



## The Kinetic Scheme

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It is possible to describe the de-excitation of a simple fluorescent molecule A by a first order kinetic scheme.

PROCESS	RATE CONSTANT	DESCRIPTION
${}^1A^* \rightarrow A$	$k_r$	radiative emission
${}^1A^* \rightarrow A$	$k_{ic}$	internal conversion
${}^1A^* \rightarrow {}^3A^*$	$k_{isc}$	inter-system crossing
${}^1A^* \rightarrow B + C$	$k_d$	dissociation
${}^1A^* + Q \rightarrow A$	$k_q$	quenching

### Scheme 1

The rate of loss of the excited singlet state may thus be given by

$$\frac{-d[{}^1A^*]}{dt} = [{}^1A^*] \{k_r + k_{ic} + k_{isc} + k_d + k_q[Q]\} \quad (1)$$

This equation may be solved to yield an exponential decay law:

$$[{}^1A^*] = [{}^1A_0^*] \exp\left(\frac{-t}{\tau}\right) \quad (2)$$

where  $[{}^1A_0^*]$  is the initial excited state concentration and the lifetime  $\tau$  is given by:

$$\tau = \frac{1}{\{k_r + k_{ic} + k_{isc} + k_d + k_q[Q]\}} \quad (3)$$

If other processes such as energy transfer or excimer formation occur, this kinetic scheme becomes more complex and the decay law may become non-exponential.

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