Past-paper walk-through

Alcohols ▪ 16.1

eXercise

Questions in this set

- 9701/11 N25 Q33 ▪ 1 mark
- 9701/11 N25 Q39 ▪ 1 mark
- 9701/12 N25 Q32 ▪ 1 mark
- 9701/12 N25 Q35 ▪ 1 mark
- 9701/14 N25 Q33 ▪ 1 mark
- 9701/24 N25 Q3 ▪ 11 marks

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 33

9701/11 N25 ▪ Q33 ▪ 1 mark

33 The balanced equation for the reaction of X with an excess of acidified $K_2Cr_2O_7$ is shown.

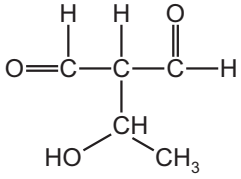
$$X + 3[O] \rightarrow Y + H_2O$$

Compound Y is the only organic product of the reaction.

Which compound is X?

A **B**

Question 33



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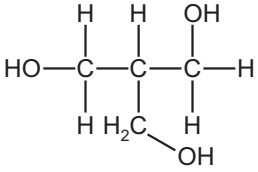

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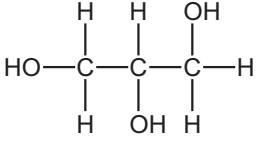
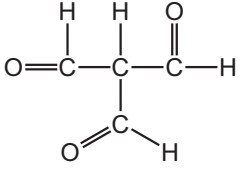




Question 33

Solution 33

Answer: **A**

Why

- Count the oxygens: three [O] used and one water released tells you how far the oxidation goes.
- A primary alcohol to an aldehyde uses one [O] and releases one water; the aldehyde to the acid uses another [O] with no water.
- Only the structure that takes exactly three [O] while losing exactly one water fits.

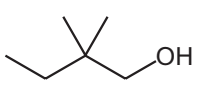
Question 39

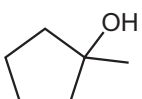
9701/11 N25 ▪ Q39 ▪ 1 mark

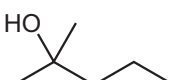
39 Some properties of compound X are listed.

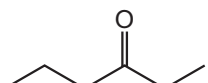
- 1.0 mol X reacts with exactly 8.5 mol oxygen when completely combusted.
- X does **not** react when heated with acidified $KMnO_4$.

What are the possible identities of X?









Question 39

1 2 3 4

A 1 and 3 **B** 2 and 4 **C** 3 only **D** 4 only

Solution 39

Answer: **B**

Why

- For $C_xH_yO_z$ the oxygen needed for complete combustion is $x + y/4 - z/2$.
- 8.5 mol fits $C_6H_{12}O$ $(6 + 3 - 0.5)$, so that is X's molecular formula.
- Of the candidates, only those that resist acidified $KMnO_4$ – a tertiary alcohol or a ketone – qualify.

Question 32

9701/12 N25 ▪ Q32 ▪ 1 mark

32 Which reaction mixture produces a primary alcohol as the major product?

A propanone with $NaBH_4$

B propene with steam in the presence of H_3PO_4

C butanoic acid with $LiAlH_4$

D ethene with hot concentrated acidified $KMnO_4$

Solution 32

Answer: **C**

Why

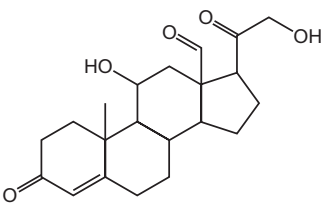
- $LiAlH_4$ reduces a carboxylic acid all the way to a primary alcohol.
- $NaBH_4$ on propanone gives a secondary alcohol, and steam on propene gives propan-2-ol, also secondary.
- Hot concentrated acidified $KMnO_4$ cleaves ethene's double bond rather than making an alcohol.

Question 35

9701/12 N25 ▪ Q35 ▪ 1 mark

35 The structure of a naturally occurring compound, Q, is shown.

compound Q



Compound Q is heated under reflux with an excess of acidified $KMnO_4$.

Organic product R is formed.

Question 35

Which row is correct?

	results of tests with compound Q	results of tests with organic product R
A	orange precipitate with 2,4-DNPH and no reaction with alkaline I_2(aq)	yellow precipitate with alkaline I_2(aq) and no reaction with Fehling's reagent
B	red precipitate with Fehling's reagent and no reaction with alkaline I_2(aq)	orange precipitate with 2,4-DNPH and no reaction with alkaline I_2(aq)
C	yellow precipitate with alkaline I_2(aq) and orange precipitate with 2,4-DNPH	no reaction with alkaline I_2(aq) and no reaction with Fehling's reagent
D	yellow precipitate with alkaline I_2(aq) and red precipitate with Fehling's reagent	yellow precipitate with alkaline I_2(aq) and orange precipitate with 2,4-DNPH

Solution 35

Answer: **B**

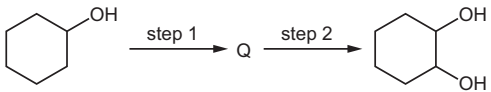
Why

- 2,4-DNPH gives an orange precipitate with any aldehyde or ketone.
- Alkaline iodine gives a yellow precipitate only for a CH_3CO– group, or a $CH_3CH(OH)$– that oxidises into one.
- So compare which of those fragments Q already has, and which appear only after the oxidation.

Question 33

9701/14 N25 ▪ Q33 ▪ 1 mark

33 Cyclohexanol is converted to cyclohexane-1,2-diol via a two-step synthesis that proceeds via intermediate Q.



Which row identifies the type of reaction in step 1 and in step 2?

	step 1	step 2
A	dehydration	oxidation
B	dehydration	nucleophilic substitution
C	reduction	oxidation
D	reduction	nucleophilic substitution

Question 33

D	reduction	nucleophilic substitution

Solution 33

Answer: **A**

Why

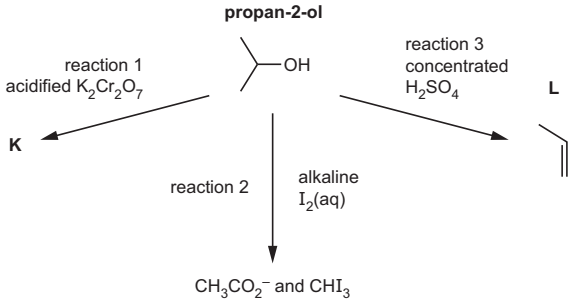
- Step 1 removes water from the alcohol to give cyclohexene – a dehydration.
- Step 2 adds two OH groups across that C=C using cold dilute manganate(VII) – an oxidation.
- Neither step is a reduction or a substitution.

Question 3

9701/24 N25 ▪ Q3 ▪ 11 marks

3 Propan-2-ol, $(CH_3)_2CHOH$, is sometimes added to fuel to help it burn.

Fig. 3.1 shows some reactions of propan-2-ol.



Question 3

Fig. 3.1

(a) (i) Draw the structure of organic compound **K**.

Question 3

[1]

(ii) State an observation you would make in reaction 2.

Question 3

(iii) State the type of reaction that is shown in reaction 3.

Question 3

(iv) Complete Fig. 3.2 to show the pi (π) bond in **L** that is formed from orbital overlap.

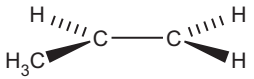
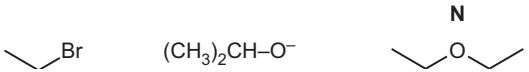


Fig. 3.2

[1]

(b) Propan-2-ol reacts with sodium to produce $(CH_3)_2CH–O^-$ anions.

These anions react with 2-bromopropane to form compound **N**, as shown in Fig. 3.3.



Question 3

Question 3

Fig. 3.3

(i) Write an equation for the reaction of propan-2-ol with sodium.

Question 3

(ii) The reaction of 2-bromopropane with $(CH_3)_2CH–O^-$ anions follows an S_N1 mechanism.

Complete Fig. 3.4 to show this mechanism. Include charges, dipoles, lone pairs of electrons and curly arrows, as appropriate.

Fig. 3.4

[3]

(iii) Suggest how the rate of the S_N1 reaction would change, if at all, if 2-chloropropane were used instead of 2-bromopropane.

Question 3

used instead of 2-bromopropane.

Question 3

. .

Explain your answer.

Question 3

(iv) **N** is also added to petrol to make it burn more smoothly.

Construct an equation for the complete combustion of **N**, $C_6H_{14}O$.

Question 3

[Total: 11]

Solution 3

(a)(i)

Mark scheme

- 1

(a)(ii)

Mark scheme

- yellow precipitate
- 1

Solution 3

(a)(iii)

Mark scheme

- elimination
- 1
- 9701/24
- October/November 2025

(a)(iv)

Mark scheme

- 1

Solution 3

(b)(i)

Mark scheme

- $(CH3)2CHOH + Na \rightarrow (CH3)2CHO(-)Na(+) + \ 1/2\ H2$
- 1

Solution 3

(b)(ii)

Mark scheme

- M1 correct dipole on $\delta+$C—Br$\delta-$ AND curly arrow from C—Br bond to Br M2
- intermediate M3
- curly arrow from lone pair of (CH3)2CHO– to C+
- 3

Solution 3

(b)(iii)

Mark scheme

- M1 rate would decrease M2
- C—Br is weaker (than C—Cl, so breaks more easily)
- 2

Solution 3

(b)(iv)

Mark scheme

- $C6H14O + 9O2 \rightarrow 6CO2 + 7H2O$
- 1