

# Writing differential equations of chemical reactions

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Find the differential equations for the following chemical reactions:

1.  $A + B \rightarrow C + D$
2.  $A + B \rightarrow A + C$
3.  $A \rightarrow B \rightarrow C$
4.  $A \rightarrow B + C, B + C \rightarrow A$
5.  $A \rightarrow B + C, B + C \rightarrow A, A + D \rightarrow E$

Here are the answers for the first four problems. I am leaving the fifth one open so you can test yourself. If there are multiple reactions than the rate of the  $i$ -th reaction is simply denoted by  $k_i$  (e.g.  $k_3$  for the rate of the third reaction).

1.  $da/dt = db/dt = -k_1ab, dc/dt = dd/dt = +k_1ab$
2.  $da/dt = 0, db/dt = -k_1ab, dc/dt = +k_1ab$
3.  $da/dt = -k_1a, db/dt = +k_1a - k_2b, dc/dt = +k_2b$
4.  $da/dt = -k_1a + k_2bc, db/dt = +k_1a - k_2bc, dc/dt = +k_1a - k_2bc$