

Period 3 trends in radius, energy and melting

Chemistry grades 11-12 (A Level · IB · Class 11-12) · Lab

Name: _____ Date: _____ Class: _____

This lab compares how well four period 3 elements conduct electricity and how they behave when struck. You will connect each result to the structure and bonding studied in the lesson, and judge how reliable a simple ammeter test is for comparing good conductors.

Level: Chemistry grades 11-12 (A Level · IB · Class 11-12) · **Curriculum:** A Level 3.2.1

Aim

Compare the electrical conductivity of magnesium, aluminium, silicon and sulfur and link the results to their structure and bonding.

Equipment

- 3.0 V supply (two 1.5 V cells) with leads and two crocodile clips
- 10.0 Ω fixed resistor
- digital ammeter (reading to 0.001 A, and a milliammeter for small currents)
- samples, each 5.0 cm long: magnesium ribbon, aluminium foil strip, silicon piece, roll sulfur
- fine sandpaper, small hammer, safety goggles

Safety

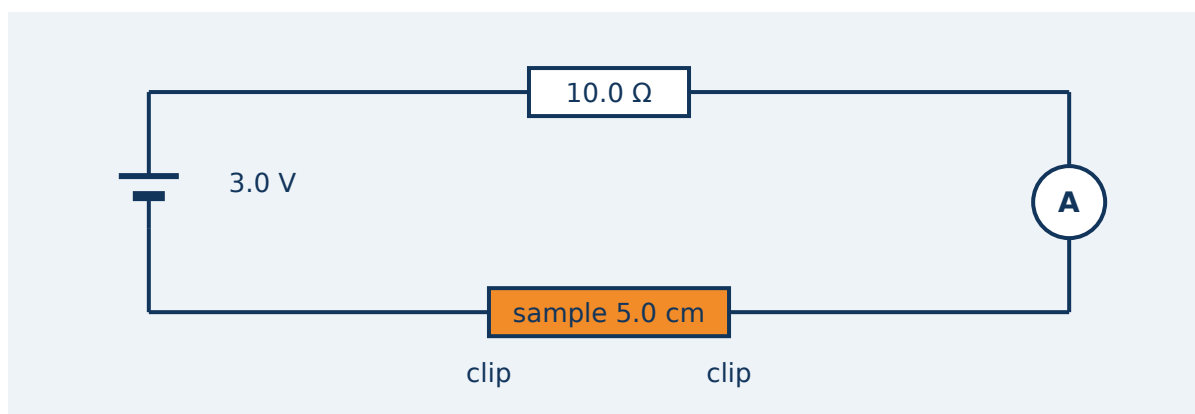
Safety

Wear safety goggles. Do not leave the circuit connected longer than 10 seconds because the samples and the resistor warm up. Sulfur dust irritates the eyes, so tap it gently inside a folded paper. Do not heat any sample.

Method

1. Rub the magnesium ribbon and aluminium strip with sandpaper to remove the oxide layer.
2. Build the series circuit shown, leaving the sample position open.
3. Clip one sample, 5.0 cm between the clips, into the circuit for a few seconds and read the current.
4. Repeat for each sample and record the value.
5. Place each sample in folded paper and tap it gently with the hammer. Record whether it

bends or shatters.



Series circuit used to compare the conductivity of the samples.

Results

Sample	Appearance	Current (A)	When tapped
Magnesium ribbon	grey, shiny after cleaning	0.297	bends
Aluminium strip	silvery, shiny	0.296	bends
Silicon piece	dark grey, shiny	0.0061	shatters
Sulfur	yellow	0.0000 (below 0.0001)	crumbles to powder

Analysis questions

Question 1 Resistance of the samples

Calculate the total resistance of the circuit and then the resistance of the sample for magnesium, aluminium and silicon (supply 3.0 V, resistor 10.0 Ω).

Question 2 Purpose of the resistor

Explain why a 10.0 Ω resistor is included in the circuit.

Question 3 Ranking by conductivity

Rank the four samples from best to worst conductor and explain the ranking in terms of structure and bonding.

Question 4 Why silicon is in the middle

Silicon conducts about 5 mA but sulfur does not. Suggest why, and predict what happens to the current in silicon when it is warmed gently.

Question 5 Malleable or brittle

Explain the tapping results for magnesium and for silicon.

Question 6 Uncertainty

The ammeter reads to ± 0.001 A. Calculate the uncertainty in the sample resistance of magnesium (use $\Delta R = V \times \Delta I / I^2$) and say whether magnesium and aluminium can be separated.

Question 7 Improving the method

Suggest two sources of error besides the ammeter and one improvement for each.

Question 8 Prediction

Predict, with reasons, whether sodium and liquid chlorine would conduct.