

## **ORDINARY LEVEL CHEMISTRY PROBLEMS**

### **PART 10: CHLORINE AND ITS COMPOUNDS**

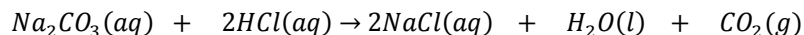
- (1) (a) Briefly describe how a dry sample of hydrogen chloride can be prepared in the laboratory
- (b) hydrogen chloride was bubbled through a solution of lead(II) nitrate
- (i) state what was observed and explain your answer
  - (ii) write an equation for the reaction that took place
- (c) A sample of hydrogen chloride gas was dissolved in water to make 250cm<sup>3</sup> of a solution. 25.0cm<sup>3</sup> of this solution required 46.0cm<sup>3</sup> of 2M sodium hydroxide for complete neutralization. Determine the mass of hydrogen chloride that was dissolved to make 250cm<sup>3</sup> of the solution
- (2) (a) Chlorine can be prepared in the laboratory using potassium manganate(VII).
- (i) Name one substance that reacts with potassium manganate(VII) to produce chlorine
  - (ii) State the conditions for the reaction
  - (iii) Write the equation for the reaction
- (b) Damp litmus paper was dropped in a gas jar containing chlorine. State what was observed and explain your observation.
- (c) A boiling tube filled with chlorine water was inverted into a beaker containing chlorine water and the mixture exposed to sunlight for some time
- (i) State what was observed
  - (ii) Explain with the aid of equation(s) your observation(s) in c(i)
- (d) Write an equation to show how chlorine can react with
- (i) Dilute potassium hydroxide solution
  - (ii) Turpentine C<sub>10</sub>H<sub>16</sub>.
- (e) Briefly describe a test you would carry out to confirm the presence of chloride ion in solution. State what would be observed and write an equation for the reaction that would take place.
- (3) (a) Describe how a pure dry sample of chlorine can be prepared in the laboratory from potassium manganate(VII) crystals
- (b) State what would be observed if chlorine was bubbled through a
- (i) Blue litmus solution
  - (ii) Potassium bromide solution
  - (iii) Solution of iron(II) ions
- (c) Write equation for the reaction in b(ii) and b(iii)
- (d) Write equation for the reaction between chlorine and
- (i) Heated iron
  - (ii) Cold dilute sodium hydroxide solution
  - (iii) Hot concentrated sodium hydroxide solution
- (4) (a) Describe how a pure sample of chlorine can be prepared in the laboratory starting from potassium permanganate
- (b) State what would be observed and write equation for the reaction that would occur if
- (i) Chlorine was bubbled into aqueous sodium hydroxide solution

- (ii) Burning magnesium was lowered into a gas jar of chlorine
    - (iii) Chlorine was passed through a solution of potassium iodide
  - (c) State the uses of chlorine
- (5)
- (a) State what would be observed if chlorine was bubbled through
    - (i) Water
    - (ii) Potassium bromide solution
  - (b) Explain your observation in
    - (i) a(i)
    - (ii) a(ii)
  - (c) write equations for the reactions taking place in each case
- (6)
- (a) hydrogen chloride can be prepared from the according to the following equation
 
$$Cl^{-}(s) + H^{+}(aq) \rightarrow HCl(g)$$

Calculate the mass of sodium chloride required to produce 3.60dm<sup>3</sup> of hydrogen chloride at room temperature
  - (b) state what would be observed and in each case write an equation for the reaction that would take place when
    - (i) an aqueous solution of hydrogen chloride is added to s solution containing lead(II) ions
    - (ii) excess dry hydrogen chloride is passed over strongly heated iron wire
  - (c) briefly explain the following
    - (i) anhydrous iron(II) chloride cannot be prepared by direct synthesis using chlorine and iron
    - (ii) an aqueous solution of hydrogen chloride gives a white precipitate with silver nitrate while a solutionof hydrogenchloride in tetrachloromethane shows no observable change when treated with silver nitrate
  - (d) write an ionic equation for the reaction between an aqueous solution of iron(II) and ammonia solution
- (7)
- (a) write equation to show how hydrogen chloride can be prepared from sodium chloride
  - (b) Draw a labeled diagram to show how aqueous hydrogen chloride can be prepared in the laboratory
  - (c) State what would be observed and write equation for the reaction that would take place when aqueous hydrogen chloride is reacted with
    - (i) Solid calcium carbonate
    - (ii) Silver nitrate solution
    - (iii) Magnesium
- (8)
- (a)
    - (i) Describe with aid of a well labeled diagram how a sample of iron(III) chloride can be prepared from concentrated hydrochloric acid and potassium permanganate
  - (b) What happens when
    - (i) Water is added to iron(III) chloride
    - (ii) Iron(III) chloride is exposed to air
  - (c) Hydrogen was used to reduce 32.5g of iron(III) chloride

- (i) Write equation for the reaction
  - (ii) Calculate the minimum volume of hydrogen required to react completely with iron(III) chloride
- (9)
  - (a)
    - (i) Describe with aid of a labeled diagram how a dry sample of chlorine can be prepared
    - (ii) Write equation for the reaction that takes place
    - (iii) State any three uses of chlorine gas
  - (b) State what was observed and write equation for the reaction that takes place when chlorine is added to
    - (i) Iron(II) chloride solution
    - (ii) Potassium iodide solution
  - (c) Burning sodium was plunged in a gas jar of chlorine
    - (i) State what was observed
    - (ii) Write equation for the reaction
- (10)
  - (a) A substance X reacts with solid sodium chloride to produce hydrogen chloride
    - (i) Identify X
    - (ii) State the conditions for the reaction
    - (iii) Write the equation for the reaction
  - (b)
    - (i) Name the substance formed when hydrogen chloride gas is dissolved in water
    - (ii) Explain why an aqueous solution of hydrogen chloride is an electrolyte whereas a solution of the gas in methylbenzene is a non - electrolyte
  - (c) An aqueous solution of hydrogen chloride was added drop wise to 4.2g of solid sodium hydrogen carbonate until there was no further change
    - (i) State what was observed
    - (ii) Write equation for the reaction(s) between the gas produced and calcium hydroxide
    - (iii) Calculate the volume of the gas produced at s.t.p
- (11)
  - (a) Draw a well labeled diagram of the apparatus that could be used to prepare a dry sample of chlorine in the laboratory using potassium permanganate. Write equation for the reaction that takes place
  - (b) Chlorine was bubbled through litmus solution. State and explain what was observed.
  - (c) State what is observed when and write equation for the reaction that takes place when
    - (i) A piece of yellow phosphorus is lowered in jar of chlorine
    - (ii) Burning turpentine ( $C_{10}H_{16}$ ) is lowered in a jar of chlorine
    - (iii) Chlorine is bubbled through potassium bromide solution
    - (iv) Chlorine is bubbled through iron(II) chloride solution
- (12)
  - (a) Chlorine can be prepared in the laboratory from hydrochloric acid
    - (i) Name the other reagent used
    - (ii) State the conditions for the reaction
    - (iii) Write the equation for the reaction

- (b) (i) Draw a well labeled diagram for to show the preparation of iron(III) chloride using chlorine
  - (ii) State what is observed during the reaction
  - (iii) Write equation for the reaction
  - (c) (i) State what is observed if aqueous ammonia was added to a solution of iron(III) chloride
  - (ii) Write an ionic equation for the reaction
13. During the preparation of chlorine in the laboratory, the gas may be passed through water and concentrated sulphuric acid before collection
- (a) State the
    - (i) Use of water
    - (ii) Use of concentrated sulphuric acid
    - (iii) Method of collection of dry chlorine gas. Give a reason for your answer.
  - (b) Chlorine is bleaching agent in the presence of water
    - (i) Write an equation for the reaction between chlorine and water
    - (ii) Using equation, explain the bleaching action of chlorine
  - (c) (i) State what would be observed if chlorine was bubbled through a solution of iron(II) sulphate
  - (ii) Explain your observation
  - (iii) Write an ionic equation for the reaction.
  - (d) Describe the industrial manufacture of chlorine
14. (a). Explain how a dry sample of hydrogen chloride can be prepared from sodium chloride (no diagram is diagram is required)
- (b). State what would be observed and write equation for the reaction that would take place if hydrogen chloride was passed.
    - (i). Over strongly heated iron wire
    - (ii). Through aqueous silver nitrate
  - (c). Aqueous hydrogen chloride reacts sodium carbonate solution to produce carbon dioxide according to the following equation



Calculate the volume of carbon dioxide that would be produced at room temperature if excess sodium carbonate solution was added to 50.0cm<sup>3</sup> of a solution containing 0.2 moldm<sup>-3</sup> of hydrogen chloride.  
(1 mole of gas occupies 24.0 dm<sup>3</sup> at room temperature)

- 15. (a). Hydrogen chloride can be produced from potassium chloride
  - (i). Name another reagent that is used with potassium chloride to produce hydrogen chloride
  - (ii). State the conditions for the reaction
  - (iii). Write an equation for the reaction leading the formation of hydrogen chloride
- (b). Write an equation for the reaction between hydrogen chloride and
  - (i). Silver nitrate solution
  - (ii). Iron in the presence of water
  - (iii). Lead(II) nitrate solution

16. (a). Dry hydrogen chloride gas can be prepared by reacting potassium chloride with substance **T**. The gas is passed through concentrated sulphuric acid and the collected.
- (i). Name substance **T**.
  - (ii). State the conditions for the reaction.
  - (iii). State what is observed during the reaction.
  - (iv). Write the equation for the reaction leading to the formation of hydrogen chloride.
  - (v). State the role of concentrated sulphuric acid.
  - (vi). Name the method of collection of the gas. Give a reason for your answer.
  - (vii). Name a reagent that can be used to identify hydrogen chloride in the laboratory, state what is observed and write equation for the reaction.
- (b). Give a reason why hydrogen chloride is called a fountain gas.
- (c). Explain why a solution of hydrogen chloride in water turns blue litmus red, while a solution of the gas in chloroform does not.
- (d). Describe how you can test for the presence of chloride ions in the laboratory, include an equation for the reaction.
- (e). Iron can react with hydrogen chloride.
- (i). State the conditions for the reaction.
  - (ii). With equation for the reaction.

**END**