GCE AS LEVEL CHEMISTRY

S21- B410

Assessment Resource D

Structure of Matter and Simple Reactions

1. Complete the equation to show what happens when $^{28}_{15}P$ decays by positron emission. [1]

$$^{28}_{15}P \longrightarrow {}^{0}_{+1}\beta + \text{.....}$$

2. *(a)* State why some covalent bonds are polar but others are not. [1]

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(b) On the formulae below show any dipoles. [1]

F—F F—Cl

3. Halogens and their compounds are used in water treatment.

State **one** halogen and **one** halide that are commonly used in water treatment. In **each** case give a reason for their use. [2]

Halogen .....

Reason for use .....

Halide .....

Reason for use .....

4. *(a)* A student said that the Periodic Table was a list of the elements arranged in order of increasing mass.

Another student said that this was not the case since it did not apply, for example, to argon and potassium.

Discuss whether the first student was correct and explain why the masses quoted in the Periodic Table for argon and potassium do not follow the general trend of increase in mass. [3]

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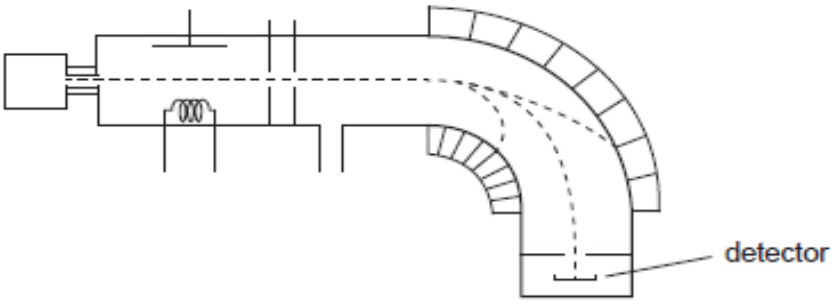
(b) (i) The relative atomic mass of a sample of an element can be found using a mass spectrometer. The diagram shows the main parts of a mass spectrometer.



Use this diagram to explain what happens to a sample of the element as it travels through the mass spectrometer. [6 QER]

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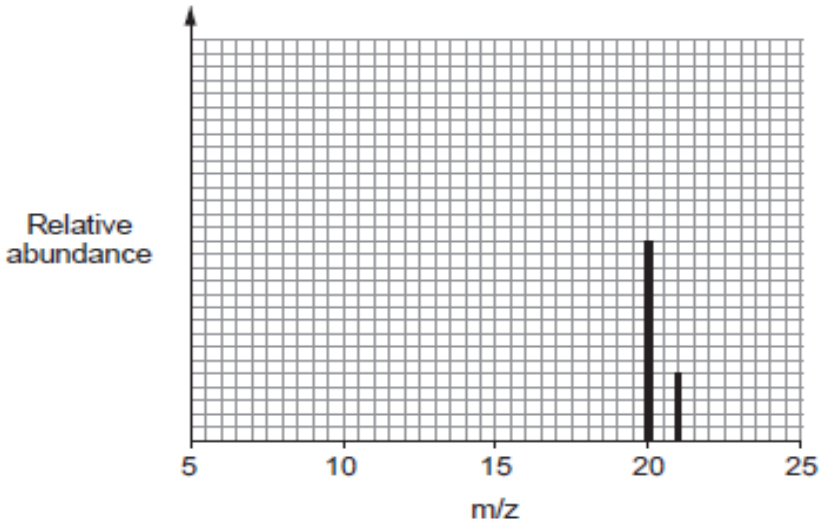
(ii) The mass spectrum of an element T is shown.

Use this to calculate the relative atomic mass, A_r, of the sample of T. [2]



A_r = ...

(iii) The mass spectrum includes a very small peak at m/z 10 (not visible above). Suggest which particle is responsible for the presence of this peak. [1]

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5. *(a)* Write the equation that corresponds to the molar first ionisation energy of an element. Use **X** to represent the element. [1]

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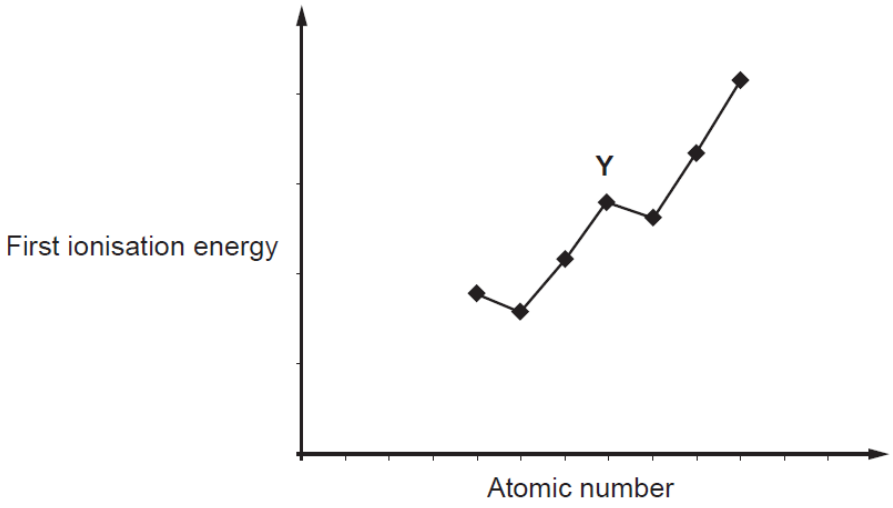
(b) The graph shows the molar first ionisation energy for successive elements in part of the Periodic Table.



(i) Explain why first ionisation energies generally increase in value as a period is crossed from left to right. [2]

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(ii) In which group of the Periodic Table is the element shown as **Y**?

Explain how you reached this conclusion. [2]

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(iii) **On the graph** plot the expected molar first ionisation energy for the next element in the Periodic Table. Label this point **Z**. [1]

(c) (i) What is meant by the Avogadro constant? [1]

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(ii) Calculate the number of oxygen atoms in 34.23 g of aluminium sulfate, $Al_2(SO_4)_3$.

Show clearly how you carried out the calculation. [3]

Number of oxygen atoms = ...

6. A sample of witherite, an ore of barium, contains barium carbonate, $BaCO_3$. A geologist investigated the ore to determine the percentage of barium carbonate present by adding a sample of ore to excess acid and then finding how much acid had been neutralised.

He followed these instructions.

Stage 1

Add a known mass of ore to about 100 cm^3 of 0.500 mol dm^{-3} hydrochloric acid in a beaker. Stir until no further reaction occurs.

The geologist used 19.15 g of ore.

Stage 2

Filter and then add more acid to make the total volume of the solution up to exactly 250 cm^3.

Stage 3

Titrate 25.0 cm^3 samples of this solution against 0.100 mol dm^{-3} sodium hydroxide using a suitable indicator.

The geologist used a mean volume of 27.80 cm^3 of the sodium hydroxide to neutralise the acid.

(a) Explain why the geologist filtered the mixture in **Stage 2** of the process. [1]

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(b) State which piece of apparatus the geologist would use to make exactly 250 cm^3 of solution in **Stage 2**. [1]

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(c) State why an indicator is used in **Stage 3**. [1]

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(d) State how many titrations the geologist should carry out in **Stage 3**.
Give a reason for your choice. [1]

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(e) Write the equation for the reaction of barium carbonate with hydrochloric acid. [1]

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(f) Calculate the total number of moles of hydrochloric acid **added** to the sample of ore. [1]

Number of moles added = ... mol

(g) Calculate the number of moles of hydrochloric acid neutralised in each titration and hence the number of moles neutralised by the original sample of ore. [3]

Number of moles neutralised by ore = ... mol

(h) State the number of moles of barium carbonate present in the original sample of ore and hence calculate the percentage by mass of barium in the ore. [3]

Percentage barium in the ore = ... %

(i) The true value for the percentage of barium present in the ore is higher than that calculated in part *(h)*. Suggest a possible reason for this. [1]

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