
How to Approach Quantitative Problems in Chemistry

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You can use this outline to help you solve quantitative problems more systematically, but don't feel that you have to stick to it rigidly. As you become more comfortable with this sequence, you'll start to find some of the steps unnecessary or automatic. Feel free to make any adjustments that you see fit.

Part I. Extracting Information

1. Read the prompt to identify the topic. Take a few seconds to skim through the prompt. Do your best to identify which concepts you've learned in class are at the heart of the question.
2. Identify the unknowns in the problem. What are you expected to find? In most cases, the unknowns are explicitly identified in the prompt (e.g., Find the solution's molarity.).
3. Identify the knowns in the problem. This is the most important part of the problem-solving process because figuring out what you already know can help you find what you need to know. Some knowns are easy to extract (e.g., 18 grams of water, at room temperature), while others may not even be explicitly stated in the prompt (e.g., should you assume ideal gas behavior?).
4. Draw a diagram to model the problem. It's sometimes helpful to sketch out a pictorial representation for the problem. Think about how all of your known and unknown variables fit together in your diagram to get a better sense of how to approach the problem.

Part II. Devising a Strategy

5. Relate the knowns and unknowns. Are there equations or relations that contain the knowns and unknowns? You may not need all of the knowns you identified, but your unknown probably needs to show up somewhere in the equation. It's best to start with the simplest ones and check:
 - a. Does the relation apply in this particular case? Are there any exceptions, constraints, or special conditions that prevent you from using the equation in this problem?
 - b. Can this problem be simplified in any way? You can reduce many problems to a series of smaller problems or use simplifying assumptions to clear away the clutter.
 - c. Have you seen this type of problem before? Is the setup similar to one that your book or your professor used to illustrate a concept? Recalling how analogous and/or related problems were solved previously may suggest some ways for you to proceed.

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6. Isolate the unknown from the equation. Manipulate the using algebra (or in advanced courses, sometimes calculus) to isolate your unknown (traditionally on the “left-hand side”). Look at the “right-hand side” to see if you need any additional variables to proceed. If so, check:
 - a. Are you missing any knowns or assumptions? Take a few seconds and reread the prompt to see if you missed any knowns or assumptions. Consult step 3 above.
 - b. Can you evaluate this additional variable? Is there another equation that can give you the value of the additional variable using your existing knowns and assumptions? If so, solve for the additional variable and plug the expression into your equation. If all seems hopeless and you’re going nowhere, return to step 5 and come up with another equation.

Part III. Getting the Answer

7. Substitute in numerical values. Always substitute in your numerical values toward the end of the process, because numbers make algebraic manipulations more tedious and confusing.
8. Interpret the answer in physical terms. Make sure the number of significant figures and the units in your answer are appropriate and then think about if the answer makes sense. Do the sign and magnitude of the answer seem reasonable to you? If not, did something go wrong?