

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 $^{10}_5\text{B}$ and $^{11}_5\text{B}$.
What is the percentage of $^{11}_5\text{B}$ 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 ?

- 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]

(Total for Question 5 = 1 mark)

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

- ($\text{H} = {}^1_1\text{H}$ $\text{D} = {}^2_1\text{H}$ $\text{He} = {}^4_2\text{He}$ $\text{O} = {}^{16}_8\text{O}$)
A OD^- B D_3O^+ C He^+ **D OH^-** [1]

(Total for Question 6 = 1 mark)

10e
9

10e

1e

10e

17

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

C: $1s^2 2s^2 2p^6 3s^2$

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

NL:

f: $1s^2 2s^2 2p^6$

5-35

7-35

5-37

237

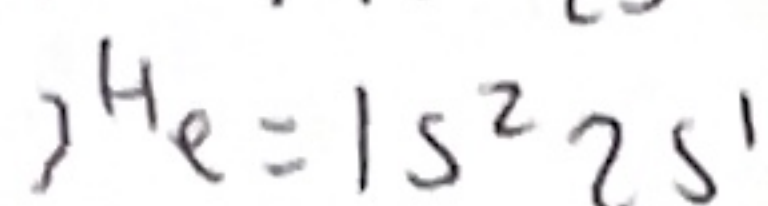
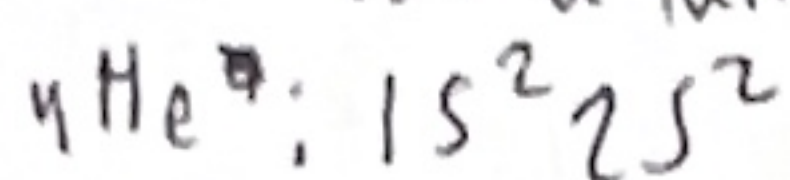
- 7 A sample of helium from a rock was found to contain two isotopes with the following composition by mass: ${}^3\text{He}$, 0.992%; ${}^4\text{He}$, 99.008%. [1]

(a) State what is meant by isotopes.

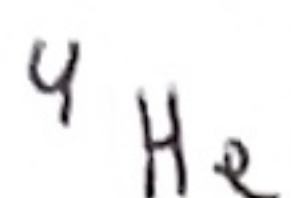
it has the same number of neutrons but different number of electrons

(b) State the difference in the atomic structures of ${}^3\text{He}$ and ${}^4\text{He}$. [1]

He^4 has a full valence shell while He^3 does not



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



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

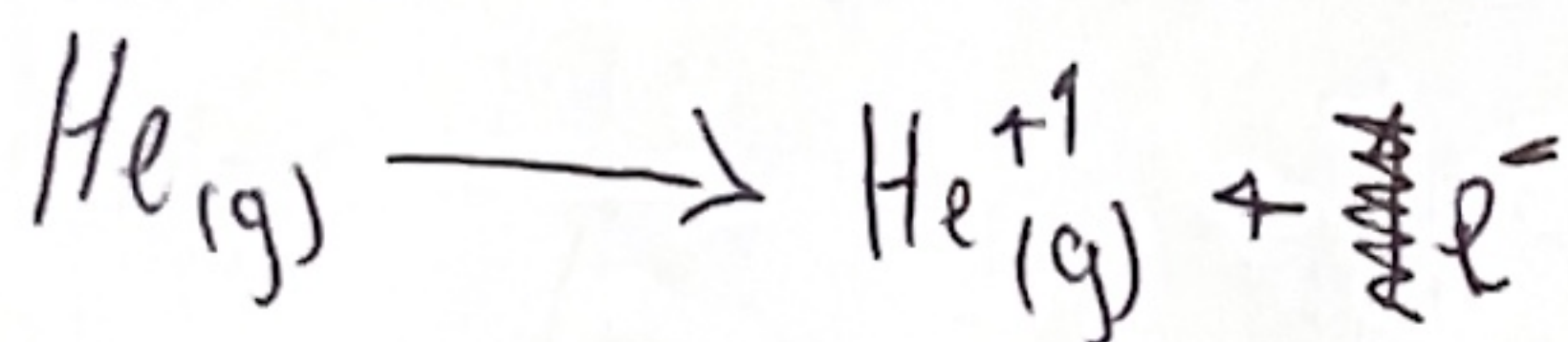
$$\text{RAM} = \frac{(0.992 \times 3) + (99.008 \times 4)}{100} = 3.99008$$

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

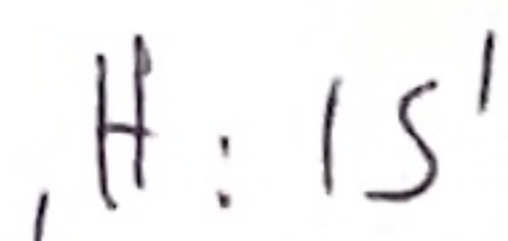
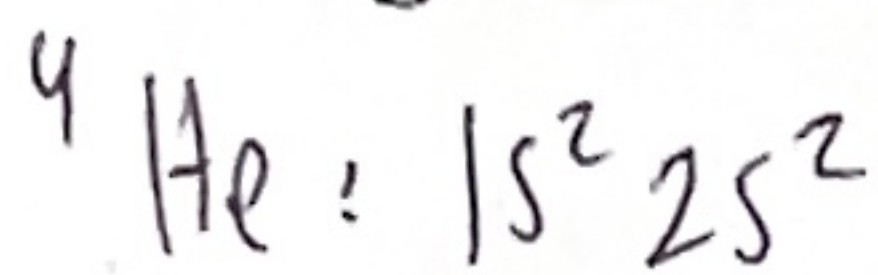
(i) State what is meant by first ionisation energy. [2]

the energy it takes to remove 1 mol of electrons from 1 mol of a gaseous atom to form a +1 gaseous ion.

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

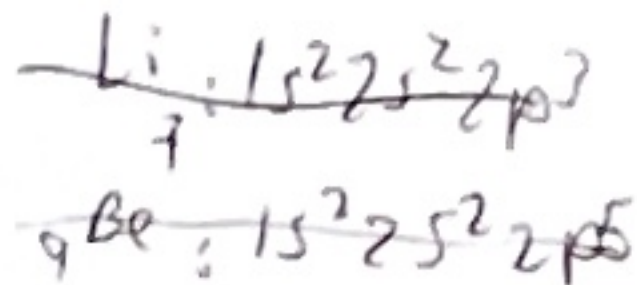


(iii) Explain why the first ionisation energy of helium is larger than that of hydrogen. [2]



(Total for Question 7 = 12 marks)

taking an electron from a stable shell like $2s^2$ is harder than taking it from $1s^1$. Since it has a more force of attraction since they're 4 protons pulling 2 electrons unlike hydrogen it only 1 proton pulling 1 electron.



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]

Boron is in group 3 since there is a big jump between the 3rd and 4th ionization energies

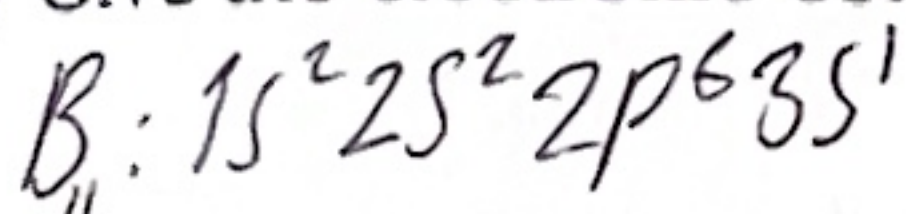
(b) Which of the following represents the **second** ionisation energy of boron?

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

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

second
it is harder to take an electron when there are 11 protons pulling 10 electrons because of more force of attraction than when 11 protons where pulling 11 electrons.

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



(e) Is boron classified as an s-, a p- or a d-block element?

Justify your answer. [2]

its an s-block element since its valence electron is in the s quantum shell.

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)

because boron has more protons than beryllium but has same shells and shielding, boron has greater attraction force than beryllium.

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	10541
aluminium	578	1817	2745	11578

Explain why:

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

~~because~~ it has the same shells and shielding but magnesium has more protons than Na so it has more attraction force so it's harder to take an electron from Mg shell.

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

it has the same shells and shielding but magnesium has more protons than Na so it has more attraction force so it's harder to take one electron from Mg shell.

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

because Mg and Al have same shells and shielding but Mg has less protons than Al so less force of attraction between the nucleus and cloud of electrons so easier to lose electrons.

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

(Total for Question 13 = 8 marks)



because removing an electron from the same quantum shell is easier than jumping from 1 quantum shell to another.