Name: KEY Official Class: _____ Date: _____

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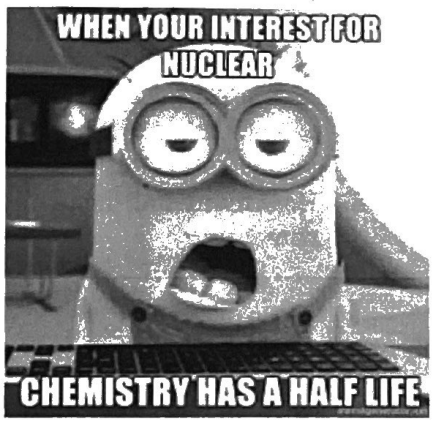
More Half Life Practice

Radioactive isotopes are unstable, which means that they spontaneously (readily) decay (break apart) into different isotopes or elements. Radioactive isotopes give off radiation during the process of radioactive decay. Radiation can be in the form of particles (alpha, beta, or positron) and/or pure energy (gamma rays). For radioactive isotopes, the rate (speed) of radioactive decay is constant. All radioactive isotopes have a specific **half-life**, or **time that it takes for exactly half of the sample to decay into something else and half of the sample to remain unchanged.** It is because of information about half-lives that we can know how old the Earth is and how old fossils are.



Time Elapsed

1. How long will it take for 30. g of ^{226}Ra to decay to 7.5 g?

HL = 1599 years 30 → 15 → 7.5 (1 H.L, 2 H.L) 2 half lives occur 2(1599) = **3198 years**

2. How long will it take for a 28 g sample of ^{19}Ne to decay to 3.5 g?

HL = 17.22 s 28 → 14 → 7 → 3.5 (1 H.L, 2 H.L, 3 H.L) 3 half lives occur 3(17.22) = **51.66 seconds**

Amount Remaining

3. How many grams of ^{16}N will be left from a 16.0 g sample after 21.6 s?

HL = 7.13 s $\frac{21.6}{7.13}$ = 3 H.L occur 16 → 8 → 4 → 2 (1 H.L, 2 H.L, 3 H.L) **2 grams remain**

4. After 9.8×10^{10} years, how many grams will be left from a 256 g sample of Th-232?

HL = 1.40×10^{10} y $\frac{9.8 \times 10^{10}}{1.4 \times 10^{10}}$ = 7 H.L occur 256 → 128 → 64 → 32 → 16 → 8 → 4 → 2 (1 H.L, 2 H.L, 3 H.L, 4 H.L, 5 H.L, 6 H.L, 7 H.L)

Fraction Remaining:

5. What fraction of a 100 g sample of K-42 will remain after 24.8 hours?

H.L = 12.36 h $\frac{24.8}{12.36}$ = 2 H.L occur 1 → $\frac{1}{2}$ → $\frac{1}{4}$ (1 H.L, 2 H.L) **$\frac{1}{4}$ remains**

2 grams remain

6. What fraction of a radioactive I-131 sample would remain unchanged after 32.28 days?

H.L = 8.021 d $\frac{32.28}{8.021}$ = 4 H.L occur 1 → $\frac{1}{2}$ → $\frac{1}{4}$ → $\frac{1}{8}$ → $\frac{1}{16}$ (1 H.L, 2 H.L, 3 H.L, 4 H.L) **$\frac{1}{16}$ remains**

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Number of Half-Lives

7. How many half-life periods will it take for 50 g of ^{99}Tc to decay to 6.25 g?

50 → 25 → 12.5 → 6.25

1H.L 2H.L 3H.L

3 Half lives occur

8. How many half-lives have elapsed if a 100 g sample of a radioactive isotope has only 12.5 g remaining?

100 → 50 → 25 → 12.5

1H.L 2H.L 3H.L

3 Half lives occur

Original Mass:

9. If 2 grams of an original sample of gold-198 remained after 13.45 days, what was the mass of the original sample? (WORK BACKWARD)

^{198}Au

H.L: 2.695d

$\frac{13.45}{2.695} = 5$ HL occur

64 → 32 → 16 → 8 → 4 → 2

original sample = 64 g

10. If 16.5 g of uranium-235 remain after 2.84×10^9 years, how much of the radioactive isotope was in the original sample? (WORK BACKWARD)

H.L = 7.04×10^8 y

$\frac{2.84 \times 10^9}{7.04 \times 10^8} = 4$ HL occur

$264_g \rightarrow 132_g \rightarrow 66_g \rightarrow 33_g \rightarrow 16.5_g$

original amount = 264 g

Half Life:

11. An original sample of the radioisotope fluorine-21 had a mass of 80.0 milligrams. Only 20.0 milligrams of this original sample remain unchanged after 8.32 seconds. What is the half-life of fluorine-21?

8.32 s.

80 → 40 → 20

1H.L 2H.L

8.32 seconds

2H.L

$\frac{8.32}{2} = 4.16$

H.L = 4.16 sec

12. What is the half-life of a 208 g sample of sodium-24 if it decays to 13.0 g of sodium-24 within 60.0 hours?

60.0 hours

208 → 104 → 52 → 26 → 13

1H.L 2H.L 3H.L 4.H.L

60 hours

4 H.L

$\frac{60}{4} = 15$

H.L = 15 hours