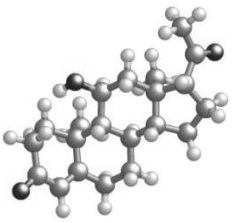

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Name: …… **( )**

Class: ……

Date: …… **/** …… **/** ……

Questions on Qualitative Analysis – Assignment 2

Question One:

The following tests were carried out to identify an unknown salt **A**.

- The white salt **A** gave an apple green flame test.
- An aqueous solution of **A** produced a white precipitate of compound **B** when treated with dilute sulphuric acid.
- A second aqueous solution of **A**, when treated with aqueous sodium carbonate, gave a solution of compound **C** and a white precipitate of compound **D**.
- The precipitate of **D** was removed by filtration. Solid **D**, when treated with dilute hydrochloric acid, produced a gas, which gave a white precipitate when bubbled through limewater.
- A portion of the filtrate, containing **C**, was treated with dilute nitric acid followed by aqueous silver nitrate. An off-white precipitate of compound **E** was formed. This precipitate of **E** dissolved easily when concentrated aqueous ammonia was added but only partially with dilute aqueous ammonia.
- When chlorine water was added to the remainder of the filtrate, containing **C**, a yellow / orange solution of substance **F** was formed.

a) Identify the cation present in **A**.

……..

(*1 mark*)

b) Identify, by name or formula, the substances **B**, **C**, **D**, **E**, **F** and **A**.

Identity of **B** ……..

Identity of **C** ……..

Identity of **D** ……..

Identity of **E** ……..

Identity of **F** ……..

Identity of **A** ……..

(*6 marks*)

c) Write an equation for the reaction between **A** and aqueous sodium carbonate.

……..

(*2 marks)*

d) Identify, by name or formula, the gas evolved when solid **D** is treated with dilute hydrochloric acid.

……..

(*1 mark*)

e) When chlorine water is added to an aqueous solution of **C**, a yellow / orange solution is formed. Write an ionic-equation for this reaction. Give the name of the type of reaction involved.

Equation: ……

Name of reaction type: ……

(*2 marks*)

Question Two:

When ionic compounds are dissolved in water, they dissociate and form positive ions (cations) and negative ions (anions). When two solutions containing ions are mixed, sometimes the oppositely charged ions that are present will combine to form a *precipitate* or insoluble compound.

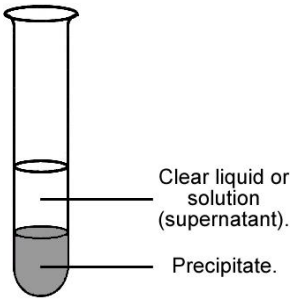
Sodium hydroxide produces sodium ions and hydroxide ions when dissolved in water:

$$NaOH_{(s)} \rightarrow Na^{+}_{(aq)} + OH^{-}_{(aq)}$$

Iron(III) chloride produces iron(III) ions and chloride ions when dissolved in water:

$$FeCl_{3(s)} \rightarrow Fe^{3+}_{(aq)} + 3Cl^{-}_{(aq)}$$

When an aqueous solution of sodium hydroxide is added to an aqueous solution of iron(III) chloride, a reddish brown precipitate of iron(III) hydroxide is formed. If this mixture is left to stand for several minutes, tiny particles of the precipitate settle to the bottom of the test tube. The clear liquid on the top is called the *supernatant*.



a) Write a balanced chemical equation for the reaction between the aqueous sodium hydroxide and aqueous iron(III) chloride:

……..

(*1 mark*)

A student performed a series of precipitation reactions to determine the concentration of a sample of iron(III) chloride. She placed 5.0 cm^3 of the iron(III) chloride solution into a test tube and then added 1.0 cm^3 of 0.1mol dm^{-3} sodium hydroxide solution. She placed a stopper in the mouth of the test tube and then shook it. She repeated the procedure using different volumes of the sodium hydroxide solution. She allowed the contents of each test tube to stand for 10 minutes and then measured the height of the precipitate. Her results are shown below:

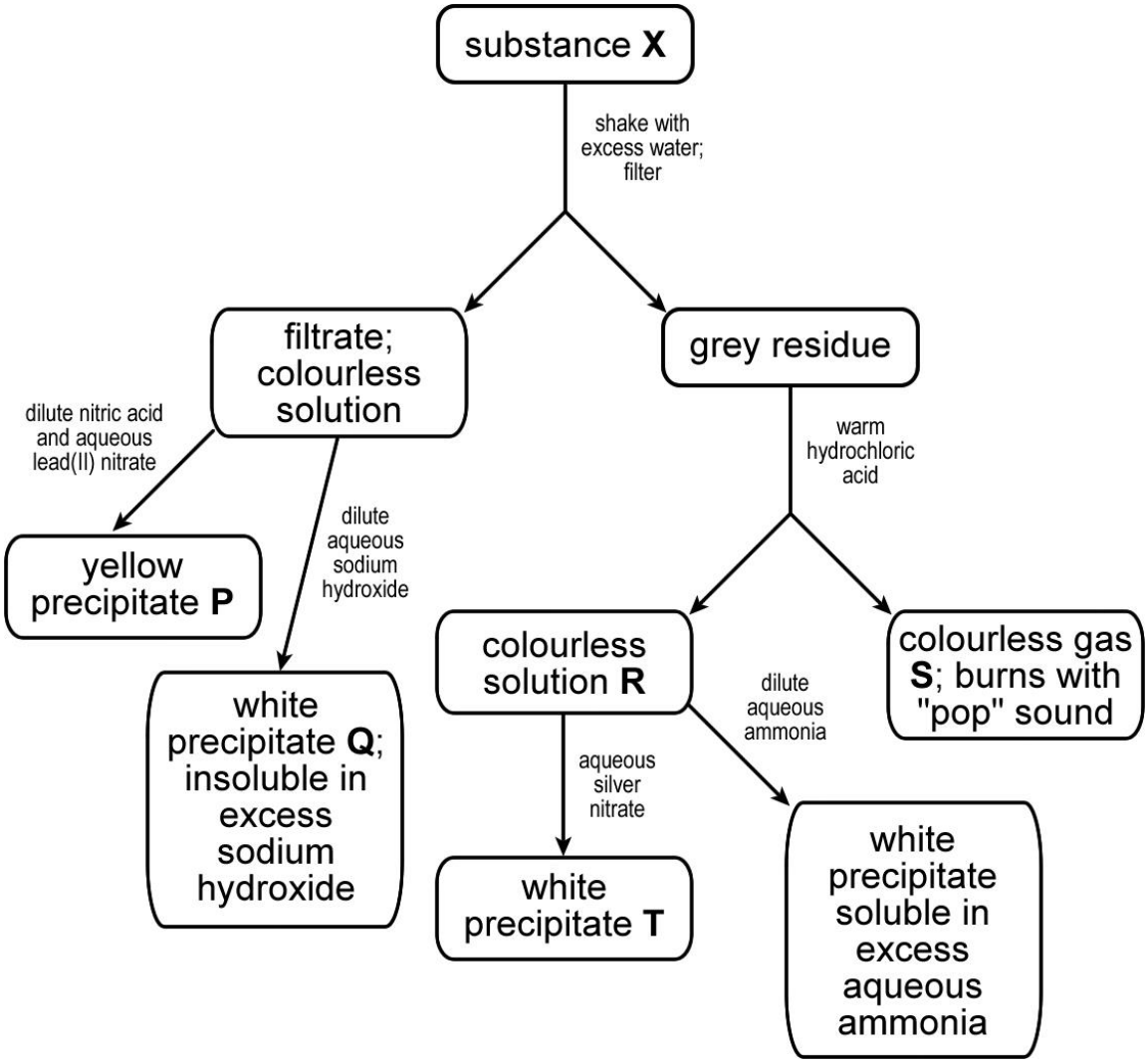
Volume of $NaOH_{(aq)}$ / cm^3	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Height of precipitate / mm	32	38	42	44	46	48	48	49	48	48

b) Using the student's results, calculate the concentration of the iron(III) chloride solution:

(*3 marks*)

Question Three:

Substance **X** is a mixture of a salt and a metal.



a) Give the name and formula of the element, compound or ion:

P ……

Q ……

R ……

S ……

T ……

X ……

(*6 marks*)

b) Write the balanced chemical equation for the formation of the yellow precipitate **P**:

……..

(*2 marks*)

c) Write the ionic equation for the formation of the white precipitate **Q**:

……..

(*2 marks*)

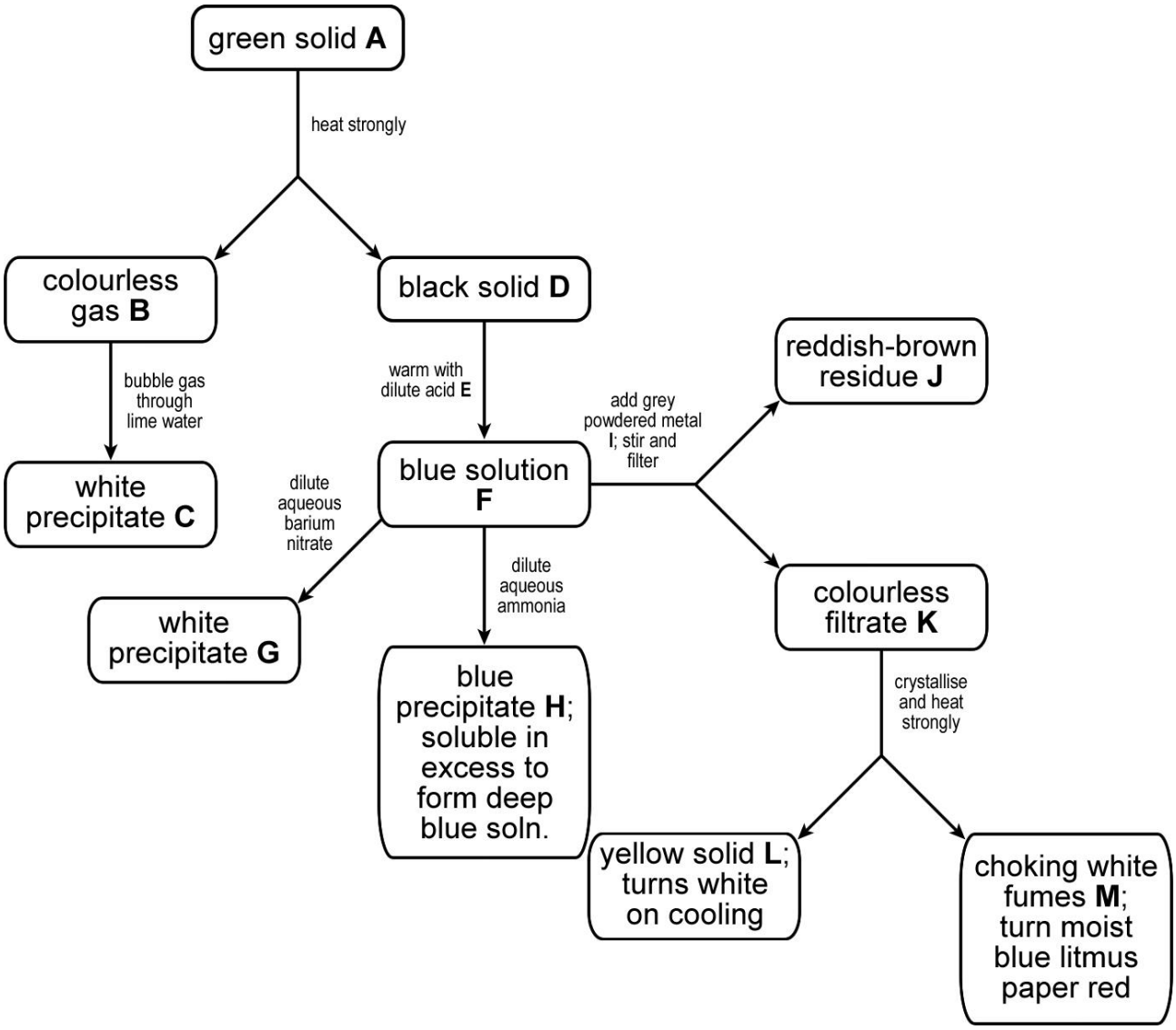
d) Write a balanced chemical equation for the formation of the white precipitate **T**:

……..

(*2 marks*)

Question Four:

Study the reaction sequence shown below:



a) Give the name and formula of the element, compound or ion:

A …… **B** ……

C …… **D** ……

E …… **F** ……

G …… **H** ……

I …… **J** ……

K …… **L** ……

M ……

(*13 marks*)

b) Write the balanced chemical equation for the formation of the black solid **D**:

……..

(*2 marks*)

c) Write the balanced chemical equation for the formation of the white precipitate **G**:

……..

(*2 marks*)

- Scan the QR code below for the answers to this assignment.

http://www.chemist.sg/qualitative_analysis/qa_assignment_2_ans.pdf