Unit 12A – Electrostatics

- Charged Objects
- Elementary Charge
- Coulombs Law
- Electric Fields
- Conductor / Insulator

Competencies

The student will be able to:

- define positively and negatively charged objects.

- describe quantization of charges. Define the elementary charge.

- define Coulomb's Law

- describe electric field of charged particles and between charged particles to illustrate attraction and repulsion.

- define: conductor, insulator and electrolyte

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Charged objects and elementary charge

Positively charged: More protons than electrons

Negatively charged: More electrons than protons

Elementary charge: $e = 1.6 \times 10^{-19}$ C

Charge of a proton: $+ e$
Charge of an electron: $- e$

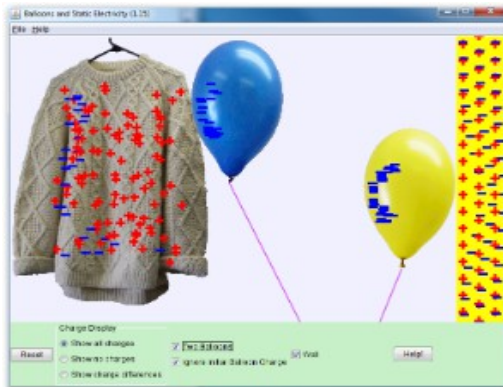**Charge is quantized:** $Q = n \cdot e$

n: number of excess protons

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How to charge an object

Friction :   Electrons transfer when rubbing two objects

Conduction :   Contact with a charged object

Induction :   A charged object is in proximity

Phet-Simulation: Balloons and static electricity
http://phet.colorado.edu/en/simulation/balloons-and-static-electricity

Youtube Videos:
Bending water: https://www.youtube.com/watch?v=u-SIJSSBsjo&feature=youtu.be
Balloon trick: https://www.youtube.com/watch?v=bjU-Ll6U1ig&feature=youtu.be

→ Do Unit XIIA Problem 4, 6

4

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Coulombs Law

Electric Force : Force between two charged objects

Coulomb constant : $k_e = 9 \times 10^9$ N m²/C²

(a) (b)

$$F_e = k_e \cdot \frac{|(q_1)| \cdot |(q_2)|}{r^2}$$

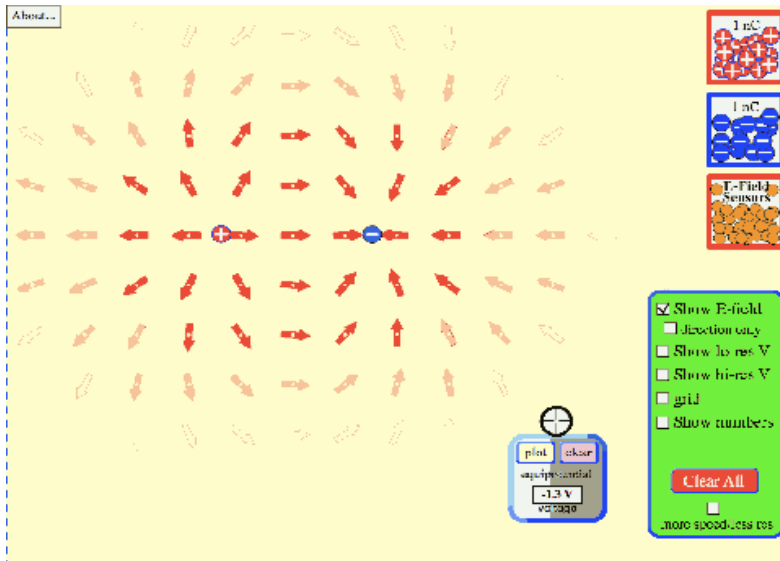| + | + | repel |
-	-	repel
+	-	attract
-	+	attract

→ Do Unit XIIA Problem 7-8

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Electric Fields

Electric field lines: Direction of the electric force on a positive test charge

From + to -

Can never cross

Phet-Simulation: Charges and Fields
https://phet.colorado.edu/sims/charges-and-fields/charges-and-fields_en.html

→ Do Unit XIIA Problem 3, 5
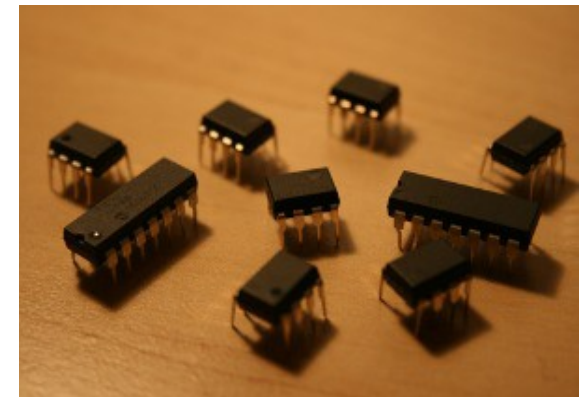
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Conductor and Insulators

Conductor: Charge can move freely (free electrons of metals or ions)

Electrolyte: Substance that makes water conducting (adding ions)

Insulator: Charges can not move freely (wood, glass, rubber, ...)

Semiconductor: Can behave as a conductor or insulator (Silicon, Gemanium)
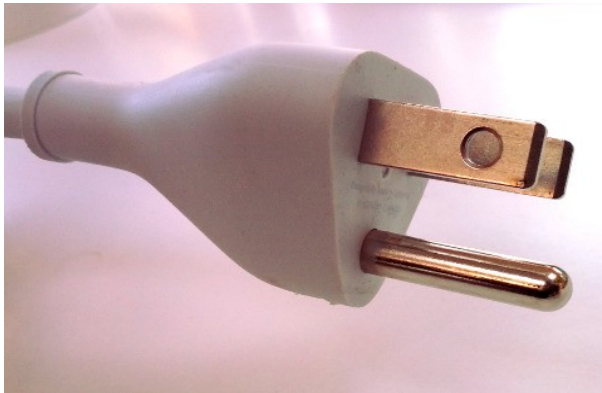
Electric Plug made of conducting metal [1]

High Voltage Insulator [2]

Semiconductor Microchips [3]

→ Do Unit XIIA Problem 1-2 and 9

Additional Resources

- Electric Charge and Electric Field, OpenStax „College Physics"
http://cnx.org/contents/Ax2o07UI@9.31:mbRj4L0x@3/Introduction-to-Electric-Charg

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