Calculating the value after a specified time period, or the time taken to reach a specified value.

**Half life**

The half-life of a drug is the period of time required for its concentration or amount in the body to be reduced by exactly one-half. The symbol for half-life is $T_{1/2}$.

**Example 1**

Drug A has a half-life of 2 hours. If the initial plasma level of the drug, given as a single dose, is 1200mg/L, what will its plasma level be after 8 hours?

**Method**

**Step 1:** Tabulate the time and value for each half-life

- $2\text{ hr} = 1\text{ half-life} = 1200 \div 2 = 600\text{ mg/L}$
- $4\text{ hr} = 2\text{ half-life} = 600 \div 2 = 300\text{ mg/L}$
- $6\text{ hr} = 3\text{ half-life} = 300 \div 2 = 150\text{ mg/L}$
- $8\text{ hr} = 4\text{ half-life} = 150 \div 2 = 75\text{ mg/L} \checkmark$
Example 2

Drug B has a half-life of 3 hours. If the initial plasma level of the drug, given as a single dose, is 3600mg/L, what will its plasma level be after 10 hours?

**Note:** In this case the time/value does not coincide with an exact half-life interval.

**Method**

**Step 1:** Tabulate the time and value for each half-life, to the next higher time/value interval.

- 3hr = 1 half-life = $3600 \div 2 = 1800 \text{mg/L}$
- 6hr = 2 half-life = $1800 \div 2 = 900 \text{mg/L}$
- 9hr = 3 half-life = $900 \div 2 = 450 \text{mg/L}$
- 12hr = 4 half-life = $450 \div 2 = 225 \text{mg/L}$

**Step 2:** Tabulate the values and times between 300mg/l and 150mg/l.

Since $180 \text{mg/L} = 300 \text{mg/L} - 0.8 \times 150 \text{mg/L}$, the time will equal $32 \text{hr} + 0.8 \times 8 \text{hr}$, value and time being inversely proportional.

**Step 3:**

\[ \begin{align*}
\text{a)} & \quad \text{Calculate the difference:} \\
& \quad 450 - 225 = 225 \\
\text{b)} & \quad \text{Multiply the difference:} \\
& \quad 225 \times \frac{1}{3} = 75 \\
\text{c)} & \quad \text{Subtract from upper value} \\
& \quad 450 - 75 = 375 \text{mg/L} \\
\end{align*} \]

Q1

Drug D has a half-life of 90 min. If the initial plasma level of the drug, given as a single dose, is 2688mg/L, what will its plasma level be after 8hr?

Q2

Drug E has a half-life of 16 hours. If the initial plasma level of the drug, given as a single dose, is 512mg/L, how long will it take for the plasma level to fall to 24mg/L?

**Answers:** Q1 = 70mg/L. Q2 = 72hr.