

91391



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Level 3 Chemistry 2021

91391 Demonstrate understanding of the properties of organic compounds

Credits: Five

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of the properties of organic compounds.	Demonstrate in-depth understanding of the properties of organic compounds.	Demonstrate comprehensive understanding of the properties of organic compounds.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

A periodic table and other reference material are provided in the Resource Booklet L3-CHEMR.

If you need more room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2–12 in the correct order and that none of these pages is blank.

Do not write in any cross-hatched area (///). This area may be cut off when the booklet is marked.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

QUESTION ONE

- (a) Complete the table below to show either the structural formula or the IUPAC (systematic) name for each organic molecule.

Structural formula	IUPAC (systematic) name
	2-methylbutanoic acid
$\text{CH}_3 - \text{CH}_2 - \overset{\text{O}}{\parallel} \text{C} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$	
	3-bromopentanoyl chloride
$\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \overset{\text{O}}{\parallel} \text{C} - \text{O} - \text{CH}_3$	

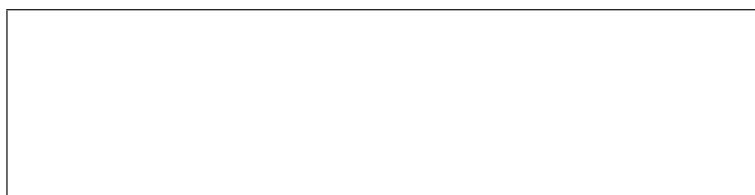
(b) $C_5H_{10}O_2$ can exist as a number of different constitutional (structural) isomers.

Draw the structural formulae for the isomers of $C_5H_{10}O_2$ that meet the following requirements:

(i) A straight-chain molecule that will form bubbles when reacted with Na_2CO_3 solution.



(ii) A branched-chain molecule with two different functional groups that cannot react with either MnO_4^-/H^+ or Na_2CO_3 solution.



(iii) A branched-chain molecule that smells pleasant and exists as enantiomers.



(iv) A straight-chain molecule that can decolourise bromine water, but cannot exist as geometric (*cis-trans*) isomers. It can react with $Cr_2O_7^{2-}/H^+$, but the resulting organic product will not form an orange-red solid when heated with Benedict's solution.



QUESTION TWO

(a) Use a chemical test to distinguish between each of the following pairs of organic molecules.

Your answer should include:

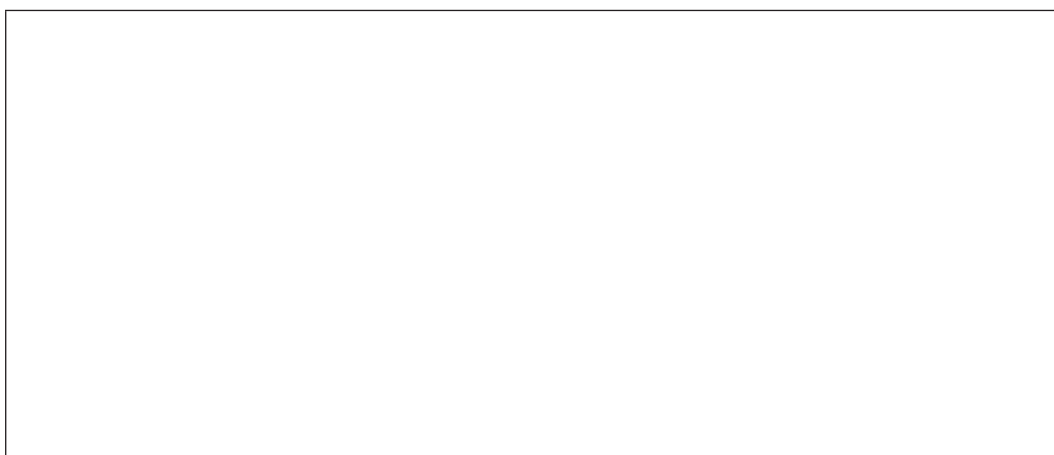
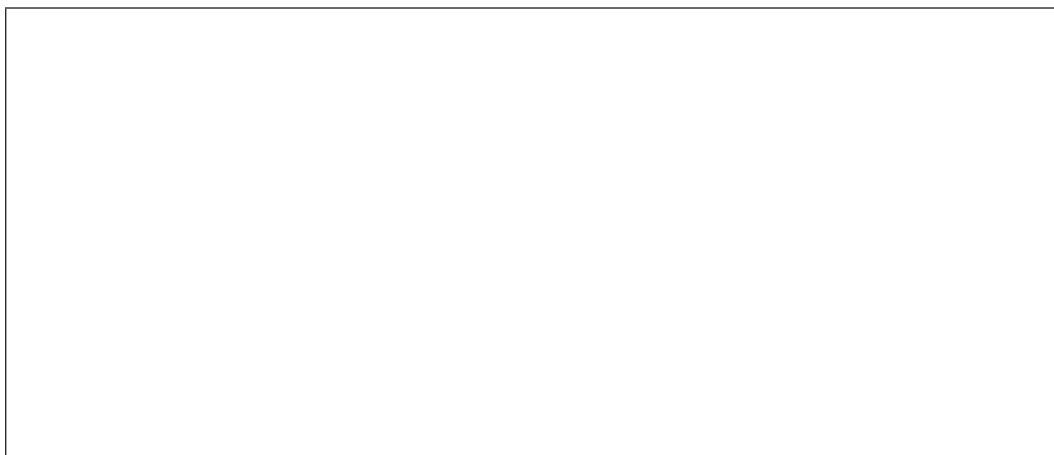
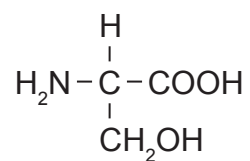
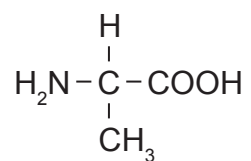
- the reagents and conditions required
- observations
- the reaction type used to distinguish each pair
- structural formulae of any organic products.

(i) propanoyl chloride and propanamide

(ii) propanal and propan-2-ol

(iii) methyl ethanoate and propene

- (b) Using the following two amino acids, draw the structural formulae for the two possible dipeptides that could be formed.



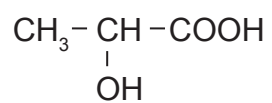
(c) Devise a reaction scheme to convert propanone into ethyl propanoate.

For each step include:

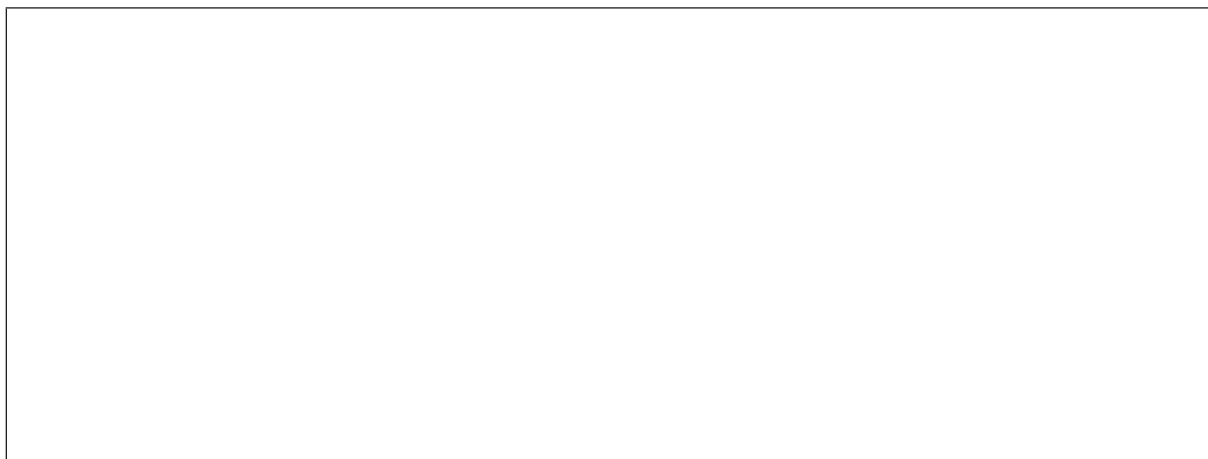
- the reagents and conditions
- the structural formula of the organic product after each step.

QUESTION THREE

- (a) 2-hydroxypropanoic acid, otherwise known as lactic acid, exists as enantiomers (optical isomers).



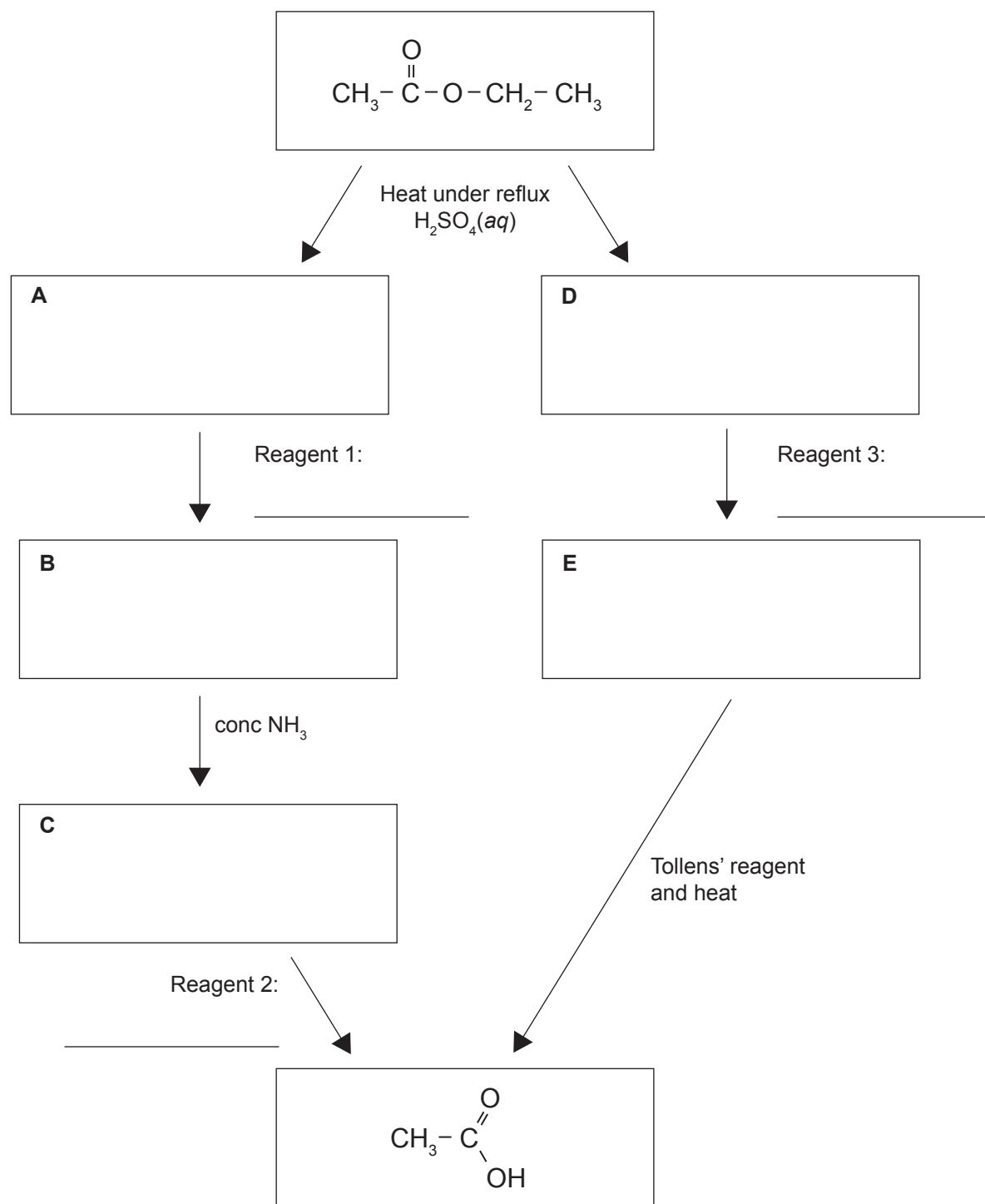
- (i) Draw the enantiomers of lactic acid in the box below.



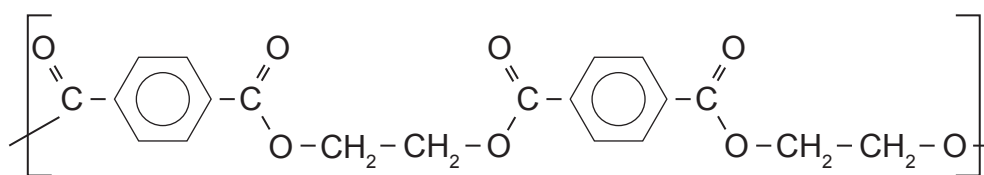
- (ii) Explain how the two enantiomers of lactic acid could be distinguished.

(b) The reaction scheme below has two pathways to CH_3COOH .

Complete the reaction scheme by drawing the structural formulae for organic molecules A, B, C, D, and E, and identifying reagents 1, 2, and 3, including any necessary conditions.



- (c) Polyethylene terephthalate (PET) is a polyester used to create fibres, film, and packaging. A section of PET, showing two repeating units, is given below:



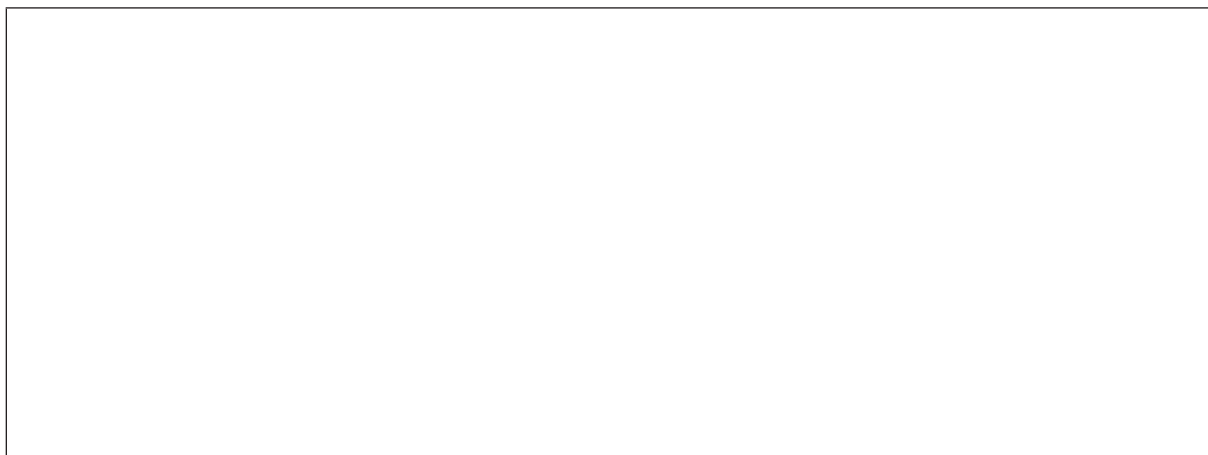
- (i) Circle ONE ester functional group.
- (ii) Elaborate on both the acidic and basic hydrolysis of PET.

Your answer should include:

- an explanation of a hydrolysis reaction
- the reagents and conditions required
- the structural formulae of the products from acidic and basic hydrolysis in the boxes provided.

Products from acidic hydrolysis:

Products from basic hydrolysis:



Extra space if required.
Write the question number(s) if applicable.

QUESTION
NUMBER

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