

PHY138Y - Physics for the Life Sciences I - Problem Solving

Although the tests and Final Exam in PHY138 will have many conceptual questions, there will be some conventional numerical problems. Thus, problem solving will be an important part of the course. Experts divide problem solving into a number of distinct steps. We will follow these steps for every example that we do in class. The textbook follows an almost identical series of steps for all of its worked examples. You should follow them for all problems that you do.

1. MODEL It is impossible to treat every detail of a situation. Simplify the situation with a *model* that captures the essential features.

2. VISUALISE This is where expert problem solvers put most of their effort

- Draw a *pictorial representation*. This is a sketch of the actual situation described in the problem. It should include:
 - All the information given in the problem (speeds, wavelength, electric charge, etc.). If that information does not include an algebraic form (v , λ , q) give each quantity a symbol.
 - Choose a coordinate system. Although in principle all coordinate systems are equally valid, some choices will simplify the amount of work necessary to solve the problem. Try to be clever in your choice.
 - Make a table of all known information, and identify the desired unknowns.
- Draw a *physical representation*. This will contain only the physical quantities of the problem. Thus it will typically be simpler and will often be the one that you use to actually solve the problem.
- Draw a *graphical representation* if it is appropriate for the problem.
- Go back and forth between these representations as needed.

3. GUESS THE ANSWER Use your "common sense" and physical intuition to try to figure out the answer first.

4. SOLVE

1. Cast the problem into an algebraic equation or set of algebraic equations using the any symbols that were given or that you have defined.
2. Solve the equation or equations to get an algebraic form of the answer.
3. If the problem is numeric, *after* all the mathematics has been done substitute the numbers and their units into the equations. Determine the units of the answer. We cannot stress too strongly that you should resist the urge to put in the numbers too soon. Keeping the problem algebraic until the end greatly reduces the chance of making a mistake and almost always reduces the amount of work necessary.

5. ASSESS Compare your answer to your guess: if they differ which do you think is correct? Is your answer believable? Does it have proper units? Does it make sense?