

## Nuclear Chemistry Worksheet

1. A bag of un-popped popcorn contains 335 kernels. After 2 minutes in the microwave, 48 kernels remain un-popped. What is the half-life of popcorn in seconds?

2. What does it mean if something is radioactive? What causes something to be radioactive?

3. How do nuclear power-plants produce energy? What is radiation and where does it come from?

4. Supply a complete symbol, with superscript and subscript, for each of the following.

a) alpha particle

b) beta particle

c) positron

d) gamma ray

5. Write a balanced nuclear equation for each of these changes.

(a) Alpha emission from Pu-242.

(b) Beta emission from Mg-28.

(c) Positron emission from Si-26.

(d) Electron capture by Ar-37.

6. Below are the products of decay reactions. Determine the species that decayed.

(a) Fm-257 by alpha emission.

(b) Bi-211 by beta emission.

(c) Nd-141 by positron emission.

(d) Ta-179 by electron capture.

7. Palladium -114 has a half-life of 2.4 minutes. What percentage of palladium-114 atoms will remain after the following periods of time?

a) 4.8 minutes

b) 4 half-lives

c) 6 minutes

8. A certain substance has a half-life of 38 years.

If 25 grams are present initially, how much remains after 7 years? How much decayed?

9. If you have 20 g of  $^{234}\text{Pa}$  ( $t_{1/2} = 7$  hours) how long do you have to wait until you have only 5 g left?

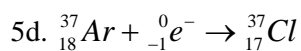
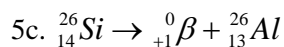
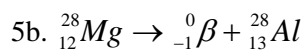
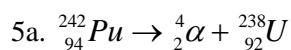
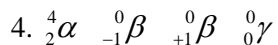
10. Once the C-14 activity in a fossil has dropped below 99.8% of its original value, it can no longer be accurately measured. What is the age of the oldest fossil we could accurately date using carbon dating? The half-life of carbon-14 is 5730 years.

## ANSWERS

1. 0.7135 minutes = 42.8 seconds

2. "Radioactive" indicates that the isotope spontaneously decays by one of the four decay modes. This is caused by an unstable nucleus (n/p ratio too high or too low).

3. Nuclear power plants use fission reactions because they produce large amounts of energy. Radiation is the emitted particles (alpha, beta, gamma) that come from the decay of fission by-products.



6a. No-261

6b. Pb-211

6c. Pm-141

6d. W-179

7a. 25%

7b. 6.25%

7c. 17.7%

8. 22 g remain, so 3 decayed

10. 14 hours

11. 51374 years = approximately 50 thousand years