

ELECTRICITY DAY 3: CHARGING PROCESSES & POLARIZATION

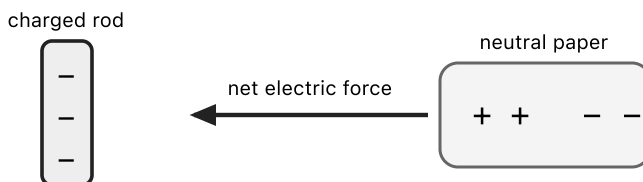
CED 10.2 · Skill 3.C · FRQ: QQT · target: neutral objects can be polarized and attracted

PREDICT BEFORE OBSERVING

A rubbed balloon approaches a neutral wall. Must the wall first receive net charge for the balloon to stick? Circle **yes / no**, then mark where you expect positive and negative charge to concentrate.

Observation source: balloon and wall; projected PhET *Balloons and Static Electricity* as an exact mechanism substitute; or the printed arrangement below.

PRINTED FALLBACK - BALLOON APPROACHING A NEUTRAL WALL



FRICTION AND POLARIZATION

Charging by friction: contact and separation transfer electrons because the two materials hold electrons differently. The object gaining electrons becomes negative; the object losing electrons becomes positive.

Polarization: charges shift within a neutral object. The positive and negative totals remain equal, but the nearer region can have the opposite sign from the charged object.

QUICK A plastic rod becomes negative after rubbing wool. Which object gained electrons? Which lost electrons?

CONDUCTION

During conduction, a charged object touches another conductor. Electrons move through the contact. After separation, the receiving conductor has the **same sign** as the original charged object.

WE DO Identical metal spheres carry $+9.5\text{nC}$ and -2.5nC . They touch and separate. Find the final charge on each and name the charging process.

INDUCTION WITH GROUNDING

1. Bring a charged object near without touching.
2. While it remains near, connect the conductor to ground.
3. Remove the ground connection first.
4. Remove the charged object.

The conductor remains charged with the sign **opposite** the nearby object.

The order matters. Removing the charged object before the ground lets the separated charge flow back and can leave the conductor neutral.

COMPARE THE MECHANISMS

Process	Contact?	Ground?	Final sign
Friction	rub + separate	no	opposite signs on the pair
Conduction	yes	no	same sign as charging object
Induction	no contact with source	yes	opposite sign from source
Polarization only	no	no	net charge remains zero

SEQUENCE A negative rod approaches a neutral metal sphere. While the rod stays, the far side is grounded. The ground is removed, then the rod is removed. Draw the charge distribution at each stage and state the final sign.

EXPLAIN Why can a neutral wall attract a negative balloon even though the wall's total charge remains zero?

PRACTICE

1. Wool loses electrons to a plastic rod. State the sign of each object.

2. A -8.5nC sphere touches an identical neutral sphere. Find the final charge on each.

3. A negative rod charges a conductor by induction with grounding. State the conductor's final sign and identify what moved through the ground connection.

4. A negative balloon approaches a neutral wall. Compare the balloon's attraction to the induced positive region with its repulsion from the induced negative region.

5. Classify each: (a) charged rod touches a neutral sphere; (b) charged rod approaches, ground connects, ground disconnects, rod leaves; (c) neutral paper shifts charge internally near a rod.