SCIENCE

Paper 2 (Chemistry) — 2018 (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) The salt solution which does not react with **ammonium hydroxide** is :

(a) Calcium Nitrate (b) Zinc Nitrate (c) Lead Nitrate (d) Copper Nitrate

Ans. (d) Calcium Nitrate

(ii) The organic compound which undergoes **substitution reaction** is :

(a) C_2H_2 (b) C_2H_4 (c) $C_{10}H_{18}$ (d) C_2H_6

Ans. (c) C_2H_6

(iii) The **electrolysis of acidified** *water* is an example of :

(a) Reduction (b) Oxidation (c) Redox reaction (d) Synthesis

Ans. (b) Redox reaction

(iv) The **IUPAC** name of dimethyl ether is :

(a) Ethoxy methane (b) Methoxy methane (c) Methoxy ethane (d) Ethoxy ethane

Ans. (c) Methoxy methane

(v) The catalyst used in the **Contact Process** is :

(a) Copper (b) Iron (c) Vanadium pentoxide (d) Manganese dioxide

Ans. (a) Vanadium pentoxide

(b) Give **one word** or a **phrase** for the following statements : **[5]**

(i) The energy released when an electron is added to a neutral gaseous isolated atom to form a negatively charged ion.

Ans. Electron affinity

(ii) Process of formation of ions from molecules which are not in ionic state.

Ans. Ionisation

(iii) The tendency of an element to form chains of identical atoms.

Ans. Catenation

(iv) The property by which certain hydrated salts, when left exposed to atmosphere, lose their water of crystallization and crumble into powder.

Ans. Efflorescence

(v) The process by which sulphide ore is concentrated.

Ans. Froth floatation

(c) Write a ***balanced chemical equation*** for each of the following : **[5]**

(i) Action of concentrated sulphuric acid on carbon.

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

(ii) Reaction of sodium hydroxide solution with iron (III) chloride solution.

Ans. $FeCl_3 + 3NaOH \rightarrow Fe(OH)_3 + 3NaCl$

(iii) Action of heat on aluminium hydroxide.

Ans. $2Al(OH)_3 \xrightarrow{1000°C} Al_2O_3 + 3H_2O$

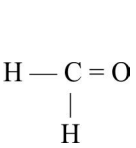
(iv) Reaction of zinc with potassium hydroxide solution.

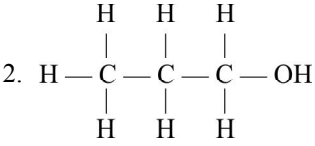
Ans. $Zn + 2KOH \rightarrow K_2ZnO_2 + H_2$

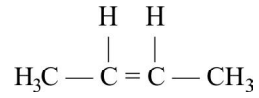
(v) Action of dilute hydrochloric acid on magnesium sulphite.

Ans. $MgSO_3 + 2HCl \rightarrow MgCl_2 + H_2O + SO_2$

(d) (i) Give the IUPAC name for each of the following : **[5]**

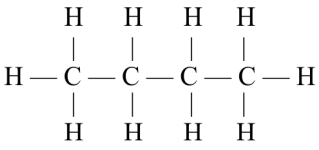
1. 

2. 

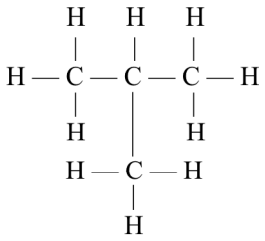
3. 

Ans. 1. Methanal 2. Propanol 3. But-2-ene

(ii) Write the structural formula of the two isomers of butane.

Ans. 

butane



2, methyl propane

(e) State one ***relevant observation*** for each of the following : **[5]**

(i) Lead nitrate solution is treated with sodium hydroxide solution drop wise till it is in excess.

Ans. Chalky white ppt. The ppt. dissolves in excess.

(ii) At the anode, when molten lead bromide is electrolyzed using graphite electrodes.

Ans. Brown vapours of bromine are seen.

(iii) Lead nitrate solution is mixed with dilute hydrochloric acid and heated.

Ans. White ppt., is formed which dissolves on heating.

(iv) Anhydrous calcium chloride is exposed to air for some time.

Ans. Absorbs moisture from the atmospheric air and become moist, ultimately dissolves in the absorbed water, forming a saturated solution.

(v) Barium chloride solution is slowly added to sodium sulphate solution.

Ans. White ppt. is formed.

(f) Give a ***reason*** for each of the following : **[5]**

(i) Ionic compounds have a high melting point.

Ans. Due to strong electrostatic force, bond is strong.

(ii) Inert gases do not form ions.

Ans. They have high ionisation energy so do not form ions.

(iii) Ionisation potential increases across a period, from left to right.

Ans. Decrease in atomic size and increase in nuclear pull increases ionisation potential.

(iv) Alkali metals are good reducing agents.

Ans. High tendency to loose electrons or low ionisation energy.

(v) Conductivity of dilute hydrochloric acid is greater than that of acetic acid.

Ans. HCl ionises to large extent. Acetic acid is an organic acid so ionises to small extent.

(g) **Name the gas** that is produced in each of the following cases : **[5]**

(i) Sulphur is oxidized by concentrated nitric acid.

Ans. Nitrogen dioxide.

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

Ans. Hydrogen sulphide.

(iii) Action of cold and dilute nitric acid on copper.

Ans. Nitric oxide.

(iv) At the anode during the electrolysis of acidified water.

Ans. Oxygen.

(v) Reaction of ethanol and sodium.

Ans. Hydrogen.

(h) Fill up the blanks with the correct choice given in brackets. **[5]**

(i) Ionic or electrovalent compounds do not conduct electricity in their ..... state. **(fused/solid)**

Ans. solid

(ii) Electrolysis of aqueous sodium chloride solution will form ..... at the cathode. **(hydrogen gas/sodium metal)**

Ans. hydrogen gas

(iii) Dry hydrogen chloride gas can be collected by ..... displacement of air. **(downward/upward)**

Ans. upward

(iv) The most common ore of iron is ..... . **(calamine/haematite)**

Ans. haematite

(v) The salt prepared by the method of direct combination is ..... **(iron (II) chloride/iron (III) chloride)**

Ans. iron (III) chloride

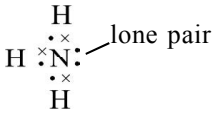
SECTION II (40 Marks)

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

Question 2

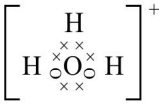
(a) (i) What do you understand by a lone pair of electrons ? **[3]**

Ans. A pair of electrons which does not take part in bond formation.



(ii) Draw the electron dot diagram of Hydronium ion. (H = 1; O = 8)

Ans.



(b) *In Period 3 of the Periodic Table, element **B** is placed to the left of element **A***. On the basis of this information, choose the correct word from the brackets to complete the following statements : **[3]**

(i) The element **B** would have (*lower/higher*) metallic character than **A**.

Ans. **B** would have higher metallic character.

(ii) The element **A** would probably have (*lesser/higher*) electron affinity than **B**.

Ans. **A** would have higher electron affinity.

(iii) The element **A** would have (*greater/smaller*) atomic size than **B**.

Ans. **A** would have smaller atomic size.

(c) Copy and complete the following table which refers to the conversion of ions to neutral particles. **[4]**

Conversion	Ionic equation	Oxidation/Reduction
Chloride ion to chlorine molecule	(i)	(i) .....
Lead (II) ion to lead	(ii)	(ii) .....

Ans.

Conversion	Ionic equation	Oxidation/Reduction
Chloride ion to chlorine molecule	(i) $2Cl^- - 2e^- \rightarrow Cl_2$	(i) Oxidation
Lead (II) ion to lead	(ii) $Pb^{2+} + 2e^- \rightarrow Pb$	(ii) Reduction

***Question* 3**

(a) (i) Write the balanced chemical equation to prepare ammonia gas in the laboratory by using an alkali. **[3]**

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

(ii) State why concentrated sulphuric acid is not used for drying ammonia gas.

Ans. Conc. sulphuric acid reacts with ammonia, so it is not used to dry ammonia

$$2NH_3 + H_2SO_4 \rightarrow (NH_4)_2SO_4$$

(iii) Why is ammonia gas not collected over water ?

Ans. Ammonia gas is not collected over water as it is highly soluble in water.

(b) (i) Name the acid used for the preparation of hydrogen chloride gas in the laboratory. Why is this particular acid preferred to other acids ? **[3]**

Ans. Conc. sulphuric acid. This acid is preferred as it is a non-volatile acid.

(ii) Write the balanced chemical equation for the laboratory preparation of hydrogen chloride gas.

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

(c) For the preparation of hydrochloric acid in the laboratory : **[2]**

(i) Why is direct absorption of hydrogen chloride gas in water not feasible ?

Ans. Direct absorption of hydrogen chloride gas in water is not feasible as the reaction would stop and might result in an explosion due to the heat produced when water comes in contact with hot conc. sulphuric acid.

(ii) What arrangement is done to dissolve hydrogen chloride gas in water ?

Ans. Funnel arrangement is used to dissolve HCl gas in water.

(d) For the electro-refining of copper : **[2]**

(i) What is the cathode made up of ?

Ans. Cathode is made up of pure copper strip.

(ii) Write the reaction that takes place at the anode.

Ans. Anode : $Cu - 2e^- \rightarrow Cu^{2+}$

***Question* 4**

(a) The percentage composition of a gas is : **[2]**

Nitrogen 82·35%, Hydrogen 17·64%

Find the empirical formula of the gas. [N = 14, H = 1]

Ans.

Percentage	At wt.		
N – 82·35	14	$\frac{82·35}{14} = 5·88$	$\frac{5·88}{5·88} = 1$
H – 17·64	1	$\frac{17·64}{1} = 17·64$	$\frac{17·64}{5·88} = 3$

Empirical formula is $\mathbf{NH_3}$

(b) Aluminium carbide reacts with water according to the following equation : **[4]**

$Al_4C_3 + 12H_2O \rightarrow 4Al(OH)_3 + 3CH_4$

(i) What mass of aluminium hydroxide is formed from 12g of aluminium carbide ?

Ans. $Al_4C_3 + 12H_2O \rightarrow 4Al(OH)_3 + 3CH_4$

$\underset{144}{\llcorner\!\lrcorner}$ $\underset{78}{\llcorner\!\lrcorner}$

144 g of Aluminium carbide produce 312 g of $Al(OH)_3$

12 g of Aluminium carbide will produce $\frac{\cancel{312}^{\cancel{12}}}{\cancel{144}_{12}}$ = **26 grams of Al_4C_3**

(ii) What volume of methane at s.t.p. is obtained from 12 g of aluminium carbide ?
[Relative molecular weight of Al_4C_3 = 144; $Al(OH)_3$ = 78]

Ans. 144 g of Aluminium carbide produce 3 × 22·4 litres methane

12 g of Aluminium carbide will produce $\frac{\cancel{3}\times 22{\cdot}4}{\cancel{144}\ \cancel{12}} \times \cancel{12} = $ **5·6 litre of methane.**
$_4$

(c) (i) If 150 cc of gas A contains X molecules, how many molecules of gas B will be present in 75 cc of B ? **[2]**
The gas A and B are under the same conditions of temperature and pressure.

Ans. 150 cc of gas A contains X molecules

75 cc of gas B will contain $\frac{X}{\cancel{150}} \times \cancel{75} = \frac{X}{2}$ cc
$_2$

(ii) Name the law on which the above problem is based.

Ans. Avogadro's law.

(d) Name the main component of the followig alloys : **[2]**

(i) Brass.

Ans. Brass — Copper, zinc.

(ii) Duralumin.

Ans. Duralumin — Aluminium, copper.

***Question* 5**

(a) Complete the following table which relates to the homologous series of hydrocarbons. **[6]**

General formula	**IUPAC name of the homologous series**	**Characterstic bond type**	**IUAC name of the first member of the series**
C_nH_{2n-2}	(A) _____	(B) _____	(C) _____
C_nH_{2n+2}	(D) _____	(E) _____	(F) _____

Ans.

General formula	**IUPAC name of the homologous series**	**Characterstic bond type**	**IUAC name of the first member of the series**
C_nH_{2n-2}	(A) Alkynes	(B) Triple bond C≡C	(C) Ethyne
C_nH_{2n+2}	(D) Alkanes	(E) Single bond	(F) Methane

(b) (i) Name the most common ore of the metal aluminium from which the metal is extracted. Write the chemical formula of the ore. **[4]**

Ans. Bauxite $Al_2O_3{\cdot}2H_2O$

(ii) Name the process by which impure ore of aluminium gets purified by using concentrated solution of an alkali.

Ans. Baeyers process

(iii) Write the equation for the formation of aluminium at the cathode during the electrolysis of alumina.

Ans. Cathode $Al^{3+} + 3e^- \rightarrow Al$

***Question* 6**

(a) A compound **X** (having vinegar like smell) when treated with ethanol in the presence of the acid **Z**, gives a compound **Y** which has a fruity smell. **[4]**

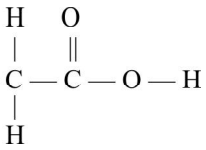
$$C_2H_5OH + X \xrightarrow{Z} Y + H_2O$$

(i) Identify **Y** and **Z**.

Ans. **Y** is ester. **Z** is conc. sulphuric acid.

(ii) Write the structural formula of **X**.

Ans.



(iii) Name the above reaction.

Ans. Esterification.

(b) Ethane burns in oxygen to from CO_2 and H_2O according to the equation : **[4]**

$$2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$$

If 1250 cc of oxygen is burnt with 300 cc of ethane.

Calculate :

(i) the volume of CO_2 formed.

Ans. $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$

2 volume of ethane produces 4 volume of CO_2

300 cc of ethane produces $\frac{4}{\cancel{2}} \times \overset{150}{\cancel{300}}$ = **600 cc**

(ii) the volume of unused O_2.

Ans. 2 volume of ethane burns with 7 volumes of oxygen

300 cc of ethane burns with $\frac{\cancel{7}}{\cancel{2}} \times \overset{150}{\cancel{300}}$ = 1050 cc

Volume of unused oxygen is 1250 – 1050 = **200 cc**

(c) Three solutions P, Q and R have pH value of 3·5, 5·2 and 12·2 respectively. Which one of these is a : **[2]**

(i) Weak acid ?

Ans. Weak acid is Q having pH 5·2.

(ii) Strong alkali ?

Ans. Strong alkali is R having pH 12·2.

***Question* 7**

(a) Give a chemical test to distinguish between the following pairs of chemicals : **[4]**

(i) Lead nitrate solution and Zinc nitrate solution.

Ans. Add NH_4OH solution to both if chalky **white** ppt is formed which is insoluble in excess of NH_4OH, it is lead nitrate solution.

If gelatinous **white** ppt soluble in excess of NH_4OH it is zinc nitrate solution.

(ii) Sodium chloride solution and sodium nitrate solution.

Ans. Add $AgNO_3$ solution to both.

White ppt of AgCl is formed with sodium chloride solution.

No observation with sodium nitrate solution.

(b) Write a balanced equation for the preparation of each of the following salts : **[2]**

(i) Copper sulphate from Copper carbonate.

Ans. $CuCO_3 + H_2SO_4 \rightarrow CuSO_4 + H_2O + CO_2$

(ii) zinc carbonate from Zinc sulphate.

Ans. $ZnSO_4 + Na_2CO_3 \rightarrow ZnCO_3 + Na_2SO_4$

(c) (i) What is the type of salt formed when the reactants are heated at a suitable temperature for the preparation of Nitric acid ? **[2]**

Ans. Acid salt.

(ii) State why for the preparation of Nitric acid, the complete apparatus is made up of glass.

Ans. All glass apparatus is used because nitric acid vapours attack rubber, cork etc.

(d) Which property of sulphuric acid is shown by the reaction of concentrated sulphuric acid with : **[2]**

(i) Ethanol ?

Ans. Dehydrating agent.

(ii) Carbon ?

Ans. Oxidising agent.