

Electric Charge

The basic property behind electric attraction and repulsion

Electric charge is the intrinsic property of matter that differentiates two kinds of electrification and causes bodies to experience an electrical force.

⚡ Etymology Note

The word electricity comes from the Greek word *elektron*, meaning amber. Thales of Miletus (~600 BC) discovered that amber rubbed with wool attracts light objects.

Two Types of Charge

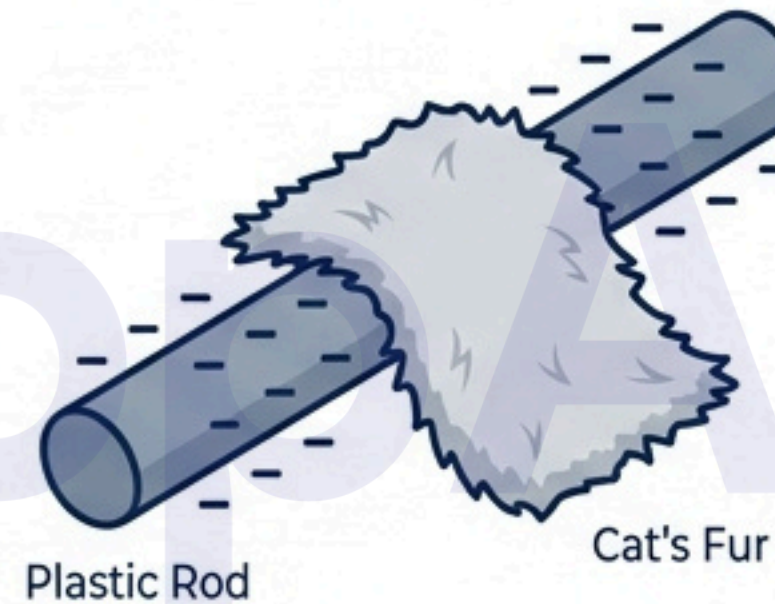
The Benjamin Franklin Naming Convention

Positive (+)



By convention, the charge acquired by a glass rod when rubbed with silk.

Negative (-)



By convention, the charge acquired by a plastic rod when rubbed with fur.

Bodies with no net charge are electrically neutral.

The Rule of Interaction

Polarity defines how charges interact with one another

Like Charges Repel



Unlike Charges Attract



The property which differentiates these two kinds of charges is called the polarity of charge.



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$$E=mc^2$$



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Measuring Charge

The International System (SI) Unit

The SI unit of charge is the Coulomb (C).
The fundamental basic unit of charge (charge of an electron/proton) is denoted by e .

$$e = 1.602 \times 10^{-19} \text{ C}$$

Practical Scale Note

1 Coulomb is a massive amount of charge (approx. 6×10^{18} electrons). In practical electrostatics, we use much smaller macroscopic units:

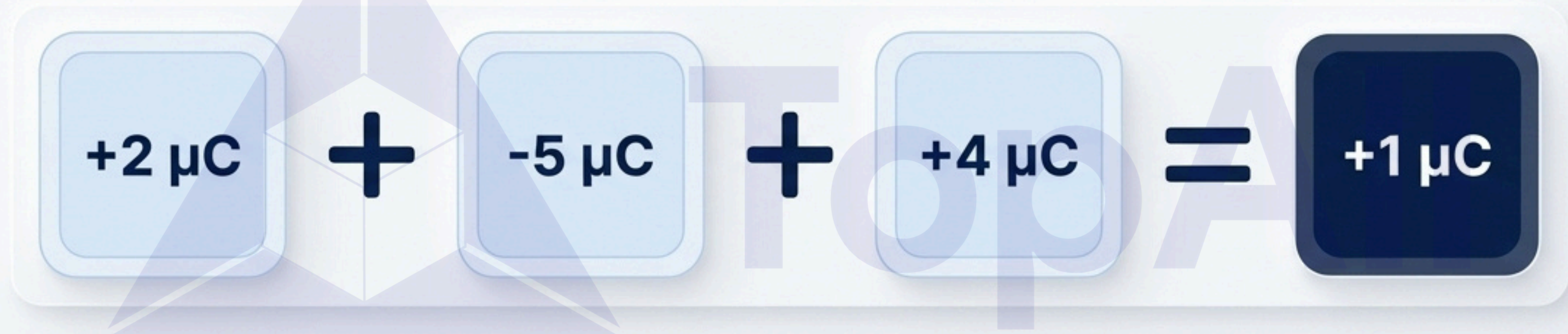
$$1 \mu\text{C (micro-coulomb)} = 10^{-6} \text{ C}$$

$$1 \text{ mC (milli-coulomb)} = 10^{-3} \text{ C}$$

Charge as a Scalar Quantity

Additivity of Electric Charges

If a system contains multiple point charges, the total charge is obtained by adding them algebraically. Charge has **magnitude** but no direction.


$$+2 \mu\text{C} + (-5 \mu\text{C}) + (+4 \mu\text{C}) = +1 \mu\text{C}$$

EXAM TRAP: Mass vs. Charge

Unlike mass, which is always positive, charge can be negative. You must retain the proper algebraic signs (+ or -) when calculating total system charge. Do not treat this like vector addition!

Synthesis & Practice

Test your understanding of fundamental charge properties

Core Principles

- ✓ There are exactly two types of charge: Positive (glass/silk) and Negative (plastic/fur).
- ✓ Like charges repel; unlike charges attract.
- ✓ Charge is a scalar quantity measured in Coulombs (C) and must be added algebraically using proper signs.

Check Your Understanding

Q: True or False: The charge on a plastic rod rubbed with cat's fur is considered positive.

False, it is negative.

Q: Calculate the net charge: A system contains charges of $+3\text{C}$, -2C , and $+4\text{C}$.

$+5\text{C}$



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