## Relating Reaction Rate to Time

So far, we have discussed the relationship between rate and initial concentration. However, it can be inconvenient to determine the initial rate of a reaction in a school laboratory. It is much easier to measure the time that elapses before a certain point in the reaction (such as a visible change) is reached. As you know, the average rate is inversely related to the elapsed time:

$$r_{av} \propto \frac{1}{\Delta t}$$

Therefore, if the rate of a reaction in which some reactant A is consumed is

$$r_{av} \propto [A]^n, \text{ then}$$

$$\frac{1}{\Delta t} \propto [A]^n$$

(Remember that [A] is the initial concentration of the reactant, not the concentration that changes as the reaction proceeds.)

We often find it easier to recognize relationships if we can see them on graphs. For example, we can use graphs to help us recognize the order of reaction with respect to a particular reactant. Plotting experimental data as shown in **Figure 3**, and looking for a straight line (indicating a direct relationship) will determine the value of *n*.

**INVESTIGATION 6.3.1**

**The Iodine Clock Reaction**
**(p. 403)**
A dramatic colour change allows you to investigate the effect of concentration on rate of reaction.

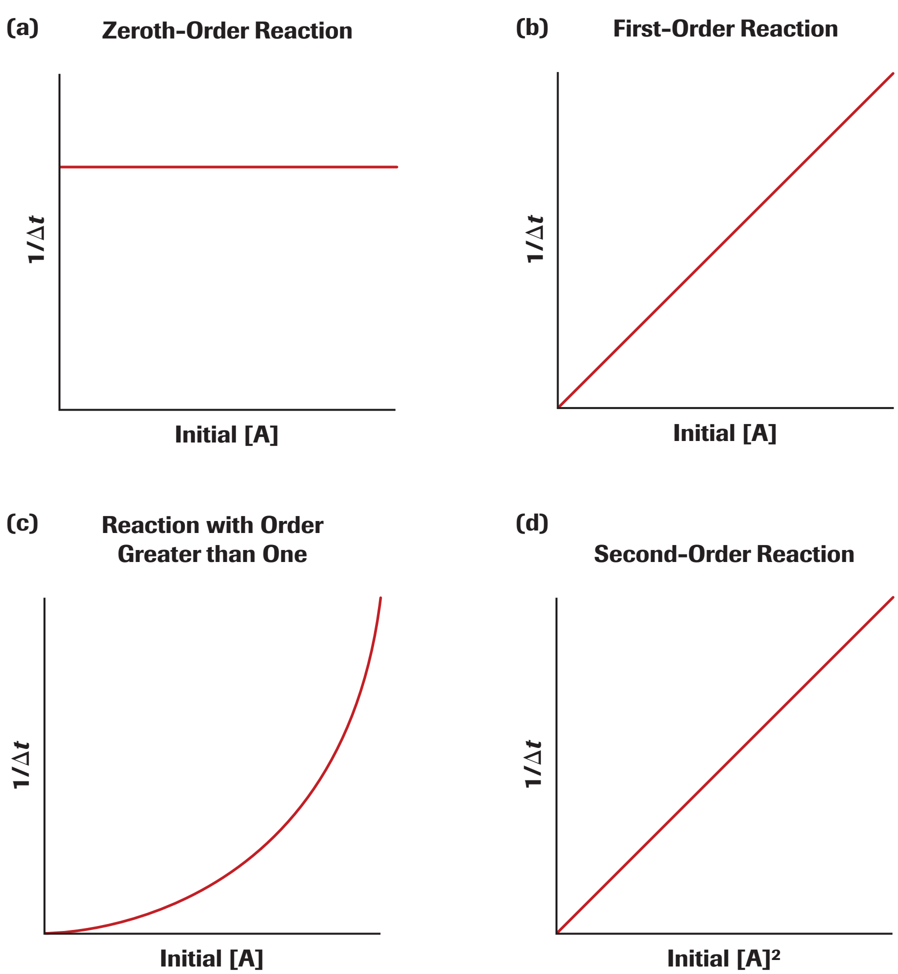


**Figure 3**
When a series of kinetics experiments is performed on a given system, the rates of reaction (1/time) are measured for different initial concentrations of a reactant. When the evidence is graphed, you may see one or more of these results.
**(a)** In this plot, $r \propto [A]^0$. The reaction is zeroth order with respect to [A].
**(b)** In this plot, $r \propto [A]^1$. The reaction is first order with respect to [A].
**(c)** In this plot, $r \propto [A]^n$, where $n$ is greater than 1.
**(d)** In this plot, $r \propto [A]^2$. The reaction is second order with respect to [A].