

Chapter 11 - Study Guide

Multiple Choice

Identify the letter of the choice that best completes the statement or answers the question.

- _____ 1. What is the process in which an unstable atomic nucleus emits charged particles or energy or both?
- radioactivity
 - oxidation
 - decomposition
 - none of the above
- _____ 2. Uranium-238 undergoes nuclear decay. Therefore, uranium-238 will
- remain stable.
 - change into a different element altogether.
 - emit neutral particles and no energy.
 - none of the above
- _____ 3. What type of nuclear decay produces energy instead of a particle?
- alpha decay
 - beta decay
 - gamma decay
 - electron decay
- _____ 4. When radium-226 decays to form radon-222, the radium nucleus emits a(an)
- alpha particle.
 - beta particle.
 - gamma ray.
 - electron.
- _____ 5. What type of radiation is emitted when polonium-212 forms lead-208?
- an alpha particle
 - a beta particle
 - gamma radiation
 - all of the above
- _____ 6. Carbon-14 forms nitrogen-14 by
- alpha decay.
 - beta decay.
 - gamma decay.
 - none of the above
- _____ 7. Alpha-emitting substances, such as radon gas, can be a serious health hazard only if
- they are inhaled or eaten.
 - their radiation strikes the skin.
 - exposure to them is external.
 - none of the above
- _____ 8. The half-life of tritium, or hydrogen-3, is 12 years. After about 36 years, how much of a sample of tritium will be left?
- $\frac{1}{8}$
 - $\frac{1}{4}$
 - $\frac{1}{3}$
 - $\frac{1}{2}$
- _____ 9. The half-life of a radioisotope is the amount of time it takes for
- half the sample to decay into something else.
 - all the sample to decay.
 - the age of an artifact to be calculated.
 - detectable radiation to be absorbed by a sample.
- _____ 10. Which of the following is a radioisotope used to date formerly living material?
- carbon-14
 - potassium-40
 - cobalt-60
 - carbon-12
- _____ 11. Transmutation involves
- nuclear change.
 - chemical change.
 - both a nuclear change and a chemical change.
 - neither a nuclear nor chemical change.

- _____ 12. In general, the nucleus of a small atom is stable. Therefore, over very short distances, such as those in a small nucleus,
- the strong nuclear force is much greater than the electric force.
 - the electric force is much greater than the strong nuclear force.
 - the strong nuclear force equals the electric force.
 - the strong nuclear force and the electric force are both attractive.
- _____ 13. During nuclear fission, great amounts of energy are produced from
- very small amounts of mass.
 - tremendous amounts of mass.
 - a series of chemical reactions.
 - particle accelerators.
- _____ 14. Which of the following is an advantage of using nuclear power plants to produce electricity?
- Nuclear power plants do not pollute the air.
 - Nuclear power plants produce wastes that are easy to dispose.
 - Nuclear power plants produce more stable wastes compared to fossil fuel combustion.
 - all of the above
- _____ 15. Which of the following is NOT a way that water is used in a nuclear power station?
- Water cools the steam in the turbine chamber.
 - Water is changed to steam by heat released by the reactor core.
 - Steam makes the turbines rotate.
 - Running water cools the rotating turbines.
- _____ 16. Many people work near a source of nuclear radiation. To detect the amount of exposure they have to radiation, they most likely will use a
- Flux capacitor
 - Dosimeter
 - radon kit.
 - lead shield.
- _____ 17. Suppose three neutrons are released when an atom in a sample of fissionable nuclei undergoes fission. Each of these neutrons has enough energy to cause another fission reaction in another nucleus of the material. If the reaction is not controlled, how many atoms will have undergone fission after a series of five additional nuclear fissions?
- 15
 - 18
 - 243
 - 729

Completion

Complete each sentence or statement.

- Francium has 36 isotopes, but only francium-223 occurs in nature. Francium-223 spontaneously emits particles and energy, so francium-223 is a(an) _____ of francium.
- An alpha particle is the same as a(an) _____ nucleus.
- In the symbol ${}^4_2\text{He}$, the superscript 4 is the _____ for helium, and the subscript 2 is the _____ for helium.
- You want to be shielded from all three types of nuclear radiation. If you find shielding that blocks _____ radiation, then it will most likely also block the other two types.
- When a human body is exposed to external nuclear radiation, the amount of tissue damage depends on the _____ power of the radiation.
- A sample of a radioisotope had a mass of 100.0 g. After exactly 24 days, 6.25 g of the sample remained. The half-life of the isotope is _____ days.

Name: _____

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24. In nuclear reactions, _____ is converted into energy.
25. Strong nuclear forces act on both _____ and _____; electric forces in the **nucleus** act only among _____.
26. In a(an) _____, neutrons released during a fission reaction cause a series of other fission reactions.
27. The fission reaction within a nuclear reactor is kept under control by the use of _____ that absorb extra _____.

Short Answer

28. How did the physicist Becquerel first observe the effects of nuclear decay?

29. What is one common source of background radiation?

30. Radiation treatments are commonly used to treat cancerous tumors. Explain why the radiation for these treatments comes in many different beams **from many different directions** toward the body instead of just one beam aimed toward the tumor.

31. What particle will balance the following nuclear equation?
$${}_{91}^{234}\text{Pa} \rightarrow {}_{92}^{234}\text{U} + ?$$

32. In terms of forces, when does a nucleus become radioactive?

33. What radioisotope is used as the fuel for a nuclear reactor?