Charging by friction: attraction and repulsion

Student activity • investigation and reasoning

YEAR 10 / LESSON 33 / PHYSICS ONLY

The question

What evidence distinguishes attraction from repulsion between charged rods?

Test dry insulating rods and compare observations with a separate low-voltage conductivity demonstration.

Equipment

- Two polythene rods, one alternative insulating rod, dry cloth, stirrup and stand per group
- Small paper pieces; staff low-voltage series lamp circuit and samples

Use smooth intact rods and keep them away from faces, electronic equipment and flames. Rub rods with cloth, not hair or clothing being worn. Staff check the battery circuit; never bridge the battery directly. No high-voltage generator is used.

Course coverage: Physics only: 2.22P, 2.23P, 2.25P. Conductors, insulators and charging.

Plan, model or apparatus sketch

Draw a labelled setup or force diagram; include the measured quantities.

Method and reasoning

Read the whole sequence before starting

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1. Observe a staff-checked battery-and-lamp circuit with a test gap. Predict and test a metal sample, graphite and a plastic sample; keep the lamp in series throughout.

2. Work in ten groups of three. Bring an uncharged plastic rod near small paper pieces and record the control observation.

3. Rub the rod with a dry cloth for about ten seconds, then bring it near the paper without touching. Record what happens and repeat.

4. Suspend a freshly rubbed polythene rod in a paper stirrup on thread. Bring a second polythene rod rubbed in the same way near one end without contact, drafts or pushing.

5. Repeat with the staff-tested second rod material and cloth. Record attraction, repulsion or no clear movement for each pair; do not force the expected result.

6. Explain why repulsion is strong evidence that both rods are charged alike, while attraction can also occur between a charged object and a neutral object.

Cleanup

- Collect paper pieces, disconnect the battery and return rods and cloths dry.

Record your evidence

Blank spaces are for your own work

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Reference and task data

Charge sign depends on the materials and preparation. The activity establishes interactions; do not infer an absolute sign from attraction alone. A lamp that does not visibly light sets a detection limit, rather than proving absolutely zero current.

Test	Before rubbing / control	After rubbing / observation
Rod and paper		
Polythene pair		
Mixed rod pair		
Repeat		

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. What does a conductor allow?

2. Which particles transfer during ordinary friction charging?

3. What happens between like charges?

4. Can a charged rod attract neutral paper?

5. Why avoid contact during the rod test?

6. Why might humid conditions reduce the effect?