AQA – Kinetics – A2 Chemistry P3

1. June/ 2020/Paper_3/No.4(4.4_4.6)

An experiment is done to investigate the rate of reaction in Question **04.2**.

0 4 . 4 During the experiment the concentration of cisplatin is measured at one-minute intervals.

Explain how graphical methods can be used to process the measured results, to confirm that the reaction is first order.

[3 marks]

In another experiment, the effect of temperature on the rate of the reaction in Question **04.2** is investigated.

Table 1 shows the results.

Table 1

Temperature T / K	$\frac{1}{T}$ / K^{-1}	Rate constant k / s^{-1}	ln k
293	0.00341	1.97×10^{-8}	–17.7
303	0.00330	8.61×10^{-8}	–16.3
313	0.00319	3.43×10^{-7}	–14.9
318		6.63×10^{-7}	
323	0.00310	1.26×10^{-6}	–13.6

0 4 . 5 Complete **Table 1**.

[2 marks]

0 4 . 6 The Arrhenius equation can be written in the form

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

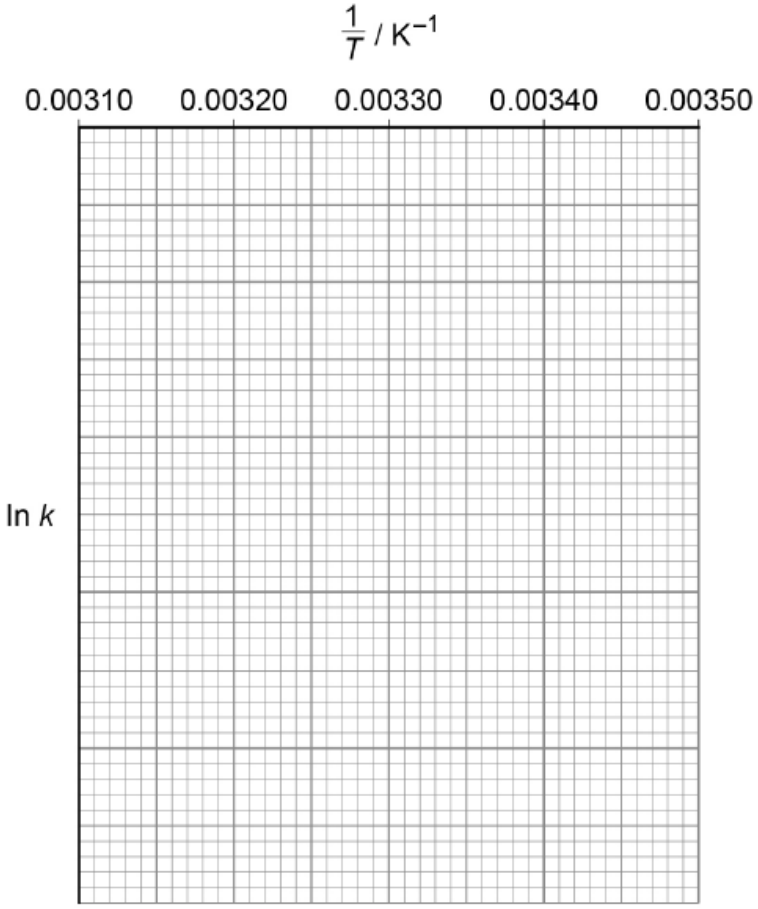
Use the data in **Table 1** to plot a graph of $\ln k$ against $\frac{1}{T}$ on the grid in **Figure 2**.

Calculate the activation energy, E_a, in kJ mol^{-1}

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

[5 marks]

Figure 2



E_a _____ kJ mol^{-1}

2. June/ 2020/Paper_3/No.12

The rate expression for the reaction between **X** and **Y** is

$$rate = k\,[\mathbf{X}]^2\,[\mathbf{Y}]$$

Which statement is correct?

[1 mark]

A The rate constant has units $mol^{-1}\ dm^3\ s^{-1}$ ⬭

B The rate of the reaction is halved if the concentration of **X** is halved and the concentration of **Y** is doubled. ⬭

C The rate increases by a factor of 16 if the concentration of **X** is tripled and the concentration of **Y** is doubled. ⬭

D The rate constant is independent of temperature. ⬭

3. June/ 2020/Paper_3/No.33

What are the units of the rate constant for a third order reaction?

[1 mark]

A $mol\ dm^{-3}\ s^{-1}$ ⬭

B $mol^{-1}\ dm^3\ s^{-1}$ ⬭

C $mol^2\ dm^{-6}\ s^{-1}$ ⬭

D $mol^{-2}\ dm^6\ s^{-1}$ ⬭

4. June/ 2019/Paper_3/No.9

Which change leads to a higher concentration of SO_3 in this equilibrium mixture?

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g) \qquad \Delta H = -188 \text{ kJ mol}^{-1}$$

[1 mark]

A higher concentration of O_2 ⬭

B higher temperature ⬭

C lower pressure ⬭

D use of a catalyst ⬭

5. June/ 2019/Paper_3/No.10

The results of an investigation of the reaction between **P** and **Q** are shown in this table.

Experiment	Initial [P] / mol dm^{-3}	Initial [Q] / mol dm^{-3}	Initial rate / mol dm^{-3} s^{-1}
1	0.200	0.500	0.400
2	0.600	To be calculated	0.800

The rate equation is: $rate = k\,[\mathbf{P}]\,[\mathbf{Q}]^2$

What is the initial concentration of **Q** in experiment 2?

[1 mark]

A 0.167 ⬭

B 0.333 ⬭

C 0.408 ⬭

D 0.612 ⬭

6. June/ 2019/Paper_3/No.11

The equation for the reaction between sulfur dioxide and oxygen is shown.

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

In an experiment, 2.00 mol of sulfur dioxide are mixed with 2.00 mol of oxygen. The total amount of the three gases at equilibrium is 3.40 mol

What is the mole fraction of sulfur trioxide in the equilibrium mixture?

[1 mark]

A 0.176 ⬭

B 0.353 ⬭

C 0.600 ⬭

D 1.200 ⬭

7. June/ 2019/Paper_3/No.12

Nitrogen reacts with hydrogen in this exothermic reaction

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

Which change increases the equilibrium yield of ammonia but has **no** effect on the value of the equilibrium constant K_p?

[1 mark]

A Add a catalyst ⬭

B Increase the partial pressure of nitrogen ⬭

C Decrease the temperature ⬭

D Decrease the total pressure ⬭