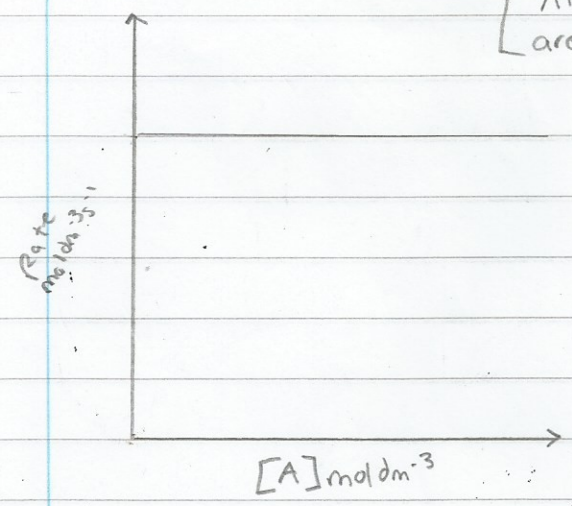
Graphs showing orders of Reactions

RATE - CONCENTRATION GRAPHS

[• All these graphs assume all other concentrations are kept constant!]

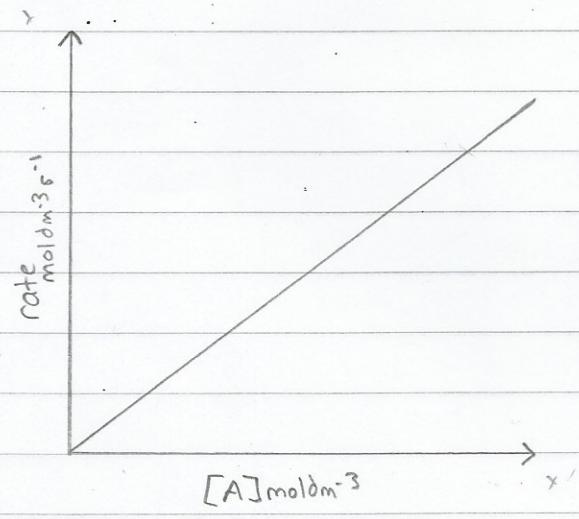


Zero order

straight horizontal line as rate is <u>not</u> affected by concentration of A.

to find k, you would simply read the rate as

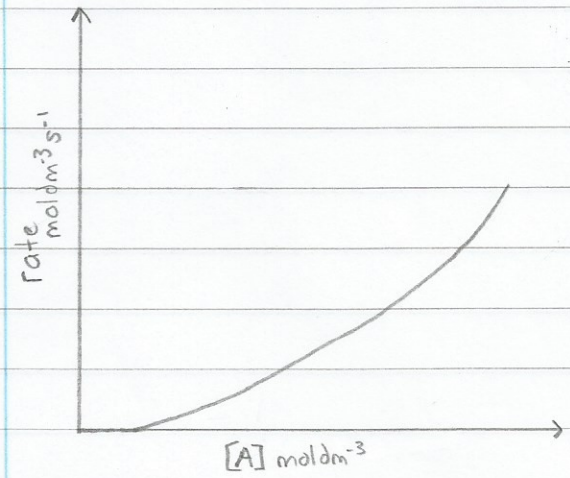
Rate = k



first order

The positive straight line shows that rate increases with [A] - it is proportional.

to find k, take the slope of the line (gradient).



Second order

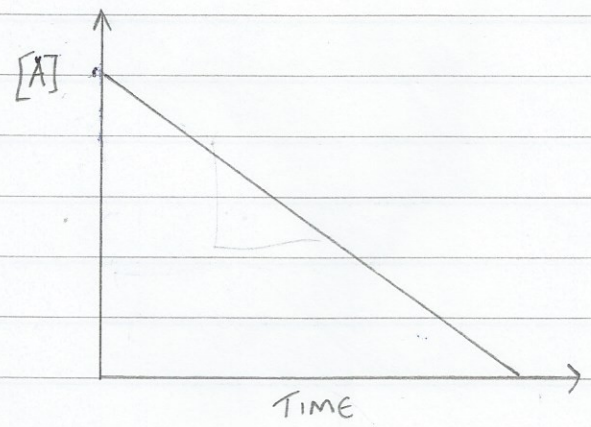
The rate is proportional to the square of concentration of [A] or if you plot rate against [A] you get a curve!

• A curve only tells you its <u>NOT</u> zero or first order. To be sure its second plot

Graphs Showing Overall orders of Reactions

[All these graphs assume only one reactant]

Concentration - time graphs

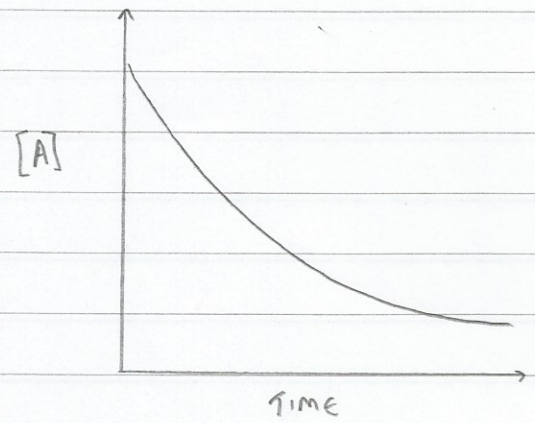


Zero order

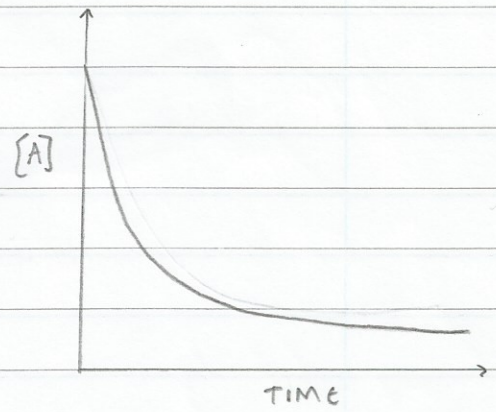
straight negative slope. This is because the fall of [A] is constant as the reaction progresses.

- Measure the slope (gradient) to find rate which is also conviniently k as rate = k.

first and second order reactions



first order curve



second order curve

- for first order reactions the rate is proportional to the concentration of A
- for a second order reaction the rate is proportional to the square of the concentration of A.
- As A falls, the reaction will get slower so you get a curve.
- The PROBLEM is you cannot tell if it is first or second order by looking at it.
- To find out you have to measure the half life.

Half Life

[for a first order reaction, the half life is constant - independent of the initial concentration.]

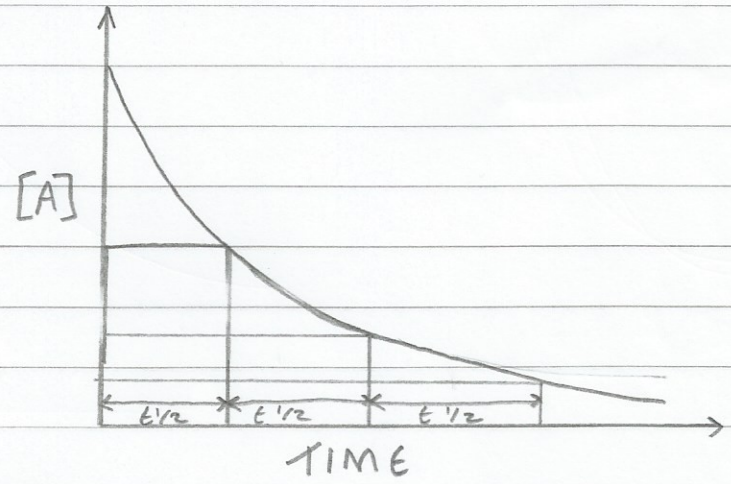
- The half life of a reaction is the time it takes for the concentration to fall to half of its initial value. Half life is given the symbol $t_{1/2}$.

for example

The half life of a first order reaction is 10minutes and the initial concentration is $1.000 mol dm^{-3}$.

In 10mins conc. will fall to $0.500 mol dm^{-3}$
In another 10mins conc. will fall to $0.250 mol dm^{-3}$ etc.

[ONLY first order reactions have a constant half life]



to find k from the half life : $k = \frac{\ln 2}{t_{1/2}}$