Coulomb's Law (SwiftStudy Printable)

Key Formula

$$F = \frac{kq_1q_2}{r^2}$$

F	force between charges	N
k	9.0×10^9 N·m^2/C^2 (constant)	
q_1, q_2	charges of objects	C
r	distance between charges	m

Tips to Remember

- The SI unit of charge is the coulomb (C). Even one coulomb is a lot of charge, so many problems will use smaller units of charge that you will need to convert to coulombs. Common units are the microcoulomb (1 μC = 10^{-6} C), the nanocoulomb (10^{-9} C), and the picocoulomb (10^{-12} C).
- The r in the denominator is squared. You'd be surprised how many students forget this. Some even write r^2 on their paper and then forget to square it in their calculators. Don't repeat their mistakes; it's a bummer of a way to miss a problem.
- The r in Coulomb's law does not stand for radius; it's **the distance between** the charges. Why does this matter? Because if you think that r is a radius, you might be tempted to divide the distance between the charges by 2 as if the full distance is a diameter. It isn't. So don't do that.
- Some problems about ions or nuclei may not give you the charges directly. When they don't, you need to know that the charge on a proton is 1.6×10^{-19} C. So a helium nucleus, which has atomic number 2 (indicating two protons in its nucleus), would have the charge of two protons, or 3.2×10^{-19} C. Similarly, an N^{-3} ion would have three excess electrons, for a net charge of -4.8×10^{-19} C.
- Don't get too hung up on whether your charges are negative or positive in this formula. Most of the time you just need the magnitude of the charge anyway, not whether it's attractive or repulsive. And you already know that opposite charges attract and like charges repel.