SCIENCE
Paper 2 (Chemistry) — 2019 (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.*
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) Choose the *correct answer* from the options given below : **[5]**

(i) An **electrolyte** which completely dissociates into ions is :

    (a) Alcohol   (b) Carbonic acid   (c) Sucrose   (d) Sodium hydroxide

Ans. (d) Sodium hydroxide

(ii) The most **electronegative element** from the following elements is :

    (a) Magnesium   (b) Chlorine   (c) Aluminium   (d) Sulphur

Ans. (b) Chlorine

(iii) The reason for using **Aluminium** in the alloy duralumin is :

    (a) Aluminium is brittle   (b) Aluminium gives strength

    (c) Aluminium brings lightness   (d) Aluminium lowers melting point

Ans. (c) Aluminium brings lightness

(iv) The **drying agent** used to **dry HCl gas** is :

    (a) Conc. H_2SO_4 (b) ZnO   (c) Al_2O_3 (d) CaO

Ans. (a) Conc. H_2SO_4

(v) A hydrocarbon which is a **greenhouse gas** is :

    (a) Acetylene   (b) Ethylene   (c) Ethane   (d) Methane

Ans. (d) Methane

(b) Fill in the blanks with the choices given in brackets. **[5]**

(i) Conversion of *ethanol to ethene* by the action of *concentrated sulphuric acid* is an example of .... **(dehydration / dehydrogenation / dehydrohalogenation)**

Ans. dehydration

(ii) When *sodium chloride* is heated with *concentrated sulphuric* acid *below 200°C*, one of the products formed is .... **(sodium hydrogen sulphate / sodium sulphate / chlorine)**

Ans. sodium hydrogen sulphate

(iii) *Ammonia* reacts with *excess chlorine* to form .... **(nitrogen / nitrogen trichloride / ammonium chloride)**

Ans. nitrogen trichloride

(iv) *Substitution reactions* are characteristic reactions of .... **(alkynes / alkenes / alkanes)**

Ans. alkanes

(v) In period 3, the *most metallic* element is .... **(sodium / magnesium / aluminium)**

Ans. sodium

(c) Write a **balanced chemical equation** for each of the following reactions : **[5]**
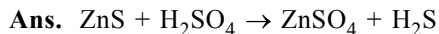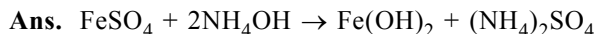
    (i) Reduction of copper (II) oxide by hydrogen.

Ans. $CuO + H_2 \rightarrow Cu + H_2O$
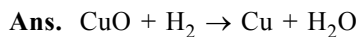
    (ii) Action of dilute sulphuric acid on sodium hydroxide.

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

    (iii) Action of dilute sulphuric acid on zinc sulphide.

Ans. $ZnS + H_2SO_4 \rightarrow ZnSO_4 + H_2S$

    (iv) Ammonium hydroxide is added to ferrous sulphate solution.

Ans. $FeSO_4 + 2NH_4OH \rightarrow Fe(OH)_2 + (NH_4)_2SO_4$

    (v) Chlorine gas is reacted with ethene.

Ans. $C_2H_4 + Cl_2 \rightarrow C_2H_4Cl_2$
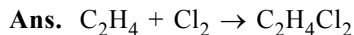
(d) State **one** observation for each of the following : **[5]**

    (i) Concentrated nitric acid is reacted with sulphur.

Ans. Brown gas is evolved.

    (ii) Ammonia gas is passed over heated copper (II) oxide.

Ans. A reddish brown or pink metal gets deposited.

    (iii) Copper sulphate solution is electrolysed using copper electrodes.

Ans. The anode diminishes and the colour of the solution remains blue.

    (iv) A small piece of zinc is added to dilute hydrochloric acid.

Ans. A gas (hydrogen) is evolved which burns with a pop sound when exposed to air.

    (v) Lead nitrate is heated strongly in a test tube.

Ans. A brown gas and a colourless gas are evolved. Residue is yellow and sticks to the test tube.

(e) (i) Calculate : **[5]**

    (1) The number of moles in 12 g of oxygen gas. [O = 16]

Ans. 32 g oxygen gas contains 1 mole

    12 g will contain $= \dfrac{1}{32} \times 12 = 0\cdot375$ mole.

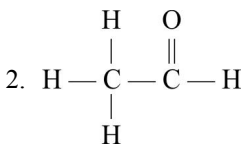   (2) The weight of 10^{22} atoms of carbon. [C = 12, Avogadro's No. = 6×10^{23}]

Ans. 6×10^{23} atoms of carbon weigh 12 g

    10^{22} atoms of carbon will weigh $\dfrac{12}{6\times10^{23}} \times 10^{22}$ g $= 0\cdot2$ g

    (ii) Molecular formula of a compound is $C_6H_{18}O_3$. Find its empirical formula.

Ans. Molecular formula $= C_6H_{18}O_3$.
    Empirical formula $= C_2H_6O$.

(f) (i) Give the IUPAC name of the following organic compounds : **[5]**

$$1.\quad H-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-C\equiv C-H \qquad\qquad 2.\quad H-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-\overset{\overset{O}{||}}{C}-H$$
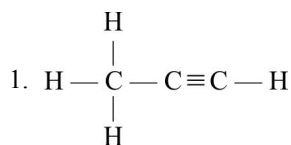
Ans. 1. Propyne   2. Ethanal

    (ii) What is the special feature of the structure of ethyne ?

Ans. Triple bond

    (iii) Name the saturated hydrocarbon containing two carbon atoms.

Ans. Ethane

(iv) Give the structural formula of Acetic acid.

Ans.

$$H - \underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}} - \overset{\overset{O}{\|}}{C} - OH$$

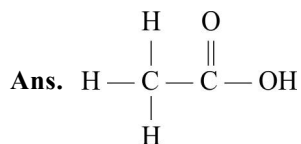**(g)** Give the appropriate term defined by the statements given below : **[5]**

(i) The formula that represents the simplest ratio of the various elements present in one molecule of the compound.

Ans. Empirical formula.

(ii) The substance that releases hydronium ion as the only positive ion when dissolved in water.

Ans. Acid.

(iii) The tendency of an atom to attract electrons towards itself when combined in a covalent compound.

Ans. Electronegativity.

(iv) The process by which certain ores, specially carbonates, are converted to oxides in the absence of air.

Ans. Calcination.

(v) The covalent bond in which the electrons are shared equally between the combining atoms.

Ans. Non-polar covalent bond.

(h) Arrange the following according to the instructions given in brackets : **[5]**

(i) K, Pb, Ca, Zn.   (*In the increasing order of the reactivity*)

Ans. Pb, Zn, Ca, K.

(ii) Mg^{2+}, Cu^{2+}, Na^{1+}, H^{1+}.   (*In the order of preferential discharge at the cathode*)

Ans. Na^{1+}, Mg^{2+}, H^{1+}, Cu^{2+}.

(iii) Li, K, Na, H.   (*In the decreasing order of their ionization potential*)

Ans. K, Na, Li, H.

(iv) F, B, N, O.   (*In the increasing order of electron affinity*)

Ans. B, N, O, F

(v) Ethane, methane, ethene, ethyne.   (*In the increasing order of the molecular weight*) [H = 1, C = 12]

Ans. Methane, ethyne, ethene, ethane.

SECTION II (40 Marks)
*Attempt any **four** questions from this Section*

Question 2

(a) Draw the electron dot structure of : **[3]**

(i) Nitrogen molecule [N = 7].

Ans. $\overset{\times\times}{\underset{\times\times}{\times N \times \times}} N^{\times}_{\times}$ $^{\times}_{\times}N \equiv N^{\times}_{\times}$

(ii) Sodium chloride [Na = 11, Cl = 17].

Ans. $Na^{\times} \overset{oo}{\underset{oo}{Cl}}^{o}_{o}$ $[Na^{+}][Cl^{-}]$

(iii) Ammonium ion [N = 7, H = 1]

Ans. $\left[H \overset{\overset{H}{oo}}{\underset{\underset{H}{ox}}{\times N \times}} H \right]^{+}$

(b) The pH values of three solutions A, B and C are given in the table. Answer the following questions : **[3]**

Solution	pH value
A	12
B	2
C	7

   (i) Which solution will have no effect on litmus solution ?

Ans. C

   (ii) Which solution will liberate CO_2 when reacted with sodium carbonate ?

Ans. B

   (iii) Which solution will turn red litmus solution blue ?

Ans. A

(c) Study the extract of the Periodic Table given below and answer the questions that follow. Give the alphabet corresponding to the element in question. DO NOT repeat an element. **[3]**

   (i) Which element forms electrovalent compound with G ?

Ans. B

   (ii) The ion of which element will migrate towards the cathode during electrolysis ?

Ans. B and A

   (iii) Which non-metallic element has the valency 2 ?

Ans. E

   (iv) Which is an inert gas ?

Ans. F

Question 3

(a) Name the particles present in : **[3]**
   (i) Strong electrolyte.

Ans. Ions

   (ii) Non-electrolyte.

Ans. Molecules

   (iii) Weak electrolyte.

Ans. Ions and molecules

(b) Distinguish between the following pairs of compounds using the reagent given in the bracket. **[3]**
   (i) Manganese dioxide and copper (II) oxide. (using concentrated HCl).

Ans. Add conc. HCl to both. With MnO_2, greenish yellow gas (Cl_2) is evolved, whereas with CuO no green gas is evolved.

   (ii) Ferrous sulphate solution and ferric sulphate solution. (using sodium hydroxide solution).

Ans. Add sodium hydroxide solution to both. With ferrous sulphate, a green ppt of Iron (II) hydroxide is formed which is insoluble in excess of NaOH. Whereas, with ferric sulphate, a brown ppt. of Iron (III) hydroxide is formed, which is insoluble in excess of NaOH.

(iii) Dilute hydrochloric acid and dilute sulphuric acid. (using lead nitrate solution).

Ans. White ppt of $PbCl_2$ will be formed when lead nitrate is added to dilute HCl. The ppt dissolves on heating. White ppt of $PbSO_4$ will be formed when lead nitrate is added to dilute H_2SO_4. The ppt does not dissolve on heating.

(c) Choose the method of preparation of the following salts, from the methods given in the list : **[4]**

[List : A. Neutralization   B. Precipitation   C. Direct combination   D. Substitution]

(i) Lead chloride.

Ans. **B** (Lead chloride – Precipitation)

(ii) Iron (II) sulphate.

Ans. **D** (Iron (II) sulphate – Substitution)

(iii) Sodium nitrate.

Ans. **A** (Sodium nitrate – Neutralisation)

(iv) Iron (III) chloride.

Ans. **C** (Iron (III) chloride – Direct combination)

Question 4

(a) Complete the following equations : **[3]**

(i) $S + conc.\ HNO_3 \rightarrow$

Ans. $S + conc.\ 6HNO_3 \rightarrow H_2SO_4 + 6NO_2 + 2H_2O$

(ii) $C + conc.\ H_2SO_4 \rightarrow$

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

(iii) $Cu + dil.\ HNO_3 \rightarrow$

Ans. $3Cu + (dil.)\ 8HNO_3 \rightarrow 3Cu(NO_3)_2 + 4H_2O + 2NO$

(b) Write a balanced chemical equation for the preparation of : **[3]**

(i) Ethene from bromoethane.

Ans. $C_2H_5Br + (alc.)\ KOH \rightarrow C_2H_4 + KBr + H_2O$

(ii) Ethyne using calcium carbide.

Ans. $CaC_2 + 2H_2O \rightarrow Ca(OH)_2 + C_2H_2$

(iii) Methane from sodium acetate.

Ans. $CH_3COONa + NaOH \xrightarrow[300°C]{CaO} Na_2CO_3 + CH_4$

(c) Name the following organic compounds : **[4]**

(i) The compound with 3 carbon atoms whose functional group is a carboxyl.

Ans. Propanoic acid

(ii) The first homologue whose general formula is C_nH_{2n}.

Ans. Ethene

(iii) The compound that reacts with acetic acid to form ethyl ethanoate.

Ans. Ethanol

(iv) The compound formed by complete chlorination of ethyne.

Ans. 1, 1, 2, 2 tetrachloro ethane

Question 5

(a) Give the chemical formula of : **[3]**

(i) Bauxite

Ans. (i) $Al_2O_3 \cdot 2H_2O$

(ii) Cryolite

Ans. Na_3AlF_6

(iii) Sodium aluminate

Ans. Na_3AlO_3 / $NaAlO_2$

(b) Answer the following questions based on the extraction of aluminium from alumina by Hall-Heroult's Process : **[3]**

(i) What is the function of cryolite used along with alumina as the electrolyte ?

Ans. It lowers the fusion temperature and acts as a solvent.

(ii) Why is powdered coke sprinkled on top of the electrolyte ?

Ans. It prevents the burning of anode.

(iii) Name the electrode, from which aluminium is collected.

Ans. Cathode.

(a) Match the alloys given in column I to the uses given in column II : **[4]**

Column I	Column II
(i) Duralumin	A. Electrical fuse
(ii) Solder	B. Surgical instruments
(iii) Brass	C. Aircraft body
(iv) Stainless Steel	D. Decorative articles

Ans. (i) Duralumin   C. Aircraft body

(ii) Solder   A. Electrical fuse

(iii) Brass   D. Decorative articles

(iv) Stainless Steel   B. Surgical instruments

Question 6

(a) Identify the substances underlined : **[3]**

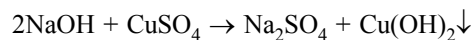(i) The catalyst used to oxidise ammonia.

Ans. Platinum

(ii) The organic compound which when solidified, forms an ice like mass.

Ans. Acetic acid

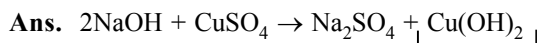(iii) The dilute acid which is an oxidizing agent.

Ans. HNO_3

(b) Copper sulphate solution reacts with sodium hydroxide solution to form a precipitate of copper hydroxide according to the equation : **[3]**

$$2NaOH + CuSO_4 \rightarrow Na_2SO_4 + Cu(OH)_2\downarrow$$

(i) What mass of copper hydroxide is precipitated by using 200 gm of sodium hydroxide ?

[H = 1, O = 16, Na = 23, S = 32, Cu = 64]

Ans. $2NaOH + CuSO_4 \rightarrow Na_2SO_4 + Cu(OH)_2$

$2(23 + 16 + 1)$ $64 + 32 + 2$

    80   98

80 g of NaOH produces 98 g of $Cu(OH)_2$

200 g of NaOH produces $\dfrac{98}{80} \times 200$ g = 245 g

(ii) What is the colour of the precipitate formed ?

Ans. The colour of the precipitate is blue

(c) Find the **empirical formula** and the **molecular formula** of an organic compound from the data given below : **[4]**

C = 75·92%, H = 6·32% and N = 17·76%

The vapour density of the compound is 39·5.

[C = 12, H = 1, N = 14]

Ans.

Element	Mass in g	Atomic mass	No. of gramm atoms	Ratio
C	75·92	12	$\dfrac{75 \cdot 92}{12} = 6 \cdot 33$	5
H	6·32	1	6·32	5
N	17·76	14	$\dfrac{17 \cdot 76}{14} = 1 \cdot 27$	1

$$\text{Empirical formula} = C_5H_5N$$
$$n \times \text{Mass of empirical formula} = 2 \times V.D.$$
$$n \times 79 = 2 \times V.D.$$
$$n \times 79 = 2 \times 39 \cdot 5$$
$$n = 1$$
$$\text{Molecular formula} = C_5H_5N$$

Question 7

(a) Name the gas evolved in each of the following cases : **[3]**
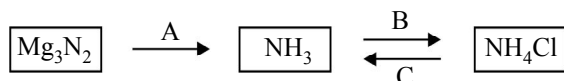
(i) Alumina undergoes electrolytic reduction.

Ans. Oxygen

(ii) Ethene undergoes hydrogenation reaction.

Ans. Ethane

(iii) Ammonia reacts with heated copper oxide.

Ans. Nitrogen

(b) Study the flow chart given and give balanced equations to represent the reactions **A, B** and **C** : **[3]**

$$\boxed{Mg_3N_2} \xrightarrow{\text{A}} \boxed{NH_3} \underset{C}{\overset{B}{\rightleftarrows}} \boxed{NH_4Cl}$$

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

       B $3Cl_2 + 8NH_3 \rightarrow 6NH_4Cl + N_2$

       C $2NH_4Cl + Ca(OH)_2 \rightarrow CaCl_2 + 2H_2O + 2NH_3$

(c) Copy and complete the following table which refers to the **industrial method for the preparation** of **ammonia and sulphuric acid :** **[3]**

Name of the compound	Name of the process	Catalytic equation (with the catalyst)
Ammonia	(i)	(ii) ....
Sulphuric acid	(iii)	(iv) ....

Ans. (i) Haber's Process

      (ii) $N_2 + 3H_2 \rightleftharpoons 2NH_3$

            Finely divided Fe

      (iii) Contact process

      (iv) $2SO_2 + O_2 \xrightarrow{V_2O_5 \, / \, Pt} 2SO_3$