APEX: A Simple Problem Solving Framework

Assess – Plan – Execute – eXamine

Why Use a Problem-Solving Framework?

In real life and in school, we constantly run into situations that need clear thinking. The APEX framework helps us break big problems into small steps so we don't panic or rush into bad decisions. Think of it like a recipe or emergency checklist—order matters! If you try to execute before planning, or plan before assessing, you might end up fixing the wrong thing... or worse.

Real-Life Scenario: The Snake and the Hiker

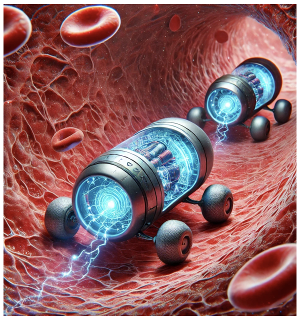
You're hiking through the woods when you see someone lying on the path.
Before you leap into hero mode, let's apply APEX:

1. **Assess:** Look around carefully. Oh snap! There's a **$7\frac{1}{2}$-foot eastern diamondback rattlesnake** curled up right next to the fallen traveler. Yikes! Stay calm. What do you know? What don't you know? Is the person moving? Is the snake angry? (Probably—it's a rattlesnake.)
2. **Plan:** Don't just charge in like an action movie star. Form a plan. Maybe find a long stick to gently move the snake away (unless you want your next problem to involve antivenom). Decide how to approach, check if the hiker is conscious, and plan to call for help.
3. **Execute:** Now, do what you planned. Move the snake (carefully!), check on the traveler, stabilize their condition, and make the emergency call. Bonus points if you look cool doing it.
4. **eXamine:** Is your plan working? Is the victim okay? Is the snake gone? Do you need to revise the plan? Maybe use your jacket as a pillow and stay with the person until help arrives. Reflect: could anything have gone better?

Why This Matters in the Classroom (and Life)

APEX isn't just for emergencies. It works for physics problems, cooking dinner, fixing a bike, or organizing a group project. When students learn to **think in steps**, they're better prepared for real-world challenges where there's no answer key.

Use APEX for a Typical Physics Problem



Nanobots to the Rescue! Two autonomous nanobots are navigating a tight channel in the human body as part of a targeted drug delivery mission. Each bot uses a miniature capacitor system to build up electric charge for navigation.

One nanobot holds a charge of $+3.0 \times 10^{-9}$ C, and the other has a charge of -2.0×10^{-9} C. If they are located 4.0 cm apart, what is the **magnitude** of the electrostatic force between them?

Let's assume they behave like point charges and are operating in a vacuum-like environment.

Assess

- Knowns:

  $q_1 = +3.0 \times 10^{-9}$ C
  $q_2 = -2.0 \times 10^{-9}$ C
  $r = 4.0 \text{ cm} = 4.0 \times 10^{-2} = 0.04$ m
  $k_C = 8.99 \times 10^9 \text{ Nm}^2/\text{C}^2$
- Unknown:

  F, the magnitude of the electrostatic force
- We want the **magnitude** of the force, so we'll drop negative signs.

Plan

- Use Coulomb's Law:

$$F = k_C \cdot \frac{|q_1 q_2|}{r^2}$$

- Plug in values for charges and distance (converted to meters), and calculate.

Execute

$$F = \left(8.99 \times 10^9 \ \frac{\text{Nm}^2}{\text{C}^2}\right) \cdot \frac{(3.0 \times 10^{-9} \text{ C})(2.0 \times 10^{-9} \text{ C})}{(0.04 \text{ m})^2}$$

$$F = (8.99 \times 10^9) \cdot \frac{6.0 \times 10^{-18}}{1.6 \times 10^{-3}} = (8.99 \times 10^9) \cdot (3.75 \times 10^{-15})$$

$$F \approx 3.37 \times 10^{-5} \text{ N}$$

eXamine

- Final answer: $\boxed{3.37 \times 10^{-5} \text{ N}}$
- Units are in newtons (N), which is correct for force.
- Sign is not required since the question asks for magnitude.
- The answer is very small, which makes sense given the tiny charges and short distance.