

AS Level Chemistry B
H033/02 Chemistry in depth

Question Set 4

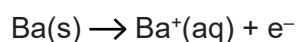
4 A student investigates the relative reactivities of calcium and barium with water and observes that barium is more vigorous than calcium.

(a) (i) The teacher asks the student to explain this observation using the following data.

Element	First ionisation enthalpy / kJ mol ⁻¹
Calcium	+590
Barium	+502

The student makes three statements:

1. The first ionisation enthalpies are the $\Delta_r H$ values for the following reactions.



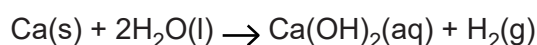
2. Less energy is needed to remove an electron from the outer shell of a barium atom than from the outer shell of a calcium atom. Therefore barium is more reactive.

3. A barium atom is bigger than a calcium atom, so the electrons are more spread out. This explains why less energy is needed to remove an electron from the outer shell of a barium atom.

Discuss the student's three statements and correct any incorrect chemistry where necessary. [4]

(ii) The student reacts 1.26 g of calcium with excess water.

Calculate the volume of hydrogen (in cm³) produced at RTP.



Give your answer to an **appropriate** number of significant figures.

volume of hydrogen = cm³ [2]

(b)* The student then wishes to compare the thermal stabilities of calcium carbonate and strontium carbonate.

Describe the experiment the student could carry out, giving reasons for the steps you describe. Suggest the expected results. [6]

(c) Another student determines the concentration of calcium hydroxide in a solution by titrating 25.0 cm³ of the solution against 0.0500 mol dm⁻³ hydrochloric acid.

The student obtains the following titres (in cm³).

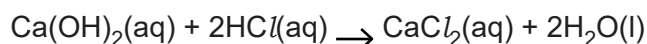
21.55 20.80 20.90

- (i) Explain why the appropriate mean titre for this titration is 20.85 cm³. [1]
- (ii) The student uses a burette that can be read to the nearest 0.05 cm³.

Calculate the percentage uncertainty in the titre of 20.80 cm³.

percentage uncertainty = % [1]

- (iii) The equation for the reaction between calcium hydroxide and hydrochloric acid is shown below.



Calculate the concentration (in g dm⁻³) of the calcium hydroxide in the student's solution.

concentration of calcium hydroxide = g dm⁻³ [3]

- (d) The elements in a modern Periodic Table are arranged by atomic number.

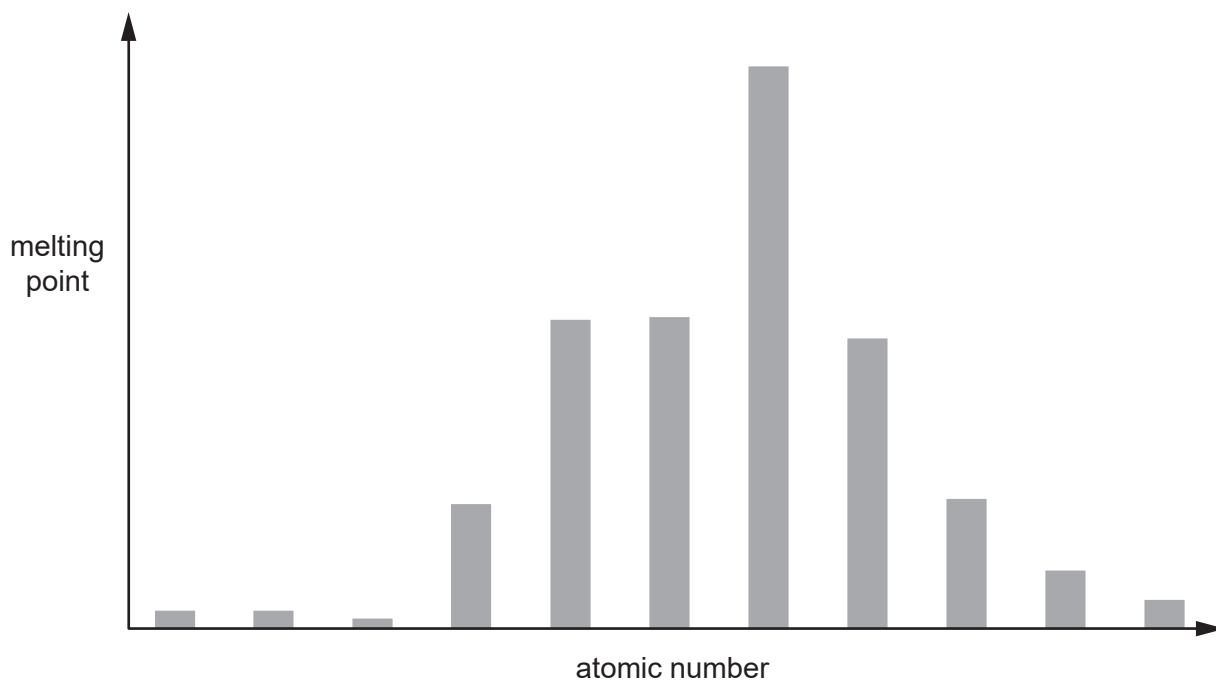
Explain the meaning of the term *atomic number*. [1]

- (e) The bar chart below shows the pattern of melting points in a series of elements.

The elements are arranged in order of increasing atomic number with no gaps.

The elements sodium to chlorine form **part** of this series.

Write the symbol **Na** above a bar to label the position of **sodium** on the chart.



[1]

Total Marks for Question Set 4: 19

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