

Module 4

A1 When barium chloride solution is mixed with a solution of silver nitrate, a reaction occurs which forms barium nitrate and silver chloride. The resulting mixture was then filtered. What would be found as the residue and the filtrate?

	<u>Residue</u>	<u>Filtrate</u>
A.	barium nitrate	silver chloride
B.	silver chloride	barium nitrate
C.	barium nitrate and silver chloride	no filtrate collected
D.	no residue collected	barium nitrate and silver chloride

A2 The table gives information about three indicators.

indicator	colour at pH = 1	pH at which colour changes	colour at pH = 12
X	red	3.8	yellow
Y	yellow	6.3	purple
Z	colourless	9.7	blue

Which colours would be seen when each indicator is put separately into pure water?

	X	Y	Z
A	red	yellow	blue
B	yellow	yellow	colourless
C	yellow	yellow	blue
D	yellow	purple	colourless

B1 Zinc sulphate crystal, ZnSO_4 is a soluble salt.

- (a) Describe how these crystals could be prepared from a named dilute acid and a named metal.
- (b) Name **TWO** other compounds that could be used to react with the named dilute acid to produce zinc sulphate.

5078 Science (Chemistry & Biology)
Module 4: Acids, Bases and Salts

B2 (a) A student attempted to prepared the salt calcium sulphate by reacting calcium carbonate with sulphuric acid. However, she was unable to obtain a satisfactory yield of the salt.

(i) Explain why the yield of the calcium sulphate was very low.

(ii) Outline an alternative method to prepare a pure, dry sample of calcium sulphate starting from calcium carbonate.

(c) A solution of zinc sulphate was made from zinc carbonate and dilute sulfuric acid by the following method.

Step 1: Add an excess of zinc carbonate to dilute sulphuric acid. Warm.

Step 2: Filter.

(i) Explain why an excess of zinc carbonate is used in step 1.

(ii) Describe how you would obtain pure, dry crystals of zinc sulphate, $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ after step 2.

Module 4 (Solutions)

A1 When barium chloride solution is mixed with a solution of silver nitrate, a reaction occurs which forms barium nitrate and silver chloride. The resulting mixture was then filtered. What would be found as the residue and the filtrate?

B.

A2 The table gives information about three indicators.

indicator	colour at pH = 1	pH at which colour changes	colour at pH = 12
X	red	3.8	yellow
Y	yellow	6.3	purple
Z	colourless	9.7	blue

Which colours would be seen when each indicator is put separately into pure water? **D.**

B1 Zinc sulphate crystal, ZnSO_4 is a soluble salt.

(a) Describe how these crystals could be prepared from a named dilute acid and a named metal.

Zinc and sulfuric acid. It can be prepared by acid reactions, where we add excess of one reagent to ensure that reaction will drive to completion. Subsequently, filter to obtain the filtrate and undergo crystallisation to obtain zinc sulfate crystal.

(b) Name **TWO** other compounds that could be used to react with the named dilute acid to produce zinc sulphate.

Zinc oxide, zinc carbonate.

B2 (a) A student attempted to prepare the salt calcium sulphate by reacting calcium carbonate with sulphuric acid. However, she was unable to obtain a satisfactory yield of the salt.

(i) Explain why the yield of the calcium sulphate was very low.

Calcium sulfate has poor solubility in water. As such, the reaction between the solid and liquid will yield low amount of CaSO_4 .

5078 Science (Chemistry & Biology)
Module 4: Acids, Bases and Salts

- (ii) Outline an alternative method to prepare a pure, dry sample of calcium sulphate starting from calcium carbonate.

First, react calcium carbonate with hydrochloric acid to obtain calcium chloride. React the solutions of calcium chloride with sodium sulfate to allow calcium sulfate to be formed via precipitation.

Filter the solution to obtain the residue and rinse it with DI water to remove impurities.

- (c) A solution of zinc sulphate was made from zinc carbonate and dilute sulfuric acid by the following method.

Step 1: Add an excess of zinc carbonate to dilute sulphuric acid. Warm.

Step 2: Filter.

- (i) Explain why an excess of zinc carbonate is used in step 1.
Ensure reaction drive to completion.
- (ii) Describe how you would obtain pure, dry crystals of zinc sulphate, $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ after step 2.

After obtaining the filtrate from filtration, perform crystallisation.

- Heat the solution and test for saturation with a clean glass rod.
- Upon reaching saturation, cool the solution to allow crystals to develop.
- Perform filtration to retrieve the crystals (residues).
- Dry crystals with clean filter paper.

(Do not wash crystals DI water as you will dissolve the zinc sulfate crystals into zinc sulfate solution!)