InkChemistry

QUESTION WORKBOOK

Ionisation energies and the evidence for subshells

Atomic structure · Unit C01

AQA 3.1.1.3 · OCR A 3.1.1

15 questions · 46 marks

NAVY SCREEN EDITION

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SECTION A · Short, 1 to 2 marks

A1 IE-Q17

Explain why the successive ionisation energies of an element always increase. [2]

A2 IE-Q18

Suggest, in terms of ionisation energy, why potassium reacts with water more vigorously than sodium does. [2]

SECTION B · Standard, 3 to 5 marks

B1 IE-Q1

State what is meant by the first ionisation energy of an element, and give the equations, with state symbols, for the first and second ionisations of calcium. [4]

B2 IE-Q14

Compare the first ionisation energies of calcium, 590 kJ mol^{-1}, and gallium, 579 kJ mol^{-1}, and explain the difference. [4]

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B3 IE-Q16 Evaluate the claim that the first ionisation energies of the Period 3 elements are evidence that electrons are arranged in subshells. [4]

B4 IE-Q4 Explain why the first ionisation energy decreases down Group 2. [3]

B5 IE-Q5 Explain why the first ionisation energy of aluminium is lower than that of magnesium. [3]

B6 IE-Q6 Explain why the first ionisation energy of sulfur is lower than that of phosphorus. [3]

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B7 IE-Q8 Explain why the second ionisation energy of sodium is much larger than its first. [3]

B8 IE-Q9 Calculate the energy, in kJ, needed to ionise all the atoms in 1.00 g of gaseous sodium. The first ionisation energy of sodium is 496 kJ mol^{-1}, and Ar of sodium is 23.0. [3]

B9 IE-Q10 Calculate the energy needed to convert one mole of gaseous calcium atoms into one mole of gaseous Ca^{2+} ions. The first and second ionisation energies of calcium are 590 and 1145 kJ mol^{-1}. [3]

B10 IE-Q11 Calculate the energy, in joules, needed to remove one electron from a single gaseous magnesium atom. The first ionisation energy of magnesium is 738 kJ mol^{-1}, and L = 6.022×10^{23} mol^{-1}. [3]

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B11 IE-Q13 Suggest why the second ionisation energy of sodium, 4562 kJ mol^{-1}, is more than twice the first ionisation energy of neon, 2081 kJ mol^{-1}, although both remove a 2p electron from the arrangement $1s^2\ 2s^2\ 2p^6$. [3]

B12 IE-Q19 Calculate the energy needed to form one mole of gaseous Sc^{3+} ions from one mole of gaseous scandium atoms. The first three ionisation energies of scandium are 633, 1235 and 2389 kJ mol^{-1}. [3]

B13 IE-Q20 Explain why the fifth ionisation energy of silicon, 16091 kJ mol^{-1}, is more than three times its fourth, 4356 kJ mol^{-1}. [3]

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