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SCIENCE

Paper 2 (Chemistry)

(One hour and a half)

Answers to this Paper must be written on the paper provided separately.

*You will **not** be allowed to write during the first 15 minutes.*

This time is to be spent in reading the Question Paper.

The time given at the head of this paper is the time allowed for writing the answers.

*Section I is compulsory. Attempt **any four** questions from Section II.*

The intended marks for questions or parts of questions are given in brackets [].

SECTION I (40 Marks)

*Attempt **all** questions from this Section.*

Question 1

- (a) Write balanced equations for the following reactions:-
- (i) Potassium hydrogen carbonate and dilute Sulphuric acid.
 - (ii) Copper oxide and dilute Hydrochloric acid.
 - (iii) Manganese(IV) oxide and concentrated Hydrochloric acid.
 - (iv) Sulphur and hot concentrated Nitric acid.
 - (v) Sodium nitrate and concentrated Sulphuric acid. [5]
- (b) The volumes of gases A, B, C and D are in the ratio, 1:2:2:4 under the same conditions of temperature and pressure.
- (i) Which sample of gas contains the maximum number of molecules?
 - (ii) If the temperature and the pressure of gas A are kept constant, then what will happen to the volume of A when the number of molecules is doubled?
 - (iii) If this ratio of gas volumes refers to the reactants and products of a reaction, which gas law is being observed?
 - (iv) If the volume of A is actually 5.6 dm^3 at s.t.p, calculate the number of molecules in the actual volume of D at s.t.p.
(Avogadro's Number is 6×10^{23}).
 - (v) Using your answer from (iv), state the mass of D if the gas is Dinitrogen oxide (N_2O). (N = 14 ; O = 16) [5]

This Paper consists of 10 printed pages.

- (c) (i) Explain why Copper, though a good conductor of electricity, is a non-electrolyte.
- (ii) Name the gas released at the cathode when acidulated water is electrolysed.
- (iii) Explain why solid Sodium chloride does not allow electricity to pass through.
- (iv) Fill in the blanks:-
- (1) As we descend the electrochemical series containing cations, the tendency of the cations to get _____ (oxidized/reduced) at the cathode increases.
- (2) The (higher/lower) _____ the concentration of an ion in a solution, the greater is the probability of its being discharged at its appropriate electrode.

[5]

- (d) Parts (i) to (v) refer to changes in the properties of elements on moving left to right across a period of the Periodic Table. For each property, choose the letter corresponding to the correct answer from the choices A, B, C and D.

- (i) The non-metallic character of the elements:-

- A decreases.
- B increases.
- C remains the same.
- D depends on the period.

- (ii) The electronegativity:-

- A depends on the number of valence electrons.
- B remains the same.
- C decreases.
- D increases.

- (iii) The ionization potential:-

- A goes up and down.
- B decreases.
- C increases.
- D remains the same.

(iv) The atomic size:-

- A decreases.
- B increases.
- C remains the same.
- D sometimes increases and sometimes decreases.

(v) The electron affinity of the elements in groups 1 to 7:-

- A goes up and then down.
- B decreases and then increases.
- C increases.
- D decreases.

[5]

(e) The questions (i) to (v) refer to the following salt solutions listed A to F:-

- A *Copper nitrate*
- B *Iron(II) sulphate*
- C *Iron(III) chloride*
- D *Lead nitrate*
- E *Magnesium sulphate*
- F *Zinc chloride.*

(i) Which *two* solutions will give a white precipitate when treated with dilute Hydrochloric acid followed by Barium chloride solution?

(ii) Which *two* solutions will give a white precipitate when treated with dilute Nitric acid followed by Silver nitrate solution?

(iii) Which solution will give a white precipitate when either dilute Hydrochloric acid or dilute Sulphuric acid is added to it?

(iv) Which solution becomes a deep/inky blue colour when excess of Ammonium hydroxide is added to it?

(v) Which solution gives a white precipitate with excess Ammonium hydroxide solution?

[5]

(f) A to F below relate to the source and extraction of either Zinc or Aluminium.

- A *Bauxite*
- B *Coke*
- C *Cryolite*
- D *Froth floatation*
- E *Sodium hydroxide solution*
- F *Zinc blende.*

(i) Write down the three letters each from the above list which are relevant to:-

- (1) Zinc
- (2) Aluminium.

(ii) Fill in the blanks using the most appropriate words from A to F:-

- (1) The ore from which Aluminium is extracted must first be treated with _____ so that pure Aluminium oxide can be obtained.
- (2) Pure Aluminium oxide is dissolved in _____ to make a conducting solution.

(iii) Write the formula of Cryolite.

(g) Match the descriptions (i) to (v) below with the appropriate term from the list A to J:-

- | | |
|---------------------------|----------------------------|
| A <i>Acidic oxide</i> | F <i>Efflorescence</i> |
| B <i>Alkali</i> | G <i>Electrolysis</i> |
| C <i>Amphoteric oxide</i> | H <i>Electrolyte</i> |
| D <i>Basic oxide</i> | I <i>Homologous series</i> |
| E <i>Deliquescence</i> | J <i>Hydrocarbons</i> |

- (i) The property of spontaneously giving up water of crystallization to the atmosphere.
- (ii) A liquid or solution, which conducts electricity with accompanying chemical change.

- (iii) A compound, which is soluble in water and the only negative ions in the solution are Hydroxide ions.
- (iv) An oxide, which forms salts when it reacts with both acids and alkalis.
- (v) A set of compounds having the same general formula, similar methods of preparation and similar chemical properties. [5]
- (h) The bleaching action of Chlorine is permanent whereas the bleaching action of Sulphur dioxide is temporary. In this context:-
- (i) Give a reason why Chlorine is not used to bleach silk.
- (ii) State the similarity in the use of Sulphur dioxide and Chlorine as bleaching agents.
- (iii) Explain the bleaching action of Sulphur dioxide with the help of chemical equations.
- (iv) Why is bleaching by Sulphur dioxide only temporary? [5]

SECTION II (40 Marks)

Attempt **any four** questions from this Section.

Question 2

- (a) Draw the *structural* formula of a compound with two carbon atoms in each of the following cases:-
- (i) An alkane with a carbon to carbon *single* bond.
- (ii) An alcohol containing two carbon atoms.
- (iii) An unsaturated hydrocarbon with a carbon to carbon *triple* bond. [3]

(b)

Ethane, Ethene, Ethanoic acid, Ethyne, Ethanol
--

From the box given above, name:-

- (i) The compound with – OH as the part of its structure.
- (ii) The compound with – COOH as the part of its structure.
- (iii) Homologue of Homologous series with general formula C_nH_{2n} . [3]

(c) Write the equations for the following *laboratory* preparations:-

- (i) Ethane from Sodium propionate.
- (ii) Ethene from Iodoethane.
- (iii) Ethyne from Calcium carbide.
- (iv) Methanol from Iodomethane.

[4]

Question 3

(a) What is observed when:-

- (i) Hydrogen sulphide gas is passed through Lead acetate solution.
- (ii) Neutral litmus solution is added to Sodium hydrogen carbonate solution.
- (iii) A small piece of Iron is placed in Copper sulphate solution.

[3]

(b) The preparation of Lead sulphate from Lead carbonate is a two-step process. (Lead sulphate cannot be prepared by adding dilute Sulphuric acid to Lead carbonate.)

- (i) What is the first step that is required to prepare Lead sulphate from Lead carbonate?
- (ii) Write the equation for the reaction that will take place when this first step is carried out.
- (iii) Why is the direct addition of dilute Sulphuric acid to Lead carbonate an impractical method of preparing Lead sulphate?

[3]

(c) Fill in the blanks with suitable words:-

An acid is a compound which when dissolved in water forms Hydronium ions as the only (1) _____ ions. A base is a compound which if soluble in water contains (2) _____ ions. A base reacts with an acid to form a (3) _____ and water only. This type of reaction is known as (4) _____.

[4]

Question 4

(a) Compound X consists of molecules.

Choose the letter corresponding to the correct answer from the choices A, B, C and D given below:-

(i) The type of bonding in X will be:-

- A ionic.
- B electrovalent.
- C covalent.
- D molecular.

(ii) X is likely to have a:-

- A low melting point and high boiling point.
- B high melting point and low boiling point.
- C low melting point and low boiling point.
- D high melting point and high boiling point.

(iii) In the liquid state, X will:-

- A become ionic.
- B be an electrolyte.
- C conduct electricity.
- D not conduct electricity.

[3]

(b) Electrons are getting added to an element Y.

(i) Is Y getting oxidized or reduced?

(ii) What charge will Y have after the addition of electrons?

(iii) Which electrode will Y migrate to during the process of electrolysis?

[3]

(c) (i) Acids dissolve in water to produce positively charged ions. Draw the structure of these positive ions.

(ii) Explain why Carbon tetrachloride does not dissolve in water.

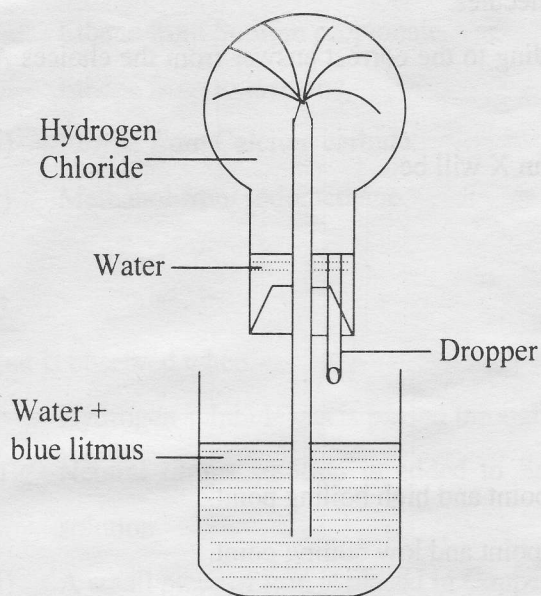
(iii) Elements Q and S react together to form an ionic compound. Under normal conditions, which physical state will the compound QS exist in?

(iv) Can Q and S, both be metals? Justify your answer.

[4]

Question 5

(a)



- (i) Name the experiment illustrated above.
- (ii) Which property of Hydrogen chloride is demonstrated by this experiment?
- (iii) State the colour of the water that has entered the round-bottomed flask.

[3]

- (b) A, B, C and D summarize the properties of Sulphuric acid depending on whether it is dilute or concentrated. Choose the property (A, B, C or D), depending on which is relevant to each of the preparations (i) to (iii):-

- A *Dilute acid (typical acid properties)*
- B *Non-volatile acid*
- C *Oxidizing agent*
- D *Dehydrating agent*

- (i) Preparation of Hydrogen Chloride.
- (ii) Preparation of Ethene from Ethanol
- (iii) Preparation of Copper sulphate from Copper oxide.

[3]

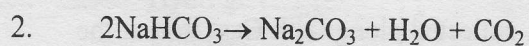
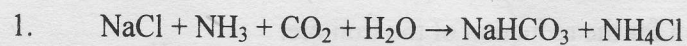
- (c) In the manufacture of Iron, a mixture of Limestone, Coke and Iron ore is added to the blast furnace. In this context:-
- (i) State the purpose of adding Limestone to the furnace.
 - (ii) Give the equation for the reduction of the Iron ore.
 - (iii) Name the substance which is collected along with Cast iron at the bottom of the furnace.
 - (iv) Write the chemical equation for the formation of the substance named in (iii) above.
- [4]

Question 6

- (a) (i) Dilute Nitric acid is generally considered a typical acid except for its reaction with metals. In what way is dilute Nitric acid different from other acids when it reacts with metals?
- (ii) Write the equation for the reaction of dilute Nitric acid with Copper.
- (iii) Account for the yellow colour that appears in concentrated Nitric acid when it is left standing in an ordinary glass bottle.
- [3]
- (b) (i) Which feature of the Ammonia molecule leads to the formation of the Ammonium ion when Ammonia dissolves in water?
- (ii) Name the other ion formed when Ammonia dissolves in water.
- (iii) Give *one* test that can be used to detect the presence of the ion produced in (b)(ii).
- [3]
- (c) (i) Write the equations for the following reactions which result in the formation of Ammonia:-
- (1) A mixture of Ammonium chloride and slaked Lime is heated.
 - (2) Aluminium nitride and water.
- (ii) Calculate the percentage of Nitrogen in Aluminium nitride.
(Al = 27, N = 14)
- [4]

Question 7

The equations given below relate to the manufacture of Sodium carbonate (Molecular weight of $\text{Na}_2\text{CO}_3 = 106$).



Questions (a) and (b) are based on the production of 21.2 g of Sodium carbonate.

(a) What mass of Sodium hydrogen carbonate must be heated to give 21.2 g of Sodium carbonate (Molecular weight of $\text{NaHCO}_3 = 84$)? [3]

(b) To produce the mass of Sodium hydrogen carbonate calculated in (a), what volume of Carbon dioxide, measured at s.t.p, would be required? [3]

(c) (i) Define the following terms:-

(1) Atomic weight.

(2) Catenation.

(ii)

Calcium, Copper, Lead, Aluminium,
Zinc, Chromium, Magnesium, Iron.

Choose the major metals from the list given above to make the following alloys:-

(1) Stainless steel.

(2) Brass. [4]



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