

Name of the Student: _____

Max. Marks : 23 Marks

Time : 23 Minutes

Q1.

This question is about the elements in Group 2.

- (a) Explain why the third ionisation energy of beryllium is **much** higher than the second ionisation energy of beryllium.

(3)

- (b) Magnesium reacts slowly with cold water but rapidly with steam.

Compare these reactions, in terms of the products formed.

You should identify one similarity in, and one difference between, these reactions.

Similarity _____

Difference _____

(2)

- (c) The reaction of calcium with water is a redox reaction.

Explain, in terms of oxidation states, why this reaction involves both oxidation and reduction.

(2)

(Total 7 marks)

Q2.

A student is provided with separate unlabelled samples of four different solutions for analysis.

The four solutions are known to be ammonium nitrate, potassium sulfate, sodium carbonate and magnesium nitrate, but the student does not know which sample is which.

Outline a series of test-tube reactions that the student can use to identify each of these solutions.

Include:

- the expected observations
- ionic equations for any reactions.

(Total 6 marks)

Q3.

This question is about an experiment to determine the solubility of strontium hydroxide in water at 20 °C

Strontium hydroxide is slightly soluble in water. Strontium hydroxide solution reacts in a similar way to calcium hydroxide solution.

- Some solid strontium hydroxide is added to approximately 1 dm³ of distilled water in a stoppered flask.
- The mixture is kept at 20 °C. Every day, the mixture is checked. If no solid is present in the flask, more solid strontium hydroxide is added.
- On the day when no more solid needs to be added, the flask is opened and the mixture is filtered into another flask and stoppered.
- A 25.0 cm³ sample of the filtrate is transferred to a conical flask with a pipette and a few drops of indicator added.
- This sample is titrated with 0.100 mol dm⁻³ hydrochloric acid.
- The titration is repeated several times with further samples of the filtrate. The results are shown in the below table in part (e).

(a) Suggest why the solution is kept until no more solid needs to be added.

(1)

(b) Suggest why it is important to remove the undissolved strontium hydroxide before the titration.

(1)

(c) After the filtration, the solution is stored in a stoppered flask.

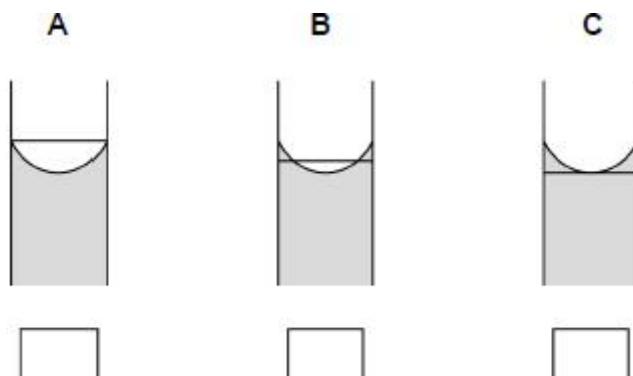
Suggest a reason for stoppering the flask.

(1)

(d) The diagrams in the figure below show the part of a pipette with the graduation line.

Which diagram identifies the pipette that is correctly filled?

Tick (✓) **one** box.



(1)

- (e) Solubility can be quoted as 'g of solute per 100 cm³ of solution'.

The table below shows the results of the titrations between strontium hydroxide and hydrochloric acid. These can be used to determine the solubility of strontium hydroxide.

Titration	Rough	1	2	3
Final burette reading / cm ³	34.40	38.00	41.05	37.00
Initial burette reading / cm ³	0.00	5.55	8.05	4.60
Titre / cm ³	34.40	32.45	33.00	32.40

Give the equation for the reaction between strontium hydroxide and hydrochloric acid.

Use the results in the above table to calculate the mean titre.

Use the mean titre to calculate the solubility of strontium hydroxide, in g per 100 cm³ of solution, at 20 °C

Equation

Mean titre _____ cm³

Solubility of strontium hydroxide _____ g per 100 cm³ solution (6)
(Total 10 marks)