

Name of the Student: _____

Max. Marks : 19 Marks

Time : 19 Minutes

Q1.

An aqueous solution **Y** is known to contain one type of group 2 metal ion and one type of negative ion.

Aqueous solutions of sulfuric acid and magnesium nitrate are added to separate samples of solution **Y**. The observations are shown in the table.

Solution added	Observation with solution Y
Sulfuric acid	A white precipitate forms
Magnesium nitrate	A white precipitate forms

- (a) Suggest the identity of the group 2 metal ion present in solution **Y**.

Write an ionic equation, including state symbols, for the reaction that takes place when sulfuric acid is added to solution **Y**.

Group 2 metal ion _____

Ionic equation _____

(2)

- (b) Suggest the identity of the negative ion present in solution **Y**.

Write an ionic equation, including state symbols, for the reaction that takes place when magnesium nitrate is added to solution **Y**.

Negative ion _____

Ionic equation _____

(2)

(Total 4 marks)

Q2.

The ionic product of water, $K_w = 2.93 \times 10^{-15} \text{ mol}^2 \text{ dm}^{-6}$ at 10°C

(a) Which is the correct expression for K_w ?

Tick (✓) **one** box.

A $K_w = \frac{[\text{H}_2\text{O}]}{[\text{H}^+][\text{OH}^-]}$ ☐

B $K_w = [\text{H}^+][\text{H}_2\text{O}]$ ☐

C $K_w = [\text{H}^+][\text{OH}^-]$ ☐

D $K_w = \frac{[\text{H}^+][\text{OH}^-]}{[\text{H}_2\text{O}]}$ ☐

(1)

(b) Calculate the pH of pure water at 10°C

Give your answer to two decimal places.

pH of water _____

(2)

(c) Suggest why this pure water at 10°C is **not** alkaline.

(1)

(d) Calculate the pH of a $0.0131 \text{ mol dm}^{-3}$ solution of calcium hydroxide at 10°C

Give your answer to two decimal places.

pH of solution _____

(3)

- (e) The $0.0131 \text{ mol dm}^{-3}$ calcium hydroxide solution at 10°C was a saturated solution.

A student added 0.0131 mol of magnesium hydroxide to 1.00 dm^3 of water at 10°C and stirred the mixture until no more solid dissolved.

Predict whether the pH of the magnesium hydroxide solution formed at 10°C is larger than, smaller than or the same as the pH of the calcium hydroxide solution at 10°C

Explain your answer.

pH of magnesium hydroxide compared to calcium hydroxide

Explanation _____

(2)

(Total 9 marks)

Q3.

This question is about ion testing.

- (a) Describe how a student could distinguish between aqueous solutions of potassium nitrate, KNO_3 , and potassium sulfate, K_2SO_4 , using one simple test-tube reaction.

Reagent _____

Observation with $\text{KNO}_3(\text{aq})$ _____

Observation with $\text{K}_2\text{SO}_4(\text{aq})$ _____

(3)

- (b) Describe how a student could distinguish between aqueous solutions of magnesium chloride, MgCl_2 , and aluminium chloride, AlCl_3 , using **one** simple test-tube reaction.

Reagent _____

Observation with $\text{MgCl}_2(\text{aq})$ _____

Observation with $\text{AlCl}_3(\text{aq})$ _____

(3)

(Total 6 marks)