

Solution of Chemistry Model Paper 2021-2022 SSC-II

MCQ'S KEY

1. C	2. C	3. A	4. C	5. B	6. B	7. D	8. C	9. B	10. C	11. A	12. A
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Section-B

i. **Classify the following substances as Lewis acids or Lewis bases.**

- a. AlBr_3 b. $\text{CH}_3\text{-CH}_2\text{-OH}$ c. CN^{-1}

Ans: a. AlBr_3 is a Lewis acid. Al in AlBr_3 has an incomplete octet. so it needs an electron pair to complete its octet.

b. $\text{CH}_3\text{-CH}_2\text{-OH}$ is a Lewis base. $\text{CH}_3\text{-CH}_2\text{-OH}$ has a lone pair on O-atom so it is an electron pair donor.

c. CN^{-1} is a Lewis base. CN^{-1} has a lone pair on N-atom so it is an electron pair donor.

ii. **How has Le-Chatlier's principle made it possible to get maximum amount of product from Habers process?**

Ans:

With application of Le-Chatlier principle ammonia can be produced with 98% yield. First equilibrium is established with help of catalyst in minimum time and then by increasing pressure and decreasing temperature equilibrium is shifted towards right.

iii. **Concentration of an aqueous solution of potassium hydroxide $1.0 \times 10^{-3} \text{ mol/dm}^3$. What is its pH? Is this solution acidic, basic or neutral?**

Ans:

$\text{KOH } 1.0 \times 10^{-3} \text{ mol/dm}^3$

$$[\text{KOH}] = 1.0 \times 10^{-3} \text{ mol/dm}^3$$

pH=?

$$[\text{H}^+][\text{OH}^-] = 1.0 \times 10^{-14} \text{ mol/dm}^3$$

$$[\text{H}^+] = \frac{1 \times 10^{-14}}{1 \times 10^{-3}} =$$

$$[\text{KOH}] = 1.0 \times 10^{-3} \text{ mol/dm}^3$$

pH=?

$$[\text{H}^+][\text{OH}^-] = 1.0 \times 10^{-14} \text{ mol/dm}^3$$

$$[\text{H}^+] = \frac{1 \times 10^{-14}}{1 \times 10^{-3}} = 1 \times 10^{-11} \text{ mol/dm}^3$$

$$\text{pH} = -\log[\text{H}^+]$$

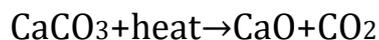
$$\text{pH} = -\log(1 \times 10^{-11}) = 11$$

The solution is basic.

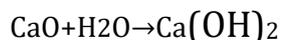
iv. **What is slaked lime? How is it produced during Solvay process?**

Ans:

Slaked lime is Calcium Hydroxide. Calcium Hydroxide is produced heating limestone in a kiln.



Equal amount of water and lime are mixed to produce slaked lime.



v. **Write the name and formulas of the three Nitrogen containing fertilizers.**

Ans:

Ammonium Sulfate $(\text{NH}_4)_2 \text{SO}_4$

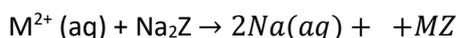
Ammonium Nitrate NH_4NO_3

Urea NH_2CONH_2

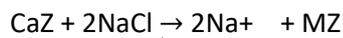
vi. **Describe ion exchange method for removal of hardness of water.**

Ans:

The hard water is passed through a container filled with a suitable resin containing sodium ion. Zeolite is one of the natural ion exchangers. Chemically it is sodium aluminium silicate. It is usually written as NaZ . The calcium and magnesium ions causing hardness are exchanged with sodium ion in resin.



The used up zeolite can be regenerated by heating with a concentrated solution of NaCl . This makes the process economical.



vii. **For the given reversible reaction equilibrium concentrations are: $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$. $[\text{N}_2] = 0.602 \text{ mol/dm}^3$, $[\text{H}_2] = 0.420 \text{ mol/dm}^3$ and $[\text{NH}_3] = 0.113 \text{ mol/dm}^3$. Calculate the value of K_c and determine the K_c unit.**

Ans:

$$K_c = \frac{[\text{NH}_3]^2}{[\text{N}_2][\text{H}_2]^3}$$

$$= \frac{(0.113)^2}{(0.602)(0.42)^3}$$

$$= \frac{0.013}{(0.602)(0.074)}$$

$$= 0.292 \text{ dm}^6 \text{ mol}^{-2}$$

Units of K_c

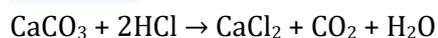
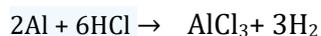
$$K_c = \frac{[\text{NH}_3]^2}{[\text{N}_2][\text{H}_2]^3} = \frac{(\text{mol dm}^{-3})^2}{(\text{mol dm}^{-3})(\text{mol dm}^{-3})^3}$$

$$= \frac{1}{(\text{mol dm}^{-3})^2} = (\text{mol dm}^{-3})^{-2}$$

$$= \text{dm}^6 \text{ mol}^{-2}$$

- viii. Write down balanced chemical equations showing the formation of salt: a. reaction of HCl acid with Al metal b. reaction of HCl acid with calcium carbonate

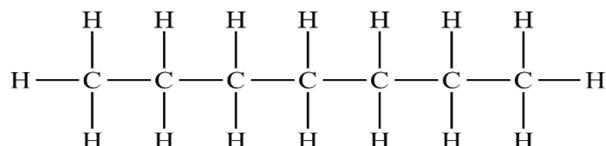
Ans:



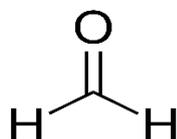
- ix. Write the structural formulas of the following

Ans:

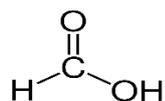
a. n-Heptane



b. Methanal



c. Methanoic acid



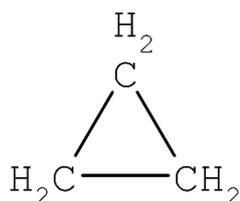
- x. Differentiate between homocyclic and heterocyclic compound with the help of structural formula.

Ans:

Homocyclic compounds

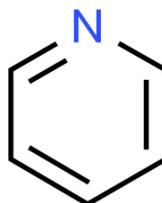
Cyclic compounds which contain rings of carbon atoms are homocyclic compounds.

For example cyclopropane contain ring of carbon atoms.



Cyclic compounds which contain one more atom other than carbon in ring are called heterocyclic compounds.

For example pyridine contains nitrogen in addition to carbon.

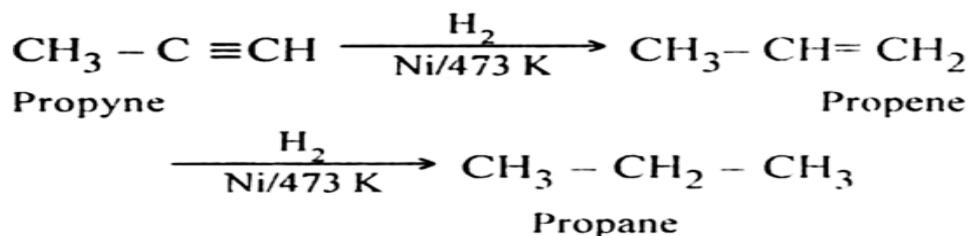


Heterocyclic compounds

- xi. Write two methods of the preparation of propane. Give chemical equation with conditions.

Ans:

Propane can be prepared by hydrogenation of propene and propyne



Hydrogenation can also be done in presence of Pt or Pd at room temperature.

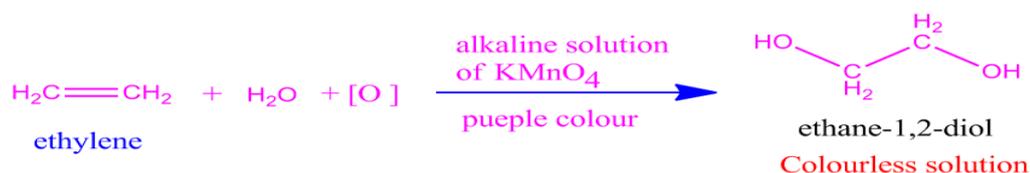


- xii. How will you differentiate between Ethane and Ethene using a chemical test.

Ans:

Ethene and Ethane can be differentiated using bayers test.

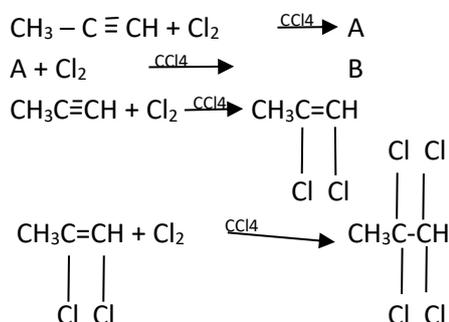
When ethene is treated with dilute alkaline solution of KMnO_4 (1%), addition of two hydroxyl groups occur across the double bond. The pink color of KMnO_4 solution is discharged.



Ethane does not give this test.

- xiii. Identify A and B in the following chemical reaction

Ans:



A = 1,2 dichloropropene

B = 1,1,2,2, tetrachloropropane

- xiv. Discuss ways by which global warming can be decreased?

Ans:

Following are some of the ways through which global warming can be decreased:

Use of catalytic converters in cars to reduce carbon dioxide emissions.

Planting trees can also capture carbon dioxide emissions.

Switch to renewable energy resources, thus emitting far less heat-trapping gases into atmosphere.

Use vehicles such as bicycle instead of those burning fossil fuels or use mass transport system.

xv. Define the following with examples: a. Lipids b. Fats c. Oils

Ans: Lipid: A lipid is any component of plant or animal tissues that is insoluble in water, but soluble in solvents of low polarity such as ether, hexane, benzene, and carbon tetrachloride.

For example, fats and oils.

Fats: A lipid is called fat if it is solid at room temperature.

For example, butter and beef fat.

Oils: A lipid is called oil if it is liquid at room temperature.

For example, palm oil and olive oil.

(SECTION : C)

Q:3(a): State law of mass action. Derive K_c expression for the following reaction:

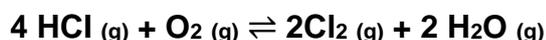
Ans: Law of Mass Action

Statement

“The rate at which a substance reacts is directly proportional to its active mass. The rate at which the reaction proceeds, is directly proportional to the product of the active masses of the reactants”.

The term active mass means concentration of reactants and products in the units of mol/dm³ and is expressed in terms of square bracket[].

Derivation of K_c Expression for the Given reaction



Rate of forward reaction $\propto [\text{HCl}]^4 \cdot [\text{O}_2]$

Rate of forward reaction (R_f) = $k_f [\text{HCl}]^4 \cdot [\text{O}_2]$

Rate of reverse reaction $\propto [\text{Cl}_2]^2 \cdot [\text{H}_2\text{O}]^2$

Rate of reverse reaction (R_r) = $k_r [\text{Cl}_2]^2 \cdot [\text{H}_2\text{O}]^2$

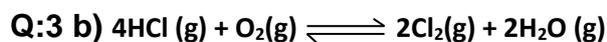
As we know that at equilibrium.

$$R_f = R_r$$

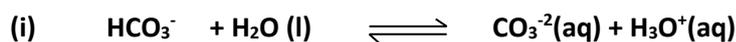
$$k_f [\text{HCl}]^4 \cdot [\text{O}_2] = k_r [\text{Cl}_2]^2 \cdot [\text{H}_2\text{O}]^2$$

$$\frac{k_f}{k_r} = \frac{[Cl_2]^2 \cdot [H_2O]^2}{[HCl]^4 \cdot [O_2]}$$

$$K_c = \frac{[Cl_2]^2 \cdot [H_2O]^2}{[HCl]^4 \cdot [O_2]}$$

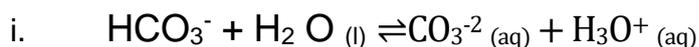


Identify Lowry – Bronsted acids and bases in the following reactions. Justify your answer.

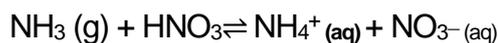
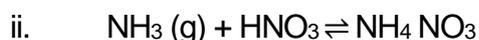


Ans: Identification of Lowry – Bronsted

Acids and Bases



HCO_3^- is a Lowry acid as it is donating proton in this reaction, whereas H_2O is behaving as a Lowry – Bronsted base as it is accepting a proton.



NH_3 is a Lowry Bronsted base due to accepting proton and HNO_3 is a Lowry Bronsted Acid as it is acting as a proton donor.



Above is a Lewis Acid-Base pair as it accepts an electron (BF_3) and donates electron pair (F^-)
No Lowry Acid – Base found.



CH₃COOH Lowry – Bronsted Acid (Proton donor)

H₂O Lowry - Bronsted Base (Proton Acceptor)

Q:4(a) What is hard water? Explain the methods for removing temporary hardness of water.

Ans: Hard Water

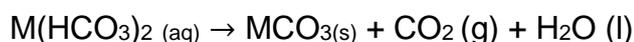
Ans: “Water that gives a little lather or form scum with soap is called hard water”.

Methods of removing temporary hardness

i) By boiling

Temporary hardness of water can simply be removed by boiling . During boiling the soluble calcium and magnesium hydrogen carbonates are decomposed forming insoluble carbonates.

Since Ca⁺² and Mg⁺² ions are removed as insoluble carbonates, water becomes soft.



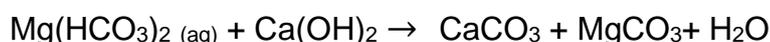
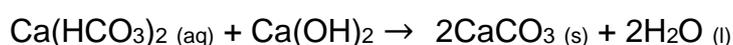
Where M = Ca⁺² or Mg⁺²

Unfortunately ,this method is too expensive to remove temporary hardness of water on the large scale.

ii) By adding slaked lime(Clark’s method)

Temporary hardness in water on the large scale can be removed by adding an estimated amount of Slaked lime in it.

The slaked lime reacts with the hydrogen carbonates to form insoluble carbonates.



Q:4 (b) What are nucleic Acid? Describe structure and function of DNA.

Ans: Nucleic Acid

Nucleic acids are vital components of all life. They are found in every living cell.

They serve as the information and control centre of the cell. They are long chain of nucleotides each nucleotide consist of three components.

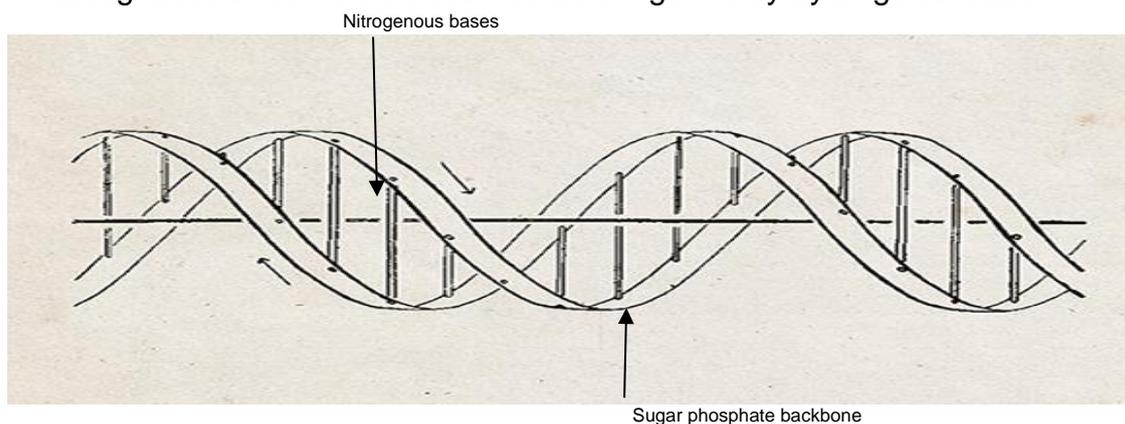
- i. Nitrogenous base
- ii. A pentose sugar or five carbon sugar
- iii. Phosphate group.

DEOXYRIBONUCLEIC ACID (DNA)

Structure of DNA

DNA exists in the form of two strands twisted around each other in a spiral formation called a double helix.

Each chair or strand is made up of a deoxyribose sugar, phosphate unit and nitrogenous base. The strands are held together by hydrogen bonds.



STRUCTURE OF DNA

Function of DNA

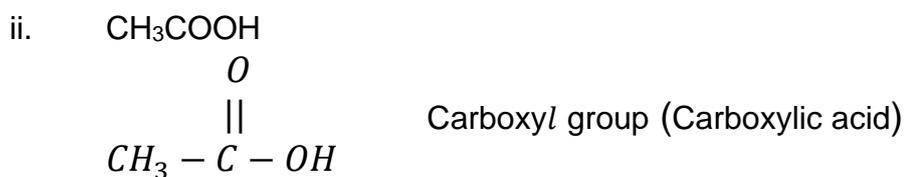
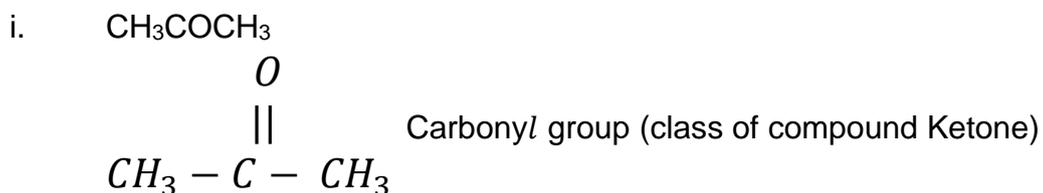
1. Stores Information which is used to produce proteins.
2. It stores genetic information and passes it on from generation to generation due to its double strand.

Q:5 (a) What is functional group? Identify the functional group in the following organic compound:



Ans: Functional Group

An atom or a group of atom that determines the characteristic properties of an organic compound is called a functional group.





b). How will you convert propene into propyne. Name the products formed in each step.

Ans: Starting material \rightarrow propene
 $CH_3 - CH = CH_2$
 End product \rightarrow propyne
 $CH_3 - C \equiv CH$

Conversion

