Physics 230 Notes

Lora Ma and Benjamin Kong

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Chapter 1

Electric Charge and Electric Field

1.0.1 Electric Charge

Electromagnetism (EM) affects only charged particles, mainly electrons and protons. All particles have charges that are integer multiples of the elementary charge e, such that the charge can be calulated with the following formula

$$q = ne \tag{1.1}$$

where q represents charge (C), n represents an integer, and $e = 1.6022 \times 10^{-19}\,\mathrm{C}$ represents the elementary charge.

Electric charge is conserved

- This means that the total charge of any isolated system with no charge moving in or out stays the same – charge is never created or destroyed.

Coulomb's Law: Force between charges

- Charges of the same sign repel and charges of the opposite sign attract.
- The force produced by charges can be calculated using the following formula

$$F = k\frac{q_1 q_2}{r^2} \tag{1.2}$$

where, $k = 9.0 \times 10^9\ \frac{\mathrm{Nm}^2}{\mathrm{C}^2}$, q_1 represents the first charge, q_2 represents the second charge, and r represents the separation distance.

1.0.2 Conductors and Insulators

Conductors are materials that conduct electricity, whereas insulators do not conduct electricity.

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