

AP Physics

Instructor: Mr. Butler

Problem Solving Guide

Follow the steps below when deriving problem solutions.

Credit for problem solutions will be awarded based on the inclusion of these steps.

1. Read – Re-Read – Interpret and Classify

- a. Read the problem carefully. You may have to read several times to gain a complete understanding of the problem and conditions of the particular situation.
- b. Develop a mental image or movie of the situation, conditions, motion, or process.
- c. Think about which quantities are known and which are unknown.
- d. Interpret the situation in terms of major principles. Classify the problem by determining which principles are important and apply to the given situation and conditions.

2. Sketch/Diagram the Physical Situation (Write: Sketch →)

- a. Draw a sketch or diagram of the physical situation. The sketch should not be an artistic work, but rather a basic diagram showing the most important elements of the event.
- b. Include in the diagram each known physical quantity using its symbol, value, and unit.
- c. Use a question mark for the value of any quantity which is unknown.
- d. Place symbols for the quantities in appropriate places in the diagram according to their physical relationship to the event.
- e. Define a positive reference direction by drawing an arrow and a + sign.
- f. Place small arrows on top of vector quantity symbols to indicate their direction.

3. Identify the Unknown Quantities (Write: Solve →)

- a. Identify, in symbolic form, the unknown physical quantities which you need to find.

4. Define Problem and State Important Relationships (Write: Define →)

- a. Determine and state the problem type based on the principles being studied.
- b. Identify any important relationships between physical quantities by writing the equations that represent those relationships.

5. Identify the Defining Equation (Write: Def. Eq. →)

- a. Write down the defining equation that represents the principle governing the event.
- b. Examine each symbol in the defining equation. Try to associate these symbols with each physical quantity and how this quantity is observed to change during the event.
- c. Try to interpret how these quantities are related and think about the relationship that exists between these quantities.

6. Solve Defining Equation Algebraically

- a. Using algebra, manipulate the defining equation to solve for the unknown physical quantity.
- b. **Manipulate variables and constant only! Do not introduce numerical values at this point!**
- c. Rearrange the equation showing the progression of each algebraic step. More than one step may be required to solve for the unknown quantity.
- d. Substitution of expressions from other equations or the use of simultaneous equations may be necessary in order to eliminate a given unknown quantity.
- e. When complete, the solved defining equation should show the unknown quantity on the left side of the equation and the known quantities on the right side of the equation.

7. Substitute Known Quantities

- a. In this step, introduce the numerical values of the known quantities into the solved equation.
- b. Rewrite the solved equation -- Substitute each known variable and replace it with its numerical value given in the problem.
- c. Be certain to include correct units for each numerical value and show cancellation of units using strikethroughs.

8. Calculate – Evaluate – Box Answer

- a. Use calculator to compute the answer.
- b. Be careful to enter the numbers correctly and in the proper sequence according to the rules of mathematical operations.
- c. Evaluate both the value and unit of your answer. Determine if they are meaningful in terms of the solved quantity and the given physical situation.
- d. Clearly identify the answer by placing a box around it.
- e. Be certain the answer includes correct symbol and units.