Anglo-Chinese School
(Barker Road)
A Methodist Institution
Founded in 1886

CHEMISTRY
DEPARTMENT OF SCIENCE

Name: ANSWERS ( ) Class: SEC 3

# SALTS – 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 |
|---|---|---|---|---|---|---|---|---|---|
| B | B | D | C | C | C | B | A | B | A |

| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|
| C | B | B | D | A | A | B | A | C | B |

1. Which of the following ionic compounds is the most soluble in water?

**A** calcium carbonate
**B** magnesium sulfate
**C** silver chloride
**D** zinc hydroxide

2. Which of the following ionic compounds is the least soluble in water?

**A** ammonium carbonate
**B** barium sulfate
**C** iron(III) chloride
**D** lead(II) nitrate

3. Which of the following pairs of salts can be separated by adding water and filtering?

**A** barium chloride, lead(II) nitrate
**B** calcium sulfate, silver chloride
**C** iron(III) sulfate, zinc nitrate
**D** magnesium carbonate, lithium iodide

4. Which two pairs of solutions, when mixed, will produce a precipitate?

**A** barium chloride, potassium nitrate
**B** copper(II) iodide, sodium nitrate
**C** hydrochloric acid, silver nitrate
**D** lead(II) nitrate, zinc nitrate

5. Which two pairs of solutions, when mixed, will **not** produce a precipitate?

**A** ammonium chloride, silver nitrate
**B** calcium chloride, sulfuric acid
**C** lead(II) nitrate, magnesium nitrate
**D** sodium hydroxide, zinc nitrate

6. Which of the following is **not** an alkali?

**A** ammonium hydroxide
**B** calcium hydroxide
**C** magnesium hydroxide
**D** sodium hydroxide

7. An unknown compound **X** is insoluble in water and reacts with acids to produce a gas. Which of the following is most likely to be **X**?

**A** aluminium hydroxide
**B** copper(II) carbonate
**C** lithium carbonate
**D** magnesium metal

8. Aqueous solutions of two salts were mixed. A white precipitate was formed, which was filtered off and transferred to another container. A few drops of dilute hydrochloric acid were added to the solid, and effervescence was observed. What could the two salts be?

**A** ammonium carbonate, barium nitrate
**B** copper(II) chloride, silver nitrate
**C** barium chloride, magnesium sulfate
**D** iron(III) sulfate, sodium hydroxide

9. Which of the following salts should be prepared by titration?

**A** calcium sulfate
**B** lithium chloride
**C** magnesium nitrate
**D** silver nitrate

10. Which of the following salts should be prepared by precipitation?

**A** calcium sulfate
**B** lithium chloride
**C** magnesium nitrate
**D** silver nitrate

11. Jeremy wishes to prepare a sample of potassium chloride. Which of the following solutions would **not** be suitable as a starting reagent?

**A** potassium carbonate
**B** potassium hydroxide
**C** potassium nitrate
**D** hydrochloric acid

12. Which pair of substances can be used in the preparation of zinc sulfate?

**A** aqueous zinc nitrate, aqueous sodium sulfate
**B** zinc metal, dilute sulfuric acid
**C** solid zinc carbonate, aqueous zinc chloride
**D** solid zinc oxide, aqueous ammonium sulfate

13. Which pair of substances can be used in the preparation of iron(II) hydroxide?

**A** aqueous iron(II) chloride, aqueous potassium iodide
**B** aqueous iron(II) nitrate, aqueous sodium hydroxide
**C** dilute iron(II) oxide, dilute hydrochloric acid
**D** solid iron(II) nitrate, potassium hydroxide

14. A student had to prepare a sample of magnesium sulfate. He chose a solid to add to dilute sulfuric acid. The preparation failed. Which solid had he chosen?

**A** magnesium carbonate
**B** magnesium hydroxide
**C** magnesium metal
**D** magnesium nitrate

15. Which of the following substances should be added to dilute sulfuric acid to prepare lead(II) sulfate?

**A** aqueous lead(II) nitrate
**B** lead metal
**C** powdered lead(II) carbonate
**D** powdered lead(II) chloride

16. Michelle wishes to prepare a sample of zinc chloride. She executes the following steps:

**Step 1:** Wash and dry and crystals formed.
**Step 2:** Add excess zinc carbonate to the solution.
**Step 3:** Heat the filtrate over an evaporating dish.
**Step 4:** Place some dilute hydrochloric acid into a beaker.
**Step 5:** Filter out the excess solid.

In which order should the above steps be carried out?

**A** 4, 2, 5, 3, 1
**B** 2, 5, 4, 1, 3
**C** 4, 3, 2, 1, 5
**D** 4, 2, 3, 5, 1

17. Which one of the following hydroxides does **not** give a good yield of a salt with dilute hydrochloric acid?

**A** iron(III) hydroxide
**B** lead(II) hydroxide
**C** magnesium hydroxide
**D** zinc hydroxide

18. How can barium sulfate be best be prepared from barium carbonate?

**A** Add dilute nitric acid, followed by potassium sulfate and filter.
**B** Add dilute sulfuric acid and filter.
**C** Add dilute sulfuric acid, followed by potassium sulfate and filter.
**D** Add excess water, followed by dilute nitric acid.

19. Which of the following describes a step in the preparation of aqueous barium chloride?

**A** Add an indicator.
**B** Add barium sulfate.
**C** Filter the mixture.
**D** Heat in evaporating dish.

20. In the preparation of copper(II) sulfate, why is copper metal a poor choice of reactant to add to the dilute sulfuric acid?

**A** A soluble reactant should be used instead.
**B** Copper is a very unreactive metal.
**C** Copper is very expensive.
**D** Metals do not react with acids.

Structured Questions [10 Marks]

21. (a) Write chemical equations, including state symbols, for the following precipitation reactions:

(i) aqueous barium chloride + dilute sulfuric acid [1]

$BaCl_2\ (aq) + H_2SO_4\ (aq) \longrightarrow BaSO_4\ (s) + 2\ HCl\ (aq)$

(ii) aqueous potassium hydroxide + aqueous iron(III) sulfate [1]

$6\ KOH\ (aq) + Fe_2(SO_4)_3\ (aq) \longrightarrow 2\ Fe(OH)_3\ (s) + 3\ K_2SO_4\ (aq)$

(b) Lead(II) chloride is an insoluble salt, and can be prepared by mixing solutions of lead(II) nitrate and potassium chloride.

(i) State the chemical equation, including state symbols, for this reaction. [1]

$Pb(NO_3)_2\ (aq) + 2\ KCl\ (aq) \longrightarrow 2\ KNO_3\ (aq) + PbCl_2\ (s)$

(ii) Outline the steps, after mixing, to obtain a dry sample of the salt. [1]

Filter the solution, wash the residue with distilled water, and allow the residue to dry between sheets of filter paper.

22. Sodium phosphate, $Na_3PO_4$, is a soluble salt, used as a water softener in washing powders. It is prepared by reacting dilute phosphoric acid, $H_3PO_4$, with an alkali.

(a) Name the alkali that should be used. [1]

Aqueous sodium hydroxide

(b) Give the formulae of the ions present in sodium phosphate. [1]

$Na^+$, $PO_4^{3-}$

(c) Construct a balanced chemical equation, including state symbols, for the reaction between dilute phosphoric acid and the alkali. [1]

$H_3PO_4\ (aq) + 3\ NaOH\ (aq) \longrightarrow Na_3PO_4\ (aq) + 3\ H_2O\ (l)$

(d) Given solutions of phosphoric acid and alkali, a suitable indicator and standard laboratory apparatus, explain how you would prepare an aqueous sample of sodium phosphate. [3]

Using a pipette, extract a fixed volume of dilute $H_3PO_4$ into a flask. Add a few drops of phenolphthalein. (1) Using a burette, add aqueous NaOH drop by drop until neutralisation. (2) Note volume of NaOH used. Repeat without indicator. (3)

**END**