Orders of Reactions

① Using the data in the following table, find the order of reaction with respect to A, B and C, and the overall reaction. Write the rate equation and calculate a value for the rate constant including units.

Experiment	Concentrations ($mol\,dm^{-3}$)			Rate of Loss of A ($mol\,dm^{-3}s^{-1}$)
	A	B	C	
1	0·1	0·1	0·1	2.0×10^{-4}
2	0·2	0·1	0·1	4.0×10^{-4}
3	0·2	0·2	0·1	1.6×10^{-3}
4	0·1	0·1	0·2	2.0×10^{-4}

② Using the data in the following table, find the order of reaction with respect to A, B and C and the overall order of reaction. Write the rate equation and calculate a value for the rate constant including units.

Experiment	Concentrations ($mol dm^{-3}$)			Rate of loss of A
	A	B	C	($mol dm^{-3} s^{-1}$)
1	0.010	0.020	0.0050	1.4×10^{-6}
2	0.010	0.010	0.0050	7.0×10^{-7}
3	0.020	0.020	0.0050	1.4×10^{-6}
4	0.020	0.020	0.015	4.2×10^{-6}

③ Using the data in the table, find the order of reaction with respect to A and B, and the overall order of reaction. Write the rate equation and calculate a value for the rate constant including units.

Experiment	Concentrations ($mol\,dm^{-3}$)		Rate of loss A ($mol\,dm^{-3}\,s^{-1}$)
	A	B	
1	0·10	0·10	2.5×10^{-5}
2	0·20	0·10	2.5×10^{-5}
3	0·30	0·20	5.0×10^{-5}

④ Using the data in the table, find the order of reaction with respect to A and B.

Experiment	Concentrations ($mol\ dm^{-3}$)		Rate of loss of A ($mol\ dm^{-3}\ s^{-1}$)
	A	B	
1	0·10	0·10	1.0×10^{-3}
2	0·10	0·20	2.0×10^{-3}
3	0·30	0·30	9.0×10^{-3}

⑤ Using the data in the following table, find the order of reaction with respect to A and B, and overall order of reaction. Write the rate equation and calculate a value for the rate constant including units.

	Experiment 1	Experiment 2	Experiment 3
[A] ($mol\,dm^{-3}$)	0·12	0·36	0·36
[B] ($mol\,dm^{-3}$)	0·04	0·04	0·20
Rate of loss of A ($mol\,dm^{-3}\,s^{-1}$)	9.0×10^{-5}	8.1×10^{-4}	8.1×10^{-4}

(6) The reaction between P and Q has the rate equation.

$$\text{Rate} = k[P][Q]^2$$

The rate constant was found to be $1.60 \times 10^{-6} \text{mol}^{-2}\text{dm}^6\text{s}^{-1}$ at a particular temperature. Calculate the rate of the reaction at that temperature if the concentration of P was 0.15mol dm^{-3} and that of Q was 0.30mol dm^{-3}.

⑦ A reaction between N and M was first order with respect to each. The rate constant was found to be $0.048 mol^{-1} dm^3 s^{-1}$ at a particular temperature. If the concentration of N was $0.10 mol dm^{-3}$, what concentration of M would be needed to give a rate of reaction of $2.4 \times 10^{-4} mol dm^{-3} s^{-1}$?

⑧ The rate equation for the reaction between D and E had the form:

$$\text{Rate} = k[D][E]^2$$

fill in the blanks in the following table.

Experiment	Concentration ($mol\,dm^{-3}$)		Rate of loss of D ($mol\,dm^{-3}\,s^{-1}$)
	D	E	
1	0·100	0·100	1.2×10^{-5}
2	0·200	0·100	A
3	0·100	B	1.08×10^{-4}
4	C	0·100	6.00×10^{-5}