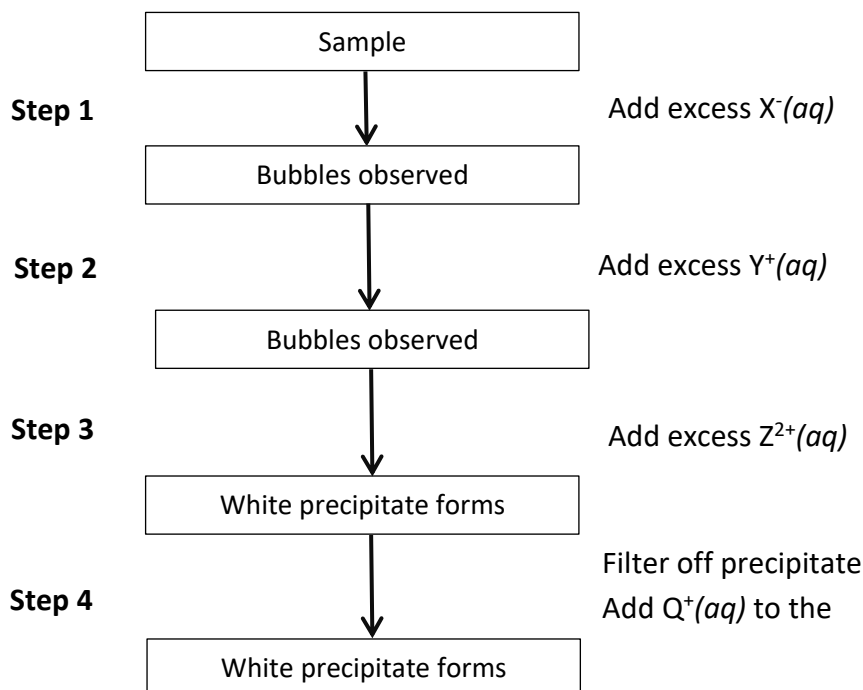


Chemistry Form 11



1. **(8 points)** There were dissolved in water some ammonium sulphate, ammonium carbonate and ammonium chloride. The flow diagram shows of tests that can be used to identify all ions presented in a sample.



Identify which ions were used for identification. Write balanced identification equations for all reactions in these steps in ionic forms.

2. **(11 points)** The table shows the value of six solutions whose labels have been lost.

Solution	A	B	C	D	E	F
pH value	13,5	3,5	7,0	8,9	6,0	1,0

a. Which solution(s) is acidic? **1 point**

b. Soap solutions are weakly alkaline. Which solution could be soap solution? **1 point**

c. Student mixed A and F solutions. The mix was evaporated and sodium sulphate was obtained. Identify solutions A and F and write balanced identification equation. **3 points**

d. What will be the pH value for solution F if it will dilute 100 times. **1 point**

e. There were added 40 ml 10 % potassium hydroxide solution (density – 1.11 g/ml) to 30 ml solution of 2 mol/l hydrochloric acid. Indicate which ion (H^+ or OH^-) excess is in solution and calculate the concentration of it. **6 points**

3. **(10 points)** When the pH of rainwater falls below 5.6 it calls as acid rain.

a. Explain why rainwater is naturally slightly acidic. Give a balanced equation to support your answer.

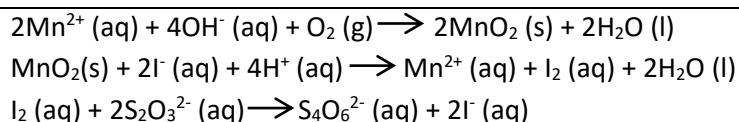
2 points

b. Identify **two** major pollutants that cause acid rain. For each, state the manmade source. **4 points**

c. One of the two major acids present in acid rain originates mainly from the burning of coal. Name these acids and give balanced equations to show how they formed. **3 points**

d. Acid rain has caused considerable damage to buildings and statues made of marble (CaCO_3). Write a balanced equation to represent the reaction of acid rain with marble. **1 point**

4. **(9 points)** In order to survive, fish require water containing dissolved oxygen. In a method to find the concentration of dissolved oxygen, manganese (IV) oxide is formed. Then it used to release iodine, which is titrated with standard thiosulfate solution. The equations for these three steps are:



a. Calculate the oxidation state of manganese in manganese dioxide (MnO_2) **1 point**

b. Name oxidizer and reducer in second reaction. **2 points**

c. Write oxidation half equation (ion-electron) for the third reaction. **1 point**

d. Write electron configuration of hydrogen ions: H^{+} and H^{-} . **2 points**

e. 1000 ml of water sample was processed by this method. It was found that 10.0 ml of 0.100 mol/l $\text{Na}_2\text{S}_2\text{O}_3$ solution were required to react with the produced iodine. Calculate the concentration **g/l** of dissolved oxygen in the water sample. **3 points**

5. **(8 points)** Biogas is a renewable fuel which consists of 70 % (by mass) methane and 30 % carbon dioxide.

a. Describe carbon dioxide molecule form. **1 point**

b. 1 mol of methane releases 890 kJ of heat, while ethane – 1559.5 kJ during the combustion. Using this information estimate which of these two substances would be more effective fuel if there would be used the same mass of fuel. **2 points**

c. Calculate the total volume of CO_2 in m^3 , which would be released after burning reaction of 1 kg biogas. **5 points**