NATIONAL ORTHODOX SCHOOL
CHEMISTRY QUIZ

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1 The relative atomic mass of boron is 10.8.

A sample of boron contains the isotopes $^{10}_{5}B$ and $^{11}_{5}B$.

What is the percentage of $^{11}_{5}B$ atoms in the isotopic mixture of this sample?

A 0.8% **B** 8.0% **C** 20% **D** 80% [1]

(Total for Question 1 = 1 mark)

2 Which of the following elements has no paired p electrons in a single uncombined atom of the element?

A carbon **B** oxygen **C** fluorine **D** neon [1]

(Total for Question 2 = 1 mark)

3. Which of the following electronic configurations is that of an atom of an element which forms a simple ion with a charge of −3? N^{3-} & P^{3-}

A $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$ **B** $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$

C $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^1\ 4s^2$ **D** $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^3\ 4s^2$ [1]

(Total for Question 3 = 1 mark)

4 A sample of chlorine contains isotopes of mass numbers 35 and 37.

The sample is analysed in a mass spectrometer. How many peaks corresponding to Cl_2^+ are recorded?

A 1 **B** 2 **C** 3 **D** 4 [1]

(Total for Question 4 = 1 mark)

5 What is the atomic number of an element that contains atoms which have four unpaired electrons in their ground state?

A 6 **B** 16 **C** 22 **D** 26 [1]

$1s^2 2s^2 2p^2$ $1s^2 2s^2 2p^6 3s^2 3p^4$ **(Total for Question 5 = 1 mark)** $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^2$ $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3$

6 Which of the following ions has more electrons than protons, and also has more protons than neutrons?

(H = $^{1}_{1}H$ D = $^{2}_{1}H$ He = $^{4}_{2}He$ O = $^{16}_{8}O$)

A OD^- **B** D_3O^+ **C** He^+ **D** OH^- [1]

(Total for Question 6 = 1 mark)

7 A sample of helium from a rock was found to contain two isotopes with the following composition by mass: ^3He, 0.992%; ^4He, 99.008%.

(a) State what is meant by isotopes. [1]

Elements with same proton number but different neutron number.

(b) State the difference in the atomic structures of ^3He and ^4He. [1]

^3He has one less neutron than ^4He so it is an isotope

(c) (i) Which isotope is used as the basis for relative atomic mass measurements? [1]

$^{12}_{6}C$

(ii) Calculate the relative atomic mass of helium in the rock sample. [2]

$\frac{99.008 \times 4 + 0.992 \times 3}{100}$ = 3.99

(d) Helium has the largest first ionisation energy of all the elements.

(i) State what is meant by first ionisation energy. [2]

1 mol of an element ~~the~~ needed to react to form $1\bar{e}$

(ii) Write an equation, including state symbols, to represent the first ionisation energy of helium. [2]

$He_{(g)} \longrightarrow He^{1+}_{(g)} + 1\bar{e}$

(iii) Explain why the first ionisation energy of helium is larger than that of hydrogen. [2]

(Total for Question 7= 12 marks)

more shells & shielding $\bar{e}$'s

So ~~the~~ bigger force of attraction between nucleus & cloud of $\bar{e}$'s

8 The five ionisation energies of boron are:

801 → 2427 → 3660 → 25 026 → 32 828

(a) State and justify the group in the Periodic Table in which boron is placed. [2]

group 3 since 3 major leaps

(b) Which of the following represents the **second** ionisation energy of boron?

A $B(g) \rightarrow B^{2+}(g) + 2e^- \quad \Delta H = +2427 \text{ kJ mol}^{-1}$

B $B^+(g) \rightarrow B^{2+}(g) + e^- \quad \Delta H = +2427 \text{ kJ mol}^{-1}$

C $B(g) \rightarrow B^{2+}(g) + 2e^- \quad \Delta H = -2427 \text{ kJ mol}^{-1}$

(D) $B^+(g) \rightarrow B^{2+}(g) + e^- \quad \Delta H = -2427 \text{ kJ mol}^{-1}$ [1]

(c) Explain why the second ionisation energy of boron is larger than the first. [2]

more electrons and higher charge

So greater force of attraction between nucleus & cloud of ē's

(d) Give the electronic configuration of a boron atom. [1]

$1s^2 2s^2 2p^1$

(e) Is boron classified as an s-, a p- or a d-block element? Justify your answer. [2]

P, since its last shell ends with p and it is a group 3 element

(f) Explain why the first ionisation energy of boron is less than that of beryllium, even though a boron atom has a greater nuclear charge. [2]

(Total for Question 8 = 10 marks)

less force of attraction but greater size. → between nucleus & cloud of ē's

9

The table gives the first four ionisation energies of the elements sodium, magnesium and aluminium.

Ionisation energy/kJ mol^{-1}				
Element	1st	2nd	3rd	4th
sodium	496	4563	6913	9544
magnesium	738	1451	7733	10 541
aluminium	578	1817	2745	11 578

Explain why:

(a) the first ionisation energy of sodium is lower than that of the first ionisation energy of magnesium. [2]

Smaller size so less force of attraction between nucleus and cloud of ē's

(b) the first ionisation energy of magnesium is higher than the first ionisation energy of aluminium. [2]

greater force of attraction between nucleus & cloud of ē's and more ē's

(c) the second ionisation energy of magnesium is lower than the second ionisation energy of aluminium. [2]

less force of attraction between nucleus & cloud of ē's and smaller size

(d) the fourth ionisation energy of aluminium is higher than its third ionisation energy. [2]

(Total for Question 13 = 8 marks)

greater force of attraction between nucleus & cloud of ē's and greater size.