Grade 10 Chemistry Kerala 2015

Q1. The impurities which are not removed during ore concentration are called ____. (gangue, flux, slag)

Solution:

The impurities which are not removed during ore concentration are called gangue.

Q2. Correct the wrong statements if found any from those given below:
(a) When the difference in electronegativity increases, the possibility of covalent bonding increases.
(b) Electronegativity increases while moving from left to right along a period.
(c) Ionic bond is present in HCl molecule.
(d) Partial Ionic bond is also there in a polar molecule.

Solution:

There is a small error in option (b). Electronegativity actually increases as we move from left to right across a period. Additionally, option (c) is incorrect because the bond in an HCl molecule is not an ionic bond; it is a covalent bond. It's important to understand these concepts to avoid confusion in chemical bonding.

Q3. The volume of a definite amount of hydrogen gas taken at 2 atm pressure 25° temperature is 400 ml.
(a) Suggest a method to increase the volume of this gas without a change in pressure
(b) If the volume of the gas is changed to 200 ml, what will be a new pressure?
(Hint: Temperature is constant)
(c) State the gas law used to solve the problem (b)

Solution:

a) To suggest a method to increase the volume of this gas without any change in pressure, take the example of the Charles Law. As per the law, when the pressure on a sample of a dry gas is held constant, the Kelvin temperature and the volume will be directly related. Hence, if we increase or decrease the temperature, then the volume will increase or decrease respectively, as they are directly proportional

b) To calculate new pressure, we can apply Boyle's law, where

$P_1V_1 = P_2V_2$

That is $2 \times 400 = P_2 \times 200$

Hence, new pressure P_2 will be = 4 atm.

(c) To solve problem (b), Boyle's law was applied. This law explains that when the amount of gas and temperature remain the same, the pressure and volume of the gas multiply to give a constant value. In simple terms, if the pressure increases, the volume decreases, and vice versa, as long as the temperature doesn't change.

Q4. Sugar taken in a watch glass was found to be charred by adding a substance "X."

a. What is substance " X "?

b. What is the reason for the charring of sugar?

c. Which catalyst is used in the industrial preparation of the substance " X "?

Solution:

a) The given substance "X" is H_2SO_4 or Sulphuric acid.

b) Sugar chars because, during the process, steam is released, and the entire substance heats up due to an exothermic reaction. This reaction produces a black, spongy carbon mass. The intense heat causes the sugar to break down, leaving behind this carbon residue.

c) Vanadium pentoxide (V_2O_5) acts as a catalyst in the large-scale production of a substance known as "X". It helps speed up the chemical reaction without being used up in the process.

Or

The Chemical equation of the industrial preparation of SO_3 is given.

$2SO_2 + O_2 \rightleftharpoons 2SO_3 + \text{Heat}$, What is the influence of the following factors in this system at equilibrium?

a. Increasing the amount of O_2.

b. SO_3 is removed from the system.

c. Decreasing temperature.

Solution:

a) When the amount of O_2 is increased, it increases the production of sulphur trioxide SO_3.

b) If SO_3 is removed from the system, which is at equilibrium then the system will try to increase this removed sulphur trioxide SO_3. Hence, the equilibrium will shift to the right, confirming forward reaction. That is $SO_2 + O_2$ will react to give SO_3.

c) When the temperature is decreased, the yield will be maximum.

Q5. Some equipment and materials are given:

$ZnSO_4$ Solution, $CuSO_4$ Solution

Zn rod, Cu rod, Voltmeter

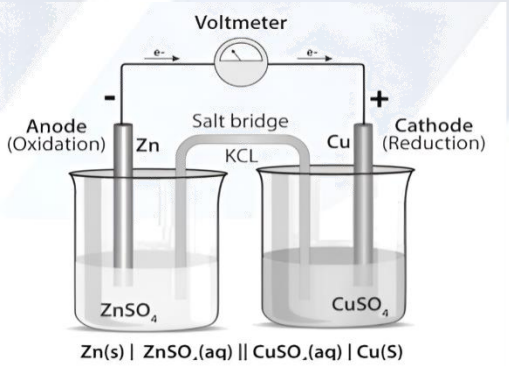
KCI Solution, the filter paper

a. Draw the diagram of the electrochemical cell, which can be constructed using this equipment and materials and label the parts.

b. Write equations of chemical reactions taking place in the two electrodes of this cell. (Hint: reactivity Zn > Cu)

Solution:

a) For the diagram of the electrochemical cell that is constructed using $ZnSO_4$ solution, $CuSO_4$ solution, Zn rod, $\overline{Cu}$ rod, Voltmeter, KCl Solution and filter paper are given below:



b) Here are the chemical reaction equations happening at the two electrodes of this cell. These reactions show how the substances change during the process.

In these electrochemical cells, the oxidation reaction happens at the anode, while the reduction reaction takes place at the cathode. Below is the redox reaction that occurs in the process.

$Zn(s) + Cu_{+2}(aq) \rightarrow Zn_{+2} + Cu(s)$

At anode (oxidation half)

$Zn(s) \rightarrow Zn_{+2} + 2e$

At cathode (reduction half)

$Cu_{+2}(aq) + 2e^{-} \rightarrow Cu(s)$

Q6. Match the items given in column *A* and *B*

A	B
-OH	Amine
-COOH	Alcohol
$-NH_2$	Aldehyde
-CHO	Carboxylic Acid

Solution:

A	B
-OH	Alcohol
-COOH	Carboxylic Acid
$-NH_2$	Amine
-CHO	Aldehyde

Q7. A small amount of MNO_2 is added to H_2O_2 taken in a test tube.

a. Suggest an experiment to identify the gas liberated.

b. Write the chemical equation of the reaction taking place.

c. What is the role of MNO_2 in this chemical reaction?

Solution:

a) When MNO_2 is added to H_2O_2 taken in a test tube, When hydrogen peroxide breaks down with the help of the catalyst manganese dioxide, it produces oxygen gas. This reaction happens faster because of the catalyst.

b) The chemical reaction of the equation taking place is $2H_2O_2 \overset{MnO_2}{\rightarrow} 2H_2O + O_2$

c) MNO_2 works as a catalyst, meaning it helps to speed up the reaction without changing itself in the process. It remains the same before and after the reaction while making the reaction happen faster.

Or

Equations of two chemical reactions are given:

$H_2 + Cl_2 \rightarrow 2HCl$

$CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$

Explain the reason for the following situations using collision theory.

(a) When the pressure decreases, the speed of formation of HCl decreases.

(b) When the particle size of $CaCO_3$ decreases the speed of chemical reaction increases.

(c) All collisions between reactant molecules are not leading to a chemical reaction.

Solution:

a) When the pressure is lowered, the reactant particles collide less often, which slows down the formation of HCl. This happens because fewer collisions mean fewer chances for the reaction to occur.

b) When the size of $CaCO_3$ particles becomes smaller, the particles collide more frequently, which speeds up the chemical reaction. This is because smaller particles have a larger surface area, allowing more collisions to happen.

c) Not every collision between reactant molecules results in a chemical reaction. Only the molecules that have energy higher than a certain minimum level, known as the threshold energy, can collide effectively to form new products.

Q8. Equal amount of NaOH solution is added to aqueous solutions of ferric sulphate and ferrous sulphate taken in two different test tubes. Precipitates of two different colours can be seen in these test tubes.

a. Which compounds are responsible for different colours?

b. Write the electronic subshell configuration of ferric ion.

[Hint: atomic number of iron- 26]

c. Why do iron form compounds with two different valencies?

Solution:

a) Compounds of transition metals display a variety of colours. This happens because of the unique way their electrons absorb and reflect light.

b) The subshell electronic configuration of a ferric ion is $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3d^5$.

c) In d-block elements like iron, the energy gap between the outermost s-subshell and the d-subshell of the second-last shell is very small. As a result, electrons can be shared or transferred from both subshells when compounds are formed. This is why iron exhibits different valencies.

Q9. Find out to which type of chemical reaction, the following changes belong:
(substitution reaction, addition reaction, polymerisation, chemical cracking)

a. Methane → Chloromethane

b. Propene → Polypropene

c. Hexane → Butene + ethane

d. Ethane → 1,2-dichloroethane

Solution:

a) This reaction involves a substitution process.

b) The type of reaction shown in this equation is polymerization.

c) In this equation, a chemical cracking reaction occurs.

d) The reaction shown in this equation is an addition reaction.

Q10. Chemical equation for the reaction between ethane gas and oxygen is given below:

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

a. How many moles of ethane should react to form 20 moles of CO_2?

b. How many molecules are present in 67.2L ethane at STP?

Solution:

a) Given that 2 moles $C_2H_6 = 4$ Moles CO_2

Calculate how many moles of ethane should react to form 20 moles of CO_2

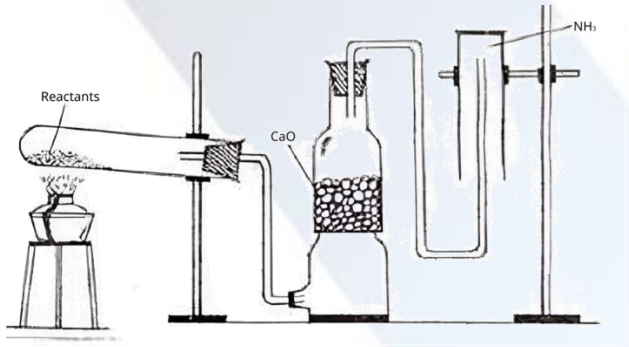
If you apply the cross multiplication method, Number of moles of $C_2H_6 = 10$

b) Meanwhile, $67.2/22.4 = 3$ moles

Thus, molecules present in 67.2 L ethane at STP $= 3 \times 6.022 \times 10^3$

Molecules $= 18.066 \times 10^{23}$ molecules.

Q11. The diagram showing the laboratory preparation of NH_3 is given below:



a. What are the reactants used?

b. Why is CaO used?

c. What is the reason for not keeping the jar in the upward position?

d. Write an experiment to identify the presence of NH_3 in the gas jar.

Solution:

a) In this experiment, we use ammonium chloride and calcium hydroxide as the starting materials. These substances react to produce a gas.

b) When the gas passes through a drying tower filled with pieces of calcium oxide (CaO), ammonia gas is formed as a result of the reaction.

c) Ammonia is collected by the downward displacement of air because it is lighter than air and easily rises.

d) The fountain experiment helps to confirm the presence of ammonia gas in the gas jar by showing a noticeable reaction.

Q12. Butan-1-ol and methoxy propane are isomers. Their structural formulae are given:

$CH_3 - CH_2 - CH_2 - CH_2 - OH$

$CH_3 - CH_2 - CH_2 - O - CH_3$

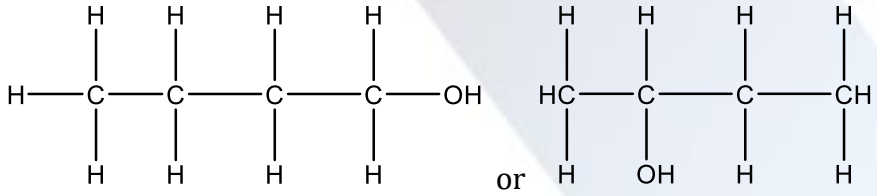
a. To which type of isomerism this belongs?

b. Write the structural formula and IUPAC name of the chain isomer of butan-1-Iol.

Solution:

a) These isomers belong to functional isomers.

b) IUPAC name of chain isomer of butan-1-ol is butan-2-ol and the structural formula of butan-2-ol is as given below:



Q13. Equations of preparation of alcohol from sugar are given:

$$C_{12}H_{22}O_{14} + H_2O \xrightarrow{invertase} \underset{A}{C_6H_{12}O_6} + \underset{B}{C_6H_{12}O_6}$$

$$C_6H_{12}O_6 \xrightarrow{Zymase} 2C_2H_5OH + 2CO_2$$

a. Write the names of compounds A and B.

b. The alcohol obtained here is known as _____.

c. How can this alcohol be converted into the rectified spirit?

d. How can power alcohol be prepared?

Solution:

a) The name of the compound A is glucose, while compound B is fructose.

b) The alcohol which is obtained here is ethanol or ethyl alcohol.

c) Rectified spirit, also known as rectified alcohol, is a strong form of ethanol that has been purified through repeated distillation, a process known as rectification. This method helps achieve a high level of concentration.

d) Power alcohol is a blend made by mixing 80% petrol with 20% ethanol, along with a small amount of benzene. It is often used as a fuel to improve engine performance.

Q14. Is it necessary to ban the use of chemical pesticides to protect your environment? Explain your response to the statement with a suitable example.

Solution:

- A large portion of pesticides misses their target, spreading into the air, water, soil, and even our food. They can cause health issues like headaches, nausea, cancer, and reproductive problems.
- Pesticides also harm soil biodiversity, reducing its quality and water retention, which are vital for plant growth. Additionally, they contaminate soil, threaten aquatic life, and are linked to birth defects and learning disabilities.
- Reducing or banning chemical pesticides is crucial to protect human health and the environment.