Physics 180A, 195, 196 Student Assessment

A. Physics Concepts Section I (20%)

There will be **2 physics concept questions** on each test. These questions will require a written explanation with a diagram and mathematical relationships. This section will demonstrate your ability to communicate in a written format. Expressing yourself in written, oral and logical mathematical communication is important in understanding physics concepts. **Please do not write in paragraphs**. Utilize bullets or numbered steps to separate your thoughts. *You should practice writing out the answer before the test.* ***Be clear, concise and complete.***

B. Mathematical Logic Section II (40%)

There will be **3 basic physics problems** and **3 multiple choice questions** on each test that will assess your ability to solve **basic physics problems**. These problems will demonstrate your ability to utilize mathematical relationships with either numbers or variables associated with the physics concepts. A diagram, an explanation or mathematical logic is required to show how you arrived at the answer. You will need to briefly explain your answer for the multiple-choice questions, too. ***In other words---always show your work for partial credit!***

C. Problem-Solving Process Section III (40%)

Physics is all about articulating in a clear, complete and logical manner. This section will demonstrate your ability to express yourself from start to finish. There will be 1 **DRS problem** that will require a complete explanation. You will be required to draw a complete and organized **diagram**, provide necessary and sufficient **reasoning** and **solve** the problem. Do not write in paragraphs. Utilize bullets or numbered steps to separate your thoughts. ***Practice these problems***.

> Two days before each test date, I will provide students with **6 conceptual questions, 9 basic numerical problems, 9 multiple-choice questions and 3 DRS problems** from which three separate tests will be made and randomly handed out on the test date.
> You will not become competent at solving problems by watching your Instructors solve the problem. You should practice solving these problems in front of friends or classmates. *One cannot learn how to hit a baseball by simply watching the pros. You will eventually need to step up to the plate and swing yourself. A few misses or foul balls are part of the game and to be expected.*

Grading Criteria

To provide partial credit to students, all problems and questions will be graded on the following criteria. You should always *be clear, concise and complete* and show your work.

Part A - ***You will receive 6, 5, 4, or (2, 0) points***

- One to three points deducted for **unclear, incomplete, disorganized, diagram, reasoning, or solution**. One should not have to struggle to read your handwriting. Utilize bullets or numbered steps to separate your thoughts. **[UNC, INC, DIS, PAR]**
- Two point deduction for use of a **derived equation**. **[DERQ]**
  Two to three point deduction for use of wrong equation **[EQU]**

Part B - ***You will receive 4, 2, 0 points*** **Box your answer**

- Two to four point deduction for correct answer or solution but an incomplete **diagram** or incomplete **reasoning** that is necessary to prove your answer or solution. **[DIG] [EXP]**
- One point deduction for **a simple calculation error,** too many or too few **significant figures** and **unit-less** solutions. Show your work. **[SIG] [UNT]**

Part C - ***You will receive 8, 7, 6, or (3, 0) points each on the Diagram, Reasoning and Solution component.***

- One to three points deducted for **unclear, incomplete, disorganized diagram, reasoning, or solution**. One should not have to struggle to read your handwriting. Utilize bullets or numbered steps to separate your thoughts. **[UNC, INC, DIS, PAR]**
- Three point deduction on both Reasoning and Solution for use of a **derived equation**. **[DERQ]**
- One point deducted for a numerically wrong answer based upon using the right mathematical relationships (**a simple calculation error**). Show your work. **[MERR]**
- Two to three point deduction for use of wrong equation **[EQU]**
- One point deduction for one too many or too few **significant figures**. Two point deduction for two or three too many sig. figs. One point deducted for **unitless** answers. **[SIG, UNT]**

Problem Solving using the Diagram, Reason and Solution Method

1) **Read the Problem**.
- This is really important, relax, calm down.
- Read the problem slowly. Reread the problem. Keep saying to yourself there are no tricks, here.
- The strict wording of the problem is to train you to scrutinize the problem at hand. Doctors, lawyers and scientists need to understand exactly what is given and exactly what is needed.

2) **Visualize the problem**.
- Draw a neat, large, organized and labeled **Diagram**.
- Your diagram demonstrates your understanding more than you may believe! Can artwork sum up an artists' mood? Ask your friends if they understand what you are trying to explain.
- Your diagram speaks for you. They are not your dirty laundry. Imagine that a Psychologist will be looking at your diagram! What do you believe they will think of your understanding of this problem?
- *Be complete, clear, and concise.*
- If your diagram is all of this---there should be few questions asked!

3) **What is given in the problem?**
- Start to use clues given to you. Write them down.
- Pay close attention to the adjectives used. Remember, there are no tricks.
- What else do you know that is not given that may be useful?
- Can you make a ballpark prediction to the solution?

4) **What are you solving for?**
- Write this down. Keep returning to this question. You may forget.

5) **Reason out your path to a solution**.
- Explain your reasoning to yourself or a group member.
- What are the main concepts and guideposts that will help you discover the solution to this problem? You should internalize this process! You will use it again and again.
- You must **articulate** your learning process through dialogue, diagramming and reasoning.
- Don't write in paragraphs. Use bullets or numbered steps. Confine your logic to small chunks.

6) **Find and utilize appropriate equations**.
- Manipulate these equations to fit your current needs.
- Do not use derived equations! These equations are like maps created by people before you. It's like following a guide on a trail. Do you always follow the map? Don't you want to create your own path?
- Look at the equation for what it is, and---it is not. Equations have feelings, too! Give them quality time. You won't get lost if you use your own well thought out process.

7) **Plug, Shove and find the Solution**.
- This is the easy part. The calculator does the work. Monkeys can punch in numbers! This is NOT learning. Getting to this step is the best part!

8) **Check and reflect on your answer**.
- How did this particular solution process relate to other problems you have already done?
- How can you generalize this solution process for future problems?
- How does the solution compare to your early prediction?
- Does the solution make sense? Is too large or too small?