rate of consumption, $v_{n,B}$ or $v_{c,B}$

The rate of consumption of a specified *reactant* may be defined in two ways:

1. As the negative of the time derivative of the amount of reactant; thus for a reactant B, present at any time in amount n_B, the rate of its consumption may be defined as:

$$v(n_B) = -(dn_B/dt)$$

This definition is particularly appropriate for open systems.

Here and elsewhere, when a rate is defined in terms of a time derivative, it must be understood that the definition relates to the process occurring in isolation. In a flow system there may be no actual changes with time, and the time derivative must be inferred. Such an inference is also required for a reaction occurring by a composite mechanism.

2. For kinetics in closed systems it is more usual to define a rate of consumption per unit volume; thus for a reactant B the rate of consumption, $v(c_B)$ is given by:

$$v\,(c_B) = -(1/V)(dn_B/dt)$$

When the volume V is constant this reduces to:

$$v(c_B) = -(d[B]/dt)$$

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

$$dc_B = Vd[B] + [B]dV$$

and therefore:

$$v(c_B) = -(d[B]/dt) - ([B]/V)(dV/dt)$$

In contrast to the rate of conversion and the rate of reaction, the rate of consumption of a reactant may be specified even for a reaction of time-dependent *stoichiometry* or of unknown stoichiometry.

The rate of consumption of a reactant is often called its rate of disappearance. However, the former expression is to be preferred since the word disappearance is not appropriately translatable into certain languages. When English is used the word disappearance might be reserved for cases where the reactant is almost completely removed.

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