Name : _____ Date : _____

Half-life Practice with Problems

1. Mercury-197 has a half-life of 3 days. If the amount of mercury-197 needed for a study is 1 gram and the time allowed for a shipment to a lab is 15 days, how much mercury-197 will the lab need to order?

2. What is the half-life of a 100-gram sample of nitrogen-16 that decays to 12.5 grams in 21.6 seconds?

3. The half-life of hafnium-156 is 0.025 seconds. How long will a 560-gram sample decay to $\frac{1}{4}^{th}$ of its original mass?

4. Chromium-48 has a short half-life of 21.6 hours. How long will it take 360 grams of chromium-48 to decay to 11.25 grams?

5. If the half-life of iodine-131 is 8.10 days, how long will it take a 50-gram sample to decay to 3.125 grams?

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Half-life Practice with Problems

Answers

1. Mercury-197 has a half-life of 3 days. If the amount of mercury-197 needed for a study is 1 gram and the time allowed for a shipment to a lab is 15 days, how much mercury-197 will the lab need to order?

   32 grams

   In 15 days, mercury-197 passes through 5 half-lives (15/3 = 5). So, the amount that the lab will need to order is $1 \times 2^5 = 32$ grams.

2. What is the half-life of a 100-gram sample of nitrogen-16 that decays to 12.5 grams in 21.6 seconds?

   7.2 seconds

   For the sample to decay from a 100 grams to 12.5 grams, it passes through 3 half-lives (100 x ½ = 50 x ½ = 25 x ½ = 12.5). So the half-life of nitrogen-16 is 21.6/3 = 7.2 seconds.

3. The half-life of hafnium-156 is 0.025 seconds. How long will a 560-gram sample decay to ¼ th of its original mass?

   0.05 seconds

   If a sample has decayed to ¼ th of its original mass, it has passed through 2 half-lives. So the time taken is = 2 x 0.025 = 0.05 seconds.

4. Chromium-48 has a short half-life of 21.6 hours. How long will it take 360 grams of chromium-48 to decay to 11.25 grams?

   108 hours

   For 360 grams to decay to 11.25 grams, it has to pass through 5 half-lives (360 x ½ = 180 x ½ = 90 x ½ = 45 x ½ = 22.5 x ½ = 11.25). So, the time taken for the sample to decay = 21.6 x 5 = 108 hours.

5. If the half-life of iodine-131 is 8.10 days, how long will it take a 50-gram sample to decay to 3.125 grams?

   32.4 days

   The sample passes through 4 half-lives (50 x ½ = 25 x ½ = 12.5 x ½ = 6.25 x ½ = 3.125). So the time taken = 8.1 x 4 = 32.4 days.