Ions

Student activity • class activity

YEAR 10 / LESSON 15 / CHEMISTRY + SCIENCE (DOUBLE AWARD)

The question

How does gaining or losing electrons change charge without changing the element?

Use proton and electron counts to model the formation of monatomic ions. The nucleus is unchanged in ordinary ion formation; only the electron count changes. Predict common main-group ion charges and practise the named metal ions in the scheme. No electrolysis or ion-migration experiment is included.

Equipment

- Student booklet, periodic table, pencil and ruler
- Per pair: twenty electron counters or pre-cut labelled paper pieces
- Paper atom/ion mats with the fixed proton counts shown in the table

Desk activity only. Use pre-cut cards or reusable counters; keep small pieces out of mouths and off the floor. No chemicals, flames, glassware or radiation sources are required.

Course coverage: 1.37–1.38: electron loss/gain, common main-group ion charges and the listed metal ions.

Charge-counting model • sodium example

Before	Electron change	After
11 protons; 11 electrons	One electron removed	11 protons; 10 electrons

The nucleus stays the same. Count positive and negative charges to explain the result.

Method and reasoning

Read the whole sequence before starting

YEAR 10 / LESSON 15 / CHEMISTRY + SCIENCE (DOUBLE AWARD)

1. Read the charge rule: net charge in elementary-charge units equals proton count minus electron count. A neutral atom starts with equal counts.

2. Model sodium with 11 fixed protons and 11 electrons. Remove one electron, leaving the proton count unchanged. Record the ion symbol and explain the positive charge.

3. Model chlorine with 17 fixed protons and 17 electrons. Add one electron and explain the resulting negative charge.

4. Complete the six-row table for the stated electron changes. Check every charge using protons minus electrons. Do not change neutron or proton counts.

5. Use the main-group pattern: metals in Groups 1, 2 and 3 commonly form +1, +2 and +3 ions; non-metals in Groups 5, 6 and 7 commonly form −3, −2 and −1 ions in the simple ionic model.

6. Practise recalling the named ions in the reference panel. Explain why Fe^{2+} and Fe^{3+} must be distinguished rather than assigned one fixed iron-ion charge.

7. Explain the difference between an atom, a monatomic ion and a molecule. Check that the charge is written as a superscript, not as the subscript used for an atom count.

Cleanup

- Count and return cards or counters. Keep your written work and corrections; recycle unwanted paper.

Record your evidence

Blank spaces are for your own work

YEAR 10 / LESSON 15 / CHEMISTRY + SCIENCE (DOUBLE AWARD)

Reference and task data

Named ions to recall: Ag^{+}, Cu^{2+}, Fe^{2+}, Fe^{3+}, Pb^{2+} and Zn^{2+}. Cations are positive; anions are negative. In the simple main-group model, charge is set by electrons lost or gained, not by changing the nucleus. The model does not mean every non-metal normally exists as isolated ions.

Atom / change	Protons	Electrons after	Net charge	Ion symbol
Na: loses 1 e	11			
Mg: loses 2 e	12			
Al: loses 3 e	13			
N: gains 3 e	7			
O: gains 2 e	8			
Cl: gains 1 e	17			

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

YEAR 10 / LESSON 15 / CHEMISTRY + SCIENCE (DOUBLE AWARD)

1. Explain why sodium becomes positive when it loses an electron.

2. Explain why chloride has 18 electrons but still belongs to the element chlorine.

3. Predict the common simple-ion charges for Groups 2, 3, 5 and 6.

4. Iron has atomic number 26. Calculate the electron counts in Fe^{2+} and Fe^{3+}.

5. Write the required ion formulae for silver, copper(II), lead(II) and zinc.

6. Correct: “An ion forms when the nucleus gains or loses protons.”