

Nuclear Chemistry Worksheet

17 Practice Problems

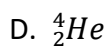
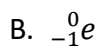
Organic Chemistry Tutor

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

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

2. Which of the following is an alpha particle?

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



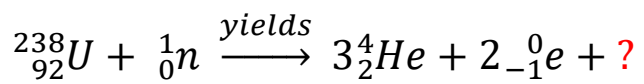
5. Which of the following processes converts a neutron into a proton?

- A. Alpha Decay
- B. Positron Production
- C. Gamma Decay
- D. Beta Decay
- E. Electron Capture

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

6. Identify the unknown element.



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

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?

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

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 1.67262×10^{-27} kg, 1.67493×10^{-27} kg, and 9.11×10^{-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. ${}^{226}_{88}\text{Ra}$

4. ${}^{131}_{54}\text{Xe}$

5. D

6. ${}^{227}_{88}\text{Ra}$

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. $\Delta m = -8.776 \times 10^{-28} \text{ kg}$

15b. NBE = 8.8 MeV per nucleon

15c. $3.33 \times 10^{14} \text{ J}$

16. D

17. B