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Class	10th	Chapter	23
Subject	Chemistry	Board	Punjab

Chapter 23: Monohydroxy Alkanes or Alcohols

A. Multiple Choice Questions

1. Which conditions are best for the fermentation of glucose?

(a) 35 ˚C, fresh yeast, absence of oxygen | (b) 45 ˚C, yeast | (c) 45 ˚C, absence of oxygen | (d) 35 ˚C, fresh yeast

- **Correct Answer: (a)**

2. Which catalyst other than H_3PO_4 can also be used for hydration of alkenes?

(a) NaOH | (b) H_2SO_4 | (c) CH_3COOH | (d) Ni

- **Correct Answer: (b)**

3. Alcohol which has the maximum heat of combustion is:

(a) $CH_3CH_2CH_2OH$ | (b) CH_3CH_2OH | (c) CH_3OH | (d) $CH_3CH_2CH_2CH_2OH$

- **Correct Answer: (d)**

4. The most environment friendly fuel is:

(a) coal | (b) kerosene oil | (c) ethanol | (d) wood

- **Correct Answer: (c)**

5. Which property or properties of ethanol make it suitable to be used in cosmetic industry?

(a) Easily Flammable | (b) Highly volatile and deodorizing | (c) Antipyretic | (d) Sedative

- **Correct Answer: (b)**

6. Which is the correct name of the following alcohol ($CH_3 - CH(OH) - CH_2 - CH(CH_3) - CH_3$):

(a) 2-Methylpentan-4-ol | (b) 4-Methylpentan-2-ol | (c) Hexan-2-ol | (d) Hexan-4-ol

- **Correct Answer: (b)**

7. Which property of ethanol makes it suitable for cleaning wounds?

(a) Good solvent | (b) Volatility | (c) Antiseptic | (d) Deodorizing

- **Correct Answer: (c)**

8. Which alcohol is used to accomplish all the following tasks: It is added in petrol to improve combustion. It serves as a feed stock to prepare vinegar and many other organic compounds.
(a) Propanol | (b) Propan-2-ol | (c) Ethanol | (d) Methanol

- **Correct Answer: (c)**

B. Short Answer Questions

23.1 Give two advantages of burning of alcohols over the burning of fossil fuel?

1. **Cleaner Combustion:** Alcohols burn with cleaner flames and produce fewer soot particles and toxic sulfur/heavy metal emissions compared to fossil fuels.
2. **Carbon Neutrality / Renewability:** Alcohols (like ethanol) can be produced from renewable biomass. The carbon dioxide released during combustion is offset by the CO_2 absorbed by plants during their growth, unlike fossil fuels which add ancient stored carbon to the atmosphere.

23.2 Which properties of ethyl alcohol make it useful for cosmetic industry? Ethyl alcohol is valued in the cosmetic industry for its **high volatility** (it evaporates rapidly without leaving an oily residue, giving a cooling sensation) and its **deodorizing properties**, making it an ideal solvent and carrier base for perfumes, body sprays, and lotions.

23.3 How is ethyl alcohol important for pharmaceutical industry? Ethyl alcohol is an excellent **solvent** used to dissolve active medicinal ingredients that are insoluble in water. It is essential in formulating cough syrups, tinctures, antiseptic solutions, and various liquid medicines.

23.4 Give any two disadvantages of fermentation reactions.

1. **Slow Rate:** Fermentation is a slow biochemical process that requires days or weeks to complete.
2. **Impure and Dilute Product:** It produces a dilute aqueous solution (around 10–14% alcohol) containing unwanted by-products like fusel oil, requiring energy-intensive fractional distillation to purify.

23.5 Write the conditions involved in the hydration of ethene.

- **Catalyst:** Phosphoric acid (H_3PO_4) or concentrated sulfuric acid (H_2SO_4).
- **Temperature:** Around 300 °C.
- **Pressure:** High pressure, around 60 atm.

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C. Constructed Response Questions

23.1 How ethanol is obtained as a by-product in sugar industry?

In the sugar industry, sucrose crystallization leaves behind a thick, dark liquid called **molasses**, which contains about 50% fermentable sugars. By diluting molasses with water, adding yeast, and maintaining a temperature of 30 °C to 35 °C in an oxygen-free environment, the enzymes in yeast convert these sugars into ethanol and carbon dioxide, turning industrial waste into valuable ethanol.

23.2 Why do we get relatively impure alcohol in the fermentation process?

Fermentation is a living biological process rather than a sterile laboratory synthesis. It takes place in large open vats where yeast acts on sugary solutions, producing a mixture containing water, unreacted sugars, yeast cells, enzymes, and organic by-products (such as higher alcohols and acids). Furthermore, yeast activity ceases when the alcohol concentration reaches 12–14% because higher concentrations are toxic to the yeast, resulting in an impure mixture.

23.3 How do properties of ethyl alcohol help us to utilize it as fuel?

- **High Heat of Combustion:** It releases a substantial amount of energy upon complete combustion ($C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O + \text{Heat}$).
- **Miscibility & Octane Rating:** It blends smoothly with petrol and has a high octane number, improving engine performance, preventing knocking, and ensuring efficient fuel combustion.

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D. Descriptive Questions

23.1 Give a comparison of fermentation reaction and catalytic hydration of ethene for the preparation of ethanol.

Feature	Fermentation Reaction	Catalytic Hydration of Ethene
Raw Materials	Renewable biomass (glucose, molasses, starch).	Non-renewable fossil fuels (ethene from petroleum).
Process Type	Biochemical process using yeast enzymes (invertase and zymase).	Direct chemical addition across the double bond.
Conditions	Mild (35 °C, atmospheric pressure, aqueous medium).	Harsh (300 °C, 60 atm, acid catalyst).
Reaction Rate	Slow (takes several days).	Fast, continuous industrial process.
Product Purity	Dilute solution (10–14% alcohol) requiring distillation.	High-purity ethanol obtained directly.

23.2 Describe the preparation of ethanol by fermentation process.

1. **Molasses Solution:** Molasses (containing ~50% sucrose) is diluted with water to a 10–15% sugar solution.
2. **Nutrient Addition:** Ammonium salts are added as nutrients for yeast growth. Yeast is introduced, and the temperature is kept between 30 °C and 35 °C in the absence of oxygen.
3. **Enzymatic Reactions:**
   - **Inversion:** The enzyme *invertase* converts sucrose into glucose and fructose:

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow{\text{Invertase}} C_6H_{12}O_6 + C_6H_{12}O_6$$

   - **Glycolysis / Fermentation:** The enzyme *zymase* converts glucose into ethanol and carbon dioxide:

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

4. **Purification:** After a few days, the resulting mixture (wash) containing 10–14% alcohol is fractionally distilled to yield concentrated rectified spirit (95% ethanol).

23.3 Describe the applications of ethanol in pharmaceutical and cosmetic industries?

- **Pharmaceutical Industry:**
  1. Acts as an essential solvent for drugs and active ingredients insoluble in water.

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2. Used to prepare cough syrups, tonics, tinctures (e.g., tincture of iodine), and liquid medicines.
3. Used in antiseptics and hand sanitizers to disinfect skin and medical instruments.

- **Cosmetic Industry:**

1. Serves as the primary solvent and base for perfumes, body sprays, and colognes due to its rapid volatility and ability to disperse fragrances.
2. Used in skin toners and astringents to give a refreshing, cooling feel.
3. Utilized in body deodorants to help neutralize odor.

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