Lab: AP Review Sheets   AP Physics

Background
One very useful learning technique involves preparing review materials for other people to use. In this long-term assignment, you'll be preparing a series of Review Documents, each one 4-pages in length, ostensibly for others to use in preparing for the AP exam. You'll almost certainly find, however, that preparing *your own* document is a far better review than reading a document prepared by someone else.

Objective
Te prepare a series of 4-page Review Documents summarizing the material covered in given units of the AP Physics C course.

Equipment
Textbook, calculator, paper, pencil, sample Review Document

Procedure
1. Examine the sample Review Document, and use it as a general model of what you'll be presenting on your own review document. Your review document should include:

   a. the **title** of the unit you're document is covering
   b. your **name**, as well as the name of any people who may have helped you listed as assistants
   c. a brief **background** or summary of the topic you'll be reviewing
   d. a few of the **major topics** covered in that unit
   e. a summary of important key phrases or **vocabulary** terms covered in the unit
   f. a collection of important **formulae**, perhaps with information regarding situations when each formula might be useful
   g. **diagrams**, pictures, and graphs
   h. at least 3 free-response **problems**, *with well-blurbed solutions* written out in detail
   i. **four** pages exactly of content--not three, not five.

   See the following pages of this lab description for a sample Review Document.

2. You may choose to type out or hand-write your review sheet, but it must be legible.
3. As already stated, the Review Document must be four pages in length, ie. more than three, and less than five. If you find that you haven't filled four pages, include additional pertinent information to your Document. If you find that you're going to need five pages, write smaller or use your space more efficiently!
4. If you work with someone else on your Review Document--and you're encouraged to--be sure to give them credit. Each person is responsible for his or her own Documents, and each person's Document needs to be *completely different* from other Documents (from other people) covering that same unit.
5. The wise student will try to choose a topic in which they are weak: that way, you'll get the chance to better learn material that is difficult for you. (I fully expect there to be a mad scramble for Chapters 10, 11, 23, 24, and 25!)
6. Review Documents, on four, single-side, 8-1/2 x 11 pieces of paper, are due on Tuesday of each week at the beginning of class.
7. For the subject of your Review Document, you'll choose/be assigned a chapter from each of the groups here, one group every week.

GROUP 1	GROUP 2	GROUP 3	GROUP 4
Chapter 4 - Motion in Two Dimensions	Chapter 10 - Rotation of a Rigid Body About a Fixed Axis	Chapter 23 - Electric Fields	Chapter 29 - Magnetic Fields
Chapter 5 - The Laws of Motion	Chapter 11 - Angular Momentum	Chapter 24 - Gauss's Law	Chapter 30 - Sources of the Magnetic Field
Chapter 6 - Circular Motions & Other Applications of Newton's Laws	Chapter 12 - Static Equilibrium	Chapter 25 - Electric Potential	Chapter 31 - Faraday's Law
Chapter 7 - Energy & Energy Transfer	Chapter 13 - Universal Gravitation	Chapter 26 - Capacitance & Dielectrics	Chapter 32 - Inductance
Chapter 8 - Potential Energy	Chapter 15 - Oscillatory Motion	Chapter 27 - Current & Resistance	
Chapter 9 - Linear Momentum & Collisions		Chapter 28 - Direct Current Circuits	

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Additional Notes

1. If you wish to type up your solutions using Microsoft Word, including diagrams and equations may be problematic. Consider these options:
   a. **Low Tech** - Leave space in your Word document so that, after printing it out, you can write in by hand all diagrams and problem solutions.
   b. **Medium Tech** - Do diagrams and problem solutions by hand on white paper, then convert them to **.jpg** graphic files by scanning them. Insert these jpegs into your Word document.
   c. **High Tech** - Use Microsoft Word's Drawing capabilities (**View > Toolbars > Drawing**) to create your diagrams within Word, and use Microsoft Word's Equation Editor (an optional install from the Microsoft Office disk) to create problem solutions in Word.

2. If you'd like to receive a small amount of extra credit for some additional work…
   a. Use Option 1c above to create your document.
   b. Convert your document to a PDF file.
      i. Apple: Print > PDF > Save as PDF…
      ii. Windows: Various techniques, depending on which version you're running. Google it.
   c. Email the PDF to the instructor for inclusion on the course website.

Chapter 2: Motion in One Dimension

(Example)

by Richard White

with the kind assistance

of J. Bush & K. Marcotte

Background / Summary

In the study of classical mechanics, the first step is carefully describing *motion*. This unit discusses the fundamentals of single-dimensional motion, including displacement, time, velocity, and acceleration.

Five Key Points to Keep in Mind!

1. *Displacement* along the x-axis is defined as $\Delta x = x_f - x_i$.
2. *Velocity* is defined as change in position over time. It may be an average velocity, $v = \Delta x / \Delta t$, or an instantaneous velocity, $v = dx/dt$.
3. *Acceleration* is a defined as change in velocity over time: $a = \Delta v / \Delta t$, or $a = dv/dt$. In this course, we only deal with constant accleration.
4. The *kinematic equations* are used to describe the relationships between position, time, velocity, and acceleration.
5. Objects free-falling near the surface of the earth accelerate at 9.80 m/s² toward the earth. Free-fall problems assume the absence of air friction.
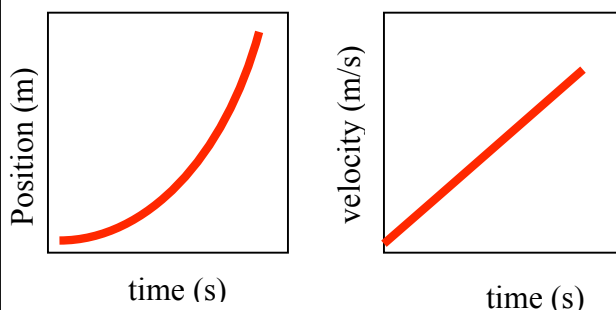
Did you know?

Mr. White insists that you draw a picture for every single stupid problem you ever do in these chapters. I mean… that's just *insane*.

For this one, the object appears to be traveling in the negative direction with a negative velocity (you can tell from the slope).
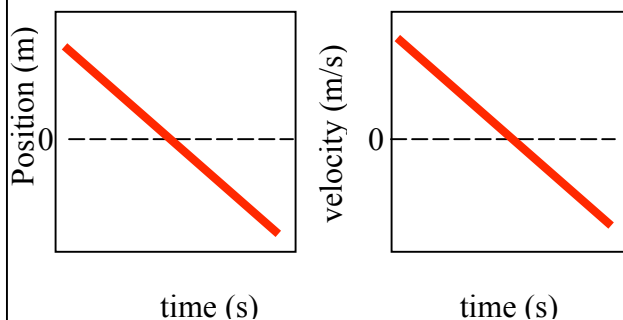
Constant velocity
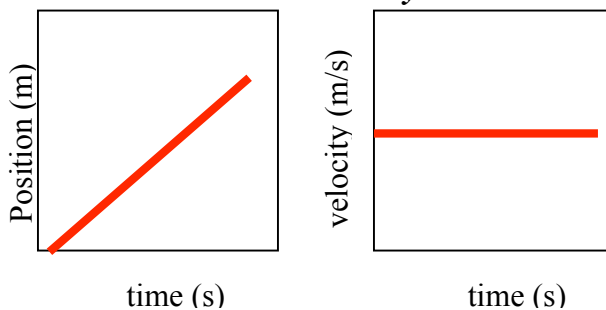
Constant acceleration

What's happening here?

This object initially has a positive velocity (above the x-axis), but that velocity is decreasing: the object is slowing down. It comes to a stop, and then begins accelerating in the negative direction.

The Kinematics Formulae

$$v = \frac{\Delta x}{\Delta t} = \frac{dx}{dt}$$

$$v_f = v_i + at$$

$$\bar{v} = \frac{v_i + v_f}{2}$$

$$\Delta x = v_i t + \frac{1}{2} at^2$$

$$v_f^{\,2} = v_i^{\,2} + 2a\Delta x$$

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Let's Do Some Problems!

1. [Easy] A jet plane lands with a speed of 100 m/s and can accelerate at a maximum rate of -5.00 m/s² as it comes to rest. What is the minimum time interval needed before it can come to rest? Can it land on a runway that is only 0.800 km long?

2. [Medium] A ball starts from rest and accelerates at 0.500 m/s² while rolling down an inclined plane 9.00 m long. When it reaches the bottom, the ball rolls up another plane were, after moving 15.0m, it comes to rest. What is the speed of the ball at the bottom of the first plane? How long does it take to roll down the first plane? What is the acceleration along the second plane? What is ball's speed 8.00 m along the second plane?

3. [Hard!] A rock is dropped from rest into a well. The sound of the splash is heard 2.40 s after the rock is released from rest. How far from the top of the well is the surface of the water? (The speed of sound in air at the ambient temperature is 336 m/s.)

Solutions:

1. First , let's write down some known values and see where that leads us:

   $v_i=100$m/s, $v_f=0$ m/s, $a=-5.00$ m/s².
   t=?
   $v_f=v_i+at$, so $t=(v_f-v_i)/a$
   $t=(0-100)/-5.00$
   $\boxed{t=20.0s}$

$a=-5.00$m/s²

x < 800m???
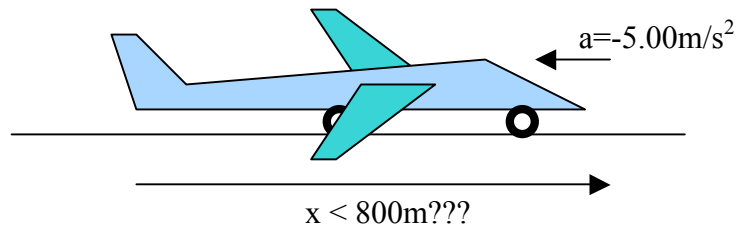
So apparently the plane is going to need to have 20.0 seconds to come to a complete halt. Now, the question becomes, how far does the plane travel during that 20.0s?

   $\Delta x=$?
   $v_f^2=v_i^2+2a\Delta x$
   $\Delta x=(v_f^2-v_i^2)/(2a)$
   $\Delta x=((0^2-100^2)/(2\bullet-5.00)$
   $\Delta x=1000$m

   $\boxed{\text{No, it won't be able to land on the 0.800 km (=800m) long runway.}}$

*For the sake of brevity, this sample document only contains a single example problem. Your assignment will need to include **three** sample problems.*