

Physics 117A – Exam #1 – Fall 2006

Only calculators and pens/pencils are allowed on your desk. No cell phones or additional scrap paper. You have 1.5 hours to complete the exam.

Name _____

Section (Circle): Hutson MWF 10:10-11:00

 Sheldon TR 11:00-12:15

I pledge my honor that I have neither given nor received aid on this work.

Signed _____



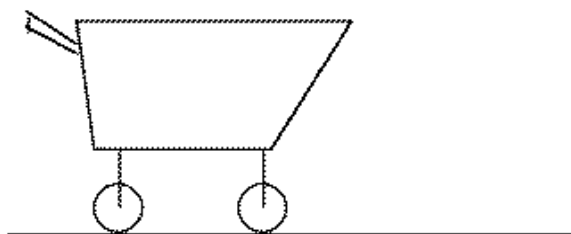
MC (50) = _____ Prob 11 (25) = _____ Prob 12 (25) = _____ Total = _____

Multiple choice, circle the correct answer (5 pts each).

1. Two vectors are given as follows: $\vec{A} = +3\hat{i} - 2\hat{j} - 3\hat{k}$ $\vec{C} = -4\hat{i} - 2\hat{j} - 3\hat{k}$

The magnitude of $|\vec{A} - \vec{C}|$ is closest to:

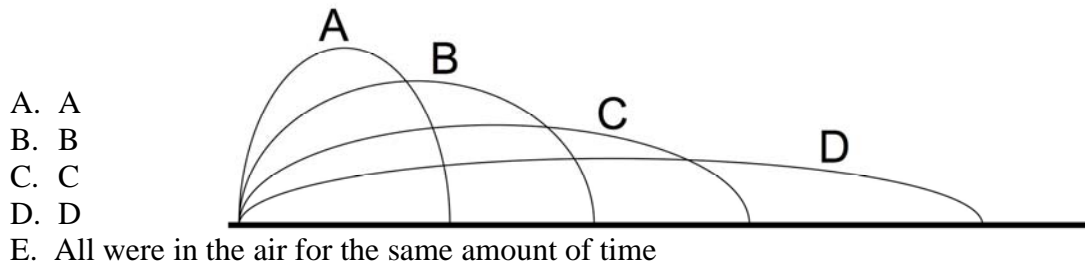
- A. 6
 - B. 8
 - C. 7
 - D. 9
 - E. 10
2. A person gives a shopping trolley an initial push along a horizontal floor to get it moving, then lets go. The trolley travels forward along the floor, gradually slowing as it moves.



Consider the *horizontal force(s)* on the trolley while it is moving forward and slowing. Which of the following is correct?

- A. Only a backward force is acting, no forward force.
 - B. Only a forward force is acting which diminishes with time.
 - C. Both a forward and a backward force are acting on the trolley, but the forward force is larger.
 - D. Both a forward and a backward force are acting on the trolley, but the backward force is larger.
3. A ball is projected upward at a time $t=0.0$ s, from a point on a roof 30 m above the ground. The ball rises, then falls to the ground. The initial velocity of the ball is 87.2 m/s. Consider all quantities as positive in the upward direction. The velocity of the ball when it is 16 m above the ground is closest to:
- A. -71 m/s
 - B. -53 m/s
 - C. -36 m/s
 - D. -89 m/s
 - E. -107 m/s

4. The figure shows the trajectories of four artillery shells. Each was fired with the same speed. Which was in the air the longest time?

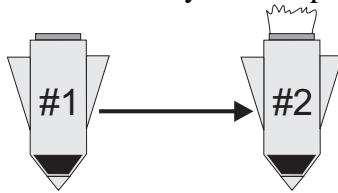


5. A long distance swimmer is able to swim through still water at 4 km/h. She wishes to try to swim from Port Angeles, WA due north to Victoria, BC, a distance of 50 km. An ocean current flows through the Strait of Juan de Fuca from west to east at 3 km/h. In what direction should she swim to make the crossing along a straight line between the two cities?
- A. 41° west of north
B. 41° east of north
C. 49° west of north
D. 37° west of north
E. 37° east of north
6. A projectile is fired from the origin (at x and $y = 0$). The initial velocity components are $v_{0x} = 940$ m/s and $v_{0y} = 96$ m/s. How high does the projectile rise above its initial y position?
- A. 45,550 m
B. 470 m
C. 45,080 m
D. 940 m
E. 90,160 m
7. A truck, with a ball free to roll around in the bed, takes a turn to the right. Which of the following forces causes the ball to roll to the left side of the truck?
- A. A frictional force.
B. The centrifugal force.
C. The attraction to the truck bed.
D. A g force.
E. No force causes it to move to the left side of the truck.

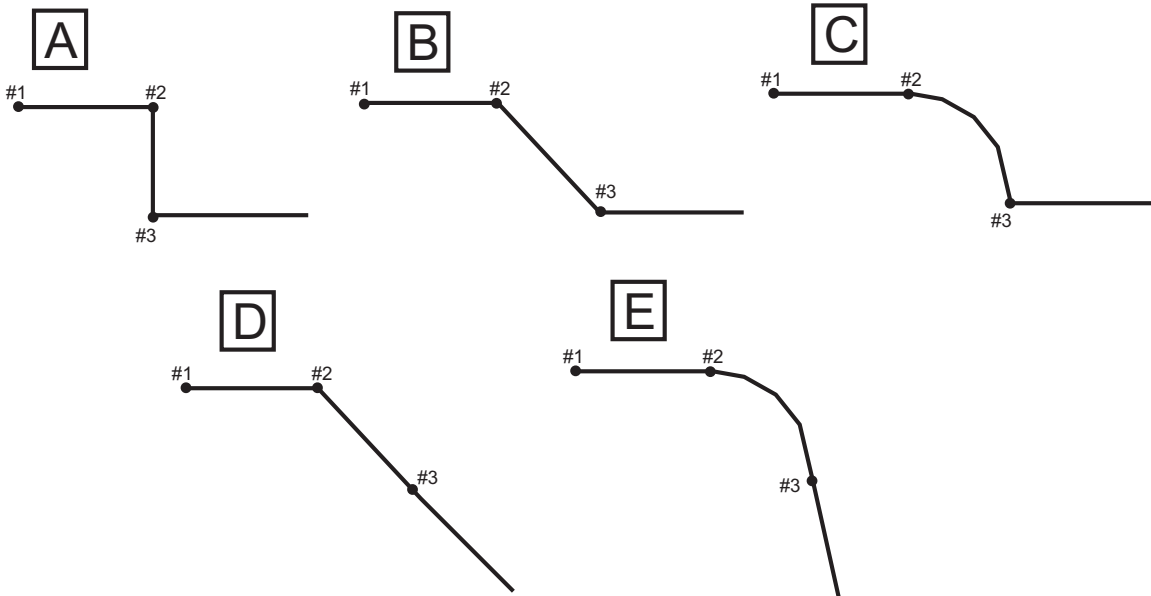
8. Consider what happens when you jump up in the air. Which of the following is the most accurate statement?

- A. It is the upward force exerted by the ground that pushes you up, but this force can never exceed your weight.
- B. You are able to spring up because the earth exerts a force upward on you which is stronger than the downward force you exert on the earth.
- C. Since the ground is stationary, it cannot exert the upward force necessary to propel you into the air. Instead, it is the internal forces of your muscles acting on your body itself which propels the body into the air.
- D. When you push down on the earth with a force greater than your weight, the earth will push back with the same magnitude force and thus propel you into the air.
- E. When you jump up the earth exerts a force F_1 on you and you exert a force F_2 on the earth. You go up because $F_1 > F_2$, and this is so because F_1 is to F_2 as the earth's mass is to your mass.

9. Beginning at point #1, a rocket is drifting sideways in deep space at constant velocity. Its engine is turned off and it is not near any stars or planets or other outside forces.



At point #2, it fires its engine (providing a constant forward thrust force). At some later time, it has reached a point #3 and turns off its engine. Which of the following best represents the rocket's trajectory?



10. Which of the following are Newton's Third Law Pairs? **Circle all letters that apply, you may circle more than one!**

- A. A book is at rest on a table: the force of gravity on the book; the normal force the book exerts on the table.
- B. You push backwards on the ground as you walk; the ground pushes forward on the bottom of your feet.
- C. In an elevator traveling with constant velocity: the normal force of the floor of an elevator on your feet; your weight.
- D. A ball hangs from a string and is at rest: the tension force of the string on the ball; the weight of the ball.

Show all your work on the problems. Place boxes around your final answers. Partial credit will be given, but we need to see your work.

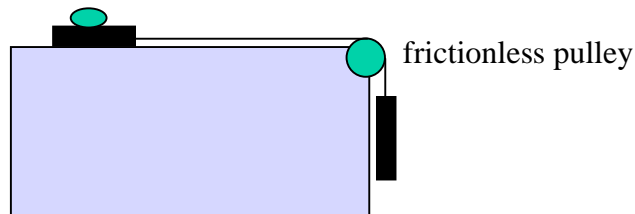
11. (25 pts) Starting from rest on the ground, a rocket takes off straight up with a constant acceleration. At $t_1 = 1.52$ s, a bolt separates from the rocket. At the moment of separation, the bolt and rocket have the same vertical position and velocity. The bolt subsequently hits the ground $\Delta t = 3.28$ s later. What was the acceleration of the rocket?

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Show all your work on the problems. Place boxes around your final answers. Partial credit will be given, but we need to see your work.

- 12. (25 pts)** A Vanderbilt physics major is constructing a linear egg accelerator. An egg is placed on a cart which slides on a frictionless table top. The cart is pulled by a hanging weight of mass $M = 21.1$ kg, as shown below. The egg and cart together have a mass of $m = 5.23$ kg. The cart is released from rest.

What is the tension in the cord pulling the cart after it is released?



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