NATIONAL ORTHODOX SCHOOL
CHEMISTRY QUIZ

NAME : Atallah

DATE : 2-11-2022

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]

C : $1s^2 2s^2 2p^2$ O : $1s^2 2s^2 2p^4$ F : $1s^2 2s^2 2p^5$

(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?

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?

35+35 : 35
35+37 : 36
37+37 : 37
35+37 : 36

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]

$1s^2 2s^2 2p^6 3s^2 3p^4$

(Total for Question 5 = 1 mark)

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)

Scanned with CamScanner

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]

Atoms that have the same number of protons and electrons but different number of neutrons

(b) State the difference in the atomic structures of ^3_2He and ^4_2He. [1]

^3_2He has 1 neutron while ^4_2He has 2.

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

^4He

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

$\frac{4+3}{2} = 3.5$

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

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

the amount of energy needed to remove 1 mole of electrons from 1 mole of gaseous atom to form 1 mole of (+1) ion in a gaseous state.

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

$^4_2He \longrightarrow {}^4_2He^{+1} + e^-$

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

(Total for Question 7= 12 marks)

because helium has same shells and Shielding electrons but Helium has greater proton number so more energy needed to remove an electron. → greater forces of attraction between positive nucleus and negative cloud of electrons

Scanned with CamScanner

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 there was two jumps between the first and second and third and fourth.

(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]

$_5B: 1s^2 2s^2 2p^1$

Because more energy is needed to remove 1 electron from fully filled s orbital than to remove an electron from p orbital,

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

$_5B: 1s^2 2s^2 2p^1$

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

p, it is found in group 3

(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)

$_5B: 1s^2 2s^2 2p^1$ $_4Be: 1s^2 2s^2$

Boron has one lone electron in the p orbital so it is easier to remove an $\bar{e}$ than to remove from fully filled s orbital in Beryllium. So less forces of attraction between positive nucleus and negative cloud of electrons so less energy needed.

Scanned with CamScanner

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]

Same shells and shielding electrons / Sodium has less proton number than Magnesium so less forces of attraction between positive nucleus and negative cloud of electrons so less ionization energy.

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

Al: $1s^2 2s^2 2p^6 3s^2 3p^1$
Mg: $1s^2 2s^2 2p^6 3s^2$

Magnesium has a fully filled s orbital but Aluminium same shells and shielding has 1 electron in the p orbital so Magnesium has greater forces of attraction between positive nucleus and negative cloud of electrons so higher ionization energy.

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

Magnesium has lower proton number so less forces of attraction between positive nucleus and negative cloud of electrons so more energy needed.

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

(Total for Question 13 = 8 marks)

The fourth ionisation energy of Aluminium has more shells and shielding so greater forces of attraction between the positive nucleus and the negative cloud of electrons so greater ionization energy.

Cl^{+3}: $1s^2 2^2 2p^6$

Al^{+2}: $1s^2 2s^2 2p^6 3s^1$

Scanned with CamScanner