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Level 3 Chemistry 2020

91391 Demonstrate understanding of the properties of organic compounds

2.00 p.m. Friday 27 November 2020
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 is 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 and clearly number the question.

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

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

TOTAL

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QUESTION ONE

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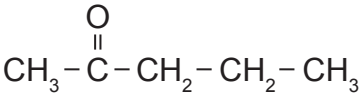
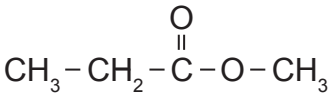
(a) (i) Complete the table below to show either the structural formula or the IUPAC (systematic) name for each organic molecule.

Compound	IUPAC (systematic) name	Structural Formula
A	3-chloropropanamide	
B		
C		
D	2-methylbutanal	

(ii) Describe and explain a chemical test to distinguish between compounds B and D from the table in part (i).

Your answer should include:

- reagents and conditions required
- observations
- the type of reaction occurring
- structural formulae of any organic product(s).

(b) Devise a reaction scheme to convert 1-bromobutane into butanoyl chloride.

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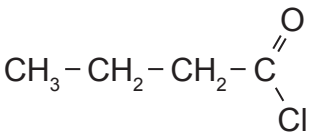

butanoyl chloride

For each step of the reaction scheme, include:

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

(c) Unknown **S** is a branched chain molecule with the molecular formula $C_5H_{10}O$. It shows the following properties and reactions:

- rapidly decolourises bromine water
- exists as enantiomers (optical isomers), but does not exist as *cis-trans* (geometric) isomers
- reacts with acidified potassium dichromate solution, $Cr_2O_7^{2-}/H^+$, to form Product **T**, which does not react with Benedict's reagent
- reacts with H_2O/H^+ to form two products, **U** and **V**. Product **V** is the major product.

Based on the information above, draw the structural formulae of Unknown **S**, and Products **T**, **U**, and **V**.

Organic molecule	Structural formula
S	
T	
U	
V	

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QUESTION TWO

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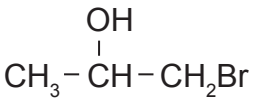
(a) 1-bromopropan-2-ol exists as enantiomers (optical isomers).



(i) Draw the enantiomers of 1-bromopropan-2-ol in the box below.

(ii) Why can 1-bromopropan-2-ol exist as enantiomers?

(iii) Explain how the two enantiomers of 1-bromopropan-2-ol could be distinguished.

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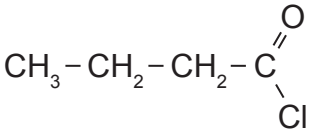
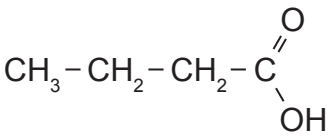
(b) Three bottles, each containing a different colourless liquid, have been incorrectly labelled. The three colourless liquids are known to be:

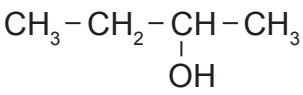
butanoyl chloride



butanoic acid



butan-2-ol



Develop a procedure to identify each of the three colourless liquids using only the following reagents:

- sodium carbonate solution, Na_2CO_3
- water, H_2O
- acidified potassium permanganate solution, $KMnO_4 / H^+$.

Your procedure should include:

- observations
- the type of reaction occurring
- structural formulae of any organic products.

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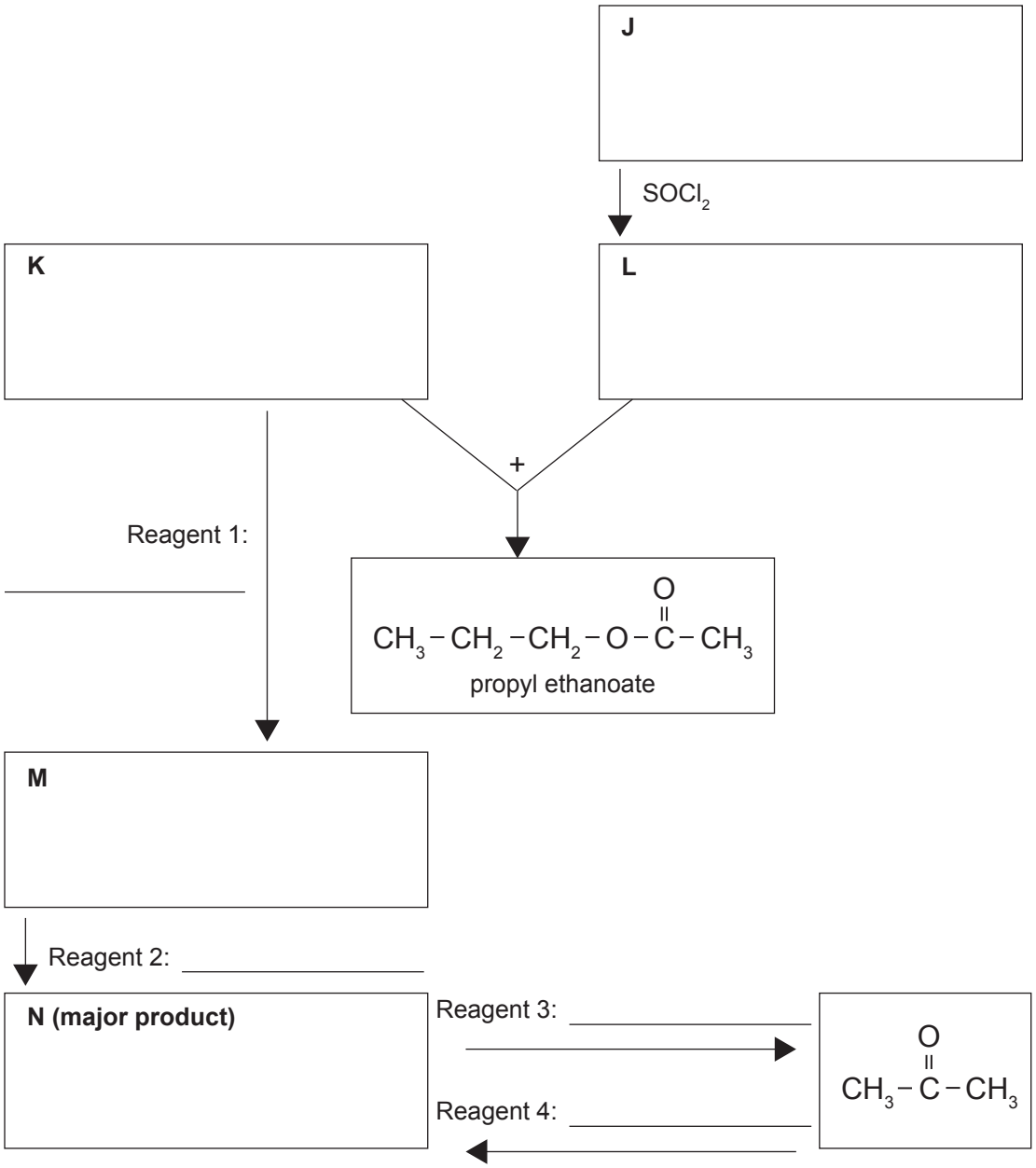
(c) Complete the following reaction scheme by drawing the structural formulae for organic molecules **J**, **K**, **L**, **M**, **N**, and identifying reagents 1, 2, 3, and 4.



QUESTION THREE

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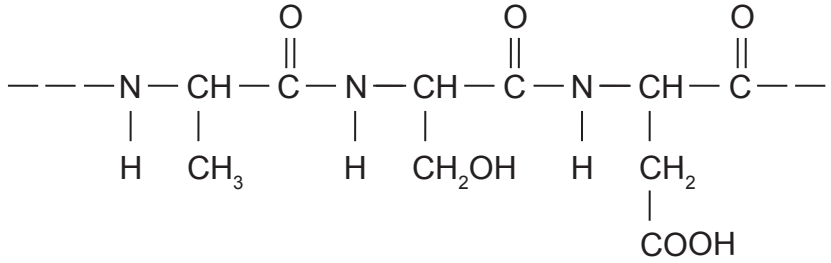
Polypeptides are made up of amino acids.

(a) **Circle** one of the peptide (amide) bonds shown in the section of the polypeptide chain below.



(b) (i) Using the following amino acids, draw the TWO possible dipeptides that could be formed.

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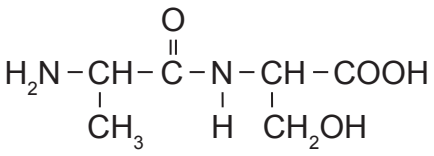
(ii) Compare and contrast the acidic and basic hydrolysis of the dipeptide shown below.



Your answer should include:

- a description of a hydrolysis reaction
- reagents and conditions required
- structural formulae of the products from BOTH acidic and basic hydrolysis.

Products from acidic hydrolysis	Products from basic hydrolysis

Question Three continues on the following page.

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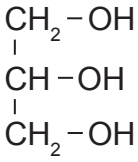
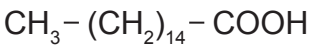
(c) (i) Draw the structural formula of the triglyceride that would be formed from glycerol and the fatty acid, palmitic acid, provided below.



glycerol



palmitic acid

(ii) Explain why this is a condensation reaction.

(iii) The triglyceride formed in (c)(i) can be hydrolysed by heating under reflux in either acidic or basic conditions.

Outline the advantages of heating under reflux when hydrolysing a triglyceride.

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

QUESTION NUMBER

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