

Half-life worksheet

1. Scintigraphy is a method of medical imaging used to visualize certain organs as they are functioning. It involves a radioactive substance, which is injected into the patient. The radioactive substances used usually have a very short half-life. Explain why they are preferred over substances with longer half-lives.

Shorter half-life means radioactive material leaves body more quickly.

2. Cesium-137 has a half-life of about 30 years. Is it normal that after more than 20 years, levels of radioactivity in the ground near Chernobyl are still very high? Explain your answer. Chernobyl nuclear explosion occurred in 1986.

They are high because 30 years still have not passed, still have more than $\frac{1}{2}$ the radioactive material. In 2016 will have $\frac{1}{2}$ gone.

3. Fill in the table which demonstrates the half life of 12 g of uranium which takes 35 000 years to decrease its radioactive substance by half.

| Gram | Decay time | Percent |
|--------|------------|---------|
| 12 g | Start | 100% |
| 6 g | 35 000 | 50 % |
| 3 g | 70 000 | 25 % |
| 1.5 g | 105 000 | 12.5 % |
| 0.75 g | 140 000 | 6.25 % |

4. In the last column of the table, write the number of days necessary for each of the isotopes to weigh less than 1 g.

| Isotope | Half-life | Mass | Number of days |
|---------------|-----------|-------|------------------|
| Sodium 24 | 15 hours | 90 g | 105 hrs 4.3 days |
| Phosphorus 32 | 14 days | 50 g | 84 days |
| Iodine 131 | 8 days | 120 g | 56 days |

5. Carbon-14 is a radioactive isotope often used to date objects discovered on archeological digs. Its half-life is 5 770 years. An archeologist has discovered a piece of wood. Analysis of the wood shows that it contains only 10% of carbon-14. What is the approximate age of the piece discovered? Show work.

$$\begin{aligned}
 \text{Start} &= 100\% \\
 5770 &= 50\% \\
 11540 &= 25\% \\
 17310 &= 12.5\% \quad \leftarrow 10\% \\
 23080 &= 6.25\%
 \end{aligned}$$

around 20 000 years old.

6. Explain when it would be useful to use polonium-216 which has a half life of 0.16 seconds and when you would want to use potassium-40 which has a half life of 1 300 000 000 years.

polonium 216 - In nuclear medicine when you don't want radiation to stay long in the body.

potassium 40 - when trying to date something very, very old - over 1300 000 000 years old.