

Name: \_\_\_\_\_

\_\_\_ 1) Compared to an ordinary chemical reaction, a fission reaction will

- 1) absorb smaller amounts of energy
- 2) absorb larger amounts of energy
- 3) release smaller amounts of energy
- 4) release larger amounts of energy

\_\_\_ 2) The atoms of some elements can be made radioactive by

- 1) separating them into their isotopes
- 2) placing them in a magnetic field
- 3) bombarding them with high-energy particles
- 4) heating them to a very high temperature

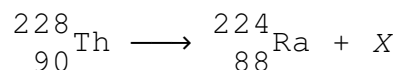
\_\_\_ 3) If 8.0 grams of a sample of  $^{60}\text{Co}$  existed in 1990, in what year will the remaining amount of  $^{60}\text{Co}$  in the sample be 0.50 gram?

- 1) 2006
- 2) 1995
- 3) 2011
- 4) 2000

\_\_\_ 4) A radioisotope is called a tracer when it is used to

- 1) kill bacteria in food
- 2) determine the age of animal skeletal remains
- 3) determine the way in which a chemical reaction occurs
- 4) kill cancerous tissue

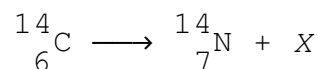
\_\_\_ 5) Given the equation:



What particle is represented by the letter X?

- 1) an alpha particle
- 2) a beta particle
- 3) a neutron
- 4) a positron

\_\_\_ 6) Given the equation:



What particle is represented by the letter X?

- 1) an alpha particle
- 2) a proton
- 3) a neutron
- 4) a beta particle

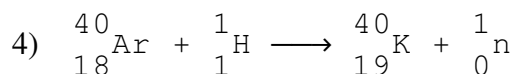
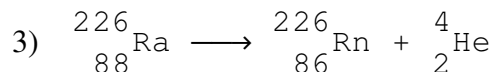
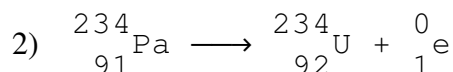
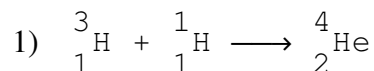
\_\_\_ 7) Radiation used in the processing of food is intended to

- 1) increase the rate of nutrient decomposition
- 2) convert ordinary nutrients to more stable forms
- 3) kill microorganisms that are found in food
- 4) replace chemical energy with nuclear energy

\_\_\_ 8) At the end of 12 days,  $\frac{1}{4}$  of an original sample of a radioactive element remains. What is the half-life of the element?

- 1) 24 days
- 2) 6 days
- 3) 48 days
- 4) 3 days

\_\_\_ 9) Which equation represents a fusion reaction?



- \_\_\_ 10) Radioactive elements include all those elements whose nuclei contain more than
- 1) 83 neutrons
  - 2) 83 amu
  - 3) 83 nucleons
  - 4) 83 protons
- \_\_\_ 11) Radioisotopes used for medical diagnosis must have
- 1) long half-lives and be slowly eliminated by the body
  - 2) long half-lives and be quickly eliminated by the body
  - 3) short half-lives and be slowly eliminated by the body
  - 4) short half-lives and be quickly eliminated by the body
- \_\_\_ 12) Given the equation:
- $$X \longrightarrow {}^4_2\text{He} + {}^{216}_{85}\text{At}$$
- What element is represented by the letter X?
- 1) Rn
  - 2) Ra
  - 3) Fr
  - 4) Bi
- \_\_\_ 13) Which fissionable elements are produced in breeder reactors?
- 1) lithium-6 and hydrogen-3
  - 2) carbon-14 and oxygen-17
  - 3) uranium-233 and plutonium-239
  - 4) cesium-137 and radon-222
- \_\_\_ 14) Which particle is given off when phosphorus-32 undergoes a transmutation reaction?
- 1) a positron
  - 2) a neutron
  - 3) an alpha particle
  - 4) a beta particle
- \_\_\_ 15) Which particle has the *greatest* mass?
- 1) an alpha particle
  - 2) an electron
  - 3) a neutron
  - 4) a beta particle
- \_\_\_ 16) A gamma ray is *best* described as having
- 1) no electric charge and no mass
  - 2) a negative charge and no mass
  - 3) a positive charge and a mass number of 2
  - 4) a positive charge and a mass number of 4
- \_\_\_ 17) A radioactive isotope has a half-life of 10 years. What fraction of the original mass will remain unchanged after 50 years?
- 1)  $\frac{1}{16}$
  - 2)  $\frac{1}{8}$
  - 3)  $\frac{1}{2}$
  - 4)  $\frac{1}{32}$
- \_\_\_ 18) A sample of  $^{131}\text{I}$  decays to 1.0 gram in 40. days. What was the mass of the original sample? [half-life = 8.07 days]
- 1) 32 g
  - 2) 4.0 g
  - 3) 8.0 g
  - 4) 16 g
- \_\_\_ 19) What conditions are required to form He-4 during the fusion reaction in the Sun?
- 1) high temperature and high pressure
  - 2) low temperature and high pressure
  - 3) high temperature and low pressure
  - 4) low temperature and low pressure
- \_\_\_ 20) Which species has a negative charge?
- 1) a lithium ion
  - 2) an alpha particle
  - 3) a beta particle
  - 4) an aluminum ion
- \_\_\_ 21) Which sample will decay *least* over a period of 30 days? [Refer to the *Selected Radioisotopes* chemistry reference table.]
- 1) 10 g of P-32
  - 2) 10 g of I-131
  - 3) 10 g of Rn-222
  - 4) 10 g of Au-198
- \_\_\_ 22) Radioactivity can be detected by use of
- 1) volumetric titration
  - 2) photographic film
  - 3) phenolphthalein dye solution
  - 4) neutral litmus paper

- \_\_\_ 23) Which list of particles can *all* be accelerated by electric and magnetic fields in a particle accelerator?
- 1) alpha particles and neutrons
  - 2) protons, electrons, and alpha particles
  - 3) neutrons, protons, and electrons
  - 4) protons, neutrons, electrons, and alpha particles
- \_\_\_ 24) Which species has a positive charge?
- 1) a beta particle
  - 2) a sulfate ion
  - 3) an alpha particle
  - 4) an bromide ion
- \_\_\_ 25) Which procedure is based on the half-life of a radioisotope?
- 1) accelerating to increase kinetic energy
  - 2) counting to determine a level of radioactivity
  - 3) radiating to kill cancer cells
  - 4) dating to determine age
- \_\_\_ 26) A fusion reaction differs from a fission reaction in that the fusion reaction requires
- 1) extremely low temperatures
  - 2) neutrons with low kinetic energy
  - 3) heavy atomic nuclei as fuels
  - 4) extremely high temperatures
- \_\_\_ 27) The structure of an alpha particle is the same as a
- 1) neon atom
  - 2) helium nucleus
  - 3) lithium atom
  - 4) hydrogen nucleus
- \_\_\_ 28) During a fission reaction, which type of particle is captured by a nucleus?
- 1) proton
  - 2) electron
  - 3) deuteron
  - 4) neutron
- \_\_\_ 29) Samples of elements that are radioactive *must* contain atoms
- 1) in the ground state
  - 2) with unstable nuclei
  - 3) in the excited state
  - 4) with stable nuclei
- \_\_\_ 30) The fission process in a reactor can be regulated by adjusting the number of neutrons available. This is done by the use of
- 1) coolants
  - 2) control rods
  - 3) shielding
  - 4) moderators
- \_\_\_ 31) Brain tumors can be located by using an isotope of
- 1) iodine-131
  - 2) uranium-238
  - 3) carbon-14
  - 4) technetium-99
- \_\_\_ 32) In a nuclear reactor, the purpose of the moderator is
- 1) split neutrons
  - 2) absorb neutrons
  - 3) slow down neutrons
  - 4) produce neutrons
- \_\_\_ 33) Given the equation:
- $${}^1_7\text{N} + {}^4_2\text{He} \longrightarrow {}^1_8\text{O} + {}^1_1\text{X}$$
- What particle is represented by the letter X?
- 1) a proton
  - 2) a deuteron
  - 3) a triton
  - 4) a neutron
- \_\_\_ 34) What does the following reaction represent an example of?
- $${}^1_7\text{N} + {}^4_2\text{He} \longrightarrow {}^1_8\text{O} + {}^1_1\text{H}$$
- 1) a natural transmutation
  - 2) an artificial transmutation
  - 3) a fission reaction
  - 4) a chain reaction

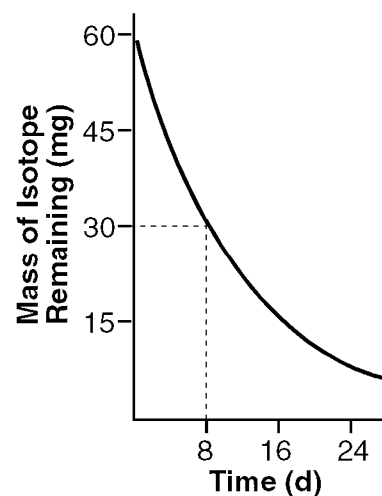
\_\_\_ 35) In the nuclear reactor, the radioisotope U-235 serves as a

- 1) shield
- 2) coolant
- 3) fissionable material
- 4) neutron absorber

\_\_\_ 36) According to the *Selected Radioisotopes* chemistry reference table, which is a decay product of Fe-53?

- |          |          |
|----------|----------|
| 1) Co-53 | 3) Mn-53 |
| 2) Ni-47 | 4) Cr-49 |

\_\_\_ 37) The graph below represents the decay of a radioactive isotope.



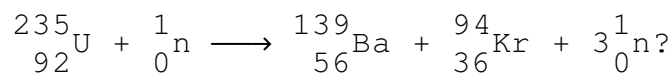
Based on the *Selected Radioisotopes* chemistry reference table, which radioisotope is *best* represented by the graph?

- |                      |                      |
|----------------------|----------------------|
| 1) $^{222}\text{Rn}$ | 3) $^{198}\text{Au}$ |
| 2) $^{32}\text{P}$   | 4) $^{131}\text{I}$  |

\_\_\_ 38) In an electric field, what emanation is deflected toward the negative electrode?

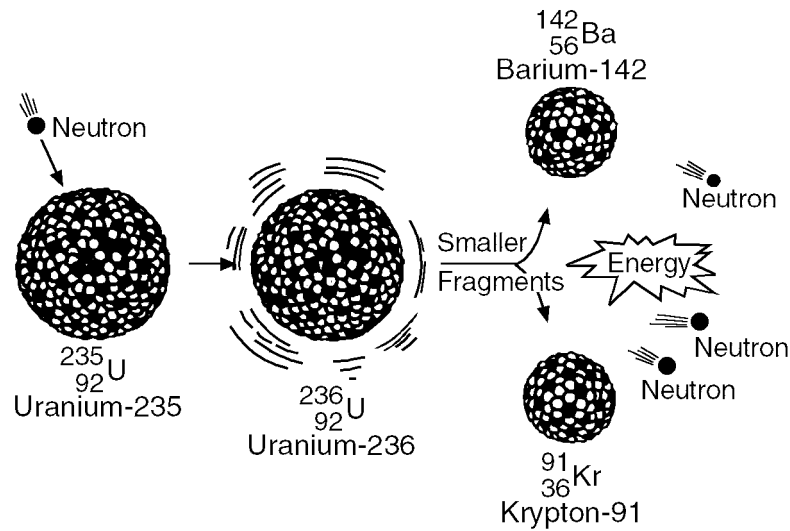
- 1) gamma rays
- 2) alpha particle
- 3) x-rays
- 4) beta particle

\_\_\_ 39) What kind of reaction is represented by the equation below?



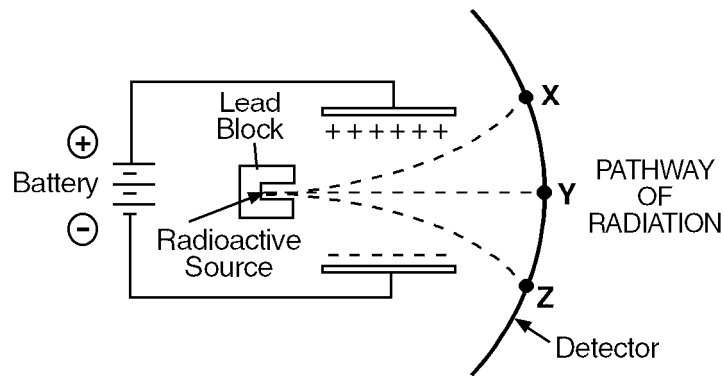
- |                  |                          |
|------------------|--------------------------|
| 1) fission       | 3) fusion                |
| 2) thermonuclear | 4) natural transmutation |

- \_\_\_ 40) The diagram below represents a nuclear reaction in which a neutron bombards a heavy nucleus.



Which type of reaction does the diagram illustrate?

- 1) fusion  
2) fission  
3) beta decay  
4) alpha decay
- \_\_\_ 41) In the diagram below, the radiation from a radioactive source is being separated as it passes between electrically charged plates.



What are the three types of radiation observed on the detector?

- 1) X = gamma, Y = beta, Z = alpha  
2) X = gamma, Y = alpha, Z = beta  
3) X = alpha, Y = beta, Z = gamma  
4) X = beta, Y = gamma, Z = alpha