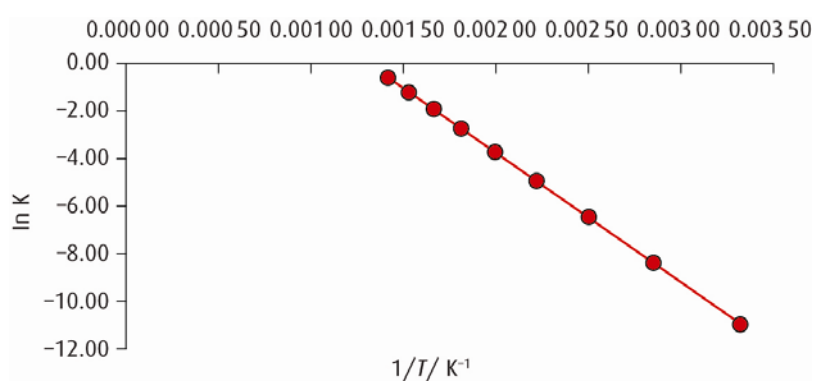


**Marking scheme for AHL Worksheet – Chapter 6**

- 1**
- a** order with respect to A is 1 [1]  
experiment 2 to 3 – halving concentration of A halves rate [1]  
order with respect to B is 1 [1]  
experiment 1 to 2 – doubling concentration of B doubles rate [1]
- b** 2 [1]
- c** using data from experiment 1 (process for other experiments is the same):  
 $2.50 \times 10^{-3} = k \times 0.400 \times 0.100$  [1]  
 $k = 0.0625$  [1]  
 $\text{mol}^{-1} \text{dm}^3 \text{s}^{-1}$  [1]
- d**  $3.13 \times 10^{-4} \text{mol dm}^{-3}$  [1]
- 2**
- a** order with respect to X is 2 [1]  
experiment 1 to 2 – three times concentration of X, rate increases by factor of 9 [1]
- b** order with respect to Y is 0 [1]  
experiment 1 to 3 – rate increases by factor of 16 [1]  
4× concentration of X causes rate to increase by 16 [1]
- c**  $\text{rate} = k[\text{X}]^2$  [1]
- d** using data from experiment 1 (process for other experiments is the same):  
 $1.28 \times 10^{-5} = k \times (2.20 \times 10^{-3})^2$  [1]  
 $k = 2.64$  [1]  
 $\text{mol}^{-1} \text{dm}^3 \text{s}^{-1}$  [1]
- e**  $100 \times 1.28 \times 10^{-5} = 1.28 \times 10^{-3} \text{mol dm}^{-3}$  [1]
- 3**
- a**  $\text{rate} = kA \exp(-E_a/RT)$  [1]
- b** increasing the temperature causes the rate constant to increase (exponentially) [1]

c graph of  $\ln k$  against  $1/T$  having calculated  $1/T$  and  $\ln k$

$T / \text{K}$	$k / \text{s}^{-1}$	$1/T / \text{K}^{-1}$	$\ln k$
300	0.0000174	0.00333	-10.96
350	0.000229	0.00286	-8.38
400	0.001589	0.00250	-6.45
450	0.00713	0.00222	-4.94
500	0.0237	0.00200	-3.74
550	0.0636	0.00182	-2.76
600	0.144	0.00167	-1.94
650	0.289	0.00154	-1.24
700	0.524	0.00143	-0.65



$1/T$  and  $\ln k$  calculated

[1]

suitable graph drawn

[1]

gradient =  $-5420 \pm 20 \text{ K}$

[1]

$$-\frac{E_a}{8.31} = -5420$$

[1]

$$E_a = 45 \text{ kJ mol}^{-1}$$

[1]

4 a  $2\text{C} + \text{A} \rightarrow \text{B} + \text{D}$

[1]

$$\text{rate} = k[\text{C}][\text{A}]$$

[1]

b  $\text{B} + 2\text{P} \rightarrow \text{C} + \text{E} + \text{S}$

[1]

$$\text{rate} = k[\text{B}][\text{P}]^2$$

[1]

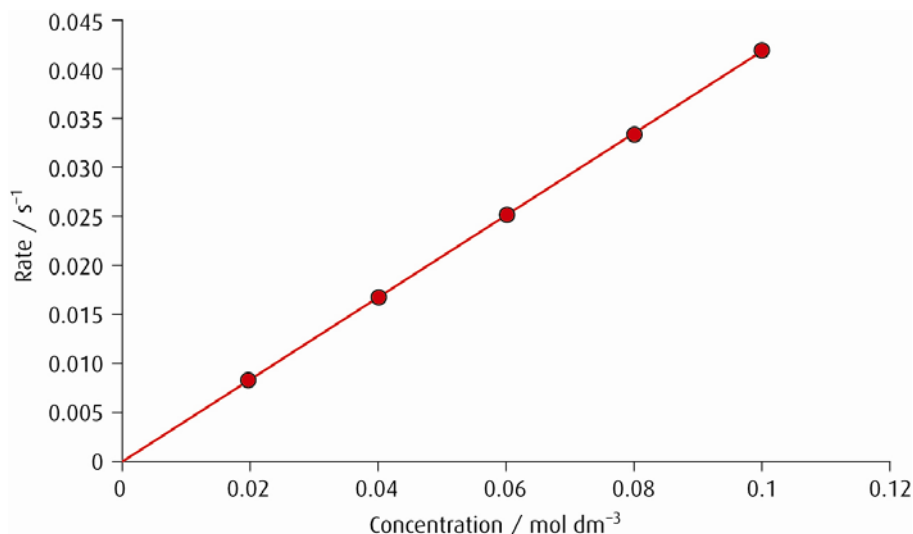
c  $2\text{D} + 2\text{P} \rightarrow \text{Y} + \text{T} + \text{X}$

[1]

$$\text{rate} = k[\text{D}]^2[\text{P}]$$

[1]

5



all points plotted correctly for 2 marks; lose 1 for each mistake

[2]

line of best fit drawn

[1]

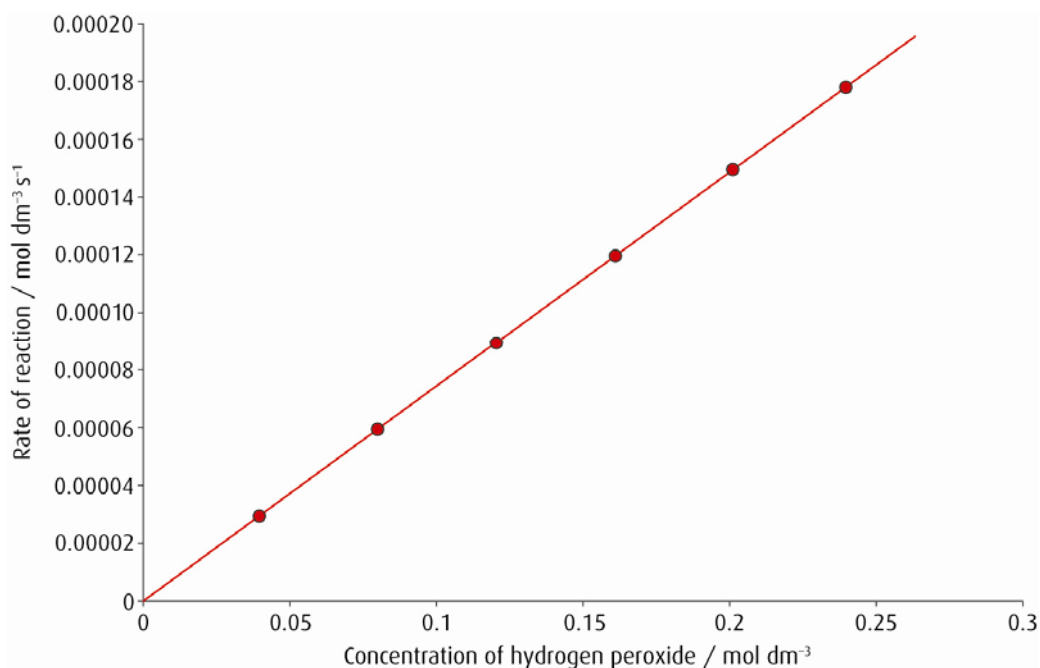
straight line passing through origin = directly proportional relationship

[1]

first order with respect to I<sup>-</sup>

[1]

6 a i



all points plotted correctly for 2 marks; lose 1 for each mistake

[2]

line of best fit drawn

[1]

straight line passing through origin = directly proportional relationship

[1]

first order with respect to H<sub>2</sub>O<sub>2</sub>

[1]

ii gradient =  $7.4 \times 10^{-4} \text{ s}^{-1}$ 

[1]

rate constant =  $7.4 \times 10^{-4} \text{ s}^{-1}$ 

[1]



- b** rate constant decreases [1]  
as catalyst reduces the activation energy /reference to the Arrhenius equation [1]
- c** this cannot be correct [1]  
two hydrogen peroxide molecules colliding in a single step would make the reaction second order with respect to  $\text{H}_2\text{O}_2$  [1]