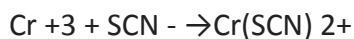


## Answer on Question #70508 - Chemistry - General Chemistry

### Question:

3. In the presence of excess thiocyanate ion,  $\text{SCN}^-$ , the following reaction is first order in chromium (III) ion,  $\text{Cr}^{+3}$ , the rate constant is  $2 \times 10^{-6} \text{ s}^{-1}$ .



a) what is the half-life in hours?

b) How many hours would be required for the initial conc of  $\text{Cr}^{+3}$  to decrease to the following values: 25% left, 12.5% left?

### Solution:

a) The half-life is a time on which the initial population decreased by half of its start value. For the first-order reaction the half-life can be calculated by the following concluding equation:

$$\tau_{1/2} = \frac{\ln 2}{k}$$
$$\tau_{1/2} = \frac{0.693}{2 \cdot 10^{-6} \text{ s}^{-1}} = 3.465 \cdot 10^5 \text{ s}$$

The half-life in hours will be:

$$\tau_{1/2} = \frac{3.5 \cdot 10^5 \text{ s}}{360 \text{ s}} = 96.3 \text{ h}$$

b) If 25% of  $\text{Cr}^{+3}$  left it means that time will be equal to  $\tau_{1/4}$ :

$$t_{25\%} = 2 \cdot \tau_{1/2} = 2 \cdot 96.3 \text{ h} = 192.6 \text{ h}$$

12.5 % of initial concentration of the ion left will be equal to  $\tau_{1/8}$ :

$$t_{12.5\%} = 3 \cdot \tau_{1/2} = 3 \cdot 96.3 \text{ h} = 288.9 \text{ h}$$

### Answer:

a)  $\tau_{1/2} = 96.3 \text{ h}$

b)  $t_{25\%} = 192.6 \text{ h}$ ,  $t_{12.5\%} = 288.9 \text{ h}$