Physics 160 Name _____

Exam 1 – Kinematics

September 17, 2010

- This is a closed book examination.
- You may use a 3x5 index card that you have made with any information on it that you would like.
- There is extra scratch paper available.
- Your explanation/work for the worked problems is worth ¾ of the points.
- Explain your answers – even on multiple choice questions!

A general reminder about problem solving:

1. Visualize - draw a picture
2. Pick a coordinate frame
3. Create a simplified picture – schematic with vectors describing motion
    a. 2D Motion: separate vectors into components
    b. Force Problem: create a simplified free body diagram
    c. Energy Problem: create energy level diagram(s)
4. Write down what you know – create separate columns for different directions
5. Write down what you don't know and/or what you want to know
6. List mathematical relationships
7. Combine mathematical formulas, Simplify and Solve
8. Check your answer – Is it reasonable? Are the units correct?

- Show all work!

Exam 1 – Frequently Asked Questions (FAQ)

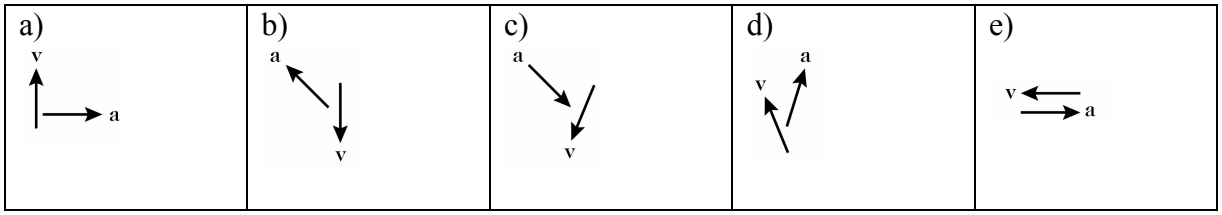
- *What does this exam cover?* This exam will cover topics from Chapter 1, Chapter 2 and Chapter 3.
- *Can I use a "helper sheet"?* You may use a 3"x5" index card that you have made with any information on it that you would like. Your full name, the date and your lab section (time) must be on your index card.
- *Do I have to use a problem solving sheet when completing the word problems?* Yes.
- *What happens if I make a mistake on a problem solving sheet?* There are extra problems solving sheets available if you need one.
- *Why do I need to enter a code for my exam?* There are different exams so the scantron machine needs to know which version of the exam you have.
- *Why do I need to explain my answers to multiple choice questions?* If you misinterpret a question or want me to consider partial credit I must be able to see what you were thinking.
- *Is everything on this study guide going to be on the exam?* Not necessarily.
- *Will there be questions not on this study guide on the exam?* Most likely.

The next two questions are general. You need to be comfortable with both 1D and 2D motion graphs. Try to think what type of multiple choice questions I could ask you about position, velocity and acceleration.

1. You toss a football as fast as you can at an angle of 60 degrees from the horizontal. Use a coordinate system where up is in the positive direction. Draw the position, velocity and acceleration curves for the football.

2. You drop a small fluffy animal from the roof of the science lab building. Draw the position, velocity and acceleration curves for this object.

3. Shown here are the velocity and acceleration vectors for an object in several different types of motion. In which case is the object slowing down and turning to <u>its</u> right?



4. A car is traveling in a circle with a constant speed.
   a) The car has a net acceleration normal to the surface of the circle (pointing radially out).
   b) The car has zero net acceleration.
   c) The car has a net acceleration towards the center of the circle (pointing radially inwards).
   d) The car has a net acceleration pointing tangential to the circle (pointing in the direction of travel).

5. You drop a golf ball from a roof and immediately throw a baseball straight up into the air. Assume the mass of the baseball is 3 times the mass of the golf ball and ignore air drag. When the baseball is at the top of its trajectory,
   a) the acceleration of the golf ball is <u>greater than</u> the acceleration of the baseball.
   b) the acceleration of the golf ball is <u>equal to</u> the acceleration of the baseball.
   c) the acceleration of the golf ball is <u>less than</u> the acceleration of the baseball.

6. A row boat is travelling across a river. The river has a strong current. If the rower wants to cross the river quickly which direction should the boat be angled?
   a) The boat should be pointed 45 degrees up the river (against the current).
   b) The boat should be pointed straight across the river.
   c) The boat should be pointed 45 degrees down the river (with the current).
   d) It does not matter which direction the boat points.

7. If the fastest you can safely drive is 65 mi/h, what is the longest time you can stop for dinner if you must travel 541 mi in 9.6 h total?
   a) 1.0 h
   b) 1.3 h
   c) 1.4 h
   d) 1.6 h
   e) You can't stop at all.

8. 11) Jordan ran up the hill at 7.0 m/s. The horizontal component of Jordan's velocity vector was 1.8 m/s. What was the angle of the hill?
   a) 15 degrees
   b) 33 degrees
   c) 57 degrees
   d) 75 degrees
   e) 84 degrees

9. A child is sitting on the outer edge of a merry-go-round that is 18 m in diameter. If the merry-go-round makes 8.3 rev/min, what is the velocity of the child in m/s?
   a) 1.2 m/s
   b) 5.5 m/s
   c) 7.8 m/s
   d) 8.3 m/s
   e) 15.6 m/s

Answer the following TRUE or FALSE questions. Explain your answer with an example.

10. Velocity and acceleration are always in the same direction.
    a) TRUE
    b) FALSE

11. Acceleration is zero if the magnitude of the velocity is constant.
    a) TRUE
    b) FALSE

12. The product of a vector by a positive scalar is a vector having the same direction of the original vector but a different magnitude.
    a) TRUE
    b) FALSE

13. Average velocity and speed are always equal.
    a) TRUE
    b) FALSE

14. If your average velocity is zero your speed is also zero.
    a) TRUE
    b) FALSE

15. Your acceleration can be zero even if the velocity is not zero.
    a) TRUE
    b) FALSE

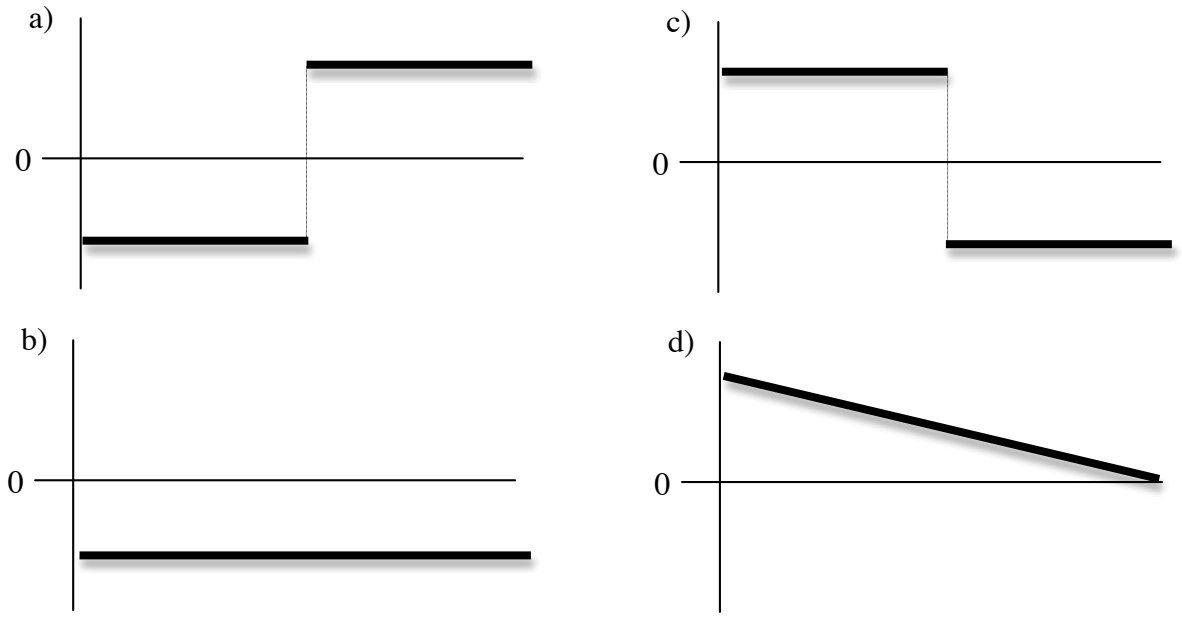
Draw a graph for the following motions. (I will have questions where you need to match graphs with described motions)

16. Position vs time graph of a biker whose is traveling at a constant speed.

17. The acceleration vs time graph of a biker approaching a stop sign at a steadily decreasing velocity.

18. Position vs time graph for a swimmer slowing down.

What motion could each of the following graphs represent? Could any of them describe the motions above?



Do the next two problems using separate problem solving sheets. There are extra problems solving sheets available if you need one.

19. [10 PTS] On a field trip to New York City you visit the 102nd floor of the Empire State Building. Standing on the observation deck you wonder how fast an object would be traveling when it hit the ground if it were dropped over the railing. You notice that the sign says that the observation deck is 1224 feet above the street.
    a) Ignoring air drag how fast would a penny (mass = 6 grams) be traveling when it hit the ground?
    b) How long would it take to hit the ground?
    c) Is your answer reasonable?

20. [10 PTS] Determine the horizontal distance (range) an object travels as a function of initial velocity and angle. Assume you are standing on the ground and ignore air drag.
    a) Write the range as a function of velocity and angle.
    b) At what angle would you throw an object to maximize the range?
    c) If you were standing on the top of a building would you now throw the object at a larger or smaller angle to maximize the range? Explain.

21. [10 PTS] A car is found on the beach 70 meters from the base of "lover's leap", a 20 meter tall vertical cliff. The ground is flat right up to the edge of the cliff. You are curious as to how fast the car was traveling right before it left the cliff. Give your answer in both m/s and miles/hour. Justify and explain all assumptions.

General Problem Solving Guide

Name:	
Lab Time:	
Date:	
Test Code:	
Problem #:	

List given information, define variables, sketch picture:

Simplify question, list target quantity:

List all related quantitative relationships:

Outline approach, sketch diagrams if needed (or sketch next to pictures above):

Obtain a general solution:

Check Units: .

Check Limiting Cases: .

Obtain a numeric solution: .
(i.e. plug in the numbers)

Why is solution reasonable? Explain.