PERTH MODERN SCHOOL

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INDEPENDENT PUBLIC SCHOOL

YEAR 12 CHEMISTRY

TEST 4 Answers

Organic Chemistry Question/Answer Booklet

STUDENT NAME _____

TEACHER _____

Recommended time: 55 minutes

Materials provided for this test

- **Test booklet**
- **Multiple-choice Answer sheet**
- **Chemistry Data Sheet**

STRUCTURE OF THIS TEST

Section One:	**15 Multiple- choice questions**	**15 marks**
Section two:	**7 Short answer questions**	**39 marks**
Section three:	**1 Extended answer question**	**6 marks**

Section One: Multiple-choice answers

.

1	A	B	C	D
2	A	B	C	D
3	A	B	C	D
4	A	B	C	D
5	A	B	C	D
6	A	B	C	D
7	A	B	C	D
8	A	B	C	D
9	A	B	C	D
10	A	B	C	D
11	A	B	C	D
12	A	B	C	D
13	A	B	C	D
14	A	B	C	D
15	A	B	C	D

Section 2: Short Answer. **(40 marks)**

Answer **all** questions. Write your answers in the spaces provided.

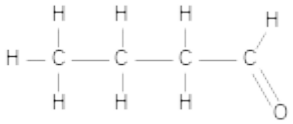
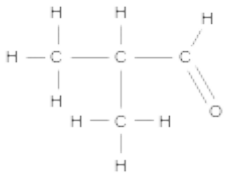
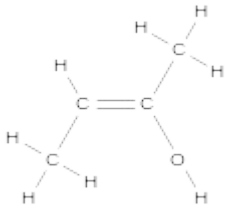
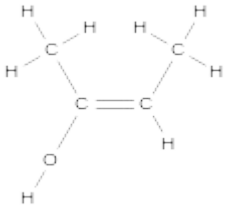
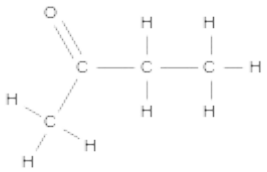
16. Complete the table below by giving a brief description of a chemical test that could be used to distinguish between propan-2-one and propanal.

    List the observations relating to the test for both propan-2-one and propanal.

Description of simple test. Add acidified oxidising agent
Observations for propan-2-one Solution remains • Purple if acidified permanganate added • Orange if acidified dichromate added
Observations for propanal Solution turns • From purple to colourless/pale pink if permanganate added • From orange to green if acidified dichromate added

Description	Marks
Addition of acidified permanganate of acidified dichromate (must be acidified)	1
Observation for substance 1 must state the initial colour remains unchanged – must mention actual colour	1
Observation for substance 2 must state initial and final colours	1
Total	3

17. C_4H_8O has several isomers. Complete the table below by drawing the isomers. Show **all** of the H atoms in your structures. Give the IUPAC name for the structures you have drawn.
(9 marks)

Two structural isomers that are both aldehydes		
Names:	Butanal	2-methylpropanal
Two geometric isomers that are both alcohols	 ***	 ***
	trans isomer	cis isomer
A straight chain saturated isomer that is not an aldehyde		
Name:	Butanone	

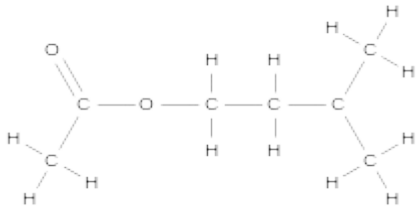
*** There are two other pairs of isomers that are correct as well. Any cis & trans versions of the following are correct:

- But-2-en-2-ol (shown above)
- But-2-en-1-ol
- But-1-en-1-ol

Description	Marks
One mark each for correctly drawn structural formulas with all H shown. (aldehydes and the ketone)	3
Correctly drawing both geometric isomers with all H shown	2
Correctly putting the trans and cis isomers in the correct space on the table	1
Correctly naming 3 compounds - both aldehydes and the ketone	3
Total	9

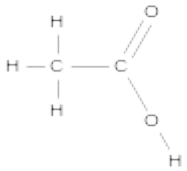
18. The compound that is responsible for the odor of candy bananas is 3-methylbutylethanoate.

(a) Draw the structure of 3-methylbutylethanoate. Show **all** of the H atoms in your structures.

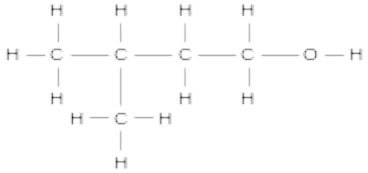


Description	Marks
Correctly drawn structure with a H shown	2
Structural formula with methyl group on wrong C	1
Structure with alkyl group and caboxylate group reversed	1
Total	2

(b) Draw and give the IUPAC names for the two compounds that can be used to synthesize this compound



AND



ethanoic acid

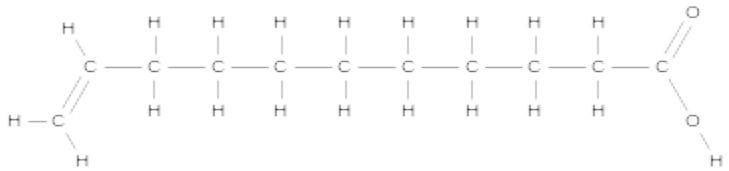
3-methylbutan-1-ol

Description	Marks
Correctly drawn structure with a H shown	2
Structural formula with methyl group on wrong C on alcohol	1
Correctly name both compounds	2
Total	4

19. Undecylenic acid ($C_{11}H_{20}O_2$) is an active ingredient in medications for skin infections, and is used to

relieve itching, burning, and irritation associated with skin problems such as athlete's foot and ringworm.

(a) It is a straight chain unsaturated carboxylic acid that is not able to form geometric isomers. Using this information draw the structural formula of this molecule showing all atoms and all bonds.



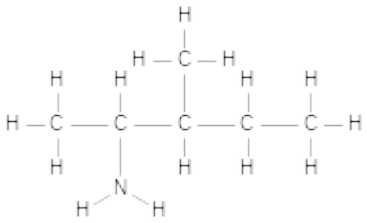
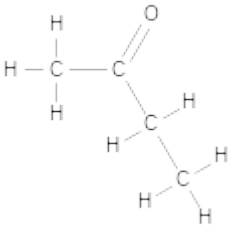
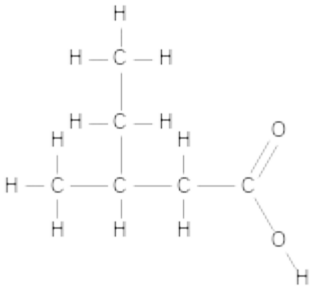
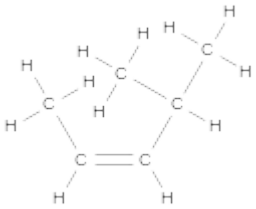
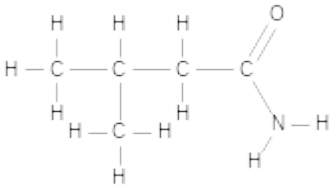
Description	Marks
Correctly drawn structure with all H atoms shown and = bond on C_1	2
Structural formula with less than 11 C	1
Total	2

(b) Describe a simple test with observations that could be used to distinguish between undecylenic acid ($C_{11}H_{20}O_2$) and undecanoic acid ($C_{11}H_{22}O_2$) .

Description	Marks
Test – Add either bromine water or iodine water	1
Observation in Undecylenic acid Bromine water orange to colourless OR Iodine water brown to colourless	1
Observation in Undecylenic acid Bromine water remains orange OR Iodine water remains brown	1
Total	3

20 Complete the table below by either naming the compound whose structural formula has been given

or use the name to draw the structural formula of the compound.
Show **all** of the H atoms in your structures.

Name	Structural formula
3-methylpentan-2-amine	
Butanone	
3-methylpentanoic acid	
cis-4-methylpent-2-ene	
3-methylbutanamide	

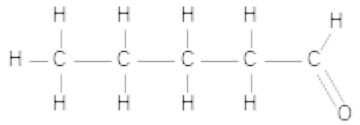
Description	Marks
Correctly drawn structures with all H atoms shown	2
Correctly named compounds	3
Total	5

21. A pure **straight chain** saturated compound with the molecular formula $C_5H_{10}O$ is treated with

2017

acidified potassium permanganate.

(a) Name and draw a possible structure of the compound that is oxidised by the acidified potassium permanganate. The isolated product of this oxidation reaction will produce a solution with a pH < 7.



pentanal

Description	Marks
Correctly drawn structure with a H shown	1
Correctly named compound	1
Total	2

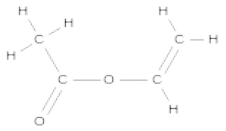
(b) Write the balanced redox equations for this reaction

Description	Marks
Oxidation half- equation $CH_3CH_2CH_2CH_2CHO + H_2O \rightarrow CH_3CH_2CH_2CH_2COOH + 2H^+ + 2e^-$	2
Total	2

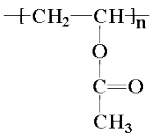
Description	Marks
Reduction half- equation $MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$	1
Total	1

Description	Marks
Overall balanced equation $2MnO_4^- + 5\ CH_3(CH_2)_3CHO + 6\ H^+ \rightarrow 5\ CH_3(CH_2)_3COOH + 2\ Mn^{2+} + 3\ H_2O$	2
Balanced overall equation using one incorrect ½ equation or 1 omission	1
Total	2

22. A commonly used polymer is polyvinyl acetate (PVA) and as an <u>emulsion</u> in water is commonly referred to as wood glue. Paper and textiles often have coatings made of PVA and other ingredients to make them shiny.
Polyvinyl acetate is made from the monomer shown below

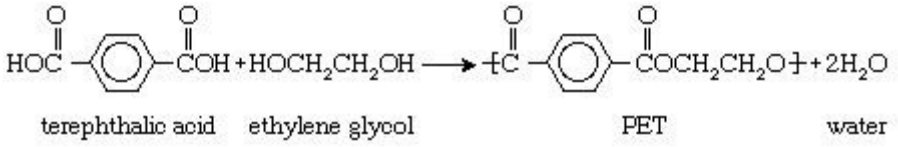


(a) Draw three units in the polymer formed from this monomer.



Description	Marks
3 repeating units with brackets	2
3 repeating units without brackets	1
Total	2

Polyethylene terephthalate is another frequently used polymer that is formed by combining two monomers: ethylene glycol and purified terephthalic acid. The equation for the process is shown below.



There are many different uses for PET. One of the most common is for drink bottles, including soft drink bottles.

(b) List two physical properties of polyethylene terephthalate that make it suitable for use as a container for soft drinks.

Description	Marks
Any two of the following • Transparent • Chemically inert • Strong • Lightweight • Low permeability to gases	2
Total	2

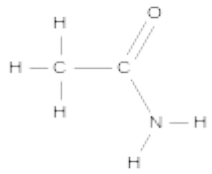
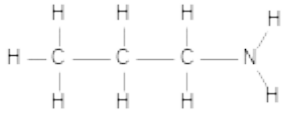
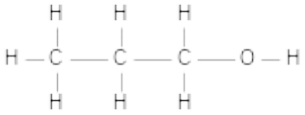
(c) What type of polymerisation reaction occurs to form the polymer from the above monomers?

Description	Marks
Condensation	1

Section Three: Extended answer **(5 marks)**

23. Amides have a significantly higher boiling point than amines and carboxylic acids that have similar

molar masses.
This is illustrated in the table below.

Compound type	Example	Molar mass ($g\ mol^{-1}$)	Boiling point ^0C
Amide	 ethanamide	59.1	221.2
Amine	 propanamine	59.1	48.5
Carboxylic Acid	 propan-1-ol	60.1	97.2

Use the data in the table, and your understanding of intermolecular forces, to <u>infer</u> the type and <u>relative</u> strength of intermolecular forces that occur in these substances.
Explain how you used the data to make your conclusions.

(5 marks)

Description	Marks
• All have H bonding – this can be shown on a correctly labelled diagram.	1
• Propanol has a higher bp than propanamine. The O-H dipole on propanol is stronger than N-H dipole on propanamine.	1
• Stronger intermolecular forces require more **energy** to break intermolecular forces which means higher boiling point.	1
• Ethanamide has two sites for H-bonding between N-H and C=O on neighbouring molecules. The C=O site is also referred to as site for dipole -dipole interaction.	1
• There are stronger intermolecular force of attraction between molecules then either propanamine or propanol therefore more energy to break intermolecular forces – higher boiling point	1
Total	5