The periodic table

Student activity • class activity

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

The question

How does atomic number organise the first twenty elements?

Arrange element cards by atomic number, then connect position to electron arrangements. This is a desk model for neutral atoms of the first twenty elements. The simplified shell pattern used here is 2,8,8,2 up to calcium; it is not a statement that the third shell can never hold more than eight electrons.

Equipment

- Periodic table and student booklet; pencil and ruler
- Per pair: a pre-cut copy of the supplied twenty element cards, or reusable cards with the same symbols and atomic numbers
- Twenty labelled electron counters or pencil dots; paper for arranging groups and periods

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: 1.18–1.19: atomic-number order, groups, periods and electron arrangements of the first twenty elements.

Element cards • first twenty neutral atoms

H Z = 1	**He** Z = 2	**Li** Z = 3	**Be** Z = 4	**B** Z = 5
C Z = 6	**N** Z = 7	**O** Z = 8	**F** Z = 9	**Ne** Z = 10
Na Z = 11	**Mg** Z = 12	**Al** Z = 13	**Si** Z = 14	**P** Z = 15
S Z = 16	**Cl** Z = 17	**Ar** Z = 18	**K** Z = 19	**Ca** Z = 20

Photocopy and pre-cut one set per pair. Arrange in groups and periods; this printed grid is only a card sheet, not the periodic-table layout.

Method and reasoning

Read the whole sequence before starting

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1. Read the supplied element cards. Order them from atomic number 1 to 20. Explain why atomic number, rather than alphabetical order or relative atomic mass, is used.

2. Lay out the cards in the first four periods of a main-group table. Keep hydrogen in Group 1 and helium in Group 0 at the far right; leave gaps for the unfilled positions. Use the periodic table to check.

3. For each chosen neutral atom, the atomic number gives both proton count and electron count. Distribute electrons using the IGCSE first-twenty shell model: first shell 2, second 8, then third 8 before the fourth is occupied for potassium and calcium.

4. Complete the six-row table. Check that the sum of electrons in the arrangement equals the atomic number.

5. Compare lithium, sodium and potassium. Record the common outer-electron count and the change in occupied shells.

6. Compare helium, neon and argon. Explain why helium belongs with the noble gases despite having two rather than eight outer electrons.

7. Draw a labelled main-group outline or use your arranged cards to show one group and one period. Explain what each direction tells you about electron arrangements.

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

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Reference and task data

Course group labels here are 1–7 and 0. Group 0 is also called Group 18 in modern numbering. For the main-group elements studied, group number relates to outer electrons; helium has a full first shell of two. Period number gives occupied shells.

Element	Atomic number	Electron arrangement	Period	Group
Lithium	3			
Carbon	6			
Neon	10			
Sodium	11			
Potassium	19			
Calcium	20			

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. Explain the difference between a group and a period.

2. Deduce the electron arrangements of carbon, sodium and calcium. Show a count check.

3. Explain why potassium is in Period 4 and Group 1.

4. Why is helium in Group 0 despite having only two electrons?

5. Explain why atomic number 12 identifies magnesium, even if a sample has different isotopes.

6. Give one limitation of the simplified shell model used for the first twenty elements.