Atomic structure and isotopes

OCR A H032 and H432 · AS and A level

Answer on your own paper. Show your working where needed.

1. Count the particles

Copper has atomic number 29. Give the number of protons, neutrons and electrons in one copper-65 ion, Cu^{2+}.

2. Explain two related quantities

Distinguish relative isotopic mass from relative atomic mass. Name the isotope used as the standard and state the fraction of that atom's mass used for comparison.

3. Check a lithium calculation

Lithium-6 and lithium-7 make up 7.40% and 92.60% of a sample. A student averages the mass numbers and reports $A_r = 6.50$. Explain the error and calculate A_r to three significant figures.

4. A bromine mass spectrum

Peaks from singly charged bromine ions occur at m/z 79 and 81. Their relative intensities are 50 and 48. Calculate A_r to two decimal places.

5. Find both abundances

A chlorine sample contains isotopes with relative masses 35 and 37 only. Its relative atomic mass is 35.48. Calculate the percentage abundance of each isotope.

6. A missing percentage

Neon-20 makes up 90.5% of a sample and neon-21 makes up 0.3%. Neon-22 makes up the rest. Using mass numbers, find the abundance of neon-22 and the relative atomic mass to two decimal places.

7. A zinc sample

A prepared zinc sample has isotopic masses 64, 66 and 68 only. Its relative atomic mass is 66.00, and 40.0% of its atoms have mass 64. Calculate the other two percentages.

8. Nickel in a sample

A 0.250 mol sample contains nickel atoms with relative isotopic masses 58 and 60 only. $A_r = 58.62$. Calculate the number of nickel-60 atoms. Use the Avogadro constant, 6.022×10^{23} mol^{-1}.

9. Extra challenge · Resolve the three peaks

A sample has singly charged isotope peaks at m/z 74, 76 and 78 only. The peak at 76 is twice as intense as the one at 78. Use the mass numbers as the isotopic masses. A_r of the sample is 75.60.

Calculate all three percentage abundances. How many atoms of mass 78 are there in 0.150 mol of this element? Use $N_a = 6.02 \times 10^{23}$ mol^{-1}.

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