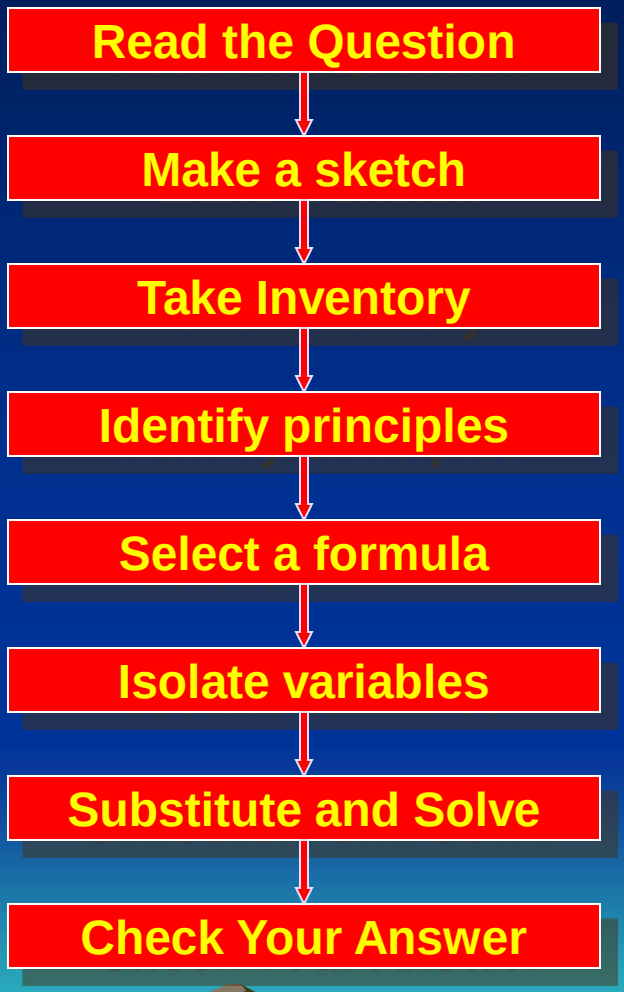
Solving Physics Problems

Problem Solving Strategy



1. Read the question

- Seriously, before you start your journey, you need to know where you are going. Understand the question before proceeding!
- Identify the exact variable you are being asked to find (using standard notation)
  - V_0 (initial velocity)?
  - F_{NET} (net force)?

2. Make a sketch

- Ancient proverb: one picture is worth a thousand words
- Select a coordinate system and establish positive directions (up and right are often positive)
- Remember, do not assume your sketch is accurate: do not make measurements on your sketch

3. Take an inventory

- Extract variables from the problem
- Identify or make assumptions about initial conditions
- Document this data in the appropriate places on your sketch
- Record all data with associated units
- Learn and use standard symbols: a for acceleration, v for velocity, etc.

4. Identify Physical Principles

- Problems assigned to you are meant to reinforce learning lessons – what physical principles apply:
  - Is object in equilibrium?
  - Is system open or closed?
  - Are conservation laws applicable?
- Divide and conquer
  - Are different principles dominant at different time intervals during the problem?

5. Select a formula

- Based on unknown and known data, identify a given equation that shows promise
- Write this equation in algebraic form before proceeding
- Make sure you know (n-1) of the (n) variables in the formula

6. Isolate the variable

- Algebraically manipulate your chosen equation to isolate the unknown variable on one side
- Check again to make sure the variables on the other side of the equation are all known values (given or assumed)
- Simplify the algebra, if possible

7. Substitute and solve

- Insert all known values into your chosen equation
- Include units with all values
- Remember algebra applies to units as well as numbers
- Look for unit cancellations
  - (for example: $m/s^2 \times s = m/s$)

8. Check your results

- Did the units match the expected answer?
- Can you estimate expected answer (i.e. order of magnitude)?
- Can you predict minimum or maximum values for the expected answer?
- Should answer be bigger or smaller than data provided in problem?

Subscripts

- $v = v_0 + at$
- $d = d_0 + v_0t + \frac{1}{2}at^2$
- Values with subscripts denote specific values, usually at specific times
  - x_0 or x_i for initial conditions, x_f for final
- Values without a subscript are usually variables, sometimes constants

Delta Notation

- $\Delta x = x_{final} - x_{initial}$ $(x_f - x_i)$
- Alternate: $\Delta x = x_1 - x_0$ (some books might use $x_2 - x_1$)
- $x_0 \rightarrow$ x "naught" (typically, this is the initial condition)
- Can you assume initial condition = zero?
  - In that case, $\Delta x = x$
- Units of Δx are the same as x