

Kinetics (2) Order of Reaction:

| Exp. | [A]* | [B]* | Initial Rate m/s |
|------|------|-------|----------------------|
| → 1 | 0.12 | 0.010 | 2.2×10^{-3} |
| → 2 | 0.36 | 0.010 | 6.6×10^{-3} |
| → 3 | 0.12 | 0.020 | 7.2×10^{-3} |

The above is the data for a reaction $A + 2B \rightarrow 2C + D$.

- (a) what is the rate law?
- (b) what is the rate constant? (k)
- (c) what is the overall order of reaction?
- (d) what is the rate when $[A] = 0.50M$ & $[B] = 0.25M$.

| | | | |
|-----|--|--|--|
| (a) | [A] const [B] change | | [B] const [A] change |
| | $\frac{\text{exp 3}}{\text{exp 1}} = \frac{0.020}{0.010} = \frac{7.2 \times 10^{-3}}{2.2 \times 10^{-3}}$ $\frac{2}{2} = \frac{4}{2} \therefore$ | | $\frac{\text{exp 2}}{\text{exp 1}} = \frac{0.36}{0.12} = \frac{6.6 \times 10^{-3}}{2.2 \times 10^{-3}}$ $3 = 3 \therefore$ |

$$\text{Rate} = k [A]^1 [B]^2$$

$$= k [A] [B]^2$$

(b) $k = \frac{\text{Rate}}{[A][B]^2} = \frac{2.2 \times 10^{-3} \text{ m/s}}{[0.12] [0.010]^2 \text{ m}^2} = \boxed{183 / \text{m}^2 \text{ s}}$

(c) $[A]^1 [B]^2 \quad 1+2 = \boxed{3}$

(d)
$$\text{Rate} = k [A] [B]^2$$

$$= \frac{183}{\text{m}^2 \text{ s}} \times (0.50 \text{ m}) \times (0.25)^2 \text{ m}^2$$

$$= 5.73 \text{ m/s}$$