



Anglo-Chinese School
(Barker Road)

A Methodist Institution
Founded in 1886

CHEMISTRY DEPARTMENT OF SCIENCE

Name: _____ () Class: SEC 3 _____

IDENTIFICATION OF IONS & GASES – ASSIGNMENT

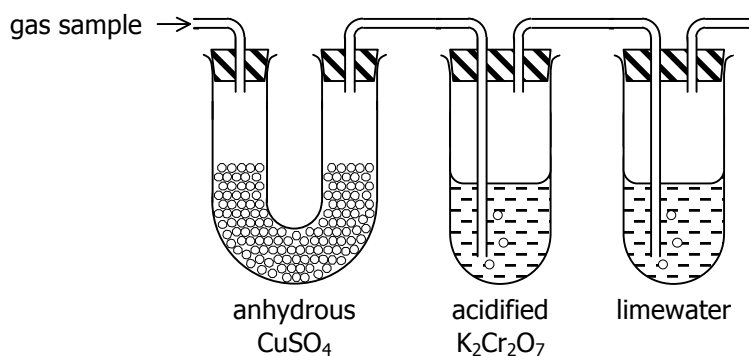
Multiple-Choice Questions [20 Marks]

TOTAL SCORE / 30

Write in your selected answer for the multiple-choice questions in the boxes provided.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

- Which of the following gases is **not** colourless?
A ammonia **B** chlorine **C** hydrogen **D** sulfur dioxide
- Which of the following gases has the highest pH when dissolved in water?
A ammonia **B** chlorine **C** hydrogen **D** sulfur dioxide
- A mixture of gases was examined using the apparatus as shown.



At the end of the experiment, it was found that the copper(II) sulfate was white, the acidified potassium dichromate(VI) was green and the limewater contained a white precipitate.

Which of the following gases must be present?

- A** carbon dioxide and chlorine
- B** carbon dioxide and sulfur dioxide
- C** carbon dioxide, sulfur dioxide and water vapour
- D** chlorine and sulfur dioxide

4. An unknown solid, **X**, was added to an excess of dilute sulfuric acid. Effervescence is observed, and a colourless, odourless gas is evolved. When tested with a lighted splint, the splint is extinguished with a 'pop' sound. The solid dissolves completely to form a colourless solution.

Which of the following could be **X**?

- A** Ca (s) **B** CaCO₃ (s) **C** Mg (s) **D** MgCO₃ (s)

5. A student has a sample of gaseous sulfur dioxide. He tests it by shaking the gas with a sample of aqueous potassium dichromate(IV) mixed with aqueous sodium hydroxide. He expects the solution to change from orange to green. What error did he make?

- A** Aqueous potassium permanganate should be used in place of potassium dichromate(VI).
B Dilute sulfuric acid should be used in place of aqueous sodium hydroxide.
C The colour change should be from green to orange instead.
D The gas should be bubbled through the solution instead.

6. When carbon dioxide is bubbled through aqueous limewater, a white precipitate is formed. Which of the following statements about this chemical reaction is true?

- A** Aqueous limewater is aqueous calcium chloride.
B Aqueous limewater must be acidified before use.
C The white precipitate dissolves in an excess of carbon dioxide.
D The white precipitate formed is calcium oxide.

7. Gaseous samples of carbon dioxide and chlorine were separately bubbled through litmus solution. Which of the following accurately describes the appearance of the solution after a long time?

	<i>carbon dioxide bubbled through litmus solution</i>	<i>chlorine bubbled through litmus solution</i>
A	blue	colourless
B	blue	red
C	red	colourless
D	red	red

8. A solid sample of salt **Y** is added to an excess of distilled water. A colourless solution is formed. A few drops of aqueous ammonia is added, and a precipitate is formed. An excess of aqueous ammonia is then added, and the precipitate dissolves.

Which of the following could be **Y**?

- A** CuSO₄ **B** K₂SO₄ **C** Zn(NO₃)₂ **D** ZnCO₃

9. Which of the following hydroxides is able to dissolve in aqueous sodium hydroxide but not able to dissolve in aqueous ammonia?

- A** Ca(OH)₂ **B** Fe(OH)₂ **C** Pb(OH)₂ **D** Zn(OH)₂

10. Which of the following cations is able to form a precipitate with aqueous ammonia?

- A** Ca²⁺ **B** H⁺ **C** Mg²⁺ **D** NH₄⁺

11. The presence of which of the following aqueous cations can be tested by adding aqueous potassium carbonate?

- A** Al^{3+} **B** H^+ **C** K^+ **D** NH_4^+

12. An aqueous sample of an unknown salt **Z** was heated in a test-tube with an equal volume of aqueous sodium hydroxide and a few pieces of aluminium foil. A piece of moist red litmus paper was placed at the mouth of the test-tube, which remained red at the end of the experiment.

Which of the following conclusions can be drawn?

- A** Salt **Z** contains ammonium ions.
B Salt **Z** contains neither nitrate ions nor ammonium ions.
C Salt **Z** contains nitrate ions.
D Salt **Z** does not contain nitrate ions.

13. In the test for sulfate ions, an equal volume of dilute nitric acid is added to the aqueous barium nitrate reagent to

- A** dissolve the barium nitrate reagent which is otherwise insoluble.
B dissolve the barium sulfate precipitate formed in the unknown solution.
C react with the sulfate ions present in the unknown solution.
D remove any carbonate or hydroxide ions in the unknown solution.

14. Which of the following salts are white?

- A** AgI **B** $\text{Fe}(\text{OH})_3$ **C** PbI_2 **D** PbSO_4

15. An unknown solution was tested with a few drops of aqueous silver nitrate. A white precipitate was formed. An equal volume of dilute nitric acid is then added. The white precipitate dissolves, without any effervescence, to form a colourless solution.

Which ion must be present in the solution?

- A** Cl^- **B** CO_3^{2-} **C** OH^- **D** SO_4^{2-}

16. An unknown solution, **P**, was subject to the following tests:

No	Procedure	Observations
1	To a small sample of P , add an equal volume of acidified silver nitrate.	A white precipitate is formed.
2	To a small sample of P , add a few drops of aqueous sodium hydroxide.	A reddish-brown precipitate is formed.

Which of the following could be **P**?

- A** $\text{CuSO}_4 (\text{aq})$ **B** $\text{FeCl}_3 (\text{aq})$ **C** $\text{FeSO}_4 (\text{aq})$ **D** $\text{PbCl}_2 (\text{aq})$

17. An unknown solution, **Q**, was subject to the following tests:

No	Procedure	Observations
1	To a small sample of Q , add an equal volume of acidified lead(II) nitrate.	A white precipitate is formed.
2	To a small sample of Q , add an equal volume of acidified barium chloride.	A white precipitate is formed.
3	To a small sample of Q , add a few drops of aqueous sodium hydroxide.	No visible change.
4	To a small sample of Q , add one spatula of powdered calcium carbonate.	Effervescence observed; a colourless, odourless gas is evolved.

Which of the following could be **Q**?

- A** H_2SO_4 (aq) **B** KI (aq) **C** Na_2SO_4 (aq) **D** ZnI_2 (aq)

18. Two bottles in a laboratory are unlabelled. One of the bottles contain dilute hydrochloric acid while the other contains aqueous calcium chloride.

Which of the following procedures will **not** help to identify the solutions?

- A** addition of acidified silver nitrate
B addition of aqueous sodium hydroxide
C addition of blue litmus paper
D addition of potassium carbonate

19. Solid samples of several ionic compounds are heated over a strong flame. The chemical formulae of the respective residues of thermal decomposition are listed below.

	ionic compound	residue
(i)	CaCO_3	CaO
(ii)	$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$	CuSO_4
(iii)	KNO_3	KNO_2
(iv)	ZnI_2	ZnO

Which is/are **incorrect**?

- A** (i) and (ii) only **C** (iii) and (iv) only
B (ii) only **D** (iv) only

20. When heated, solid **R** gives off a gas which produces a white precipitate with limewater. The residue reacts with dilute acid and also with aqueous alkali. Which could be **R**?

- A** aluminium sulfate **C** sodium sulfate
B magnesium carbonate **D** zinc carbonate

Structured Questions [10 Marks]

21. An aqueous solution **P** is believed to be zinc chloride. Describe the chemical tests, including predicted observations, to prove the presence of

(a) zinc ions, [2]

Procedure:

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Observations:

.....

(b) chloride ions. [2]

Procedure:

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Observations:

.....

22. An aqueous solution **Q** contains a mixture of copper(II) nitrate and potassium sulfate. It is divided into equal 2 cm³ portions and placed through several chemical tests as described below. Complete the qualitative analysis table for the expected observations. [6]

No	Procedure	Observation
1	(a) To a sample of Q , add a few drops of aqueous ammonia. (b) To the resulting mixture, add an excess of aqueous ammonia.	
2	(a) To a sample of Q , add a few drops of aqueous barium chloride. (b) To the resulting mixture, add an excess of dilute nitric acid.	
3	(a) To a sample of Q , add an excess of aqueous sodium hydroxide. (b) Then add a few pieces of aluminium foil and then warm gently. (c) Test for any gas evolved with a piece of moist red litmus paper.	

END