Past-paper walk-through

Carboxylic acids ▪ 18.1

eXercise

Questions in this set

- 9701/11 N25 Q34 ▪ 1 mark
- 9701/11 N25 Q37 ▪ 1 mark
- 9701/12 N25 Q33 ▪ 1 mark
- 9701/12 N25 Q36 ▪ 1 mark
- 9701/12 N25 Q37 ▪ 1 mark

Question 34

9701/11 N25 ▪ Q34 ▪ 1 mark

34 Three mixtures are heated under reflux.

Which mixtures will produce sodium propanoate as one product?

1 CH_3CH_2CHO + $NaBH_4(aq)$

2 $CH_3CH_2CH_2OH$ + $Na(s)$

3 CH_3CH_2CN + $NaOH(aq)$

A 1, 2 and 3 **B** 1 and 2 only **C** 2 and 3 only **D** 3 only

Solution 34

Answer: **D**

Why

- Alkaline hydrolysis of a nitrile gives the sodium salt of the carboxylic acid, so mixture 3 works.
- $NaBH_4$ *reduces* propanal to propan-1-ol – no acid is formed.
- Sodium metal with an alcohol gives the alkoxide, sodium propoxide, not the propanoate.

Question 37

9701/11 N25 ▪ Q37 ▪ 1 mark

37 The table shows the reagents and products of three reactions.

	reagents	products
1	ethanoic acid + Na_2CO_3	$CH_3CO_2Na + H_2O + CO_2$
2	ethanoic acid + Mg	$(CH_3CO_2)_2Mg + H_2O$
3	ethanoic acid + CH_3OH	$CH_3CO_2CH_3 + H_2O$

Which rows are correct?

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

Solution 37

Answer: **C**

Why

- Reaction 1 is right: a carboxylic acid with a carbonate gives salt, water and carbon dioxide.
- Reaction 2 is wrong: a metal with an acid gives *hydrogen*, not water.
- Reaction 3 is right: acid plus alcohol gives an ester and water.

Question 33

9701/12 N25 ▪ Q33 ▪ 1 mark

33 $HOCH_2CHO$ is heated under reflux with an excess of acidified $K_2Cr_2O_7$ until there is no further reaction.

What is the final product of this reaction?

A HOOCCHO

B $HOCH_2COOH$

C HOOCCOOH

D $HOOCCH_2COOH$

Solution 33

Answer: **C**

Why

- The molecule has both a primary alcohol group and an aldehyde group.
- Excess acidified dichromate oxidises *both* of them to carboxylic acids.
- The final product is therefore ethanedioic acid, HOOCCOOH.

Question 36

9701/12 N25 ▪ Q36 ▪ 1 mark

36 Which organic starting material could be used in a single reaction to produce propanoic acid?

A ethanenitrile

B propan-2-ol

C propanal

D propyl ethanoate

Solution 36

Answer: **C**

Why

- Oxidising propanal gives propanoic acid in a single step.
- Propan-2-ol is a secondary alcohol, so it would give propanone, not an acid.
- Ethanenitrile has only two carbons, and propyl ethanoate hydrolyses to ethanoic acid.

Question 37

9701/12 N25 ▪ Q37 ▪ 1 mark

37 In four separate reactions, W, X, Y and Z, 1 mol of an organic compound reacts with an excess of a reagent.

	organic compound	reagent
W	$(CH_2COOH)_2$	Na
X	$CH_3CH(OH)CH_2COOH$	Na_2CO_3
Y	$CH_3CH(OH)CH_2COOH$	NaOH
Z	$CH(OH)(COOH)CH_2COOH$	Na

The volume of any gas produced is collected and measured. All gas volumes are measured at the same temperature and pressure.

What is the order of the reactions from greatest total volume of gas collected to least total volume of gas collected?

Question 37

	greatest volume → least volume			
A	W	Y	Z	X
B	W	Z	Y	X
C	Z	W	X	Y
D	Z	X	W	Y

Solution 37

Answer: **C**

Why

- Sodium metal reacts with *both* –OH and –COOH groups, giving $\frac{1}{2}$ mol H_2 per group.
- A carbonate reacts only with the –COOH, and NaOH gives no gas at all.
- Counting groups: Z gives 1.5 mol, W gives 1.0, X gives 0.5 mol CO_2 and Y gives none – so Z, W, X, Y.