Australian Islamic College 2020

ATAR Chemistry Units 3 and 4

Task 8A (Weighting: 2%)

Organic Chemistry Test 1

Test Time: 25 minutes

Please do not turn this page until instructed to do so.

First Name	Surname
ANSWERS	

Teacher

Mark / 25	Percentage

Equipment allowed: Pens, pencils, erasers, whiteout, correction tape, rulers and non-programmable calculators permitted by the Schools Curriculum and Standards Authority.

Special conditions:

2 marks will be deducted for failing to write your full name on this test paper.

Teacher help: Your teacher can only help you during your test in one situation.

> If you believe there is a mistake in a question show your teacher and your teacher will tell you if there is a mistake in the question and if appropriate, how to fix that mistake.

Spelling of Science words must be correct. Unless otherwise indicated, science words with more than one letter wrong (wrong letter and/or wrong place) will be marked wrong.

Unless otherwise stated, **equations** must be written balanced and with correct state symbols or they will be marked wrong.

Questions must be answered in this booklet.

Total marks: 25

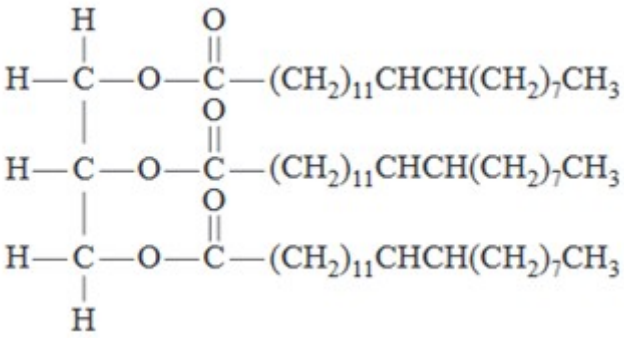
PART ONE: MULTIPLE CHOICE QUESTIONS (3 MARKS)

Circle the correct answer on this page.

1. A student wants to use a physical property to distinguish between two alcohols, octan-1-ol and propan-1-ol. Both alcohols are colourless liquids at standard laboratory conditions (SLC).
   The student should use
   a. Density because propan-1-ol has a much higher density than octan-1-ol.
   b. <u>Boiling point because octan-1-ol has a higher boiling point than propan-1-ol.</u>
   c. Electrical conductivity because octan-1-ol has a higher conductivity than propan-1-ol.
   d. Spectroscopy because it is not possible to distinguish between the alcohols using their physical properties.

2. How many structural isomers are there with the molecular formula $C_5H_{11}Br$?
   a. 6
   b. 7
   c. <u>8</u>
   d. 9

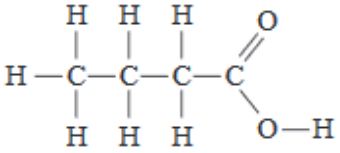
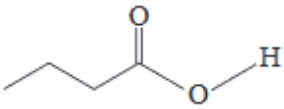
3. Which two words most correctly describe the molecule shown below?



   a. Alcohol, carboxylic acid.
   b. Glycerol, lipid.
   c. <u>Ester, triglyceride.</u>
   d. Fatty acid, soap.

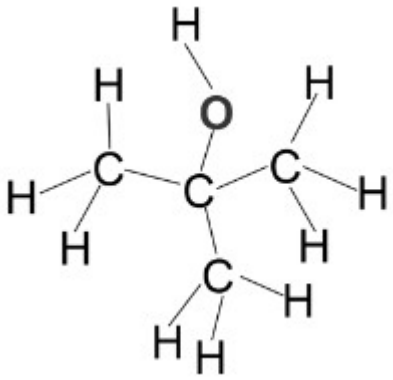
PART TWO: SHORT ANSWER QUESTIONS (22 MARKS)

1. The following table shows different representations of organic molecules, using butanoic acid as an example.
   Refer to the ways that organic molecules can be represented when answering this question.

Formula	Representation
molecular formula	$C_4H_8O_2$
structural formula	
semi-structural (condensed) formula	$CH_3CH_2CH_2COOH$ or $CH_3(CH_2)_2COOH$
skeletal structure	

a. Draw the structural formula of 2-methylpropan-2-ol.

(1 mark)



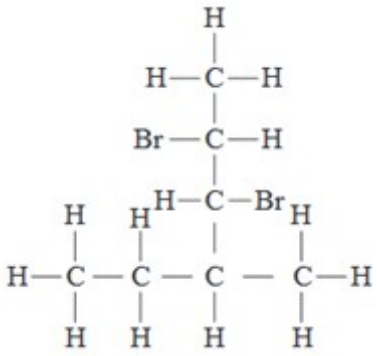
Marker: All atoms and all bonds must be drawn. Bond angles need not be correct. No part marks.

b. Give the molecular formula of but-2-ene.

(1 mark)

C_4H_8

No part marks.



c. Give the IUPAC name of the compound that has the structural formula shown above.

(1 mark)

2,3-dibromo-4-methylhexane

Marker: All parts of the name must be correct, including commas and hyphens. No part marks.

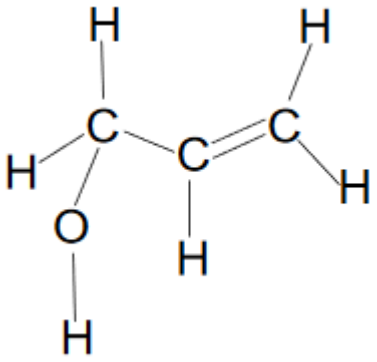
d. Write the semi-structural formula for the structural isomer of propanal that is a ketone.

(1 mark)

CH_3COCH_3 (also accept H_3CCOCH_3)
No part marks.

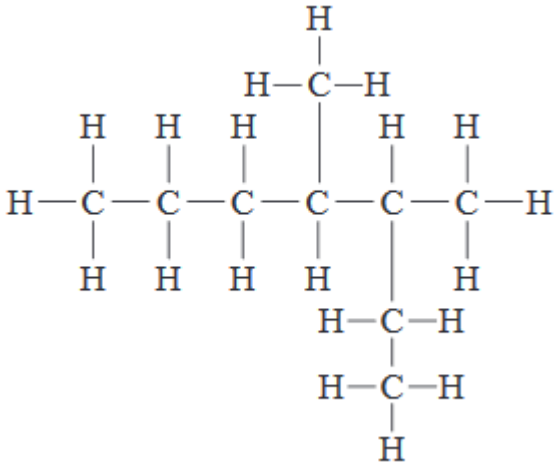
e. Draw the structural formula of another structural isomer of propanal that is not a ketone or an aldehyde.

(1 mark)



Marker: All atoms and all bonds must be drawn. Bond angles need not be correct. No part marks.
Hydroxyl group can be on any carbon.

Note: Also accept the structural formula of cyclopropanol.

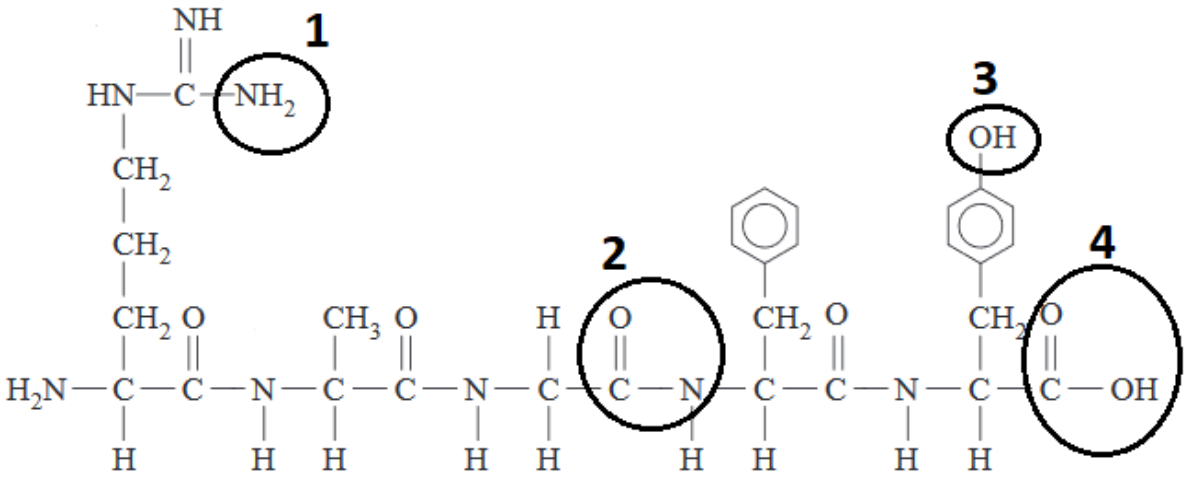


f. Give the IUPAC name of the compound with the structural formula shown above.

(1 mark)

3,4-dimethylheptane
Marker: All parts of the name must be exactly correct, including commas and hyphens and with no spelling mistakes. No part marks.

2. Substance P is a molecule found in the human body. It is associated with inflammation and pain.
The structure of substance P is shown below.



Name the numbered functional groups. Spelling must be exactly correct.

(4 marks)

Functional group 1:

Amine / Amino

Functional group 2:

Amide

Functional group 3:

Alcohol / Hydroxy / Hydroxyl

Functional group 4:

Carboxylic acid / Carboxyl

Marker: Spelling must be exactly correct. No part marks.

3. Mixtures of propan-2-ol and propanone can be separated by distillation due to their different boiling points. Explain why these compounds have such different boiling points even though they have very similar molar masses.

(3 marks)

Description	Marks
Recognition that dispersion forces in the two substances are similar	1
Recognition that predominant IMF in propanone is dipole-dipole forces and in propan-2-ol is hydrogen bonding	1
Recognition that hydrogen bonding is stronger than dipole-dipole forces	1
Total	**3**

4. List butane, butan-2-ol and butanone from most soluble to least soluble in water.

(1 mark)

Butan-2-ol, butanone, butane.
No part marks.

5. Ethanol and methanol are completely miscible (soluble) in water.
   a. By referring to any intermolecular forces present, describe the dissolving process as ethanol is added to water.

(3 marks)

Description	Marks
H bonds,(dipole-dipole) and dispersion forces between water molecules are disrupted	1
H bonds, dipole-dipole and dispersion forces between ethanol are disrupted	1
New H bonds, dipole-dipole and dispersion forces are formed between ethanol and water molecules Note: any discussion including energy or strength of bonds acceptable but not required for full marks	1
Total	**3**
Note: For full marks evidence of disruption of existing forces and formation of new forces must be demonstrated. Alternative response Disruption of pre-existing hydrogen bonds between water molecules and between ethanol molecules and formation of new hydrogen bonds between water and ethanol molecules – one mark Similar statement for dipole-dipole forces – one mark Similar statement for dispersion forces – one mark	

   b. Explain what happens to the solubility of alcohols in water as the hydrocarbon chain length increases.

(3 marks)

Description	Marks
The solubility of alcohol in water decreases as the hydrocarbon chain length increases	1
The longer the chain length of an alcohol, the greater the strength of the dispersion forces between the molecules	1
The difference between the energy released in the formation of new forces of attraction and the energy required to overcome the existing forces of attraction increases	1
Total	**3**

c. For each of the following substances, list all force/s of attraction formed between the solute and the solvent when each substance dissolves in water.

(2 marks)

Substance	Force/s of Attraction With Water
Propanal	**Hydrogen bonding, dipole-dipole forces, dispersion forces.**
Methanoic acid	**Hydrogen bonding, dipole-dipole forces, dispersion forces.**

Marker: One mark each. All forces of attraction for each substance must be stated for the mark to be awarded.