

Answer on Question# 42887 - Chemistry - Physical Chemistry

Question:

Handwritten solution for a chemical kinetics problem. The problem asks for the net rate of change of concentration of substance C for a set of reactions. The solution shows the derivation of the rate expression for C, which is $k_1[A][B] - k_2[C] - k_3[C][B]$. This expression is then compared to four options: (a) $-d[A]/dt$, (b) $-d[B]/dt$, (c) $d[C]/dt$, and (d) $d[D]/dt$. Option (c) is marked as the correct answer with a checkmark.

51. For the set of reactions
(i) $A+B \xrightleftharpoons[k_2]{k_1} C$; (ii) $C+B \xrightarrow{k_3} D$,
 $k_1[A][B] - k_2[C] - k_3[C][B]$ is equal to

(a) $\frac{-d[A]}{dt}$ (b) $\frac{-d[B]}{dt}$
(c) $\frac{d[C]}{dt}$ (d) $\frac{d[D]}{dt}$

Solution:

Write the expressions for the concentration change of its substance. For each reaction, if the substance is consumed in it, the reaction rate should be subtracted, and if the substance forms in the reaction, the reaction rate expression should be added.

$$\frac{d[A]}{dt} = -k_1[A][B]$$

$$\frac{d[B]}{dt} = -k_1[A][B] - k_3[C][B]$$

$$\frac{d[C]}{dt} = k_1[A][B] - k_2[C] - k_3[C][B]$$

$$\frac{d[D]}{dt} = k_3[C][B]$$

It is clear that the expression from the corresponds to the change in concentration of substance C.

Answer: (c) $d[C]/dt$