
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)

Compulsory: To be attempted by all candidates.

Question 1

(a) Name (formula is not acceptable) the gas produced in each of the following reactions:-

(i) Action of concentrated nitric acid on copper.

(ii) Exposure of chlorine water to sunlight.

(iii) Burning of sulphur.

(iv) Heating of ammonium nitrate (name only the nitrogen containing compound).

(v) Warming ammonium sulphate with sodium hydroxide solution. [5]

(b) State what do you observe when:—

(i) Neutral litmus solution is added to an alkaline solution.

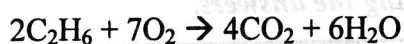
(ii) Ammonium hydroxide is added to iron (III) sulphate solution.

(iii) Lead nitrate solution and sodium chloride solution are mixed.

This paper consists of 8 printed pages.

- (iv) Ethene is bubbled through a solution of bromine in tetrachloromethane (carbon tetrachloride).
- (v) Sulphur burns. [5]
- (c) (i) When gases react together, their reaction volume bears a simple ratio to each other under the same conditions of temperature and pressure. Who proposed this gas law?

- (ii) What volume of oxygen would be required for the complete combustion of 100 litres of ethane according to the following equation?



- (iii) The gases chlorine, nitrogen, ammonia and sulphur dioxide are collected under the same conditions of temperature and pressure. Copy the following table which gives the volumes of gases collected and the number of molecules (X) in 20 litres of nitrogen. You are to complete the table giving the number of molecules in the other gases in terms of X.

Gas	Volume (litres)	Number of Molecules
Chlorine	10	
Nitrogen	20	X
Ammonia	20	
Sulphur dioxide	5	

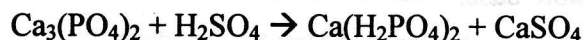
- (d) Copy and complete the table. The table summarizes the observations following the addition of barium chloride solution and lead nitrate solution to solutions of zinc salts. If nothing happens write 'no reaction' as shown or write 'white precipitate'.

	Barium Chloride solution	Lead Nitrate solution
Zinc chloride solution		
Zinc nitrate solution		No reaction
Zinc sulphate solution		

(e) (i) Calculate the percentage of phosphorus in the fertilizer superphosphate $\text{Ca}(\text{H}_2\text{PO}_4)_2$. (correct to 1 dp)

(H = 1; O = 16; P = 31; Ca = 40)

(ii) Write out and balance the following equation correctly:—



(iii) Copy and complete the following sentence:—

Superphosphate is an example of a compound called _____ (acid salt / basic salt / normal salt).

[5]

(f) Write the balanced equations for the following reactions of:—

(i) dilute hydrochloric acid and sodium sulphite.

(ii) chlorine and *hot concentrated* potassium hydroxide solution.

(iii) an acid and an alkali.

(You must first write – “The acid is _____ and the alkali is _____”, then write the equation.)

[5]

(g) Copy and complete the following sentences choosing the correct word or words from those given in brackets at the end of each sentence:—

(i) The properties of the elements are a periodic function of their _____ (atomic number, mass number, relative atomic mass.)

(ii) Moving across a _____ of the Periodic Table the elements show increasing _____ character (group, period, metallic, non-metallic.)

(iii) The element at the bottom of a group would be expected to show _____ metallic character than the element at the top (less, more.)

(iv) The similarities in the properties of a group of elements is because they have the same _____ (electronic configurations, number of outer electrons, atomic numbers.)

[5]

- (h) Mention the terms defined by the following sentences:—
- (i) The mass of a given volume of gas compared to the mass of an equal volume of hydrogen.
 - (ii) A soluble base.
 - (iii) The insoluble solid formed when two solutions are mixed together.
 - (iv) Compounds containing carbon and hydrogen only.
 - (v) An acidic solution in which there is only partial ionization of the solute molecules.
- [5]

SECTION II (40 Marks)

Attempt any four questions.

Question 2

- (a) Write the equation for:—
- (i) the preparation of Hydrogen chloride from Sodium chloride and Sulphuric acid. State whether the Sulphuric acid should be concentrated or dilute.
 - (ii) the preparation of Ammonia from Ammonium chloride and Calcium hydroxide.
 - (iii) the reaction of hydrogen chloride with ammonia.
- [4]
- (b) (i) What are the products formed when Ammonia is oxidized with copper oxide?
- (ii) Name one lead compound that can be used to oxidize hydrogen chloride to chlorine.
- [4]
- (c) What is the difference between the chemical nature of an aqueous solution of hydrogen chloride and an aqueous solution of ammonia?
- [2]

Question 3

- (a) Choosing only words from the following list, write down the appropriate words to fill in the blanks (i) to (v) below:—

Addition, carbohydrates, C_nH_{2n-2} , C_nH_{2n} , C_nH_{2n+2} , electrochemical, homologous, hydrocarbons, saturated, substitution, unsaturated.

The alkanes form an (i) _____ series with the general formula (ii) _____. The alkanes are (iii) _____ (iv) _____ which generally undergo (v) _____ reactions.

[5]

- (b) Ethanol can be converted to ethene which can then be changed to ethane.

Choose the correct word or phrase from the brackets to complete the following sentences:—

(i) The conversion of ethanol to ethene is an example of _____ (dehydration, dehydrogenation.)

(ii) Converting ethanol to ethene requires the use of _____ (concentrated hydrochloric acid, concentrated nitric acid, concentrated sulphuric acid.)

(iii) The conversion of ethene to ethane is an example of _____ (hydration, hydrogenation.)

(iv) The catalyst used in the conversion of ethene to ethane is commonly _____ (iron, cobalt, nickel.)

[4]

- (c) Write down the equation for the preparation of ethyne from calcium carbide.

[1]

Question 4

- (a) Choose the correct word from the brackets to complete the sentences
- (a) (i) and (a) (iii).
- (i) Sulphur can be converted to sulphuric acid using _____ (concentrated / dilute) nitric acid.
- (ii) Write the equation for reaction in 4 (a) (i).
- (iii) Sodium nitrate reacting with _____ (concentrated/dilute) sulphuric acid produces nitric acid.
- (iv) Write the equation for reaction 4 (a) (iii). [4]
- (b) Write the equations for the following reactions:—
- (i) Dilute nitric acid producing carbon dioxide.
- (ii) Dilute sulphuric acid producing hydrogen.
- (iii) Between copper and concentrated nitric acid.
- (iv) Between lead nitrate solution and dilute sulphuric acid. [4]
- (c) (i) Classify the solutions of the following as acids, bases or salts:—
ammonium hydroxide, barium chloride, sodium chloride, sodium hydroxide, H_2SO_4 and HNO_3 .
- (ii) Explain how a reagent chosen from those in 4 (c) (i) enables you to distinguish between the two acids mentioned therein. [2]

Question 5

- (a) A metal M forms a volatile chloride containing 65.5% chlorine. If the density of the chloride relative to hydrogen is 162.5, find the molecular formula of the chloride. ($M = 56$; $\text{Cl} = 35.5$) [4]
- (b) The reaction $4\text{N}_2\text{O} + \text{CH}_4 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O} + 4\text{N}_2$ takes place in the gaseous state. If all volumes are measured at the same temperature and pressure, calculate the volume of dinitrogen oxide (N_2O) required to give 150 cm^3 of steam. ($N = 14$, $O = 16$, $C = 12$, $H = 1$) [2]

(c) From the equation:-



Calculate:

(i) the volume of nitrogen at STP, evolved when 63g of ammonium dichromate are heated.

(ii) the mass of chromium (III) oxide (Cr_2O_3) formed at the same time.

[4]

(N = 14, H = 1, Cr = 52, O = 16)

Question 6

(a) Choosing only substances from the list given in the box below, write equations for the reactions which you would use in the laboratory to obtain:—

(i) Sodium sulphate.

(ii) Copper sulphate.

(iii) Iron (II) sulphate.

(iv) Zinc carbonate.

Dilute sulphuric acid

Copper

Copper carbonate

Iron

Sodium carbonate

Sodium

Zinc

[5]

(b) From the formulae listed below, choose one, in each case, corresponding to the salt having the given description:—

AgCl , CuCO_3 , $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, KNO_3 , NaCl , NaHSO_4 , $\text{Pb}(\text{NO}_3)_2$,

ZnCO_3 , $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$.

(i) an acid salt.

(ii) an insoluble chloride.

(iii) on treating with concentrated sulphuric acid, this salt changes from blue to white.

(iv) on heating, this salt changes from green to black.

(v) this salt gives nitrogen dioxide on heating.

[5]

Question 7

- (a) Zinc is extracted from zinc blende. The zinc blende is roasted. The solid product is mixed with coke in a blast furnace from which zinc vapour emerges.
- (i) What is the zinc compound in zinc blende?
 - (ii) Write the equation for the roasting of zinc blende.
 - (iii) What is the purpose of using coke?
 - (iv) What is the reducing agent in this extraction?
 - (v) How is the zinc vapour condensed to liquid? [5]
- (b) From the metals copper, iron, magnesium, sodium and zinc, select a different metal in each case which:—
- (i) does not react with dilute hydrochloric acid.
 - (ii) can form 2+ and 3+ ions.
 - (iii) has a hydroxide that reacts with both acids and alkalis. [4]
 - (iv) does not react with cold water but reacts with steam when heated. [4]
- (c) Arrange the metals of 7(b) in decreasing order of reactivity. [1]

Question 5

- (a) A metal M forms a volatile chloride containing 56.5% chlorine. The density of the chloride relative to air is 4.7. The molecular formula of the chloride is MCl_2 . On treating with concentrated sulphuric acid, this salt changes to a white solid. [4]
- (b) The reaction $4N_2O + CH_4 \rightarrow CO_2 + 2H_2O$ takes place in the gaseous state. If all volumes are measured at the same temperature and pressure, calculate the volume of dinitrogen oxide required to burn 150 cm³ of steam. [2]