

AP Chemistry

Name: _____ Score: _____

1. A reactant drops from 0.9 M to 0.6 M in 5 s. The average rate (in M/s)?

_____ M/s

2. For rate = $k[A]^2$, doubling $[A]$ multiplies the rate by...

☐ 4

☐ 2

☐ 8

3. If a plot of $\ln[A]$ versus time is a straight line, the reaction is...

☐ first order

☐ second order

☐ zero order

4. An intermediate is a species that is...

☐ made in one step and used up in a later one

☐ present at the start and end

☐ never involved in the reaction

5. Select **both** conditions a collision needs to cause a reaction.

☐ enough energy

☐ correct orientation

☐ a colour change

Tick every correct option.

6. Reactants at 40 kJ, peak at 100 kJ. The activation energy (in kJ)?

_____ kJ

7. The rate-determining step is the...

☐ slowest elementary step

☐ fastest elementary step

☐ last step

8. If the slow first step is $\text{NO}_2 + \text{NO}_2 \rightarrow \text{products}$, the rate law is...

☐ rate = $k[\text{NO}_2]^2$

☐ $\text{rate} = k[\text{NO}_2]$

☐ $\text{rate} = k$

9. An intermediate is allowed to remain in the final rate law.

☐ True ☐ False

10. A first-order reaction starts at 16 M with a 10 s half-life. Concentration after 20 s (in M)?

_____ M

AP Chemistry

1. **0.06 M/s**

$$\text{Rate} = (0.9 - 0.6)/5 = 0.06 \text{ M/s.}$$

2. **4**

Second order means $2^2 = 4$ times the rate.

3. **first order**

A linear $\ln[A]$ -versus-time plot indicates first order.

4. **made in one step and used up in a later one**

An intermediate forms then is consumed, so it cancels overall.

5. **enough energy; correct orientation**

A successful collision needs both sufficient energy and the right orientation.

6. **60 kJ**

$$E_a = 100 - 40 = 60 \text{ kJ (peak minus reactants).}$$

7. **slowest elementary step**

The slowest step is the bottleneck controlling the overall rate.

8. **rate = $k[\text{NO}_2]^2$**

Two NO_2 react in the slow step, so it is second order.

9. **False**

It must be substituted out using the fast equilibrium.

10. **4 M**

Two half-lives give $16 \rightarrow 8 \rightarrow 4 \text{ M}$.