

Class 15: E&M Problem Solving

AP Physics

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Files for You to Download

Download from the school website:

1. 15-problemSolving.pdf—This presentation. The slides only contain the problems that we are solving in class, but you will have to follow (and write) the solution yourself.
2. 15-Homework.pdf—Homework assignment for Classes 14 and 15.

Electric Field ¹

Example 1: A spherical shell of radius $R = 3$ m has its center at the origin and carries a surface charge density $\sigma = 3$ nC/m². A point charge $q = 250$ nC is on the y axis at $y = 2$ m. Find the electric field on the x axis at:

1. $x = 2$ m
2. $x = 4$ m

Electric Potential ²

Example 2: A ring of radius 4 cm carries a uniform charge of 8 nC. A small particle of mass $m = 6$ mg and charge of $q_0 = 5$ nC is placed at $x = 3$ cm and released. Find the speed when the charge is at a great distance from the ring.

²Paul A. Tipler, pages 661–662

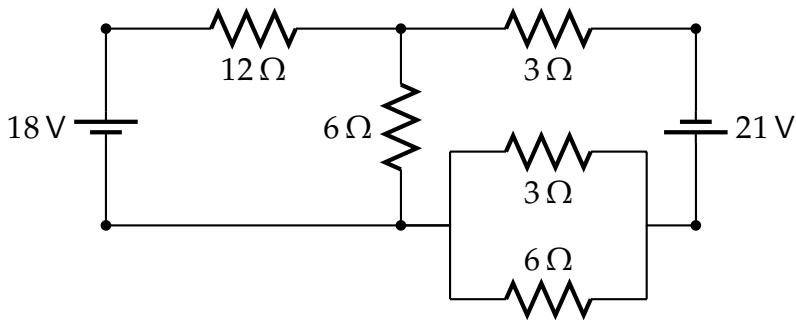
Electric Potential ³

Example 3: A hollow spherical conductor that is uncharged has inner radius a and outer radius b . A positive charge $+q$ is in the cavity at the center of the sphere. Find the potential $V(r)$ everywhere, assuming that $V(\infty) = 0$.

³Paul A. Tipler, pages 674–675

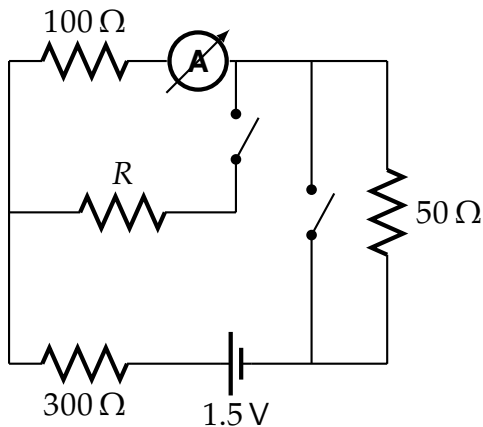
Multi-Loop Circuits ⁴

Example 4: Find the current in each of the part of the circuit.



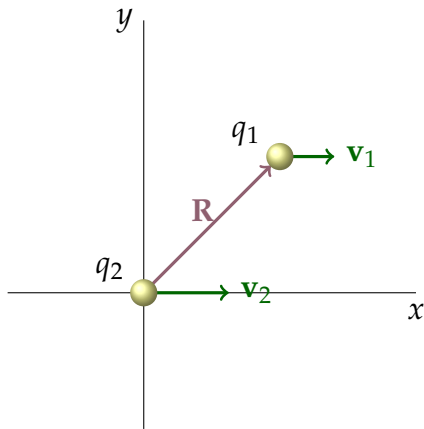
Circuit Analysis ⁵

Example 5: In the circuit below, the reading of the ammeter is the same with both switches open and both closed. Find the resistance R .



Magnetic Force ⁶

Example 6: A point charge q_1 is at the point $\mathbf{R} = x\mathbf{i} + y\mathbf{j}$ and is moving parallel to the x axis with velocity $\mathbf{v}_1 = v_1\mathbf{i}$. A second point charge q_2 is at the origin and moving along the x axis with velocity $\mathbf{v}_2 = v_2\mathbf{i}$. Find the magnetic force exerted by each charge on the other.



Magnetic Field from a Current Loop ⁷

Example 7: A circular loop of radius 5.0 cm has 12 turns and lies in the xy plane. It carries a current of 4 A in the direction such that the magnetic moment of the loop is along the x axis. Find the magnetic field on the x axis at

1. $x = 15$ cm
2. $x = 3$ m

Magnetic Field from a Current-Carrying Wire ⁸

Example 8: An infinitely-long wire carrying current of 4.5 A is bent as shown in the figure. Find the magnetic field at the point $x = 3\text{ cm}$, $y = 2\text{ cm}$.

