**Nuclear Chemistry**

 **Worksheet**

17 Practice Problems

Organic Chemistry Tutor

1. How many protons, neutrons, and electrons are present in Mercury-201?

2. Which of the following is an alpha particle?

A. $$

B. $$

C. $$

D. $$

E. $$

3. What element will be formed if Thorium-230 undergoes alpha decay?

4. What element will be produced if Iodine-131 undergoes beta decay?

5. Which of the following processes converts a neutron into a proton?

A. Alpha Decay

B. Positron Production

C. Gamma Decay

D. Beta Decay

E. Electron Capture

6. Identify the unknown element.

$$+ → 3+2 + ?$$

7. Which of the following elements will most likely undergo radioactive decay?

A. Carbon-12

B. Nitrogen-14

C. Carbon-14

D. Oxygen-16

E. Neon-20

8. Which form of radioactive decay will Carbon-14 use to increase its nuclear stability?

A. Alpha Decay

B. Positron Production

C. Gamma Decay

D. Beta Decay

E. Electron Capture

9. Which of the following elements will not undergo radioactive decay?

A. Lead-206

B. Radium-226

C. Thorium-234

D. Uranium-238

E. Radon-222

10. What is the difference between nuclear fission and nuclear fusion. Give examples.

11. The half-life of Oxygen-15 is 2 minutes. If there are 320 g of Oxygen-15 in a sample, how many grams of Oxygen-15 will remain after 10 minutes?

12. Iodine-131 has a half-life of 8 days. If there are 1200 g of Iodine-131, how long will it take for 1125g of I-131 to decay?

A. 16 days

B. 24 days

C. 32 days

D. 40 days

E. 48 days

13. What fraction of a sample undergoing radioactive decay will remain after 5 half-lives?

A. 1/4

B. 1/8

C. 1/16

D. 1/32

E. 1/64

14. A living tree has a Carbon-14 decay rate of 13.6 counts per minute per gram. A sample of wood from a similar tree has a decay rate of 8.4 counts per minute per gram. How long has it been since the wood was part of a living tree? The half-life of Carbon-14 is 5,730 years.

15. The mass of a proton, neutron, and electron are 1.67262 x 10-27 kg, 1.67493 x 10-27 kg, and 9.11 x 10-31 kg respectively. (a) What is the mass defect (in kg) of Iron-56 (55.9349 amu)? (b) Calculate the nuclear binding energy in MeV per nucleon of Fe-56. (c) If 7 moles of Fe-56 were formed from protons, neutrons, and electrons, how much energy would be released in Joules?

16. The half-lives of certain isotopes are shown below. Which of the following isotopes has the highest kinetic stability?

A. Oxygen-15 (2 min)

B. Iodine-131 (8 days)

C. Sodium-24 (14 hours)

D. Carbon-14 (5730 years)

17. Which of the following isotopes has the highest thermodynamic stability given the binding energy per nucleon?

A. Carbon-12 (7.7 MeV)

B. Iron-56 (8.79 MeV)

C. Hydrogen-2 (1.11 MeV)

D. Oxygen-16 (7.98 MeV)

**Answers:**

1. 80 protons, 80 electrons, and 121 neutrons.

2. D

3. $$

4. $$

5. D

6. $$

7. C

8. D

9. A

10. Nuclear Fission splits heavy atoms into smaller atoms. Nuclear fusion combines smaller atoms into larger atoms.

11. 10 grams

12. C

13. D

14. 3,983 years

15a. Δm = -8.776 x 10-28 kg

15b. NBE = 8.8 MeV per nucleon

15c. 3.33 x 1014 J

16. D

17. B