

## **GENERAL PHYSICS TUTORIAL**

Tutorial is intended to hone your practical problem solving skills. Through pre-class reading and classroom discussion, you will have already been introduced to the applicable material that we will employ here. Therefore, you should be familiar with the basic terms and concepts, though you are not expected to have yet reached a level of mastery. Feedback is essential, so please ask questions whenever they arise.

During tutorial, the instructor will first work through a demonstration problem as the students observe and offer suggestions. You should be attentive, follow carefully, and take thorough notes. In particular, you should pay attention to how the instructor monitors the work and continually assesses it. At the end, you will be given a transcript of the solution, but this does not lessen the importance of taking good notes yourself! Remember that the path taken to solving a problem is what's truly essential. The answer is only one detail.

The techniques you learn here are not all just applicable to physics. Some are quite specific, while others are generalizable to a broad range of situations. It will help you to continually reflect on the nature of the methods used and to identify when a particular strategy or tactic is used. Here are some common approaches you will encounter:

### **Strategies**

- Drawing on your insight from classroom discussions, explicitly identify the physical concepts applicable to the problem at hand
- If the problem is too complicated, divide it into several parts, each of which is governed by a single concept
- Analyze each part with the appropriate concept
- Identify and relate quantities that appear in multiple parts
- If the problem is too difficult, construct a related but similar problem and try to solve it to gain intuition and insight

### **Tactics**

- As you work, explain what you are doing in words to capture your thought processes
- When you make errors, don't erase them! Rather, record why you now think they are mistakes
- Sketch the situation to help organize your thoughts and your work
- Assign unique, unambiguous, and memorable symbols to all relevant quantities
- Identify formulas that are applicable to each part, always writing down the most familiar version before manipulating into other forms
- Identify relationships among quantities defined in different periods
- Solve algebraically for unknown quantities
- Substitute in numerical values with units and check for consistency
- Always write out unit conversions explicitly
- Estimate numerical results, then use a calculator
- Examine results to see if they are reasonable

For the second half hour of tutorial, you will be assigned a problem to work on yourself. Interacting with your neighbors is encouraged! The assigned problems will not be identical to the demonstrated ones, of course. Your goal is to follow the general approach modeled by the instructor, not to simply reproduce the solution in a slightly different context.

Each week you will receive an additional assignment that is not due till later, so take your time to work carefully. Presentation is a key aspect on which your work will be assessed. The purpose is not simply that the grader can understand your work. Rather, it's that you learn to document your thoughts in a way that will actually facilitate solving problems.

You will be graded according to the following rubric. The abbreviated second version will appear on your paper, and the grader will indicate whether you have earned full ( $\otimes$ ), partial ( $\oslash$ ), or no credit ( $\circ$ ) on each point. NOTE: You must submit the cover page with the rubric stapled atop it to earn any credit!

### **Presentation and communication**

- ☐ **Writing:** legible handwriting, only one side of paper used, full name printed clearly
- ☐ **Explanation:** clear reasoning in English that describe the reasoning for each step
- ☐ **Figure:** appropriate to question, clearly labeled with symbols
- ☐ **Variables:** values are identified and given unique, unambiguous symbols
- ☐ **Conclusion:** physical implications of the answer are considered in physical context

### **Mathematics and manipulation**

- ☐ **Formulas:** Equations are presented initially in most fundamental algebraic form
- ☐ **Algebra:** problem is worked substantially in algebraic form
- ☐ **Units:** all numerical values include units that are carried through the manipulations
- ☐ **Approximation:** numbers are rounded and simple arithmetic is used to approximate the answer before checking with a calculator
- ☐ **Result:** answer is correct, including units

### **Presentation and communication**

- ☐ Writing
- ☐ Explanation
- ☐ Figure
- ☐ Variables
- ☐ Conclusion

### **Mathematics and manipulation**

- ☐ Equations
- ☐ Algebra
- ☐ Units
- ☐ Approximation
- ☐ Result