

## Answer on Question# 57491 - Chemistry - Physical chemistry

### Question:

A reaction in which A, B and C react to form products is zero order in A, one-half order in B, and second order in C.

By what factor does the reaction rate change if [A] is doubled (and the other reactant concentrations are held constant)?

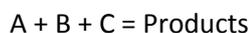
By what factor does the reaction rate change if [B] is doubled (and the other reactant concentrations are held constant)?

By what factor does the reaction rate change if [C] is doubled (and the other reactant concentrations are held constant)?

By what factor does the reaction rate change if the concentrations of all three reactants are doubled?

### Solution

For the reaction



a rate law expression is

$$v = k[A]^0[B]^{0.5}[C]^2 = k[B]^{0.5}[C]^2.$$

The overall order of the reaction is  $0+0.5+2 = 2.5$ .

If the concentrations of all three reactants are doubled

$$\frac{v(1)}{v(2)} = \frac{[B(1)]^{0.5}[C(1)]^2}{[B(2)]^{0.5}[C(2)]^2} = \frac{[1]^{0.5}[1]^2}{[2]^{0.5}[2]^2} = 0.177;$$

The reaction will speed up  $1/0.177 = 5.65$  times.

If the concentration of A is doubled, the reaction rate will be **unchanged**, as the reaction is of zero order by A.

If the concentration of B is doubled,

$$\frac{v(1)}{v(2)} = \frac{[B(1)]^{0.5}}{[B(2)]^{0.5}} = \frac{1^{0.5}}{2^{0.5}} = 0.707.$$

The reaction will speed up  $1/0.707 = 1.41$  times.

If the concentration of C is doubled,

$$\frac{v(1)}{v(2)} = \frac{[C(1)]^2}{[C(2)]^2} = \frac{1^2}{2^2} = \frac{1}{4}.$$

The reaction will speed up **4** times.