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D Classification of Alcohols

D Based on the number of hydroxyl groups they possess

a) Monohydric alcohol - One hydroxyl group present in the alcohol structure eg C_2H_5OH (ethanol)

b) Dihydric alcohol - Two hydroxyl groups present eg ethylene glycol

$$\begin{array}{l} CH_2OH \\ | \\ CH_2OH \end{array}$$

c) Trihydric alcohol - Three hydroxyl groups present eg glycerol

$$\begin{array}{l} CH_2OH \\ CHOH \\ CH_2OH \end{array}$$

d) Polyhydric alcohol - more than three hydroxyl groups present. e.g Heptane 2, 3, 4, 5, 6 - Pentaol - $CH_3CH(OH)CH(OH)CH(OH)CH(OH)CH(OH)CH_3$

2) Based on the number of hydrogen atoms attached to the carbon atom containing the hydroxyl group

a) Primary alcohol (1°) - Hydrogen atom attached to

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the carbon atom bearing the hydroxyl group are three or two eg ethanol

b) Secondary alcohol (2°) - One hydrogen atom attached with two alkyl group attach to the carbon atom eg butan-2-ol.

c) Tertiary alcohol (3°) - No hydrogen atom, three alkyl group attached to the carbon atom carrying the hydroxyl group e.g 2 methyl propan-2-ol.

Question Two

Solubility of alcohols in water, Organic Solvents

All monohydric alcohols are soluble in Organic solvents The solubility of simple alcohols and polyhydric alcohols is largely due to their ability to form hydrogen bonds with water molecules

lower alcohols with up to three carbon atoms in their molecules are soluble in water because these lower alcohols can form hydrogen bond with water molecules. The water solubility of alcohols decreases with increasing relative molecular mass.

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Question Three

Industrial manufacture of ethanol

1) The starch containing substances are crushed and treated with steam to extract the starch from them. Malt made from germinated barley is added and then kept warm (60°C) for about 1 hour. The enzyme diastase present in malt catalyses the conversion of starch to maltose

$$2(C_6H_{12}O_5)_n + nH_2O \xrightarrow[60^\circ C]{\text{Diastase}} nC_{12}O_{22}O_{11}$$

maltose

2) The yeast is the added, which contains enzyme maltase and zymase. The maltase catalyses the conversion of maltose to glucose at 15°C.

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow[\text{maltase}]{15^\circ C} 2C_6H_{12}O_6$$

Glucose

3) Zymase catalyses the conversion of glucose to ethanol and carbon(IV) oxide at 15°C

$$C_6H_{12}O_6 \xrightarrow[\text{zymase}]{15^\circ C} 2C_2H_5OH_{(aq)} + 2CO_{2(g)}$$

Ethanol

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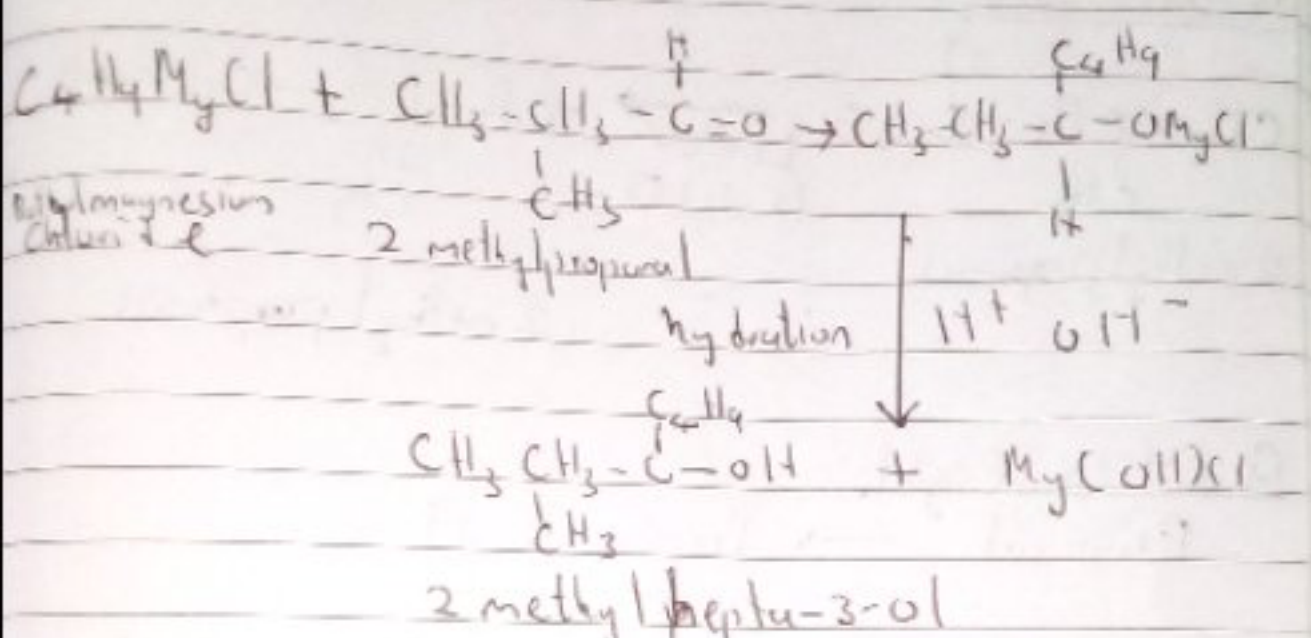
Question four



Question five

2-methyl propanone does not exist.

Question six

2-methyl propanone does not exist. The oxygen atom must carry a double bond. The methyl group would not fit in the second carbon atom of propanone.

CH_3COCH_3 $\xrightarrow[(C_2H_5)_2O]{LiAlH_4}$ $(CH_3)_2CHOH$

Propanone

2-propanol / Isopropyl alcohol

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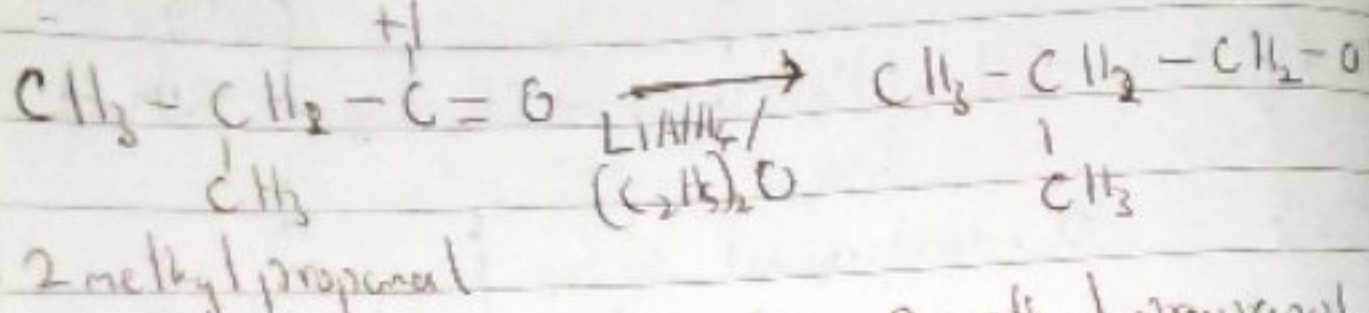
Question Seven

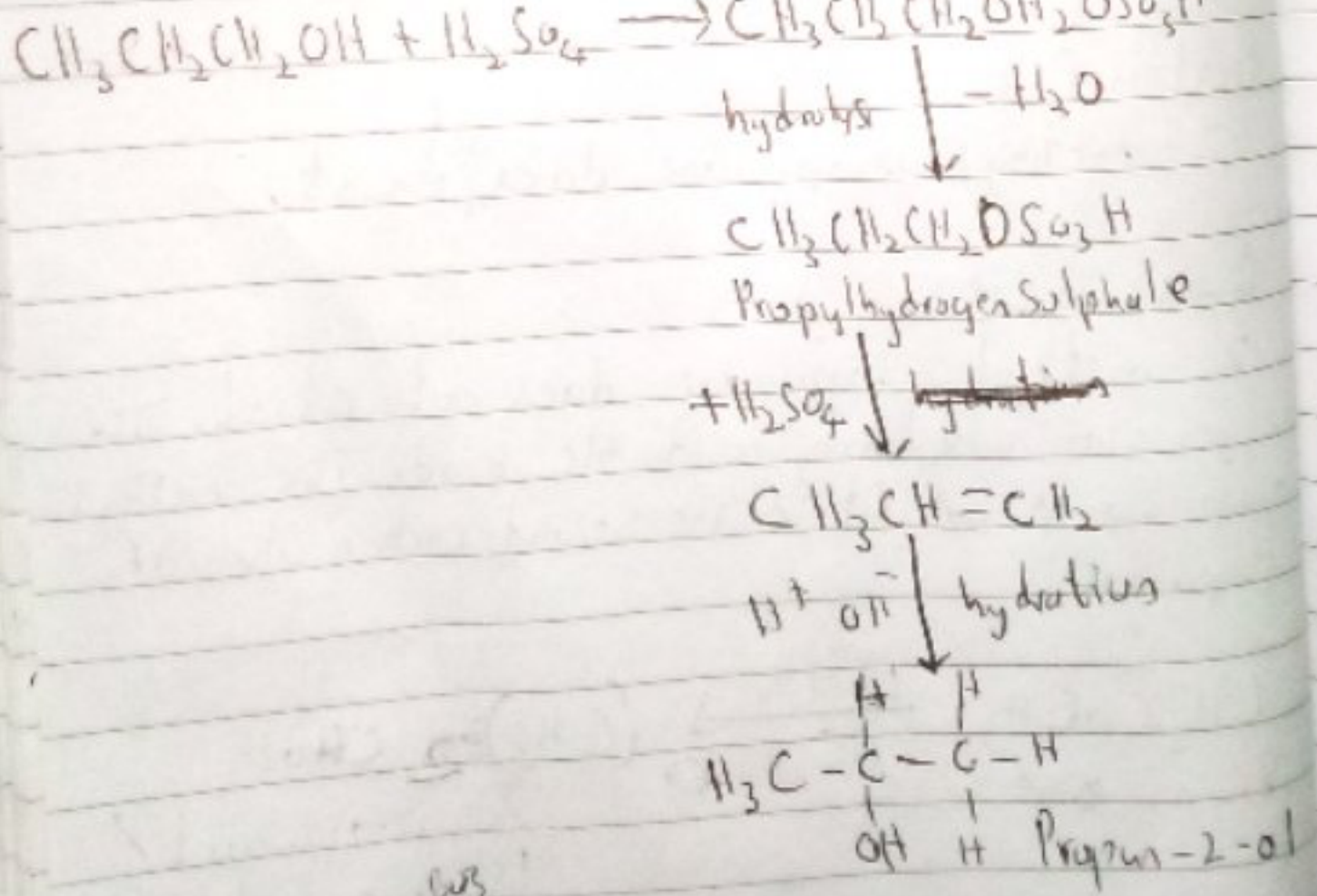


2 methyl propanal

2 methyl propanol

Question Eight

Propanol → Propan-2-ol



Propan-2-ol