

Kaplan USMLE Step 1: Calculating a drug's half-life

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If you're preparing for the United States Medical Licensing Examination[®] (USMLE[®]) Step 1 exam, you might want to know which questions are most often missed by test-prep takers. Check out this example from Kaplan Medical, and read an expert explanation of the answer. Also check out all posts in this series.

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This month's stumper

A new investigational drug is undergoing Phase I clinical trials. The half-life of this drug is nine hours. A healthy volunteer has an adverse reaction, and the drug is immediately discontinued.

How long will it take until the plasma drug level is about 6% of the initial steady state level?

- A. Nine hours.
- B. 18 hours.
- C. 27 hours.
- D. 36 hours.
- E. 45 hours.
- F. 54 hours.

The correct answer is D.

Kaplan Medical explains why

The rule of thumb is that the levels decrease by half every half-life. Therefore, 50% will remain after one half-life, 25% will remain after two half-lives, 12.5% will remain after three half-lives, and 6.25% will remain after four half-lives. In this case, the half-life of this drug is nine hours, so it will reach about 6% of steady state levels in 36 hours:

- | One half-life: 50% drug left, time = Nine hours.
- | Two half-lives: 25% drug left, time = 18 hours.
- | Three half-lives: 12.5% drug left, time = 27 hours.
- | Four half-lives: 6.25% drug left, time = 36 hours.

Tips to remember

- | The half-life ($t_{1/2}$) is the time it takes for the plasma concentration of a drug or the amount of drug in the body to be reduced by 50%.
- | 50% will remain after one half-life, 25% after two half-lives, 12.5% after three half-lives, and 6.25% after four half-lives.

For more prep questions on USMLE Steps 1, 2 and 3, view other posts in this series.