

Shells, groups and the periodic table

Chemistry grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · Lab answers

These model answers use the sample card data. They link the pattern in chloride formulas to outer electrons and show why a gap in mass points to missing elements.

Level: Chemistry grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · **Curriculum:** HS-PS1-1, HS-PS1-2

Question 1 Describe the pattern

The numbers run 1, 2, 3, 4, then return to 1, 2, 3, 4, then 1, 2. The sequence repeats.

The pattern 1, 2, 3, 4 repeats.

Question 2 Find the columns

Column 1: Li, Na, K. Column 2: Be, Mg, Ca. Column 3: B, Al. Column 4: C, Si.

Li, Na, K; Be, Mg, Ca; B, Al; C, Si.

Question 3 Link to electrons

The number of chlorine atoms equals the number of outer electrons for these cards (Li 1, Be 2, B 3, C 4, and so on). An element with 3 outer electrons would form XCl_3 , the same as BCl_3 and AlCl_3 .

Prediction: XCl_3 .

Question 4 Explain the mass gaps

C to Na: $23.0 - 12.0 = 11.0$. Si to K: $39.1 - 28.1 = 11.0$. Elements 7 to 10 (nitrogen, oxygen, fluorine, neon) lie between carbon and sodium, and elements 15 to 18 (phosphorus, sulfur, chlorine, argon) lie between silicon and potassium.

Jumps of 11.0; four elements missing each time.

Question 5 Explain the repeat

Li is 2,1, Na is 2,8,1 and K is 2,8,8,1. Each has one outer electron, so they form similar chlorides. After a shell fills, the next element starts a new shell with one outer electron, so the pattern repeats.

Same outer electrons give the same chemistry.

Question 6 Evaluate and improve

With only ten cards the gaps look like jumps and the full length of the period is hidden.

Rounded masses could also hide the true order. Improvement: use all eighteen cards for atomic numbers 3 to 20 and order them by atomic number.

Use a complete set of cards ordered by atomic number.