**Homework 1 – Kinetics**

**Part 1**

1. Explain what is meant by the term "rate of reaction".

2. The initial rates of the reaction 2A + B 🡪 2C + D at various concentrations of A and B are given below:

|  |  |  |
| --- | --- | --- |
| [A] moldm-3 | [B] moldm-3 | Initial rate /moldm-3s-1 |
| 0.01 | 0.20 | 0.10 |
| 0.02 | 0.20 | 0.20 |
| 0.01 | 0.40 | 0.40 |

1. What is the order of reaction with respect to A and B?
2. What is the overall order of reaction?
3. What is the rate constant?
4. What will be the rate of the reaction if the concentrations of A and B are both 0.01 moldm-3?

3. For the reaction 2NO(g) + H2(g) 🡪 N2O(g) + H2O(g), the following rate data were collected:

|  |  |  |
| --- | --- | --- |
| Initial [NO]/M | Initial [H2]/M | Initial rate/Ms-1 |
| 0.60 | 0.37 | 3.0 x 10-3 |
| 1.20 | 0.37 | 1.2 x 10-2 |
| 1.20 | 0.74 | 1.2 x 10-2 |

What is the rate constant for the reaction?

What can you deduce about the rate-determining step of the reaction?

4. For the reaction PCl3 + Cl2 🡪 PCl5, the following data were obtained:

|  |  |  |  |
| --- | --- | --- | --- |
| Experiment No. | [PCl3]/M | [Cl2]/M | Rate /Ms-1 |
| 1 | 0.36 | 1.26 | 6.0 x 10-4 |
| 2 | 0.36 | 0.63 | 1.5 x 10-4 |
| 3 | 0.72 | 2.52 | 4.8 x 10-3 |

Deduce the rate equation and the rate constant.

5. Two compounds, X and Y, are known to undergo the reaction

X + 3Y 🡪 XY3

Using the experimental results in the table below:

|  |  |  |  |
| --- | --- | --- | --- |
| EXPERIMENT | Initial concentration of X/moldm-3 | Initial concentration of Y/moldm-3 | Initial rate of formation of XY3/moldm-3s-1 |
| 1 | 0.100 | 0.100 | 0.00200 |
| 2 | 0.100 | 0.200 | 0.00798 |
| 3 | 0.100 | 0.300 | 0.01805 |
| 4 | 0.200 | 0.100 | 0.00399 |
| 5 | 0.300 | 0.100 | 0.00601 |

Find the rate constant.

6. The data in the table below relates to the reaction between hydrogen and nitrogen monoxide at 673K. 2NO(g) + 2H2(g) 🡪 N2(g) + 2H2O(g)

|  |  |  |  |
| --- | --- | --- | --- |
| Experiment number | Initial concentration of H2 /moldm-3 | Initial concentration of NO /moldm-3 | Initial rate of production of N2 / moldm-3s-1 |
| 1 | 2.0 x 10-3 | 6.0 x 10-3 | 6.0 x 10-3 |
| 2 | 3.0 x 10-3 | 6.0 x 10-3 | 9.0 x 10-3 |
| 3 | 6.0 x 10-3 | 1.0 x 10-3 | 0.5 x 10-3 |

Deduce the rate equation and calculate the rate constant.

**Part 2**

7. State and explain the effect of the following on the rate of a reaction:

a) increasing the temperature

b) increasing the pressure

c) increasing the concentration of one of the reactants

d) adding a catalyst

In each case state what will happen to the rate constant, k.

………………… Out of 17 (Grade )