SCIENCE

Paper 2 (Chemistry) — 2014 (SOLVED)

(Two hours)

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

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

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) Choose the correct answer from the options given below: **[10]**

(i) Ionisation potential increases over a period from left to right because the:

A. Atomic radius increases and nuclear charge increases
B. Atomic radius decreases and nuclear charge decreases
C. Atomic radius increases and nuclear charge decreases
D. Atomic radius decreases and nuclear charge increases.

Ans. D

(ii) A compound X consists of only molecules. Hence X will have:

A. A crystalline hard structure
B. A low melting point and low boiling point
C. An ionic bond
D. A strong force of attraction between its molecules.

Ans. B

(iii) When fused lead bromide is electrolysed we observe:

A. a silver grey deposit at anode and a reddish brown deposit at cathode
B. a silver grey deposit at cathode and a reddish brown deposit at anode
C. a silver grey deposit at cathode and reddish brown fumes at anode
D. silver grey fumes at anode and reddish brown fumes at cathode.

Ans. C

(iv) The main ore used for the extraction of iron is:

A. Haematite B. Calamine C. Bauxite D. Cryolite

Ans. A

(v) Heating an ore in a limited supply of air or in the absence of air at a temperature just below its melting point is known as :

A. smelting B. ore dressing C. calcination D. bessemerisation

Ans. C

(vi) If an element A belongs to Period 3 and Group II then it will have,

A. 3 shells and 2 valence electrons
B. 2 shells and 3 valence electrons
C. 3 shells and 3 valence electrons
D. 2 shells and 2 valence electrons

Ans. A

(vii) The molecule containing a triple co-valent bond is:

A. ammonia B. methane C. water D. nitrogen

Ans. D

(viii) The electrolyte used for electroplating an article with silver is:

A. silver nitrate solution
B. silver cyanide solution
C. sodium argentocyanide solution.
D. nickel sulphate solution

Ans. C

(ix) Aluminium powder is used in thermite welding because,

A. it is a strong reducing agent
B. it is a strong oxidising agent
C. it is corrosion resistant
D. it is a good conductor of heat

Ans. A

(x) The I.U.P.A.C. name of acetylene is,

A. propane B. propyne C. ethene D. ethyne

Ans. D

(b) Fill in the blanks from the choice given within brackets : **[10]**

(i) The basicity of Acetic acid is ..... (3, 1, 4)

(ii) The compound formed when ethanol reacts with sodium is ..... (sodium ethanoate, sodium ethoxide, sodium propanoate).

(iii) Quicklime is not used to dry HCl gas because ..... (CaO is alkaline, CaO is acidic, CaO is neutral).

(iv) Ammonia gas is collected by ..... (an upward displacement of air, a downward displacement of water, a downward displacement of air).

(v) Cold, dilute nitric acid reacts with copper to form ..... (Hydrogen, nitrogen dioxide, nitric oxide).

Ans. (i) 1

(ii) sodium ethoxide

(iii) CaO is alkaline or base or basic

(iv) downward displacement of air or upward delivery

(v) Nitric oxide

(c) Give one word or phrase for the following : **[5]**

(i) The ratio of the mass of a certain volume of gas to the mass of an equal volume of hydrogen under the same conditions of temperature and pressure.

Ans. Vapour density

(ii) Formation of ions from molecules.

Ans. Ionisation

(iii) Electrolytic deposition of a superior metal on a baser metal.

Ans. Electroplating

(iv) Hydrocarbons containing a $-\overset{\overset{O}{\|}}{C}-$ functional group.

Ans. Ketones or alkanones

(v) The amount of energy released when an atom in the gaseous state accepts an electron to form an anion.

Ans. Electron affinity

(d) Match the options A to E with the statements (i) to (v): **[5]**

A	alkynes	(i)	No. of molecules in 22·4 dm^3 of carbon dioxide at s.t.p.
B	alkane	(ii)	An element with electronic configuration 2, 8, 8, 3
C	iron	(iii)	$C_n H_{2n+2}$
D	$6{\cdot}023 \times 10^{23}$	(iv)	$C_n H_{2n-2}$
E	metal	(v)	The metal that forms two types of ions

Ans. (i) A (ii) $C_n H_{2n-2}$

(ii) B (iii) $C_n H_{2n+2}$

(iii) C (iv) The metal that forms two types of ions

(iv) D (i) No. of molecules in 22·4 dm^3 of carbon dioxide at s.t.p.

(v) E (ii) An element with electronic configuration 2, 8, 8, 3

(e) Write balanced equations for the following : **[5]**

(i) Action of heat on a mixture of copper and concentrated nitric acid.

Ans. $Cu + 4HNO_3 \rightarrow Cu(NO_3)_2 + 2H_2O + 2NO_2$

(ii) Action of warm water on magnesium nitride.

Ans. $Mg_3N_2 + 6H_2O \rightarrow 3Mg(OH)_2 + 2NH_3$

(iii) Action of concentrated sulphuric acid on carbon.

Ans. $C + 2H_2SO_4 \rightarrow CO_2 + 2H_2O + 2SO_2$

(iv) Action of dilute hydrochloric acid on sodium sulphide.

Ans. $Na_2S + 2HCl \rightarrow 2NaCl + H_2S$

(v) Preparation of ethane from sodium propionate.

Ans. $H_3C{\cdot}CH_2COONa + NaOH \rightarrow C_2H_6 + Na_2CO_3$

(f) Distinguish between the following pairs of compounds using the test given within brackets: **[5]**

(i) Iron(II) sulphate and iron(III) sulphate (using ammonium hydroxide).

Ans. Add ammonium hydroxide in excess to solutions. Iron(II) sulphate will form an insoluble dirty **green** ppt while iron(III) sulphate will form an insoluble **reddish brown** ppt.

(ii) A lead salt and a zinc salt (using excess ammonium hydroxide).

Ans. Add ammonium hydroxide in excess to solutions of a lead salt and a zinc salt. The lead salt will form **insoluble** chalky **white** ppt. While the zinc salt will form a gelatinous **white ppt which dissolves in excess** to form a colourless solution.

(iii) Sodium nitrate and sodium sulphite (using dilute sulphuric acid).

Ans. Add dilute sulphuric acid separately to sodium nitrate and sodium sulphite. In sodium sulphite colourless gas is produced with effervescence and suffocating odour and turns acidified potassium permanganate colourless or turns acidified potassium dichromate solution from orange to green while no effect on sodium nitrate.

(iv) Dilute sulphuric acid and dilute hydrochloric acid (using barium chloride solution).

Ans. Add barium chloride solution to dilute sulphuric acid and to dilute hydrochloric acid, **white** ppt is formed in sulphuric acid no ppt is formed in the hydrochloric acid.

(v) Ethane and ethene (using alkaline potassium permanganate solution).

Ans. In ethane the purple colour of the permanganate is retained but in ethene the purple colour is decolourised or it turns green.

(g) (i) Oxygen oxidises ethyne to carbon dioxide and water as shown by the equation: **[5]**

$$2C_2H_2 + 5O_2 \rightarrow 4CO_2 + 2H_2O$$

What volume of ethyne gas at s.t.p. is required to produce 8·4 dm^3 of carbon dioxide at s.t.p. ?

[H = 1, C = 12, O = 16]

Ans. $2C_2H_2 + 5O_2 \rightarrow 4CO_2 + 2H_2O$

$4 \times 22{\cdot}4$ dm^3 of CO_2 is formed from $2 \times 22{\cdot}4$ dm^3 of ethyne

8·4 dm^3 of CO_2 is formed from $\frac{2 \times 22{\cdot}4}{4 \times 22{\cdot}4} \times 8{\cdot}4$

$\therefore$ Volume of ethyne = 4·2 dm^3

(ii) A compound made up of two elements X and Y has an empirical formula X_2Y. If the atomic weight of X is 10 and that of Y is 5 and the compound has a vapour density (V.D.) 25, find its molecular formula. **[5]**

Ans. Empirical formula X_2Y

n (Empirical formula weight) = Molecular wt.

n (25) = 2 × V.D.

n (25) = 2 × 25

n = 2

$\therefore$ Molecular formula is $2(X_2Y)$ or X_4Y_2

SECTION II (40 Marks)

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

***Question* 2**

(a) State your observation in each of the following cases: **[5]**

(i) When dilute hydrochloric acid is added to sodium carbonate crystals.

Ans. Brisk effervescence of a gas which turns lime water milky.

(ii) When excess sodium hydroxide is added to calcium nitrate solution.

Ans. A chalky **white** ppt insoluble in excess of sodium hydroxide.

(iii) At the cathode when acidified aqueous copper sulphate solution is electrolyzed with copper electrodes.

Ans. Reddish brown deposit.

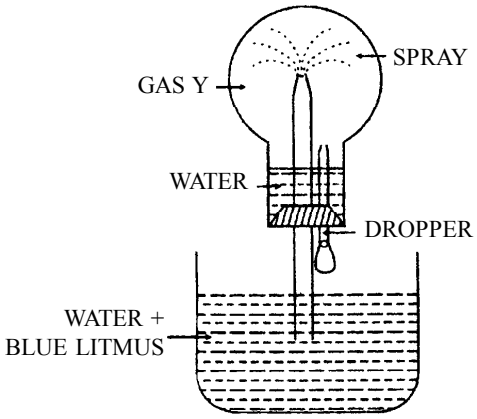
(iv) When calcium hydroxide is heated with ammonium chloride crystals.

Ans. Gas with a pungent smell which gives dense white fumes with glass rod dipped in conc. HCl.

(v) When moist starch iodide paper is introduced into chlorine gas.

Ans. The paper turns blue black.

(b) Study the figure given below and answer the questions that follow: **[3]**



(i) Identify the gas Y.

Ans. Hydrogen chloride (HCl)

(ii) What property of gas Y does this experiment demonstrate ?

Ans. High solubility

(iii) Name another gas which has the same property and can be demonstrated through the experiment.

Ans. Ammonia

(c) (i) Name the other ion formed when ammonia dissolves in water. **[2]**

Ans. Hydroxyl ion

(ii) Give one test that can be used to detect the presence of the ion produced.

Ans. Add copper sulphate solution – pale blue ppt. or any other test.

***Question* 3**

(a) State the conditions required for the following reactions to take place: **[5]**

(i) Catalytic hydrogenation of ethyne.

Ans. Catalyst Nickel and temperature 300°C.

(ii) Preparation of ethyne from ethylene dibromide.

Ans. Alcoholic KOH or alcoholic NaOH.

(iii) Catalytic oxidation of ammonia to nitric oxide.

Ans. Catalyst platinum and temperature 700–800°C.

(iv) Any two conditions for the conversion of sulphur dioxide to sulphur trioxide.

Ans. Catalyst V_2O_5, temperature 450–500°C, pressure 1-2 atmosphere.

(b) State the main components of the following alloys. **[3]**

(i) Brass

Ans. Copper, Zinc

(ii) Duralumin

Ans. Aluminium, Copper

(iii) Bronze

Ans. Copper, Tin

(c) Give balanced equations for the following: **[5]**

(i) Laboratory preparation of nitric acid.

Ans. $KNO_3 + H_2SO_4$ (conc.) $\rightarrow KHSO_4 + KNO_3$

(ii) Preparation of ethanol from monochloroethane and aq. sodium hydroxide.

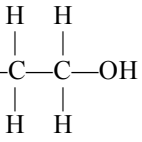
Ans. $C_2H_5Cl + NaOH \rightarrow C_2H_5OH + NaCl$

***Question* 4**

(a) Give the structural formula of the following: **[4]**

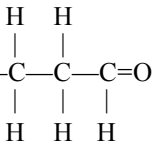
(i) ethanol

Ans.



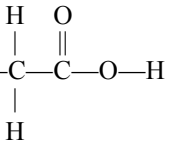
(ii) 1-propanal

Ans.



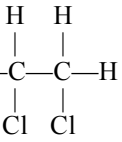
(iii) ethanoic acid

Ans.



(iv) 1, 2, dichloroethane.

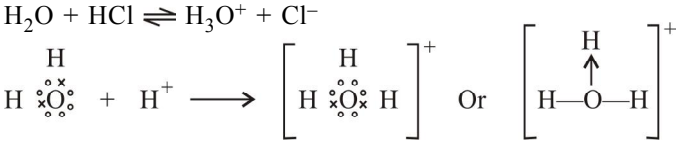
Ans.



(b) Draw the structure of the stable positive ion formed when an acid dissolves in water. **[4]**

Ans. When acid dissolves in water the stable ion formed is H_3O^+

$H_2O + HCl \rightleftharpoons H_3O^+ + Cl^-$



(c) State the inference drawn from the following observations: **[2]**

(i) On carrying out the flame test with a salt P a brick red flame was obtained. What is the cation in P ?

Ans. Ca^{2+}

(ii) A gas Q turns moist lead acetate paper silvery black. Identify the gas Q.

Ans. H_2S

(iii) pH of liquid R is 10. What kind of substance is R ?

Ans. alkaline

(iv) Salt S is prepared by reacting dilute sulphuric acid with copper oxide. Identify S.

Ans. $CuSO_4$

***Question* 5**

(a) Name the following : **[3]**

(i) The property possessed by metals by which they can be beaten into sheets.

Ans. Malleability

(ii) A compound added to lower the fusion temperature of electrolytic bath in the extraction of aluminium.

Ans. Cryolite or Na_3AlF_6

(iii) The ore of zinc containing its sulphide.

Ans. Zinc blende

(b) Give one equation each to show the following properties of sulphuric acid : **[3]**

(i) Dehydrating property

Ans. $CuSO_4 \cdot 5H_2O \xrightarrow[H_2SO_4]{\text{Conc.}} CuSO_4 + 5H_2O$

OR

$C_{12}H_{22}O_{11} \xrightarrow[H_2SO_4]{\text{Conc.}} 12C + 11H_2O$

(ii) Acidic nature

Ans. $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

or any reaction with oxide / hydroxide / carbonate / sulphite / sulphide with dil. H_2SO_4

(iii) As a non-volatile acid

Ans. $NaNO_3 + H_2SO_4$ (conc.) $\rightarrow NaHSO_4 + HNO_3$

$NaCl + H_2SO_4$ (conc.) $\rightarrow NaHSO_4 + HCl$

(c) Give balanced chemical equations to prepare the following salts : **[3]**

(i) Lead sulphate from lead carbonate.

Ans. $PbCO_3 + 2HNO_3 \rightarrow Pb(NO_3)_2 + H_2O + CO_2$

$Pb(NO_3)_2 + Na_2SO_4 \rightarrow 2NaNO_3 + PbSO_4$

(ii) Sodium sulphate using dilute sulphuric acid

Ans. $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

(iii) Copper chloride using copper carbonate.

Ans. $CuCO_3 + 2HCl \rightarrow CuCl_2 + H_2O + CO_2$

***Question* 6**

(a) (i) State Avogadro's Law. **[2]**

Ans. Equal volumes of all gases contain the same no. of molecules under similar conditions.

(ii) A cylinder contains 68 g of ammonia gas at s.t.p.

(1) What is the volume occupied by this gas ?

Ans. Molar mass of NH_3 is 17 $\quad \therefore$ 17 g of ammonia will occupy 22·4 dm^3

68 g will occupy $\frac{22{\cdot}4}{\cancel{17}} \times \overset{4}{\cancel{68}} = 89{\cdot}6\ dm^3$

(2) How many moles of ammonia are present in the cylinder ?

Ans. No of moles = $\frac{\text{Given mass}}{\text{Molar mass}} = \frac{68}{17} = 4$ moles

(3) How many molecules of ammonia are present in the cylinder ? [N–14, H–1]

Ans. No of molecules = $4 \times 6{\cdot}023 \times 10^{23} = 2{\cdot}4 \times 10^{24}$

(b) (i) Why do covalent compounds exist as gases, liquids or soft solids ? **[3]**

Ans. The molecules are held together by the weak vander Waals' forces. As this force of attraction is weak they are gases liquids or soft solids.

(ii) Which electrode: anode or cathode is the oxidising electrode ? Why ?

Ans. Anode — It takes up the electrons from the anions.

(c) Name the kind of particles present in : **[3]**

(i) Sodium hydroxide solution

Ans. Only ions

(ii) Carbonic acid

Ans. Ions and molecules

(iii) Sugar solution

Ans. Only molecules

***Question* 7**

(a) An element Z has atomic number 16. Answer the following questions on Z: **[5]**

(i) State the period and group to which Z belongs.

Ans. Electronic configuration of Z is 2, 8, 6 so Z belongs to period 3 and Group 16 or VIA.

(ii) Is Z a metal or a non-metal ?

Ans. Z is a non-metal.

(iii) State the formula between Z and Hydrogen.

Ans. H_2Z

(iv) What kind of a compound is this ?

Ans. Covalent compound.

(b) M is a metal above hydrogen in the activity series and its oxide has the formula M_2O. This oxide when dissolved in water forms the corresponding hydroxide which is a good conductor of electricity. In the above context answer the following: **[5]**

(i) What kind of combination exists between M and O ?

Ans. Electrovalent combination

(ii) How many electrons are there in the outermost shell of M ?

Ans. One

(iii) Name the group to which M belongs.

Ans. Group I or 1A or alkali metal.

(iv) State the reaction taking place at the cathode.

Ans. $H^+ + e^- \rightarrow H$

$H + H \rightarrow H_2$

(ii) Name the product at the anode.

Ans. Oxygen