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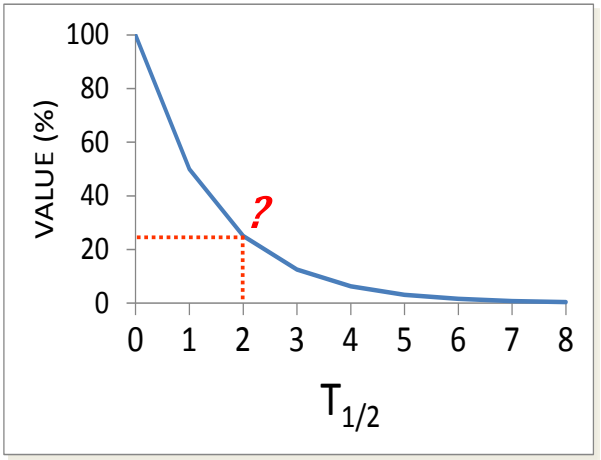
AT A GLANCE/ PHARMACY CALCULATIONS HALF-LIVES

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 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

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

Student Learning Advisory Service

Contact us

Please come and see us if you need any academic advice or guidance.

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Our offices are next to Santander Bank

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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?

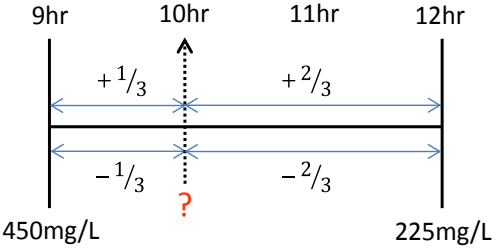
Note: In this case the time/value does not coincide with an exact half-life interval.

Method

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

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

Step 2: Tabulate the times and values between 9hr and 12 hr.



Since 10hr equals 9hr + 1/3 of the interval to 12hr, the value will equal that at 9hr – 1/3 of the difference, time and value being inversely proportional.

Step 3: ⓐ Calculate the difference:

$$450 - 225 = 225$$

ⓑ Multiply the difference:

$$225 \times {}^{1}/_{3} = 75$$

ⓒ Subtract from upper value

$$450 - 75 = \mathbf{375}\boldsymbol{mg/L}$$ ✓

Example 2

Drug C has a half-life of 8 hours. If the initial plasma level of the drug is, given as a single dose , is 4800mg/L, how long will it take for the plasma level to fall to 180mg/L?

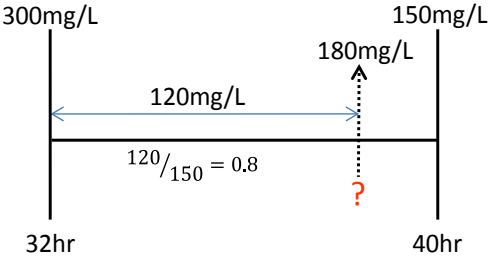
Note: Here we are solving for time rather than value.

Method

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

$$8\text{hr} = 1\text{ half} - \text{life} = 4800 \div 2 = 2400mg/L$$
$$16\text{hr} = 2\text{ half} - \text{life} = 2400 \div 2 = 1200mg/L$$
$$24\text{hr} = 3\text{ half} - \text{life} = 1200 \div 2 = 600mg/L$$
$$32\text{hr} = 4\text{ half} - \text{life} = 600 \div 2 = 300mg/L$$
$$40\text{hr} = 4\text{ half} - \text{life} = 600 \div 2 = 150mg/L$$

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



Since 180mg/l equals 300mg/l – 0.8 x 150mg/l, the time will equal 32hr + 0.8 x 8hr, value and time being inversely proportional.

Step 3: ⓐ Calculate the difference:

$$40 - 32 = 8hr = 480\ min$$

ⓑ Multiply the difference:

$$480 \times 0.8 = 384\ min = 6hr\ 24min$$

ⓒ Add to lower value

$$32hr + 6hr\ 24min = \mathbf{38hr\ 24min}$$ ✓

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.