadnought in 3.0 seconds, what is the X-wing's acceleration?

- (a) 911.1 m/s^2
- (b) $1.3 \times 10^3 \text{ m/s}^2$
- (c) $9.1 \times 10^2 \text{ m/s}^2$
- (d) $4.6 \times 10^2 \text{ m/s}^2$

2. For vector $\vec{A} = (5, 30^\circ \text{ above the horizontal})$ determine the component's A_x and A_y in the coordinate systems shown.

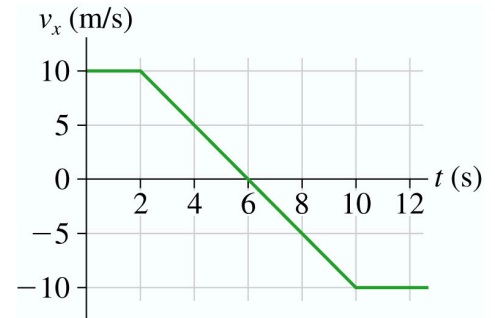
- (a) (+4.8, -1.3)
- (b) (4.3, 2.5)
- (c) (+1.3, -4.8)
- (d) (-2.5, +4.3)



3. 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

4. For the following velocity versus time graph, which is not a possible time when the particle is at 35 m? Assume the starting position is origin.



- (a) 4.0 s
- (b) 5.0 s
- (c) 8.0 s
- (d) not possible to determine

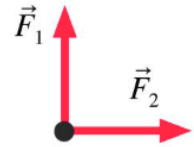
5. A rocket car is launched from rest across a level floor with a constant acceleration. A 2nd rocket is added to the car, and the car now launches from rest with double the original acceleration. What is a correct description of the “two rocket” car’s subsequent motion? Ignore friction and assume the rocket continually fires.

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

6. Which of the following position versus time graphs could represent the motion diagram shown.



- (a)
- (b)
- (c)
- (d)



7. Three forces are acting on the same point and the system has a net force of zero. If F_1 and F_2 are equal to 4.0 N each. What is the magnitude and direction of the 3rd balancing force?

- (a) 8.0 N to the North East
- (b) 8.0 N to the South West
- (c) 5.7 N to the North East
- (d) 5.7 N to the South West

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

What are the combined SI base units for this equation?

- (a) $\frac{s^4}{m^2}$
- (b) $\frac{m^2}{s^4}$
- (c) $m^{-2}s^{-2}$
- (d) m^2

9. A skier is gliding along at 3.0 m/s on a horizontal, frictionless snow. He suddenly starts down a 10° incline. If his speed at the bottom is 15 m/s, how long is the incline?

- (a) 63 m
- (b) 7.4 m
- (c) 42 m
- (d) 11 m

10. In week 4 lab, you performed a video analysis of a basketball shot on the earth. If you repeat this for a basketball shot on the moon, the vertical position version time graph and the equation yields... $y(t) = 0.80t^2 + 2.0t + 1.0$

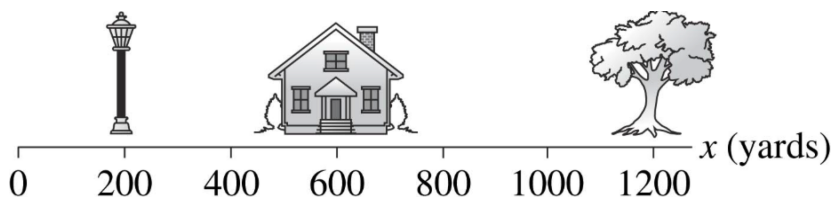
What is the magnitude of the acceleration due to gravity on the moon?

- (a) 0.80 m/s
- (b) 0.40 m/s²
- (c) 1.6 m/s²
- (d) 58.80 m/s²

11. A balloon is flying with a speed of 2.0 m/s to the West and 1.0 m/s to the North. It experiences a steady wind that causes an acceleration of 1.0 m/s^2 to the East. If this wind acted on the balloon for 10 seconds, what is the displacement of the balloon in the East-West direction during the wind?

- (a) 50 m to the East
- (b) 30 m to the East
- (c) 70 m to the West
- (d) 60 m to the West

12. Larry leaves home at 9:05 and runs at a constant speed to the lamppost. He reaches the lamppost at 9:07, immediately turns around and runs to the tree. Larry arrives at the tree at 9:10. What is Larry's average velocity for the entire run to three significant figures?



- (a) +280 yd/min
- (b) -200 yd/min
- (c) +333 yd/min
- (d) +120 yd/min

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?

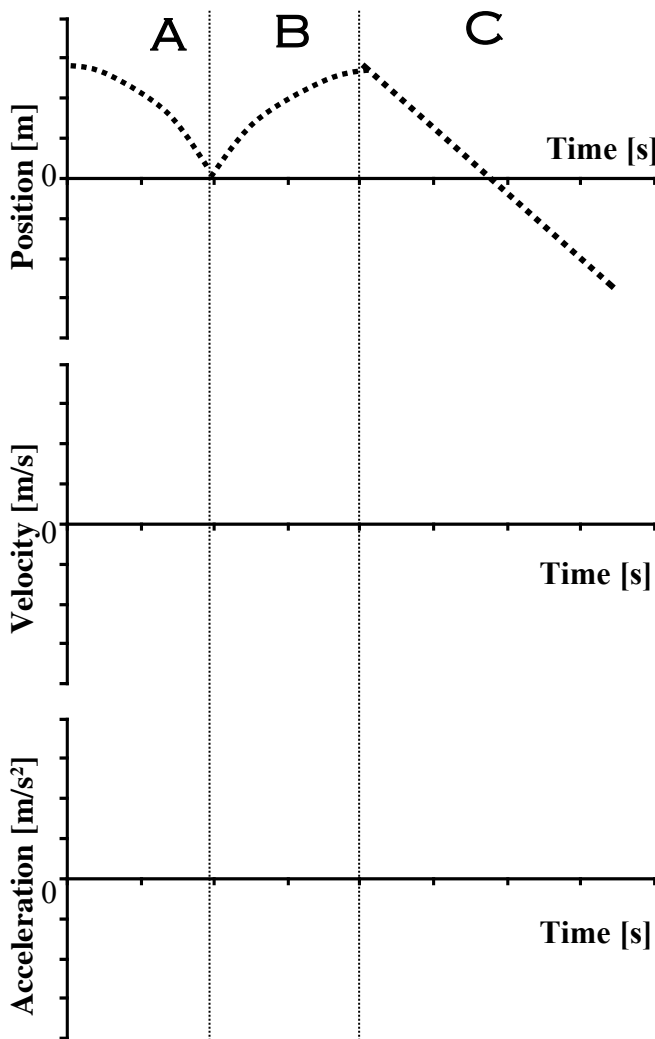
(b) Sketch the acceleration versus time.

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)**

You're 6.0 m from one wall of a house, and want to toss a ball to your friend who is 6.0 m from the opposite wall. The throw and catch occur 1.0 m above the ground, and the total horizontal distance between you and your friend is 18.0 m. The top of the roof is 6.0 m from the ground,

(a) What is the minimum vertical velocity that will allow the ball to clear the roof?

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

(c) What horizontal component of velocity is necessary to get it to your friend?

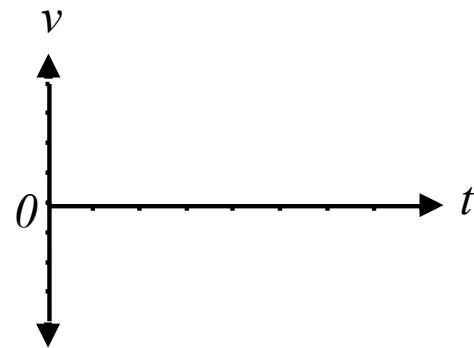
(d) Is it possible to decrease the initial horizontal velocity while also changing the initial vertical velocity and still get it to your friend? Explain your answer with theory and possibly equations, also if this is possible, indicate whether you increase or decrease the vertical velocity.

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 m/s when the hand is 2.0 m above the ground. The student moves her hand out of the way and the ball hits the ground.

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



(b) What is the velocity of the ball right before it hits the ground?

(c) How long was the ball in the air?

(d) What maximum vertical displacement from the ground did the ball reach?

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

A robber is being lowered by a rope tied around his waste into a jewelry store. He is initially traveling with a velocity of -2.0 m/s for 2.0 second and then slows to rest over a displacement of -2.0 m.

(a) Draw a full motion diagram for the motion of the robber during the entire motion. Be sure to clearly label the start and end of the motion in question.

(b) How far (mag + dir) did the robber travel while traveling at a constant velocity?

(c) What is the robber's acceleration (mag + dir) as he slows?

(d) How long did it take to slow?