EXAM QUESTIONS:

OL 2017

8. Ethanol is broken down in the human body as shown in the scheme on the right.

ethanol → ethanal → ethanoic acid → CO_2 + H_2O

(*a*) Draw the structure of an **ethanol** molecule.
Circle its functional group.
Explain why ethanol is very soluble in water. (17)

(*b*) To which homologous series does **ethanal** belong? (6)

(*c*) Which of the compounds ethanol, ethanal and ethanoic acid,
(*i*) is found in vinegar,
(*ii*) produces a red precipitate when heated with blue Fehling's reagent,
(*iii*) results in fizzing when magnesium metal is added to a solution of it in cold water? (15)

(*d*) Name *or* give the formula of a reagent that could be used to oxidise a sample of ethanol in the school laboratory. (6)

(*e*) Select *one* of the following instrumental methods of analysis that can be used to detect ethanol in a blood sample: colorimetry, carbon-14 dating, gas chromatography (GC), mass spectrometry. (6)

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8. Alkanes, alcohols and carboxylic acids are *homologous series* studied in organic chemistry.

(*a*) Explain the underlined term. (8)

(*b*) In the case of any **two** of the homologous series above, give the name and structural formula of **one** member of the series. (18)

(*c*) Give **one** common use for each of the compounds you have named in (*b*). (6)

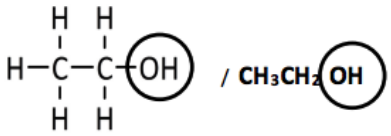
(*d*) Alcohols can be readily converted to carboxylic acids.
What type of organic reaction is involved? (6)

(*e*) Give the name or formula of the gas produced when moist sodium carbonate (Na_2CO_3) reacts with a carboxylic acid.
What simple test could be carried out on this gas to confirm its identity? (12)

EXAM MARKING SCHEME:

OL 2017

QUESTION 8

(*a*) DRAW:  / **CH_3CH_2OH** **(5)**

[Hs of ethyl group need not be explicitly shown.]

CIRCLE: **circle around OH** (6)
[Allow OH in incorrect **alcohol**.]

EXPLAIN: ethanol is **polar** covalent / **hydrogen bonds (dipole-dipole attractions) can form between ethanol and water** (6)
['*Like dissolves like*' allow (3).]['*OH makes it soluble in water*' allow (3).]

(*b*) TO WHICH: **aldehyde** (6)

(*c*) WHICH: (*i*) **ethanoic acid //**
(*ii*) **ethanal //**
(*iii*) **ethanoic acid** [Accept ethanol.] (6 + 6 + 3)

(*d*) NAME OR GIVE: potassium **permanganate {manganate(VII)} / $KMnO_4$ /MnO_4^-/ sodium (potassium) dichromate / $Na_2Cr_2O_7$ / $Cr_2O_7^{2-}$, etc** (6)

(*e*) SELECT: **gas chromatography (GC) / mass spectrometry** (6)

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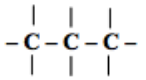
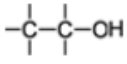
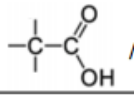
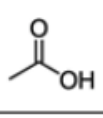
QUESTION 8

(*a*) EXPLAIN: **general formula // differ by CH_2 // same functional group // similar chemical properties // gradation in physical properties // similar preparation** ANY TWO: (5 + 3)
[Accept "uniform chemical type" for "similar chemical properties."]

(*b*) GIVE: **name 1 // name 2**
[Accept "methyl alcohol" for methanol; accept "formic"& "acetic" for "methanoic" & "ethanoic" resp.]
structure 1 // structure 2 (2 × 6 + 2 × 3)
[For the alkane, the minimum required is that all Cs must be separated e.g. CH_3CH_3 for ethane. However, methane must be fully expanded. For the alcohol and carboxylic acid, the functional group must be shown but the alkyl radical need not be expanded.]

Examples
alkane: propane // **$CH_3CH_2CH_3$** /  /

alcohol: ethanol // **C_2H_5OH / CH_3CH_2OH** /  

acids: ethanoic acid // **CH_3COOH** /  / 

(c) GIVE: **use of 1 // use of 2** (2 × 3)

Uses:
methane:**fuel / cooking / heating / electricity generation / hydrogen prod.**
ethane: **prod. of ethene / prod. of chloroethene (vinyl chloride) / prod. of ethanoic (acetic) acid**
propane: **fuel / LPG / cooking / heating**
butane: **fuel / LPG / cooking / heating** / cigarette **lighters //**
methanol: **fuel / solvent / denaturing** agent **(methylated spirit) / antifreeze / camping stoves / fuel cells**
ethanol: **drinks / fuel / solvent / antiseptic / disinfectant / preservative / spirit lamps / production of esters (halides) //**
methanoic acid: **preservative / silage-making / tanning / dyeing / cleaning** fluid
ethanoic acid: **preserving / pickling / flavouring / cellulose acetate**
[The uses must match the two compounds named in (b)] (2 × 3)

(d) TYPE: **oxidation** (6)

(e) GIVE: **carbon dioxide / CO_2** (6)

TEST: bubble through **limewater [calcium hydroxide {$Ca(OH)_2$} solution] //**

turns **milky** / goes **cloudy** / **white precipitate (ppt)** produced / precipitate of **calcium carbonate ($CaCO_3$)** produced (2 × 3)