

Past-paper walk-through

Carboxylic acids ■ 11.7

eXercise

Questions in this set

- 0620/21 N25 Q37 ■ 1 mark
- 0620/22 N25 Q35 ■ 1 mark
- 0620/22 N25 Q38 ■ 1 mark
- 0620/23 N25 Q38 ■ 1 mark
- 0620/42 N25 Q6 ■ 8 marks
- 0620/43 N25 Q6 ■ 17 marks
- 0620/21 J25 Q14 ■ 1 mark
- 0620/21 J25 Q36 ■ 1 mark
- 0620/22 J25 Q33 ■ 1 mark

Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- **//** separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = “or words to that effect” – the wording need not match.

Question 37

0620/21 N25 ■ Q37 ■ 1 mark

37 What is produced by the bacterial oxidation of ethanol?

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

Solution 37

Answer: **D**

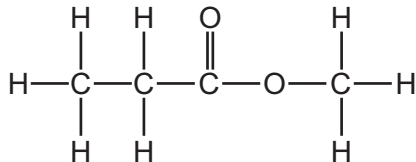
Why

- Bacteria oxidise ethanol in the presence of air to ethanoic acid.
- A dilute solution of ethanoic acid is vinegar.
- Sodium ethanoate would need an alkali, and an ester would need an alcohol as well.

Question 35

0620/22 N25 ■ Q35 ■ 1 mark

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

Solution 35

Answer: **D**

Why

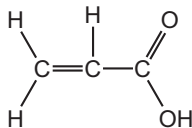
- Name the acid part first – it supplies the “-anoate” ending.
- The alkyl group on the single-bonded oxygen supplies the first word.
- Count the carbons on each side of the -COO- carefully: three in the acyl part and one in the alkyl group.

Question 38

0620/22 N25 ■ Q38 ■ 1 mark

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

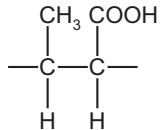
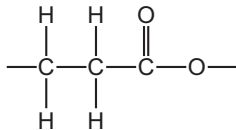
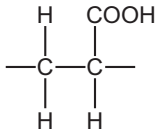
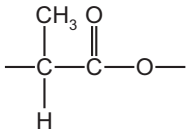
The structure of propenoic acid is shown.



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

A**B****C****D**

Question 38



Solution 38

Answer: **B**

Why

- Only the $\text{C}=\text{C}$ takes part in addition polymerisation.
- The $-\text{COOH}$ group is a spectator and appears unchanged in the repeat unit.
- So the repeat unit is $-\text{CH}_2-\text{CH}(\text{COOH})-$ with single bonds along the backbone.

Question 38

0620/23 N25 ■ Q38 ■ 1 mark

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.

Solution 38

Answer: **D**

Why

- Bacteria *oxidise* ethanol to ethanoic acid, using oxygen from the air.
- Magnesium forms $2+$ ions, so its ethanoate is $(\text{CH}_3\text{COO})_2\text{Mg}$, not CH_3COOMg .
- Ethanoic acid is a weak acid: only a fraction of its molecules dissociate at any moment.

Question 6

0620/42 N25 ■ Q6 ■ 8 marks

- 6 Compound **E** shown in Fig. 6.1 is an ester.

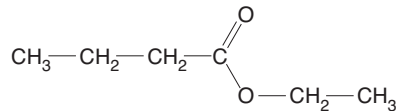


Fig. 6.1

- (a) On **Fig. 6.1**, draw a circle around all the atoms which make up the ester linkage. [1]
- (b) Name compound **E**.

Question 6

(c) Deduce the empirical formula of compound **E**.

Question 6

- (d) Compound **E** is produced when two different compounds react together in the presence of a catalyst.
- (i) Name the **two** compounds that react together to produce compound **E**.

Question 6

Question 6

[2]

- (ii) Suggest a suitable catalyst for this reaction.

Question 6

- (e) Determine the number of unbranched esters which have the molecular formula $\text{C}_5\text{H}_{10}\text{O}_2$.

Question 6

- (f) All unbranched esters with the molecular formula $\text{C}_5\text{H}_{10}\text{O}_2$ combust completely to form carbon dioxide and water only.

Write the symbol equation for the complete combustion of $\text{C}_5\text{H}_{10}\text{O}_2$.

Question 6

IV	V	VI	VII	VIII
				2 He helium 4
6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
82 Pb lead 207	83 Bi bismuth 209	84 Po polonium —	85 At astatine —	86 Rn radon —
114 Fl flerovium —	115 Mc moscovium —	116 Lv livermorium —	117 Ts tennessine —	118 Og oganeson —

68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
100 Fm fermium —	101 Md mendelevium —	102 No nobelium —	103 Lr lawrencium —

[Total: 8]

Question 6

| |

Question 6

The Periodic Table of Elements

Group																	
III																	
1	H																
hydrogen	1																
5	B																
boron	11																
13	Al																
aluminium	27																
31	Ga	30	Zn	29	Cu	28	Ni	27	Co	26	Fe	25	Mn	24	Cr	23	V
gallium	70	zinc	65	copper	64	nickel	59	cobalt	59	iron	56	manganese	55	chromium	52	vanadium	51
49	In	48	Cd	47	Ag	46	Pd	45	Rh	44	Ru	43	Tc	42	Zr	41	Nb
indium	115	cadmium	112	silver	108	palladium	106	rhodium	103	ruthenium	101	technetium	98	zirconium	90	niobium	89
81	Tl	80	Hg	79	Au	78	Pt	77	Ir	76	Os	75	Re	74	Mo	73	Tc
thallium	204	mercury	201	gold	197	platinum	195	iridium	192	osmium	190	rhenium	187	molybdenum	96	technetium	98
113	Nh	112	Cn	111	Rg	110	Ds	109	Mt	108	Hs	107	Bh	106	Sg	105	Hf
nihonium	—	copernicium	—	roentgenium	—	darmstadtium	—	meitnerium	—	hassium	—	bohrium	—	seaborgium	—	tungsten	74
67	Ho	66	Dy	65	Tb	64	Gd	63	Eu	62	Sm	61	Pm	60	Nd	59	Pr
holmium	165	dysprosium	163	terbium	159	gadolinium	157	euporium	152	samarium	150	promethium	—	neodymium	144	praseodymium	141
99	Es	98	Cf	97	Bk	96	Cm	95	Am	94	Pu	93	Np	92	U	91	Th
einsteinium	—	californium	—	berkelium	—	curium	—	americium	—	plutonium	—	neptunium	—	uranium	92	thorium	90

ature and pressure (r.t.p.).

Question 6

| | |

|) est |

lum |

2 m | | m |

|) lum |

) um |

ra

Question 6

II	

Key

	4 Be beryllium 9							atomic number atomic symbol name relative atomic mass
	12 Mg magnesium 24							
um	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn mangan 55		
im	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc techneti –		
m	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rheniui 186		
m	88 Ra radium –	89–103 actinoids	104 Rf rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohriui –		

anoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm prometh –
oids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptuni –

volume of one mole of any gas is 24 dm³ at room tempe

Question 6

— — | —

— 3 — j iur 7 — | 1 — la iur 23 — | 9 — < sst 39 — | 7 — b diu 35 — | 5 — s sst 33 — | 7 — r diu — —

h:

nc

i v

Question 6

—
—
—

—
L
lith
—
1
N
sod
2
—
1
P
potas
3
—
3
R
rubik
8
—
5
C
cae
1
—
8
F
fran
—

lant

acti

The

Solution 6

(a)

Mark scheme

- correctly circled ester link (including 2 C atoms and 2 O atoms)
- 1

Solution 6

(b)

Mark scheme

- ethyl butanoate
- 1

Solution 6

(c)

Mark scheme

- $\text{C}_3\text{H}_6\text{O}$
- 1

Solution 6

(d)(i)

Mark scheme

- M1 butanoic acid **M2**
- ethanol
- 2

Solution 6

(d)(ii)

Mark scheme

- acid
- 1

Solution 6

(e)

Mark scheme

- 4
- 1

Solution 6

(f)

Mark scheme

- $2\text{C}_5\text{H}_{10}\text{O}_2 + 13\text{O}_2 \rightarrow 10\text{CO}_2 + 10\text{H}_2\text{O}$
- 1
- 0620/42
- October/November 2025

Question 6

0620/43 N25 ■ Q6 ■ 17 marks

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**.

Question 6

Question 6

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

Question 6

(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.

Question 6

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

Question 6

(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**.

Question 6

Question 6

[2]

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

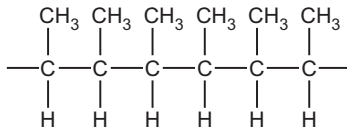


Fig. 6.1

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

Question 6

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

Question 6

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

Question 6

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

Question 6

[2]

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

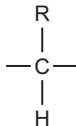


Fig. 6.2

- (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.

Question 6

H

O

H

O

Question 6

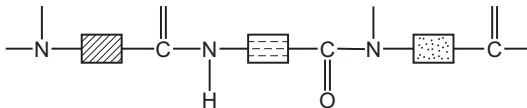


Fig. 6.3

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

[1]

- (iii) State the name given to natural polyamides made from amino acids.

Question 6

[illegible]

[Total: 17]

68	Er	erbium	167	69	Tm	thulium	169	70	Yb	ytterbium	173	71	Lu	lutetium	175
100	Fm	fermium	—	101	Md	mendelevium	—	102	No	nobelium	—	103	Lr	lawrencium	—

Question 6

The Periodic Table of Elements

Group										III
1	H hydrogen 1									5 B boron 11
13	Al aluminium 27									13 Al aluminium 27
31	Ga gallium 70									31 Ga gallium 70
49	In indium 115									49 In indium 115
81	Tl thallium 204									81 Tl thallium 204
113	Nh nihonium —									113 Nh nihonium —
67	Ho holmium 165									67 Ho holmium 165
99	Es einsteinium —									99 Es einsteinium —

rature and pressure (r.t.p.).

Question 6

	=
	-

		Key											
		atomic number atomic symbol name relative atomic mass											
3	Li lithium 7	4	Be beryllium 9										
11	Na sodium 23	12	Mg magnesium 24										
19	K potassium 39	20	Ca calcium 40	21	Sc scandium 45	22	Ti titanium 48	23	V vanadium 51	24	Cr chromium 52	25	Mn manganese 55
37	Rb rubidium 85	38	Sr strontium 88	39	Y yttrium 89	40	Zr zirconium 91	41	Nb niobium 93	42	Mo molybdenum 96	43	Tc technetium 98
55	Cs cesium 133	56	Ba barium 137	57–71	lanthanoids	72	Hf hafnium 178	73	Ta tantalum 181	74	W tungsten 184	75	Re rhenium 186
87	Fr francium 223	88	Ra radium 226	89–103	actinoids	104	Rf rutherfordium 261	105	Ds dubnium 262	106	Sg seaborgium 266	107	Bh bohrium 264

lanthanoids

57	La lanthanum 139	58	Ce cerium 140	59	Pr praseodymium 141	60	Nd neodymium 144	61	Pm promethium —
----	-------------------------------	----	----------------------------	----	----------------------------------	----	-------------------------------	----	------------------------------

actinoids

89	Ac actinium —	90	Th thorium 232	91	Pa protactinium 231	92	U uranium 238	93	Np neptunium —
----	----------------------------	----	-----------------------------	----	----------------------------------	----	----------------------------	----	-----------------------------

volume of one mole of any gas is 24 dm^3 at room temperature.

Question 6

—
—
—

— L lith — 1
N soc — 2
— 1
P pota: — 3
— 3
R rubi — 8
— 5
C cae — 1
— 8
F fran —

ant

acti

The

Solution 6

(a) Mark scheme

- M1 C $50(.00) \div 12$
- H $5.56 \div 1$
- O $44.44 \div 16$
- OR
- $4.17:5.56:2.78$ (M2)
- fractions shown dividing all by smallest
- OR
- $1.5:2:1$

Solution 6

- OR
- 3:4:2 (M3)
- $\text{C}_3\text{H}_4\text{O}_2$
- 3

Solution 6

(b)

Mark scheme

- $\text{C}_4\text{H}_4\text{O}_4$
- 1

Solution 6

(c)(i)

Mark scheme

- water
- 1

(c)(ii)

Mark scheme

- acid
- 1

Solution 6

(c)(iii)

Mark scheme

- M1 propanoic acid (M2)
- butan-1-ol
- 2

Solution 6

(d)(i)

Mark scheme

- addition
- 1

(d)(ii)

Mark scheme

- polymers are of indefinite length
- 1

Solution 6

(d)(iii)

Mark scheme

- 3 / three
- 1
- 0620/43
- October/November 2025

Solution 6

(d)(iv)

Mark scheme

- M1 $C = C$ (M2)
- displayed formula of but-2-ene
- OR
- 2

Solution 6

(e)(i)

Mark scheme

- M1 -NH_2 displayed **M2**
- -COOH displayed
- functional groups can be on either side
- 2

Solution 6

(e)(ii)

Mark scheme

- one circle around either amide linkage
- 1

(e)(iii)

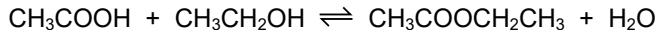
Mark scheme

- proteins
- 1

Question 14

0620/21 J25 ■ Q14 ■ 1 mark

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

Solution 14

Answer: **D**

Why

- The equation is written with a double arrow, so it proceeds in both directions.
- The ester and water can react back to give the acid and the alcohol.
- Esterification is a reversible condensation – not an addition or a reduction.

Question 36

0620/21 J25 ■ Q36 ■ 1 mark

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

Question 36

- C** alcohol
- D** carboxylic acid

Solution 36

Answer: **D**

Why

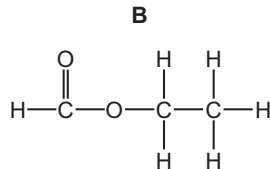
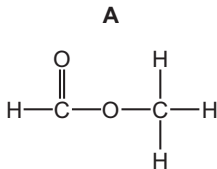
- Releasing carbon dioxide from a carbonate proves J is an acid.
- A pH of 3 means it is a *weak* acid, not a strong one.
- A water-soluble liquid weak acid is a carboxylic acid, such as ethanoic acid.

Question 33

0620/22 J25 ■ Q33 ■ 1 mark

33 Methanol reacts with ethanoic acid to form an ester.

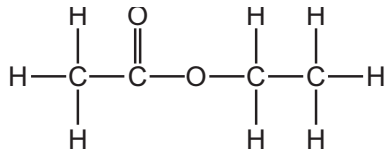
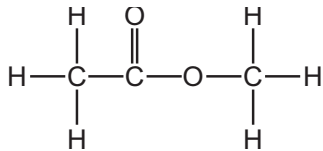
What is the displayed formula for this ester?



C

D

Question 33



Solution 33

Answer: **C**

Why

- The acid supplies the acyl part and the alcohol supplies the rest, with water lost between them.
- Ethanoic acid gives $\text{CH}_3\text{CO}-$ and methanol gives $-\text{OCH}_3$.
- So the ester is methyl ethanoate, $\text{CH}_3\text{COOCH}_3$, with three carbons in total.