

Chemistry Question Paper

2002

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 below the gas that matches the description given in each case and answer the questions that follow:

Ammonia, chlorine, hydrogen chloride, sulphur dioxide.

(i) Gas A is a reducing agent which contains oxygen.

- i. What is the name of gas A?
- ii. What will you observe if gas A is bubbled through acidified potassium dichromate solution?

(ii) Gas B turns moist red litmus paper blue.

- i. What is the name of gas B?
- ii. Write the equation for the reaction that takes place when gas B is passed over heated copper oxide.

(iii) When gas C is mixed with gas B, dense white fumes are seen and there is no other product.

- i. What is the name of gas C?
- ii. What is the name of the product of the reaction between gas B and gas C? [6]

(b) Samples of the gases O_2 , N_2 , CO_2 and CO under the same conditions of temperature and pressure contain the same number of molecules represented by X. The molecules of oxygen (O_2) occupy V litres and have a mass of 8 gms. Under the same conditions of temperature and pressure:

- i. What is the volume occupied by:
(1) X molecules of N₂ (2) 3X molecules of CO?
- ii. What is the mass of CO₂ in grams?
- iii. In answering the above questions, which law have you used? (C = 12, N = 14, O = 16) [6]

(c) The following table shows the tests a student performed on four aqueous solutions A, B, C and D. Write down on your answer script the observations (i) to (iv) that were made.

Test	Observations	Conclusions
(i) To solution A, barium chloride solution and dilute hydrochloric acid were added.	(i)	A contains SO ₄ ²⁻ ions
(ii) To solution B sodium hydroxide solution was added.	(ii)	B contains Fe ³⁺ ions
(iii) To solution C ammonium hydroxide was added slowly till in excess.	(iii)	C contains Cu ²⁺ ions
(iv) To solution D silver nitrate solution and dilute nitric acid were added.	(iv)	D contains Cl ⁻ ions

(d) List 1 contains metal/alloys 1, 2, 3, 4, 5 and list 2 contains their uses A, B, C, D, E.

List 1

Metal/Alloy

1. Aluminium
2. Lead
3. Brass
4. Iron
5. Zinc

List 2

Uses

- A. Steel making
- B. Aeroplane wings
- C. Galvanizing
- D. Radiation shield
- E. Electrical fittings

Copy and complete the following table writing down the letter for the correct use of each metal. An answer may be used only once. The first one has been done for you.

Metal	1	2	3	4	5
Uses	B				

- (e) (i) What is meant by a Group in the Periodic Table?
- (ii) Within a Group where would you expect to find the element with:
- The greatest metallic character?
 - The largest atomic size?
- (iii) State whether the ionization potential increases or decreases on going down a Group.
- (iv) How many elements are there in Period 2? [5]
- (f) (i) What is the type of reaction taking place between ethane and chlorine to form mono-chloroethane?
- (ii) The reaction between ethene and chlorine forms only one product. Name the type of this reaction.
- (iii) (1) Draw the structural formula of ethene.
- (2) What is the feature of the ethene structure which allows ethene to react with chlorine in the way it does? [4]
- (g) (i) Calculate the percentage of platinum in ammonium chloroplatinate $(\text{NH}_4)_2\text{PtCl}_6$ (Give your answer correct to the nearest whole number).
- (ii) The percentage composition of sodium phosphate as determined by analysis is 42.1% sodium, 18.9% Phosphorus and 39% oxygen. Find the empirical formula of the compound (work to upto two decimal places).
(H = 1, N = 14, O = 16, Na = 23, P = 31, Cl = 35.5, Pt = 195) [6]
- (h) Write the balanced equations for the preparation of the following compounds (as the major product) starting from iron and using only one other substance:
- | | |
|--------------------------|-----------------------------|
| (i) Iron (II) chloride. | (ii) Iron (III) chloride. |
| (iii) Iron (II) sulphate | (iv) Iron (II) sulphide [4] |

SECTION II (40 marks)

Answer any four questions from this section

Question 2

- (a) (i) Write down the words or phrases from the brackets that will correctly fill in the blanks in the following sentences:

- i. Pure water consists almost entirely of (ions/molecules)
- ii. We can expect that pure water (will/will not) normally conduct electricity.

(ii) To carry out the so-called "electrolysis of water", sulphuric acid is added to water. How does the addition of sulphuric acid produce a conducting solution?

(iii) Copy and complete the following sentence:

With platinum electrodes hydrogen is liberated at the and oxygen at the during the electrolysis of acidified water?

(iv) When the electrolysis of acidified water is carried out:

- i. What is the ratio of the volume of hydrogen produced to the volume of oxygen?
- ii. Give the equation for the discharge of ions at the cathode. [7]

(b) Copy and complete the following table: Sodium Phosphorus Formula of chloride [3]

	Sodium	Phosphorus
Formula of chloride		
Physical state of chloride at room temperature (i.e., solid, liquid or gas)		
Nature of bonding in chloride. (i.e., ionic or covalent)		

Question 3

In order to obtain 1 tonne of aluminium, the following inputs are required: 4 tonnes of bauxite, 150 kg. of sodium hydroxide and 600 kg. of graphite. The aluminium compound in bauxite is aluminium oxide and the main impurity is iron (III) oxide. Aluminium is obtained by the electrolysis of aluminium oxide dissolved in cryolite.

(a) When bauxite is treated with sodium hydroxide solution what happens to:

- i. The aluminium oxide?
- ii. The Iron (III) oxide? [2]

(b) (i) Name the process used for the purification of bauxite.

(ii) Write the equation for the action of heat on aluminium hydroxide. [2]

(c) (i) Write the formula of cryolite.

(ii) Write down the word which correctly completes the following sentence:

"By dissolving aluminium oxide in cryolite a (conducting/non-conducting) solution is produced.

(iii) Why is so much graphite required for this electrolytic process?

(iv) Write the equation for the reaction which takes place at the cathode. [4]

(d) In construction work, why is the alloy of aluminium, i.e., duralumin is used rather than pure aluminium? [2]

Question 4

(a) (i) What happens when dilute hydrochloric acid is added to lead nitrate I solution?

(ii) Describe the two colour changes which take place when moist blue litmus is placed in a gas jar of chlorine.

(iii) What is the colour change that takes place when chlorine water is exposed to sunlight? [4]

(b) Manganese (IV) oxide, Lead (IV) oxide and Red Lead (Pb_3O_4) react with concentrated hydrochloric acid, liberating chlorine.

(i) What is the common property being shown by these metal oxides?

(ii) Write the equation for the reaction of concentrated hydrochloric acid with Pb_3O_4

(iii) What kind of compound can be added to bleaching powder to obtain chlorine? [3]

(c) (i) When moist chlorine reacts with hydrogen sulphide two products are formed:

- i. A gas which fumes in moist air; and
 - ii. A yellow solid.
- Name these products.

(ii) What type of reaction is taking place when chlorine acts as a bleaching agent? [3]

Question 5

(a) Write the equation for the action of heat on: (i) ammonium chloride and (ii) ammonium nitrate? State whether each reaction is an example of thermal decomposition or thermal dissociation. [4]

(b) (i) What compounds are required for the laboratory preparation of nitric acid?

(ii) Why does pure nitric acid take on a yellowish brown colour when exposed to light? [3]

(c) Write equations for the following reactions:

- Copper and concentrated nitric acid.
- Copper oxide and dilute nitric acid. [2]

(d) The first step in the manufacture of nitric acid is the catalytic oxidation of ammonia. What is the name of the catalyst? [1]

Question 6

(a) Copy and complete the following table. Column 3 has the names of gases to be prepared using the substance you enter in column 1 along with dilute or concentrated sulphuric acid as indicated by you in column 2. [8]

Column 1	Column 2	Column 3
Substance reacted with acid	Dilute or concentrated sulphuric acid	Gas
		Hydrogen
		Carbon dioxide
		Only chlorine

(b) Write the equations for the laboratory preparation of:

- Sodium sulphate using dilute sulphuric acid.
- Lead sulphate using dilute sulphuric acid. [2]

Question 7

(a) The list of some organic compounds is given below:

Ethanol, ethane, methanol, methane, ethyne, and ethene.

From the list above, name a compound:

- i. Formed by the dehydration of ethanol by concentrated sulphuric acid.
- ii. Which will give red precipitate with ammoniacal cuprous chloride solution.
- iii. Which forms methanoic acid on oxidation in the presence of copper at 200°C.
- iv. Which has vapour density 14 and turns alkaline potassium permanganate green.
- v. Which forms chloroform on halogenation in the presence of sunlight.
- vi. Which decolourises bromine solution in carbon tetrachloride. [6]

(b) Write balanced equations for the preparation of the following:

- i. Ethane from sodium propionate.
- ii. Ethene from ethanol.
- iii. Ethyne from calcium carbide.
- iv. Methanoic acid from ethane. [4]