Chemistry Department
Christ Church Grammar School

Year 12
2021

Organic Topic Test

Time allowed: 45 minutes

Instructions
Please ensure you enter your name and circle your teacher's initials below.
Scientific calculators only. Chemistry Data Sheet will be provided

Name

ANSWERS

Teacher: (circle)

DGM JPT NMO

Mark:_____ / ~~45~~ 42

Section 1: Multiple Choice (Total 10 marks)

1. How many isomers are there for a saturated hydrocarbon with molecular formula C_5H_{10}?

A. 2
B. 3
C. 4
D. 5

2. Cyclobutanol can be oxidised by acidified potassium dichromate solution to form

A. cyclobutanoic acid
B. cyclobutanal
C. cyclobutanone
D. cyclobutanol is resistant to oxidation

Questions 3 and 4 refer to the compounds, numbered I to IV, below.

I. $CH_3CH_2CH_2CH_2COOH$
II. $CH_3CH_2CH_2CH_2CH_2OH$
III. $CH_3CH_2CH_2CH_2CHO$
IV. $CH_3CH_2CH_2CH_2CH_3$

3. Which one of the following lists the compounds in order of decreasing solubility in water?

A IV>III>II>I
B I>II>III>IV
C I>III>II>IV
D II>I>III>IV

4. Which two compounds can react to form an ester?

A I and II
B I and III
C II and III
D I and IV

D C D
C A D
B C
A C

5. Which of the following has an empirical formula different to the other three substances?

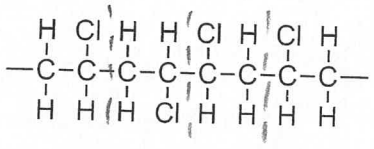
A. glucose, $C_6H_{12}O_6$ → CH_2O

B. ethanoic acid $C_2H_4O_2$ → CH_2O

C. methyl ethanoate → $C_3H_6O_2$

D. methanal → CH_2O

6. Choose the monomer that could form the polymer, part of which is shown below:



A. $CHClCH_2$

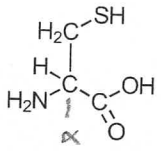
B. $CH_2ClCHCH_2$

C. CCl_2CH_2

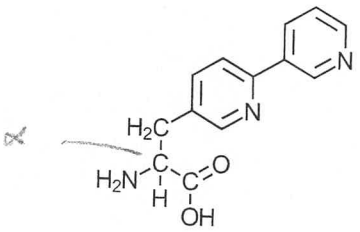
D. CH_2CH_2CHCl

7. Which of the following is not an α-amino acid:

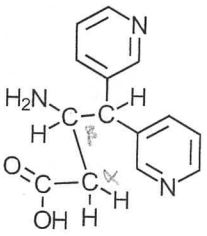
A.



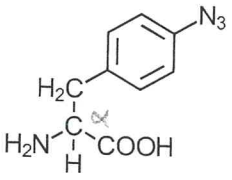
B.



C.



D.



8. Which of the following statements about soap and the soap making process (saponification) is FALSE?

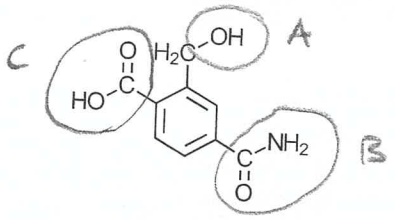
A. The starting material that soap is made from is a triester.

B. The unadjusted pH of soap is greater than 7.

C. Magnesium propanoate is a soap.

D. Glycerol is a product of saponification.

9. Which functional group listed does not appear in the molecule below?



A. alcohol
B. amide
C. carboxylic acid
D. ketone

10. Which of the following are possible oxidation products of propan-1-ol?

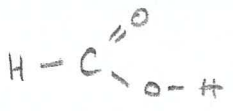
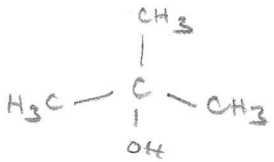
I. C_3H_7OH
II. CH_3CH_2CHO
III. CH_3CH_2COOH
IV. CO_2 and H_2O

A. I and II
B. II and III
C. I and III
D. II, III and IV

Section 2: Short Answer **35 marks**

Question 11 **10 marks**

Name and **draw** full structural formula to represent the following substances;

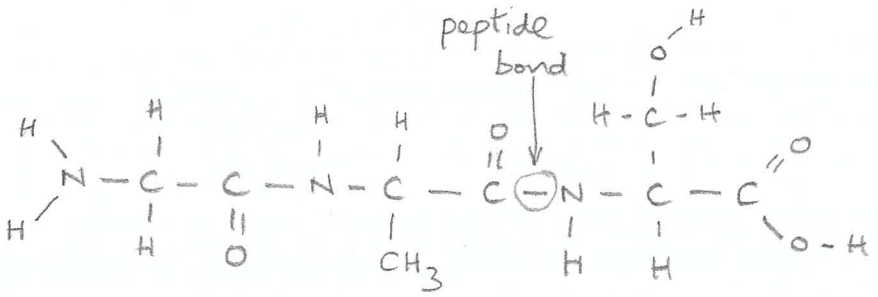
The product of reacting methanol with an **excess** of acidified potassium dichromate	 Name methanoic acid.
An isomer of propanal that is resistant to oxidation	 Name propanone
A cyclic isomer of methylpropene	 or  methylcyclopropane Name cyclobutane
The organic product of reacting 1 mole of benzene with 1 mole of bromine with a suitable catalyst	 Name bromobenzene
A tertiary alcohol which is a structural isomer of butan-1-ol	 Name methylpropan-2-ol. although WACE want 2-methylpropan-2-ol.

Question 12

4 marks

a) Draw the tripeptide formed by the α-amino acids Gly-Ala-Ser in the space below.

(3 marks)



zwitterion form is also fine.

b) Clearly label the peptide bond between Ala and Ser on the structure you have drawn above.

(1 mark)

Question 13

6 marks

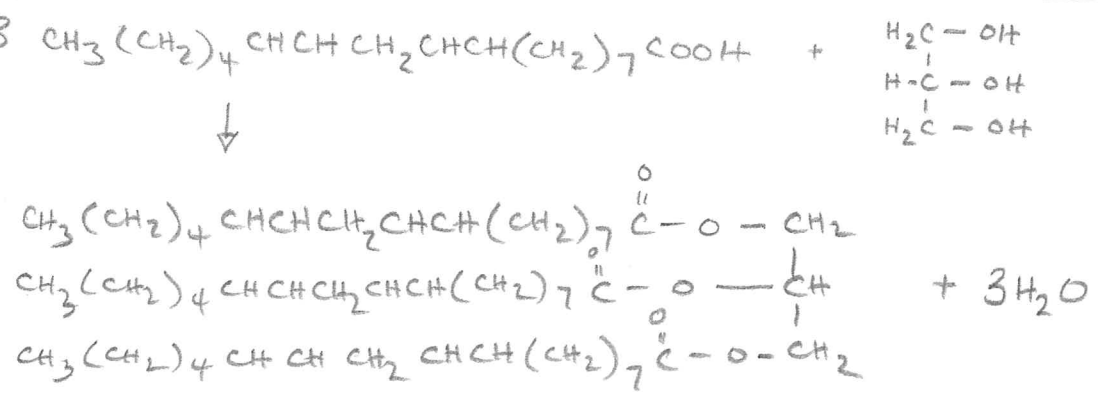
When oils and fats are not metabolized by the body, the body stores these as triglycerides. One component of a food oil is shown below:

$$CH_3(CH_2)_4CHCHCH_2CHCH(CH_2)_7COOH$$

a) The substance above would be referred to as a fatty acid.

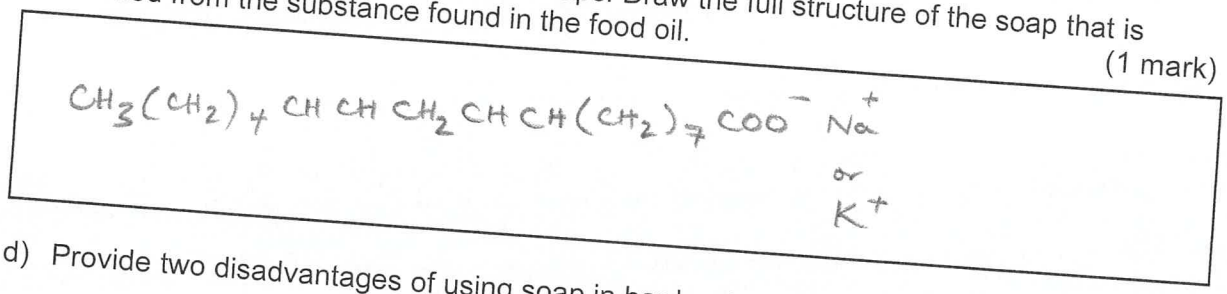
(1 mark)

b) Write a reaction showing the formation of the triglyceride formed in the body from the substance above



(2 marks)

c) Triglycerides can be used to make soaps. Draw the full structure of the soap that is formed from the substance found in the food oil. (1 mark)



d) Provide two disadvantages of using soap in hard water areas. (2 marks)

1. More required to have the same cleaning action.

2. Formation of scum - causes issues with laundering of textiles.

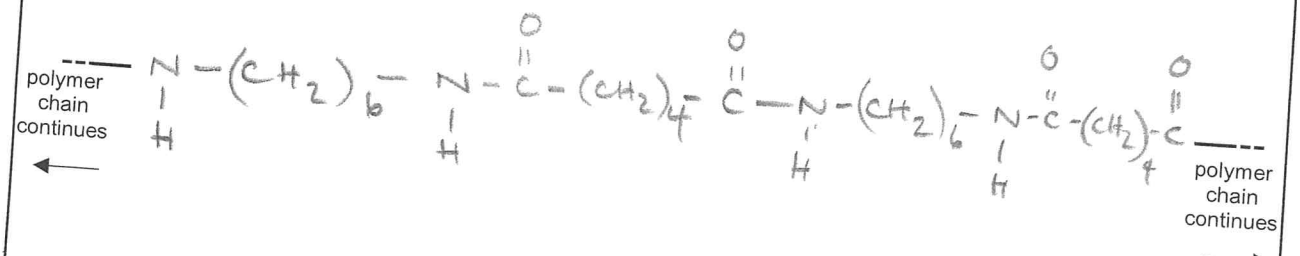
Question 14

The monomers for nylon-6,6 are given below. **(5 marks)**

$H_2N-(CH_2)_6-NH_2$ (hexamethylenediamine)

$HOOC-(CH_2)_4-COOH$ (adipic acid)

a) Draw two repeating units for the polymer that would be produced by the reaction of these two monomers. Draw any new bonds formed in full.



- correct # of repeating units
- amide groups correct
- bonds formed correct

deduct 1 per error.

(3 marks)

b) Nylon-6,6 is classified as a condensation polymer. Other polymers like polyethene are addition polymers. Give two features that distinguish between the monomers used in each.

(2 marks)

Addition monomers have a carbon-carbon double bond ✓

Condensation monomers possess two functional groups that will react, bonding together and eliminating a small/water molecule. ✓

Question 15 **(10 marks)**

An excess of a substance **W** with the molecular formula C_3H_8O was added to an acidified solution of sodium dichromate. Two new organic substances **X** and **Y** were isolated from the resulting mixture.

When **W** and **X** were added to each other and acidified, a new substance **Z** was produced. The boiling points of **W**, **X** and **Y** were also measured.

a) Write a fully balanced redox equation for the reaction of **W** with acidified dichromate to produce **Z**.

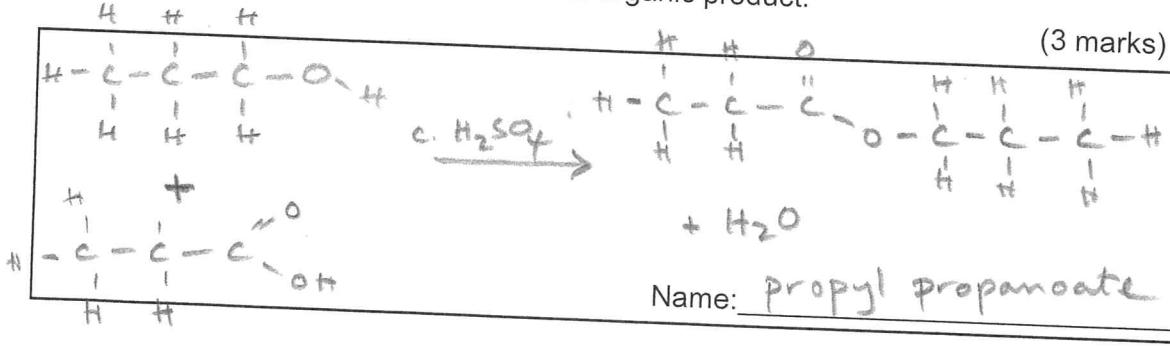
(3 marks)

Oxidation	$(CH_3CH_2CH_2OH + H_2O \longrightarrow CH_3CH_2COOH + 4H^+ + 4e^-) \times 3$
Reduction	$(Cr_2O_7^{2-} + 14H^+ + 6e^- \longrightarrow 2Cr^{3+} + 7H_2O) \times 2$
Overall	$3CH_3CH_2CH_2OH + 2Cr_2O_7^{2-} + 16H^+ \longrightarrow 3CH_3CH_2COOH + 4Cr^{3+} + 11H_2O$

Apologies. One letter makes all the difference. REMOVED.

b) Write the equation for the reaction of **W** with **X**, showing full structures for all organic substances and provide the name of the organic product.

(3 marks)



Name: propyl propanoate

c) Explain why the boiling point of ethanol would be higher than that of ethanal.

(4 marks)

The intermolecular forces present in ethanol are dispersion, dipole-dipole and hydrogen ✓ bonding. Those present between molecules of ethanal are dispersion and dipole-dipole ✓ forces.

As the molecules have a similar number of electrons ✓, the summation of forces present between molecules of ethanol are stronger than those in ethanal and so the energy required to break these forces is larger ✓ leading to a higher boiling point.

END OF TEST