Do Now Nuclear Chemistry

1. When an alpha particle is emitted by an atom, the atomic number of the atom will

   A) decrease by 2 B) increase by 2
   C) decrease by 4 D) increase by 4

2. Alpha particles are emitted during the radioactive decay of

   A) carbon-14 B) neon-19
   C) calcium-37 **D) radon-222**

3. A carbon-14 atom spontaneously decayed to form a nitrogen-14 atom. This change took place because

   A) a transmutation occurred without particle emission
   B) a transmutation occurred with particle emission
   C) nitrogen-14 has an unstable nucleus
   D) carbon-14 has a stable nucleus

4. Which nuclear equation represents beta decay?

   A) $^{27}_{13}Al + {}^{4}_{2}He \rightarrow {}^{30}_{15}P + {}^{1}_{0}n$
   B) $^{238}_{92}U \rightarrow {}^{234}_{90}Th + {}^{4}_{2}He$
   C) $^{14}_{6}C \rightarrow {}^{14}_{7}N + {}^{0}_{-1}e$
   D) $^{37}_{18}Ar + {}^{0}_{-1}e \rightarrow {}^{37}_{17}Cl$

5. An electron has a charge identical to that of

   A) a neutron B) a proton
   C) an alpha particle **D) a beta particle**

6. Which of these types of radiation has the greatest penetrating power?

   A) alpha B) beta
   C) gamma D) positron

7. Which nuclear emission has the greatest penetrating power?

   A) alpha particle B) beta particle
   C) gamma radiation D) positron

8. Which statement best describes gamma radiation?

   A) It has a mass of 1 and a charge of 1.
   B) It has a mass of 0 and a charge of –1.
   C) It has a mass of 0 and a charge of 0.
   D) It has a mass of 4 and a charge of +2.

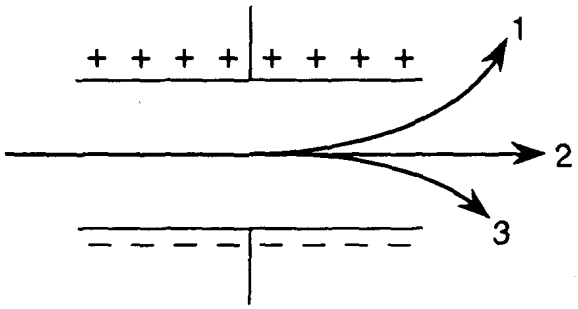
9. As a radioactive element emits gamma radiation only, the atomic number of the element

   A) decreases B) increases
   C) remains the same

10. Which nuclear emission has no charge and no mass?

    A) alpha particle B) beta particle
    C) gamma ray D) positron

11. A mixture of emanations from radioactive atoms is passed through electrically charged plates, as shown in the diagram below.



    The nuclear emanations 1, 2, and 3 are called, respectively,

    A) alpha, beta, and gamma
    B) beta, gamma, and alpha
    C) gamma, alpha, and beta
    D) gamma, beta, and alpha

12. Which type of radiation is most similar to high- energy x-rays?

    A) alpha B) beta
    C) neutron **D) gamma**

13. Which nuclear decay emission consists of energy, only?

    A) alpha particle B) beta particle
    C) gamma radiation D) positron

14. Which radioisotope undergoes beta decay and has a half-life of less than 1 minute?

    A) Fr-220 B) K-42
    C) N-16 D) P-32

15. What was the original mass of a radioactive sample that decayed to 25 grams in four half-life periods?

    A) 50 g B) 100 g C) 200 g **D) 400 g**

16. A sample of ^{131}I decays to 1.0 gram in 40. days. What was the mass of the original sample?

    A) 8.0 g B) 16 g **C) 32 g** D) 4.0 g

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17. Which equation represents a transmutation reaction?

A) $^{239}_{92}\mathrm{U} \rightarrow {}^{239}_{92}\mathrm{U} + {}^{0}_{0}\gamma$
B) $^{14}_{6}\mathrm{C} \rightarrow {}^{14}_{7}\mathrm{N} + {}^{0}_{-1}\mathrm{e}$
C) $\mathrm{C_3H_8} + 5\ \mathrm{O_2} \rightarrow 3\ \mathrm{CO_2} + 4\ \mathrm{H_2O}$
D) $n\mathrm{C_2H_4} \xrightarrow{\text{catalyst}} (-\mathrm{C_2H_4}-)n$

18. A change in the nucleus of an atom that converts the atom from one element to another element is called

A) combustion B) neutralization
C) polymerization **D) transmutation**

19. What is the name of the process in which the nucleus of an atom of one element is changed into the nucleus of an atom of a different element?

A) decomposition **B) transmutation**
C) substitution D) reduction

20. The reaction:

$^{14}{}_{7}\mathrm{N} + {}^{4}{}_{2}\mathrm{He} \rightarrow {}^{17}{}_{8}\mathrm{O} + {}^{1}{}_{1}\mathrm{H}$

Is an example of

A) a fission reaction
B) a chain reaction
C) an artificial transmutation
D) a natural transmutation

21. Which nuclear equation represents a natural transmutation?

A) $^{9}_{4}\mathrm{Be} + {}^{1}_{1}\mathrm{H} \rightarrow {}^{6}_{3}\mathrm{Li} + {}^{4}_{2}\mathrm{He}$
B) $^{27}_{13}\mathrm{Al} + {}^{4}_{2}\mathrm{He} \rightarrow {}^{30}_{15}\mathrm{P} + {}^{1}_{0}\mathrm{n}$
C) $^{14}_{7}\mathrm{N} + {}^{4}_{2}\mathrm{He} \rightarrow {}^{17}_{8}\mathrm{O} + {}^{1}_{1}\mathrm{H}$
D) $^{235}_{92}\mathrm{U} \rightarrow {}^{231}_{90}\mathrm{Th} + {}^{4}_{2}\mathrm{He}$

22. Which particles can be accelerated in an electric or magnetic field?

A) alpha and gamma B) beta and neutron
C) alpha and beta D) beta and gamma

23. A particle accelerator is used to provide charged particles with sufficient

A) kinetic energy to penetrate a nucleus
B) kinetic energy to penetrate an electron cloud
C) potential energy to penetrate a nucleus
D) potential energy to penetrate an electron cloud

24. A positively charged particle has great difficulty penetrating a target nucleus because the target nucleus has

A) a positive charge, which repels the particle
B) a negative charge, which attracts the particle
C) the protection of surrounding electrons
D) a very high binding energy

25. What is the primary result of a fission reaction?

A) conversion of mass to energy
B) conversion of energy to mass
C) binding together of two heavy nuclei
D) binding together of two light nuclei

26. Which substance has *chemical* properties similar to those of radioactive ^{235}U?

A) ^{235}Pa B) ^{233}Pa **C) ^{233}U** D) ^{206}Pb

27. Compared to an ordinary chemical reaction, a fission reaction will

A) release smaller amounts of energy
B) release larger amounts of energy
C) absorb smaller amounts of energy
D) absorb larger amounts of energy

28. Which statement best describes a primary occurrence in an uncontrolled fission reaction?

A) Mass is created and energy is released.
B) Mass is created and energy is stored.
C) Mass is converted to energy, which is released.
D) Mass is converted to energy, which is stored.

29. Which statement best describes what happens in a fission reaction?

A) Heavy nuclei split into lighter nuclei.
B) Light nuclei form into heavier nuclei.
C) Energy is released and less stable elements are formed.
D) Energy is absorbed and more stable elements are formed.

30. When a nucleus with a high mass undergoes fission, the resulting nuclei are more stable than the original nucleus because they have a

A) higher binding energy per nucleon
B) lower binding energy per nucleon
C) higher number of electrons
D) lower number of electrons

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31. In which reaction is mass converted to energy by the process of fission?

A) $^{14}_{7}N + {}^{1}_{0}n \rightarrow {}^{14}_{6}C + {}^{1}_{1}H$
B) $^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{87}_{35}Br + {}^{146}_{57}La + 3\,{}^{1}_{0}n$
C) $^{226}_{88}Ra \rightarrow {}^{222}_{86}Ra + {}^{4}_{2}He$
D) $^{2}_{1}H + {}^{2}_{1}H \rightarrow {}^{4}_{2}He$

32. Which equation represents nuclear fusion?

A) $^{14}_{6}C \rightarrow {}^{14}_{7}N + {}^{0}_{-1}e$
B) $^{27}_{13}Al + {}^{4}_{2}He \rightarrow {}^{30}_{15}P + {}^{1}_{0}n$
C) $^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{139}_{56}Ba + {}^{94}_{36}Kr + 3\ {}^{1}_{0}n$
D) $^{2}_{1}H + {}^{3}_{1}H \rightarrow {}^{4}_{2}He + {}^{1}_{0}n$

33. In the reaction:

$$^{14}_{7}N + {}^{4}_{2}He \rightarrow {}^{17}_{8}O + {}^{1}_{1}X$$

The *X* represents a

A) triton
B) deuteron
C) proton
D) neutron

34. In the equation:

$$^{234}_{91}Pa \rightarrow {}^{234}_{92}U + X$$

The *X* represents a

A) helium nucleus
B) beta particle
C) proton
D) neutron

35. Which isotopic ratio needs to be determined when the age of ancient wooden objects is investigated?

A) uranium-235 to uranium-238
B) hydrogen-2 to hydrogen-3
C) nitrogen-16 to nitrogen-14
D) carbon-14 to carbon-12

36. A radioactive-dating procedure to determine the age of a mineral compares the mineral's remaining amounts of isotope ^{238}U and isotope

A) ^{206}Pb B) ^{206}Bi C) ^{214}Pb D) ^{214}Bi

37. Which radioactive isotope is used in treating cancer?

A) carbon-14
B) cobalt-60
C) lead-206
D) uranium-238

38. A radioisotope which is sometimes used by doctors to pinpoint a brain tumor is

A) carbon-12
B) lead-206
C) technetium-99
D) uranium-238

39. What is a problem commonly associated with nuclear power facilities?

A) A small quantity of energy is produced.
B) Reaction products contribute to acid rain.
C) It is impossible to control nuclear fission.
D) It is difficult to dispose of wastes.

40. Which pair of isotopes can serve as fissionable nuclear fuels?

A) U-235 and Pb-208
B) U-235 and Pu-239
C) Pb-208 and Pu-239
D) Pb-206 and U-235

Answer Key
Do Now Unit 12 Nuclear Chemistry

1. **A**
2. **D**
3. **B**
4. **C**
5. **D**
6. **C**
7. **C**
8. **C**
9. **C**
10. **C**
11. **B**
12. **D**
13. **C**
14. **C**
15. **D**
16. **C**
17. **B**
18. **D**
19. **B**
20. **C**
21. **D**
22. **C**
23. **A**
24. **A**
25. **A**
26. **C**
27. **B**
28. **C**
29. **A**
30. **A**
31. **B**
32. **D**
33. **C**
34. **B**
35. **D**
36. **A**
37. **B**
38. **C**
39. **D**
40. **B**