NAME and LAB SECTION NUMBER (Please print) _____

Physics 116A, First Exam

Chapters 1–4

Useful constant: $g = 9.8$ m/s^2

Pledge

I pledge that I have taken this exam by the guidelines of the Vanderbilt University Honor Code.

_____

(Signature)

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Part I Multiple Choice Circle the correct answer on this page *and* fill in the OpScan sheet (5 points each.)

1. A particle starts out at the origin with a velocity given by $16\hat{\mathbf{i}} - 12\hat{\mathbf{j}}$ (in m/s) and has an acceleration given by $3\hat{\mathbf{i}} - 6\hat{\mathbf{j}}$ (in m/s^2). What is the speed of the particle at $t = 2$ seconds (answer in m/s)?

a) 52 b) 39 c) 46 d) 33 e) none of these

2. In the lecture demonstration called "shoot–the–monkey", it was best to aim the projectile

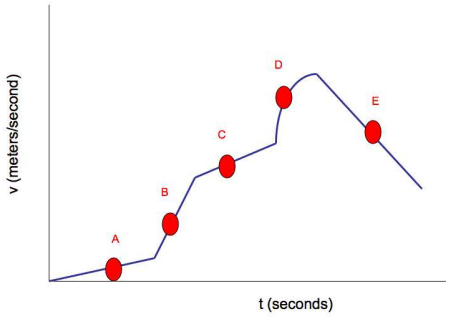
a) above the target b) in the center of the target c) below the target
d) didn't matter, the projectile missed both times e) none of these

3. At all times the net force on an object

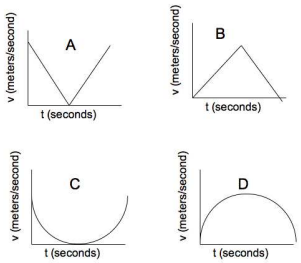
a) is in the direction of the motion b) is opposite to the direction of motion
c) is at right angles to the motion d) is in the direction of the acceleration e) none of these

4. At which point on the accompanying speed-time $v(t)$ graph for one dimensional motion is the instantaneous acceleration negative?

a) point A b) point B c) point C d) point D e) point E



5. A ball is thrown vertically upward from the Earth's surface and then falls back to Earth. Ignoring air resistance, which of the following graphs plots speed vs time correctly (speed is a magnitude, and is always positive)



E) None of these

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6. If a vector $\vec{B}$ is added to a vector $\vec{A}$, the result is $6\,\hat{\mathbf{i}} + \hat{\mathbf{j}}$. If the vector $\vec{B}$ is subtracted from $\vec{A}$, the result is $-4\,\hat{\mathbf{i}} + 7\,\hat{\mathbf{j}}$. What is the *magnitude* of $\vec{A}$?

a) 5.1 b) 4.1 c) 5.4 d) 5.8 e) 8.2

7. Assuming that L has dimensions of length, and g is the gravity acceleration, which of the following formulas could be a valid expression for the time T it takes a pendulum to complete one swing back and forth

a) $T = 2\pi L/g$ b) $T = 2\pi\sqrt{L/g}$ c) $T = 2\pi\sqrt{g/L}$ d) $T = 2\pi g/L$ e) none of these is possible

8. A person is driving a car on a flat road in a horizontal circle at constant speed. What can be said about the acceleration vector of the car?

a) it is zero b) its magnitude is constant c) its direction is down
d) its value is 9.8 m/s^2 e) its direction is constant

9. What is the maximum height in meters for a projectile fired on the Moon's surface with initial velocity components $v_{x0} = 3.0$ m/s and $v_{y0} = 4.0$ m/s, given that the gravity acceleration on the moon has a value 1.6 m/s^2

a) 0.50 b) 2.0 c) 3.0 d) 4.0 e) 5.0

10. A 4.0 kg mass starts from rest and is acted upon by a constant force. If the mass moves 64 m in 4.0 s, what is the magnitude of the force in Newtons?

a) 4 b) 8 c) 16 d) 32 e) 64

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Please circle the correct answer and fill in the circle on the OpScan answer sheet. (5 points each)

11. A 2 kg cart collides with a 8 kg cart. During the collision which car experience the greater force?

a) The 2 kg car b) The 8 kg cart c) The forces are equal in magnitude but not zero
d) The net force on either cart is 0 e) impossible to say which force is greater

12. A book is at rest on a horizontal table. A lipstick is at rest on the book. The forces acting on the book are

a) the weight of the book and the weight of the lipstick
b) the weight of the book, the weight of the lipstick, and the normal force from the table
c) the weight of the book, the normal force on the lipstick, and the normal force from the table
d) the weight of the book, the weight of the lipstick, the normal force on the lipstick, and the normal force from the table
e) the weight of the book, the weight of the lipstick, the normal force on the lipstick, the normal force from the table, and the weight of the table.

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Part II Worked Problems Solve each of the problems. **Show clearly all your work and which equations you use in order to obtain partial credit.** All numerical answers must have units attached where appropriate.

1. During a tennis match, a player serves a ball with a speed of 23.6 m/s with the ball leaving the racquet in the horizontal direction at a height of 2.37 m off the ground.

a) How long does it take the ball to reach the net if the net is 12 m away from the racquet? (6 points)

b) If the net is 0.9 m high, does the ball go over the net? If so, by how much does it clear the net? If not, by how much does it hit below the top of the net ? (7 points)

Part II Worked Problems Solve each of the problems. **Show clearly all your work and which equations you use in order to obtain partial credit.** All numerical answers must have units attached where appropriate.
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2. A somewhat daring cowboy is sitting on the branch of a tree. He sees a horse coming towards him at a constant horizontal speed of 10.0 m/s. He decide that he will drop from the tree branch onto the horse, after he estimates that the horse's saddle is 3.00 meters vertical distance below the tree branch.

a) How long in seconds with the cowboy be falling, assuming that he does land on the horse's saddle (6 points)

b) How close in meters should the horse be in horizontal distance when the cowboy drops from the branch, assuming that the cowboy does land in the saddle? (7 points)

Part II Worked Problems Solve each of the problems. **Show clearly all your work and which equations you use in order to obtain partial credit.** All numerical answers must have units attached where appropriate.
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3. A 1.00 kg mass is observed to accelerate at a value of 10.0 m/s^2 in a direction 30 degrees North of East (horizontal). A force $\vec{F}_2$ is acting on the mass in the vertical (North) direction with a magnitude of 5.00 N. What is the magnitude of a force $\vec{F}_1$ which is acting in the horizontal direction on this mass which causes the observed acceleration? (14 points)