Practice Question Set For A-Level
Subject : Chemistry
Paper-2 Topic: Rate Equations

Merit Minds
www.merit-minds.com
Exam Preparation and Free Resources

Name of the Student:_____
Max. Marks : 20 Marks **Time : 20 Minutes**

Q1.

The Arrhenius equation can be written as:

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

The table below shows the value of the rate constant at different temperatures for a reaction.

Rate constant k/s^{-1}	ln k	Temperature/K	$\frac{1}{T}$
6.13×10^{-5}		700	
2.75×10^{-4}		727	
8.25×10^{-4}		746	
8.23×10^{-3}		793	

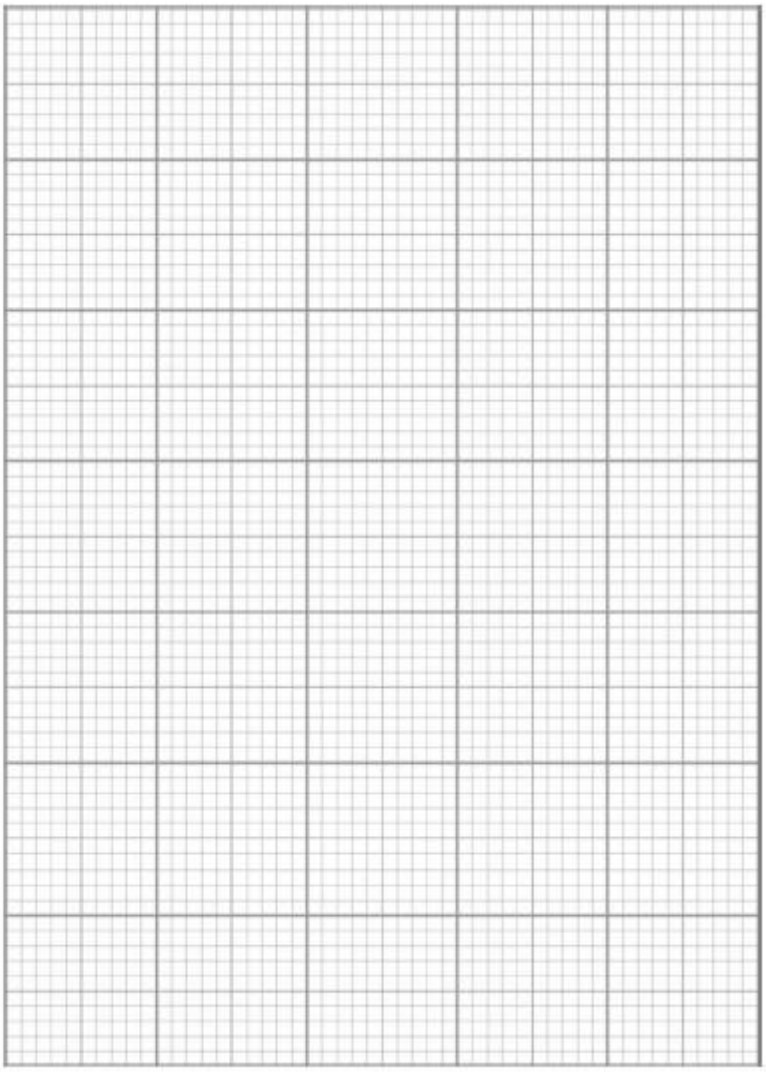
Complete the table by calculating the values of ln k and $\frac{1}{T}$ at each temperature.

Plot a graph of ln k against $\frac{1}{T}$ on the grid opposite.

Use your graph to calculate a value for the activation energy, in kJ mol^{-1}, for this reaction.

To gain full marks you must show all your working.

The gas constant R = 8.31 J K^{-1} mol^{-1}



E_a _____ kJ mol^{-1}

(Total 8 marks)

Q2.

This question involves the use of kinetic data to deduce the order of a reaction and calculate a value for a rate constant.

The data in **Table 1** were obtained in a series of experiments on the rate of the reaction between compounds **A** and **B** at a constant temperature.

Table 1

Experiment	**Initial concentration of A / mol dm^{-3}**	**Initial concentration of B / mol dm^{-3}**	**Initial rate / mol dm^{-3} s^{-1}**
1	0.12	0.26	2.10×10^{-4}
2	0.36	0.26	1.89×10^{-3}
3	0.72	0.13	3.78×10^{-3}

(a) Show how these data can be used to deduce the rate expression for the reaction between **A** and **B**.

(3)

The data in **Table 2** were obtained in two experiments on the rate of the reaction between compounds **C** and **D** at a constant temperature.

Table 2

Experiment	**Initial concentration of C / mol dm^{-3}**	**Initial concentration of D / mol dm^{-3}**	**Initial rate / mol dm^{-3} s^{-1}**
4	1.9×10^{-2}	3.5×10^{-2}	7.2×10^{-4}
5	3.6×10^{-2}	5.4×10^{-2}	To be calculated

The rate equation for this reaction is

$$rate = k[\mathbf{C}]^2[\mathbf{D}]$$

(b) Use the data from experiment **4** to calculate a value for the rate constant, k, at this temperature. Deduce the units of k.

k = _____ Units = _____

(3)

(c) Calculate a value for the initial rate in experiment **5**.

Initial rate = _____ mol dm^{-3} s^{-1}

(1)

(d) The rate equation for a reaction is

$$rate = k[\mathbf{E}]$$

Explain qualitatively why doubling the temperature has a much greater effect on the rate of the reaction than doubling the concentration of **E**.

_____

_____

_____

_____

_____

_____

(3)

(e) A slow reaction has a rate constant $k = 6.51 \times 10^{-3}$ mol^{-1} dm^3 at 300 K.

Use the equation $\ln k = \ln A - E_a / RT$ to calculate a value, in kJ mol^{-1}, for the activation energy of this reaction.

The constant $A = 2.57 \times 10^{10}$ mol^{-1} dm^3.
The gas constant $R = 8.31$ J K^{-1} mol^{-1}.

Activation energy = _____

(2)

(Total 12 marks)