

Chemistry Question Paper

2006

General Instructions

1. *Section I* is compulsory. Attempt **any four** questions from *Section II*.
2. 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) Select from the list given below (A to F), the one substance in each case which matches the descriptions given in parts (ii) to (vi). Copy and complete the given grid with your answers as shown for part (i). [5]

	(i)	(ii)	(iii)	(iv)	(v)	(vi)
A						
A		<i>Ammonia</i>				
B		<i>Copper oxide</i>				
C		<i>Copper sulphate</i>				
D		<i>Hydrogen chloride</i>				
E		<i>Hydrogen sulphide</i>				
F		<i>Lead bromide</i>				

- Although this compound is not a metal hydroxide, its aqueous solution is alkaline in nature.
- A solution of this compound is used as the electrolyte when copper is purified.
- When this compound is electrolysed in the molten state, lead is obtained at the cathode.
- This compound can be oxidized to chlorine.
- This compound smells of rotten eggs
- This compound can be reduced to copper when heated with coke.

(b) Match the following:- [5]

- i. A substance that turns moist starch iodide paper blue
- ii. A compound which releases a reddish brown gas on reaction with concentrated sulphuric acid and copper turnings.
- iii. A solution of this compound gives a dirty green precipitate with sodium hydroxide.
- iv. A compound which on heating with sodium hydroxide produces a gas which forms dense white fumes with hydrogen chloride.
- v. A white solid which gives a yellow residue on heating.

(c) Name the following:- [5]

- i. A metal which is a liquid at room temperature.
- ii. A compound which is added to lower the fusion temperature of the electrolytic bath in the extraction of aluminium.
- iii. The process of heating an ore to a high temperature in the presence of air
- iv. The compound formed by the reaction between calcium oxide and silica.
- v. The middle region of the blast furnace.

(d) [5]

1. Determine the empirical formula of a compound containing 47.9% potassium, 5.5% beryllium and 46.6% fluorine by mass.
(Atomic weight of Be = 9; F = 19; K = 39) Work to one decimal place.
2. Given that the relative molecular mass of copper oxide is 80, what volume of ammonia (measured at stp) is required to completely reduce 120 g of copper oxide?
The equation for the reaction is:
$$3\text{CuO} + 2\text{NH}_3 \rightarrow 3\text{Cu} + 3\text{H}_2\text{O} + \text{N}_2$$

(Volume occupied by 1 mole of gas at s.t.p. is 22.4 litres).

(e) The elements of one short period of the Periodic Table are given below in order from left to right:- [5]

Li Be B C O F Ne

- i. To which period do these elements belong?
- ii. One element of this period is missing. Which is the missing element and where should it be placed?
- iii. Which one of the elements in this period shows the property of catenation?
- iv. Place the three elements fluorine, beryllium and nitrogen in the order of increasing electro-negativity.
- v. Which one of the above elements belongs to the halogen series?

(f) Write balanced chemical equations for the following reactions:- [5]

- i. Zinc and dilute hydrochloric acid.
- ii. Aluminium oxide and sodium hydroxide solution.
- iii. Ethane and oxygen in the presence of molybdenum oxide.
- iv. Preparation of methane from anhydrous sodium ethanoate (sodium acetate).
- v. Heating ethanol at 443 K (170°C) in the presence of concentrated sulphuric acid.

(g) State what is observed when:- [5]

- i. Copper sulphate solution is electrolysed using a platinum anode.
- ii. Hydrochloric acid is added to silver nitrate solution.
- iii. Sulphur dioxide is passed through a jar containing bromine water.
- iv. Nitric acid is kept in a reagent bottle for a long time.
- v. Excess of ammonia is passed through an aqueous solution of lead nitrate.

(h) [5]

(i) Study the diagram given below and answer the questions that follow:-

- i. Give the names of the electrodes A and B.
- ii. Which electrode is the oxidizing electrode?

(ii) A strip of copper is placed in four different colourless salt solutions. They are KNO_3 , AgNO_3 , $\text{Zn}(\text{NO}_3)_2$, $\text{Ca}(\text{NO}_3)_2$. Which one of the solutions will finally turn blue?

(iii) Write the equations of the reactions which take place at the cathode and anode when acidified water is electrolysed.

SECTION II (40 Marks)

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

Question 2

(a) Mention the colour changes observed when the following indicators are added to acids:- [3]

- i. Alkaline phenolphthalein solution.
- ii. Methyl orange solution.
- iii. Neutral litmus solution.

(b) [3]

- i. What is a lone pair of electrons?
- ii. Draw an electron dot diagram of a hydronium ion and label the lone pair of electrons.
- iii. Name a neutral covalent molecule which contains one lone pair of electrons.

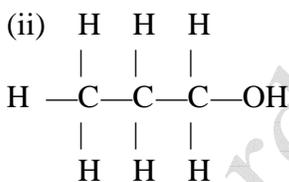
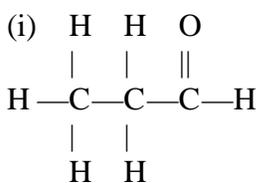
Question 2

(c)

- i. Calculate the number of moles and the number of molecules present in 1.4 g ethylene gas. What is the volume occupied by the same amount of ethylene?
- ii. What is vapour density of ethylene ?
(Avogadro's Number = 6×10^{23} ; Atomic weight of C = 12, H = 1; Molar volume = 22.4 liters at S.T. P.)

Question 3

(a) Give the correct IUPAC name and the functional group for each of the compounds whose structural formulae are given below:- [3]



Question 3

(b)[3]

- i. Write the equation for the preparation of carbon tetrachloride from methane.
- ii. Draw the structural formula of ethyne.
- iii. How is the structure of alkynes different from that of alkenes?

Question 3

(c) Fill in the blanks with the correct words from the brackets:- [4]

Alkenes are the (i) _____ (analogous/homologous) series of (ii) _____ (saturated/unsaturated) hydrocarbons. They differ from alkanes due to the presence of (iii) _____ (double/single) bonds. Alkenes mainly undergo (iv) _____ (addition/substitution) reactions.

Question 4

(a) [3]

- i. Explain why *only all-glass apparatus should be used for the preparation of nitric acid by heating concentrated sulphuric acid and potassium nitrate.*
- ii. Write a chemical equation to illustrate the acidic nature of nitric acid.
- iii. Name the products formed when ammonium nitrate is heated.

(b) Choose the correct answer from the choices A, B, C and D:- [3]

(i) The property which is characteristic of an electrovalent compound is that:-

- i. A it is easily vaporized.
- ii. B it has a high melting point.
- iii. C it is a weak electrolyte.
- iv. D it often exists as a liquid.

(ii) When a metal atom becomes an ion:-

- i. A it loses electrons and is oxidized.
- ii. B it gains electrons and is reduced.
- iii. C it gains electrons and is oxidized.
- iv. D it loses electrons and is reduced.

(iii) Which of the following hydroxides is not an alkali?

- i. A ammonium hydroxide
- ii. B calcium hydroxide
- iii. C copper hydroxide
- iv. D sodium hydroxide

(c) [4]

- i. Name the process used for the large scale manufacture of sulphuric acid.
- ii. Which property of sulphuric acid accounts for its use as a dehydrating agent?
- iii. Concentrated sulphuric acid is both an oxidizing agent and a non-volatile acid. Write one equation each to illustrate the above mentioned properties of sulphuric acid.

Question 5

(a) Write balanced chemical equations for the following reactions:-

(Leave no spaces when typing your answer. Copy and paste → (arrow) symbol.) [3]

- i. Carbon and carbon dioxide
- ii. Iron (III) oxide and carbon monoxide
- iii. Calcium bicarbonate and dilute hydrochloric acid

(b) [3]

- i. Name the oxide which acts as flux in the blast furnace.
- ii. Is the amount of carbon in pig iron/cast iron more than, less than or the same as the amount of carbon in steel?
- iii. Name an allotrope of a non-metal that allows electricity to pass through it.

(c) Fill in the blanks with the substances given in the box:- [4]

Carbon monoxide, carbon dioxide, coal, coke,
lime, iron (II) oxide, iron(III) oxide, limestone.

The raw-materials required for the extraction of iron from haematite are (i) _____ (ii) _____ and hot air. The mineral present in haematite is (iii) _____ which is reduced by (iv) _____ to iron.

Question 6

(a) Give reasons for the following:- [3]

- i. Carbon dioxide and sulphur dioxide cannot be distinguished by using lime water.
- ii. Sulphur dioxide is used as an antichlor.
- iii. A solution of silver nitrate is a good electrolyte but it is not used for electroplating an article with silver.

(b) Identify the following reactions as either oxidation or reduction:-

- i. $O + 2e^- \rightarrow O^{2-}$
- ii. $K - e^- \rightarrow K^+$
- iii. $Fe^{3+} + e^- \rightarrow Fe^{2+}$

(c) [4]

- i. Name the substance used for drying ammonia.
- ii. Write an equation to illustrate the reducing nature of ammonia.

- iii. With reference to Haber's process for the preparation of ammonia, write the equation and the conditions required.

Question 7

(a) [3]

- i. Draw the structural formulae of the two isomers of Butane. Give the correct IUPAC name of each isomer.
- ii. State one use of acetylene.

(b) Give one test each to distinguish between the following pairs of chemicals:- [3]

- i. Zinc nitrate solution and calcium nitrate solution
- ii. Sodium nitrate solution and sodium chloride solution.
- iii. Iron (III) chloride solution and copper chloride solution.

(c) [4]

- i. Calculate the percentage of sodium in sodium aluminium fluoride (Na_3AlF_6) correct to the nearest whole number.
(F = 19; Na = 23; Al = 27)
- ii. (ii) 560 ml of carbon monoxide is mixed with 500 ml of oxygen and ignited. The chemical equation for the reaction is as follows:-
 $2\text{CO} + \text{O}_2 \rightarrow 2\text{CO}_2$
Calculate the volume of oxygen used and carbon dioxide formed in the above reaction.