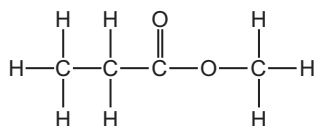


37 What is produced by the bacterial oxidation of ethanol?

- A ethene
- B sodium ethanoate
- C ethyl ethanoate
- D vinegar

35 The structure of an ester is shown.

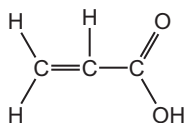


What is the name of this ester?

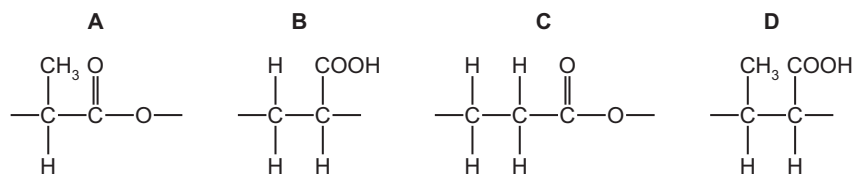
- A ethyl methanoate
- B methyl ethanoate
- C propyl methanoate
- D methyl propanoate

38 Propenoic acid is an organic compound that is both an alkene and a carboxylic acid.

The structure of propenoic acid is shown.



Which structure represents one repeat unit of the addition polymer formed from propenoic acid?



38 Which statement about ethanoic acid is correct?

- A Ethanol is reduced by bacteria to produce ethanoic acid.
- B Ethanoic acid reacts with magnesium to produce a salt of formula CH_3COOMg .
- C Ethanoic acid and methanol react in the presence of an acid catalyst to produce ethyl methanoate.
- D Ethanol reacts with acidified aqueous potassium manganate(VII) to produce ethanoic acid.

3



- (e) Determine the number of unbranched esters which have the molecular formula $C_5H_{10}O_2$.
..... [1]
- (f) All unbranched esters with the molecular formula $C_5H_{10}O_2$ combust completely to form carbon dioxide and water only.

[Total: 8]

The Periodic Table of Elements

Group																											
I	II							III	IV	V	VI	VII	VIII														
		1Hhydrogen1										2Hehelium4															
Key atomic number atomic symbol name relative atomic mass																											
3Li lithium 7	4Be beryllium 9																										
11Na sodium 23	12Mg magnesium 24																										
19K potassium 39	20Ca calcium 40	21Sc scandium 45	22Ti titanium 48	23V vanadium 51	24Cr chromium 52	25Mn manganese 55	26Fe iron 56	27Co cobalt 59	28Ni nickel 59	29Cu copper 64	30Zn zinc 65	31Ga gallium 70	32Ge germanium 73	33As arsenic 75	34Se selenium 79	35Br bromine 80	36Kr krypton 84										
37Rb rubidium 85	38Sr strontium 88	39Y yttrium 89	40Zr zirconium 91	41Nb niobium 93	42Mo molybdenum 96	43Tc technetium —	44Ru ruthenium 101	45Rh rhodium 103	46Pd palladium 106	47Ag silver 108	48Cd cadmium 112	49In indium 115	50Sn tin 119	51Sb antimony 122	52Te tellurium 128	53I iodine 127	54Xe xenon 131										
55Cs caesium 133	56Ba barium 137	57-71 lanthanoids		72Hf hafnium 178	73Ta tantalum 181	74W tungsten 184	75Re rhenium 186	76Os osmium 190	77Ir iridium 192	78Pt platinum 195	79Au gold 197	80Hg mercury 201	81Tl thallium 204	83Bi bismuth 209	84Po polonium —	85At astatine —	86Rn radon —										
87Fr francium —	88Ra radium —	89-103 actinoids		104Rf rutherfordium —	105Db dubnium —	106Sg seaborgium —	107Bh bohrium —	108Hs hassium —	109Mt meitnerium —	110Ds darmstadtium —	111Rg roentgenium —	112Cn copernicium —	113Nh nihonium —	115Mc moscovium —	116Lv livermorium —	117Ts tennessine —	118Og oganeson —										
lanthanoids												71Lu lutetium 175	70Yb ytterbium 173	69Tm thulium 169	68Er erbium 167	67Ho holmium 165	66Dy dysprosium 163	65Tb terbium 159	64Gd gadolinium 157	63Eu europium 152	62Sm samarium 150	61Pm promethium —	60Nd neodymium 144	59Pr praseodymium 141	58Ce cerium 140	57La lanthanum 139	
actinoids												103Lr lawrencium	102No nobelium	101Md mendelevium	100Fm fermium	99Es einsteinium	98Cf californium	97Bk berkelium	96Cm curium	95Am americium	94Pu plutonium	93Np neptunium	92U uranium	91Pa protactinium	90Th thorium	89Ac actinium	88Ra radium

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

6 This question is about organic compounds.

(a) Organic compound **Q** has the following composition by mass.

C, 50.00%; H, 5.56%; O, 44.44%

Calculate the empirical formula of compound **Q**.

empirical formula = [3]

(b) Organic compound **R** has the empirical formula CHO and a relative molecular mass of 116.

Determine the molecular formula of compound **R**.

molecular formula = [1]

(c) Carboxylic acids react with alcohols to form esters.

(i) Name the other product that is formed when a carboxylic acid reacts with an alcohol.

..... [1]

(ii) Name the **type** of catalyst that is used when a carboxylic acid reacts with an alcohol.

..... [1]

(iii) Ester **S** has the structural formula $\text{CH}_3\text{CH}_2\text{COOCH}_2\text{CH}_2\text{CH}_2\text{CH}_3$.

Name the carboxylic acid and the alcohol which react together to form ester **S**.

carboxylic acid

alcohol

(d) Fig. 6.1 shows part of a polymer structure.

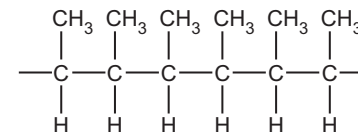


Fig. 6.1

(i) Name the type of polymerisation that is used to produce this polymer.

..... [1]

(ii) Suggest why it is **not** possible to write the molecular formula of this polymer.

..... [1]

(iii) State the number of monomer units that are needed to make the part of the polymer structure shown in Fig. 6.1.

..... [1]

(iv) Draw the displayed formula of the monomer used to make this polymer.

[2]

(e) Fig. 6.2 shows part of the general structure of an amino acid.

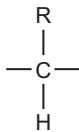


Fig. 6.2

(i) Complete Fig. 6.2 to show all the atoms and all the bonds in the two functional groups of the amino acid. [2]

(ii) Part of a natural polyamide structure is shown in Fig. 6.3.

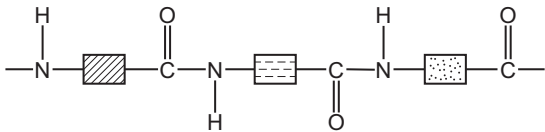


Fig. 6.3

On Fig. 6.3, draw a circle around **one** amide linkage. [1]

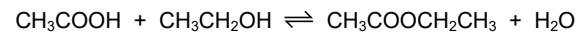
(iii) State the name given to natural polyamides made from amino acids. [1]

[Total: 17]

The Periodic Table of Elements

Group																	
I	II	Key												III	IV	V	VII
3	4	atomic number atomic symbol name relative atomic mass												5	6	7	8
Li lithium 7	Be beryllium 9	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Na sodium 23	Mg magnesium 24	H hydrogen 1	He helium 4	B boron 11	C carbon 12	N nitrogen 14	O oxygen 16	F fluorine 19	Ne neon 20	Al aluminium 27	Si silicon 28	P phosphorus 31	S sulfur 32	Cl chlorine 35.5	Ar argon 40	K potassium 39	Ca calcium 40
K potassium 39	Sc scandium 45	Fe iron 56	Mn manganese 55	Co cobalt 59	Ni nickel 59	Cu copper 64	Zn zinc 65	Ga gallium 70	Ge germanium 73	As arsenic 75	Se selenium 79	Br bromine 80	Kr krypton 84	Xe xenon 131	Rn radon -	Rb rubidium 85	Sr strontium 88
Rb rubidium 85	Y yttrium 89	Hs hassium -	Bh bohrium -	Mt meitnerium -	Ds darmstadtium -	Rg roentgenium -	Cn copernicium -	Nh nihonium -	Fl flerovium -	Mc moscovium -	Lv livermorium -	Ts tennessine -	Og oganeson -	Fr francium -	Ra radium -	Cs caesium 133	Ba barium 137
La lanthanum 139	Pr praseodymium 141	Os osmium 190	Re rhenium 186	Ir iridium 192	Pt platinum 195	Au gold 197	Hg mercury 201	Tl thallium 204	Pb lead 207	Bi bismuth 209	Po polonium -	At astatine -	Rn radon -	Ac actinium -	Th thorium 232	Pa protactinium 231	U uranium 238
La lanthanoids	Pr praseodymium	Os osmium	Re rhenium	Ir iridium	Pt platinum	Au gold	Hg mercury	Tl thallium	Pb lead	Bi bismuth	Po polonium	At astatine	Rn radon	Ac actinoids	Th thorium	Pa protactinium	U uranium
La lanthanoids	Pr praseodymium	Os osmium	Re rhenium	Ir iridium	Pt platinum	Au gold	Hg mercury	Tl thallium	Pb lead	Bi bismuth	Po polonium	At astatine	Rn radon	Ac actinoids	Th thorium	Pa protactinium	U uranium

14 The equation represents the reaction between ethanoic acid and ethanol.



Which type of reaction does this show?

- A addition
- B neutralisation
- C reduction
- D reversible

36 Some properties of an organic compound, J, are listed.

- It is a liquid at room temperature.
- It is soluble in water.
- A solution of J reacts with calcium carbonate to form carbon dioxide.
- A solution of J has a pH of 3.

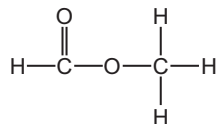
In which homologous series does J belong?

- A alkane
- B alkene
- C alcohol
- D carboxylic acid

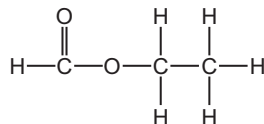
33 Methanol reacts with ethanoic acid to form an ester.

What is the displayed formula for this ester?

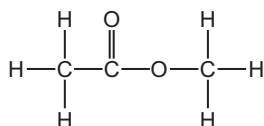
A



B



C



D

