

**rate of formation,  $v_{n,y}$  or  $v_{c,y}$** 

Like the *rate of consumption*, the rate of formation of a specified product may be defined in two ways:

1. As the time derivative of the amount of a product. Thus for a product Y, present at any time in amount  $n_Y$ , the rate of its formation may be given by:

$$v(n_Y) = (dn_Y/dt)$$

This definition is particularly appropriate for open systems.

2. For kinetics in closed systems it is more usual to define a rate of formation per unit volume, denote  $v(c_Y)$ :

$$v(c_Y) = (1/V)(dn_Y/dt)$$

When the volume is constant this reduces to:

$$v(c_Y) = (1/V)(dn_Y/dt) = (d[Y]/dt)$$

When the volume is not constant the relationship  $n_Y = [Y]V$  may be differentiated to give:

$$dn_Y = Vd[Y] + [Y]dV$$

and the rate of formation becomes:

$$v(c_Y) = (d[Y]/dt) + ([Y]/V)(dV/dt)$$

A rate of formation may be specified even for a reaction of time dependent *stoichiometry* or of unknown stoichiometry.

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