MONYETLA BURSARY PROJECT

ORGANIC CHEMISTRY: PHYSICAL PROPERTIES

GRADE 12

FS SEPT 2025

QUESTION 3 (Start on a new page.)

The boiling points of four organic compounds are shown in the table below.

COMPOUND		BOILING POINT (°C)	MOLAR MASS ($g \cdot mol^{-1}$)
A	CH_3CH_2COOH	141,1	74
B	$CH_3(CH_2)_3OH$	....	74
C	$CH_3CH(CH_3)CH_2OH$	108	74
D	$CH_3COCH_2CH_3$	79,6	72

3.1 Define the term *boiling point*. (2)

3.2 Compounds **C's** boiling point is lower than that of compound **B**. Fully explain. (3)

3.3 Consider compounds **A**, **B** and **D**.

3.3.1 Predict the value of the boiling point of compound **B** in °C. Choose from:

145	141	117,7

(1)

3.3.2 Fully explain the answer to QUESTION 3.3.1. (6)

3.4 The vapour pressures of three straight-chained alkanes **E**, **F** and **G** are shown below.

COMPOUND		VAPOUR PRESSURE at 25 °C (kPa)
E	C_2H_6	4 187
F	C_3H_8	1 050
G	C_4H_{10}	250

3.4.1 Write the IUPAC NAME of the compound with the highest BOILING POINT. (2)

3.4.2 Fully explain the trend in the vapour pressure from compound **E** to compound **G**. (3)
[17]

GAU SEPT 2025

QUESTION 3 (Start on a new page.)

During an investigation, a table of data was collected for four organic compounds **A, B**, **C** and **D**. The compounds have different functional groups.

	COMPOUND	MOLAR MASS	BOILING POINT (°C)
A	$CH_3CH_2CH_2CH_2CH_3$	72	36,1
B	$CH_3CH_2CH_2CHO$	72	74,8
C	$CH_3COCH_2CH_3$	72	79,64
D	CH_3CH_2COOH	74	163,5

3.1 Define the term *boiling point*. (2)

3.2 In the investigation above, name the independent variable. (1)

3.3 Explain the trend in the boiling points among **A**, **B**, and **C** as shown in the table above. (4)

3.4 Which compound, **C** or **D**, would have the lowest vapour pressure?

Give a reason for the answer. (2)

3.5 Write down the following:

3.5.1 The phase of compound **A** at room temperature (1)

3.5.2 The structural formula of the functional group of **B** (1)

3.5.3 The IUPAC name of compound **C** (1)
[12]

QUESTION 3 (Start on a new page.)

The vapour pressures of different organic compounds are determined at 20 °C. The vapour pressures of compounds **A**, **B** and **C** are NOT shown in the table.

COMPOUND	IUPAC NAME	MOLAR MASS ($g \cdot mol^{-1}$)	VAPOUR PRESSURE (kPa) AT 20 °C
A	Pentane	72	
B	2-methylbutane	72	
C	2,2-dimethylpropane	72	
D	Propanoic acid	74	0,32
E	Butanal	72	12,2

3.1 Define the term *vapour pressure*. (2)

3.2 The vapour pressures of compounds **A**, **B** and **C** are given in random order below.

79 kPa	146 kPa	58 kPa

3.2.1 Write down the vapour pressure of compound **C**. (1)

3.2.2 Fully explain your answer to QUESTION 3.2.1. (3)

3.3 Compounds **D** and **E** are compared.

3.3.1 Which compound has the lower boiling point? (1)

3.3.2 Fully explain the difference in the vapour pressures between compounds **D** and **E**. (4)

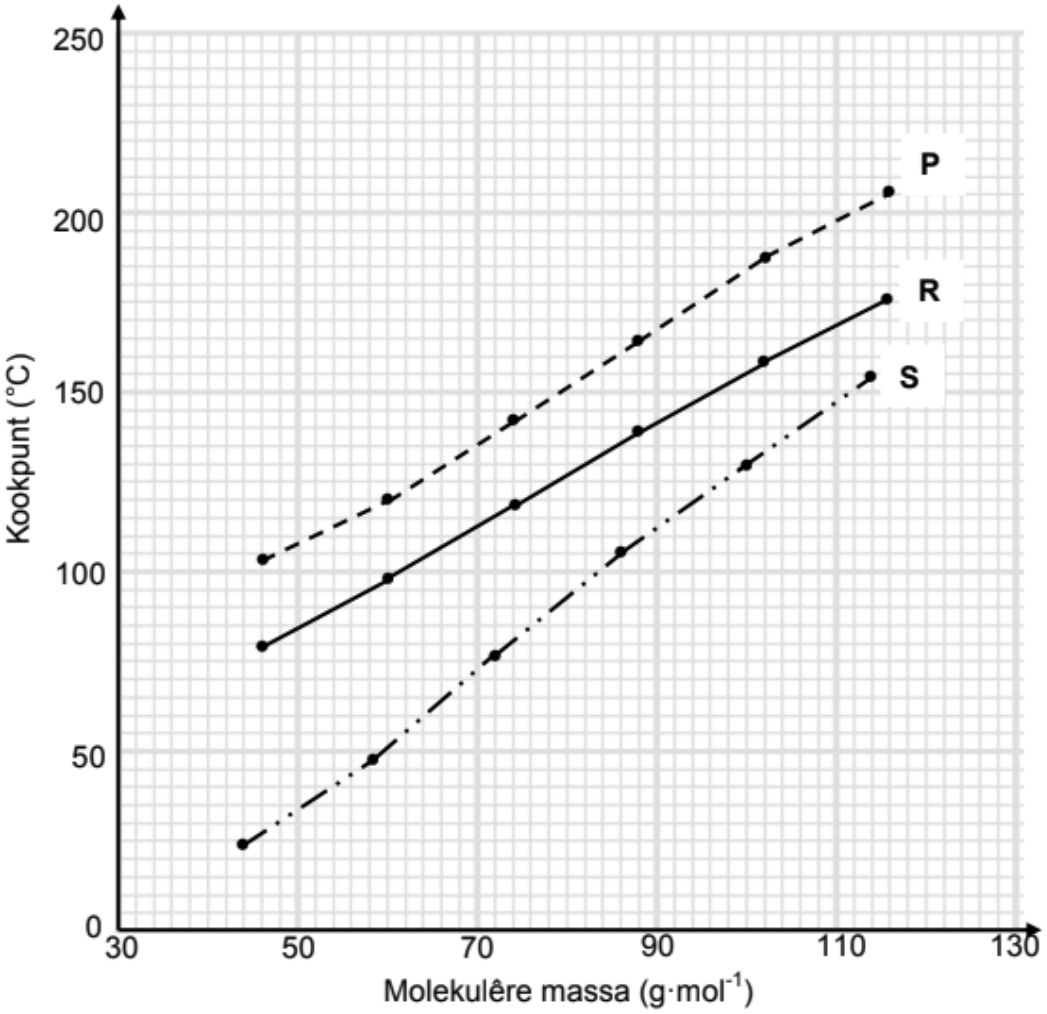
[11]

DBE NOV 2023

VRAAG 3 (Begin op 'n nuwe bladsy.)

Die verwantskap tussen kookpunt en die molekulêre massa van aldehiede, karboksielsure en primêre alkohole word ondersoek. Kurwes **P**, **R** en **S** word verkry. Alle verbindings wat gebruik word, is reguitkettingmolekule.

GRAFIEK VAN KOOKPUNT TEENOOR MOLEKULÊRE MASSA



3.1 Definieer die term *kookpunt*. (2)

3.2 Skryf die gevolgtrekking neer wat vir kurwe **P** gemaak kan word. (2)

3.3 Verduidelik die antwoord op VRAAG 3.2 in terme van die struktuur van die verbindings. (2)

3.4 Kurwe **R** verteenwoordig die alkohole.

3.4.1 Watter homoloë reeks word deur kurwe **S** verteenwoordig? (1)

3.4.2 Verduidelik die antwoord op VRAAG 3.4.1 deur na die sterkte van intermolekulêre kragte te verwys. (2)

3.5 Vir kurwe **R**, skryf neer die:

3.5.1 Molekulêre massa van die verbinding met 'n kookpunt van 97 °C (1)

3.5.2 IUPAC-naam van die verbinding in VRAAG 3.5.1 (2)

3.6 Twee verbindings, **A** en **B**, wat in hierdie ondersoek gebruik word, het 'n molekulêre massa van 74 $g \cdot mol^{-1}$. **A** het 'n kookpunt van 118 °C en **B** het 'n kookpunt van 142 °C. Verduidelik die verskil in hierdie kookpunte deur na die strukture van hierdie verbindings te verwys. (3)

[15]

DBE NOV 2022

QUESTION 3 (Start on a new page.)

3.1 The melting points of some organic compounds are given in the table below.

COMPOUND	IUPAC NAME	MELTING POINTS (°C)
A	Propanone	-95,4
B	Butanone	-86,9
C	Pentan-2-one	-77,8
D	3-methylbutanone	-92

3.1.1 To which homologous series do the above compounds belong? (1)

The melting points of compounds **A**, **B** and **C** are compared.

3.1.2 Write down the controlled variable for this comparison. (1)

The melting points of compounds **C** and **D** are compared.

3.1.3 Fully explain the difference in the melting points of these two compounds. (4)

3.2 The table below shows the results obtained from an experiment to determine the vapour pressure of different STRAIGHT CHAIN primary alcohols at 300 K.

ALCOHOL	VAPOUR PRESSURE (kPa)
CH_3OH	16,8
C_2H_5OH	7,88
C_3H_7OH	2,8
C_4H_9OH	0,91
$C_5H_{11}OH$	0,88
$C_6H_{13}OH$	0,124

3.2.1 Define the term *vapour pressure*. (2)

3.2.2 Write down a suitable conclusion for this investigation. (2)

3.2.3 Write down the IUPAC name of the alcohol with the HIGHEST boiling point. (3)

3.2.4 The experiment is now repeated at 320 K.

Will the vapour pressure of each compound INCREASE, DECREASE or REMAIN THE SAME? (1)

[14]