

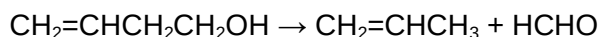
Name of the Student: _____

Max. Marks : 19 Marks

Time : 19 Minutes

Q1.

The thermal decomposition of but-3-en-1-ol is investigated at different temperatures (T).



The results from the investigation are used to calculate the rate constant, k , at each temperature.

The table below shows some of the results.

T / K	$\frac{1}{T} / \text{K}^{-1}$	k / s^{-1}	$\ln k$
553	1.81×10^{-3}	4.6×10^{-4}	-7.68
563	1.78×10^{-3}	8.4×10^{-4}	-7.08
573		15.6×10^{-4}	
583	1.72×10^{-3}	28.0×10^{-4}	-5.88
593	1.69×10^{-3}	49.9×10^{-4}	-5.30

(a) Complete the table with the missing values at 573 K

(1)

(b) The overall order of the reaction can be deduced from a piece of information in one of the column headings in the table.

Identify this piece of information and deduce the overall order.

Piece of information _____

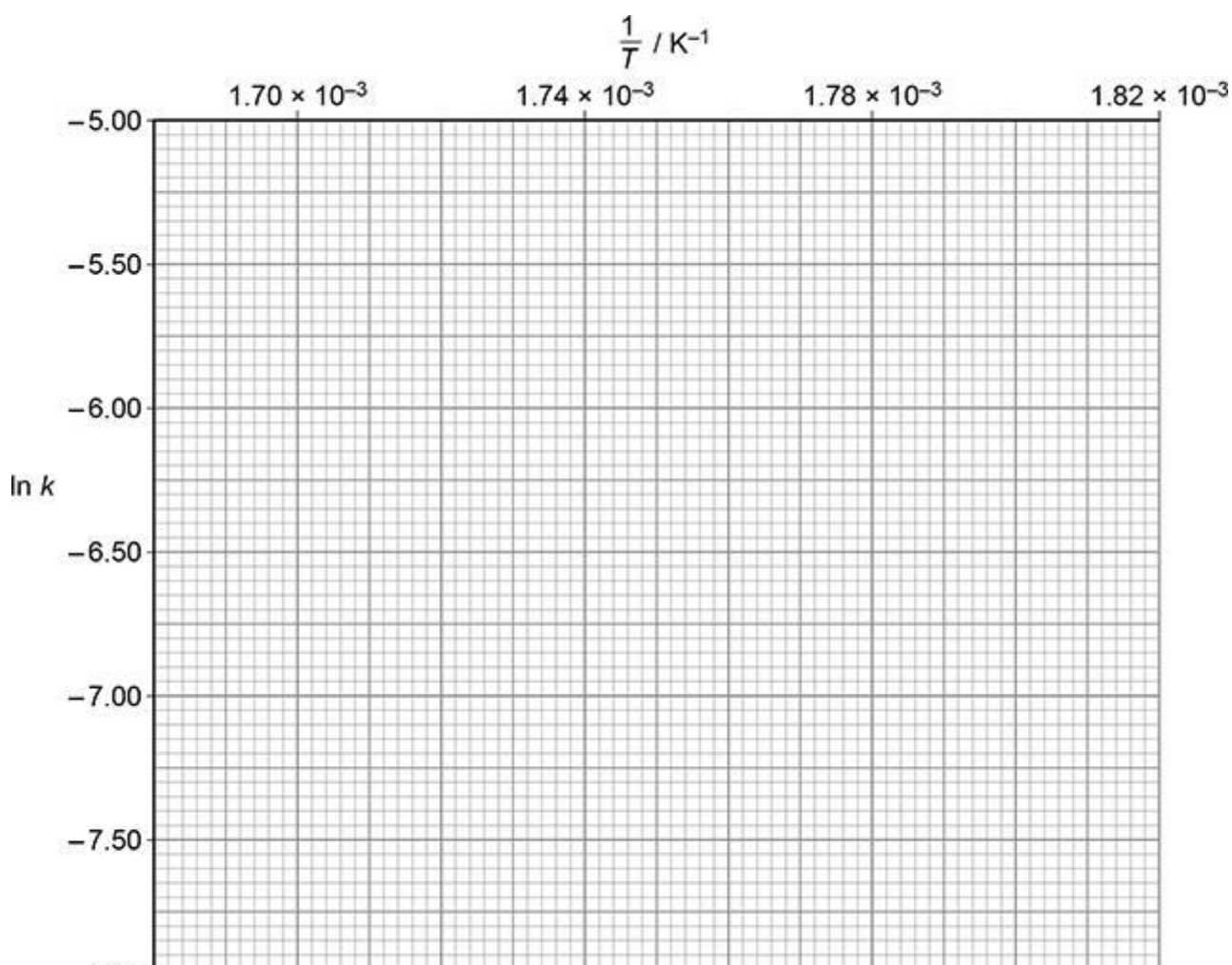
Overall order _____

(2)

(c) The Arrhenius equation can be written in the form shown.

$$\ln k = \ln A - \frac{E_a}{RT}$$

On the grid in below figure plot a graph of $\ln k$ against $\frac{1}{T}$



(2)

- (d) Use your graph from part (c) to calculate a value for E_a , in kJ mol^{-1} , for the thermal decomposition of but-3-en-1-ol.

The gas constant, $R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$

E_a _____ kJ mol^{-1}

(3)

- (e) 2-Methylpent-4-en-2-ol decomposes in a similar way to but-3-en-1-ol, to produce an alkene and a carbonyl compound.

Deduce the structures of the alkene and the carbonyl compound.



(2)

(Total 10 marks)

Q2.

This question is about the analysis of organic compounds.

For each pair of compounds in parts (a) and (b), give a reagent (or combination of reagents) that could be added separately to each compound in a single reaction to distinguish between them.

State what is observed in each case.

- (a) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$ and $\text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CH}_3$

Reagent(s) _____

Observation with $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$ _____

Observation with $\text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CH}_3$ _____

(3)

- (b) Cyclohexane and cyclohexene

Reagent(s) _____

Observation with cyclohexane _____

Observation with cyclohexene _____

(3)

- (c) The table below gives the precise relative molecular masses (M_r) of some organic compounds measured using high resolution mass spectrometry.

Molecular formula	C_5H_{12}	C_5H_{10}	C_6H_6
M_r	72.1416	70.1260	to be calculated

Use these data to find the relative atomic masses (A_r) of hydrogen and carbon. Give your answers to 4 decimal places.

Use these calculated A_r values to find the relative molecular mass (M_r) of C_6H_6 . Give your answer to 4 decimal places.

A_r of hydrogen _____

A_r of carbon _____

M_r of C_6H_6 _____

(3)

(Total 9 marks)