Half-Life Worksheet

1. Define the term half-life.

2. What is the utility of determining the half-life of a radioactive isotope?

3. The half-life of iodine-125 is 60 days. What fraction of iodine-125 nuclides would be left after 360 days?

4. An isotope of cesium-137 has a half-life of 30 years. If 1.0 g of cesium-137 disintegrates over a period of 90 years, how many grams of cesium-137 would remain?

5. How long does it take 180 grams of Au-198 to decay to ⅛ th its original mass? (Half-life of Au-198 = 2.70 days)

6. The half-life of chromium-51 is 28 days. How much of a sample of 510 grams of chromium-51 would remain after 56 days?

7. Titanium-51 has a half-life of 6 minutes. How much titanium-51 would remain after an hour?

Half-Life Worksheet

1. Define the term half-life.

    The amount of time taken by half the radioactive atoms in an isotope to decay and become stable is termed half-life.

2. What is the utility of determining the half-life of a radioactive isotope?

    If the half-life of a radioactive isotope is known, we can determine how long it will be radioactive, how long it will need to be stored, and when it will be safe to handle.

3. The half-life of iodine-125 is 60 days. What fraction of iodine-125 nuclides would be left after 360 days?

    $1/64^{th}$

    Number of half-lives of iodine-125: 360/60 = 6

    If we start with 1 gram of iodine-125, then after one half-life, we'll have ½ gram. After five more half-lives, we get ½ → ¼ → ⅛ → 1/16 → 1/32 → 1/64

4. An isotope of cesium-137 has a half-life of 30 years. If 1.0 g of cesium-137 disintegrates over a period of 90 years, how many grams of cesium-137 would remain?

    0.125 grams

    Number of half-lives of cesium-137: 90/30 = 3

    If we start with 1 gram of cesium-137, then after three half-lives, we'll have

    1 x ½ x ½ x ½ = ⅛ or 0.125 grams.

5. How long does it take 180 grams of Au-198 to decay to ⅛ th its original mass? (Half-life of Au-198 = 2.70 days)

    8.1 days

    For Au-198 to decay to $⅛^{th}$ of its original mass, it must go through 3 half-lives (1 → ½ → ¼ → ⅛). Hence, the time required = 3 x 2.7 days = 8.1 days.

6. The half-life of chromium-51 is 28 days. How much of a sample of 510 grams of chromium-51 would remain after 56 days?

    127.5 grams

    After 56 days, chromium-51 will have gone through 2 half-lives (56/28 = 2). So the amount of chromium-51 left after 56 days will be = 510 x ½ x ½ = 127.5 grams (128 grams if rounded off).

7. Titanium-51 has a half-life of 6 minutes. How much titanium-51 would remain after an hour?

    $1/1024^{th}$

    After 1 hour, 10 half-lives of titanium-51 will have passed (1 hour = 60 minutes; 60/6 = 10). So after 10 half-lives, we would be left with $1/2^{10} = 1/1024^{th}$ titanium-51.