

# 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)  $^{27}_{13}\text{Al} + ^4_2\text{He} \rightarrow ^{30}_{15}\text{P} + ^1_0\text{n}$
  - B)  $^{238}_{92}\text{U} \rightarrow ^{234}_{90}\text{Th} + ^4_2\text{He}$
  - C)  $^{14}_{6}\text{C} \rightarrow ^{14}_{7}\text{N} + ^0_{-1}\text{e}$
  - D)  $^{37}_{18}\text{Ar} + ^0_{-1}\text{e} \rightarrow ^{37}_{17}\text{Cl}$
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.
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- 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  $^{131}\text{I}$  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)  $^{239}_{92}\text{U} \rightarrow ^{239}_{92}\text{U} + ^0_0\gamma$
- B)  $^{14}_6\text{C} \rightarrow ^{14}_7\text{N} + ^0_{-1}\text{e}$
- C)  $\text{C}_3\text{H}_8 + 5 \text{O}_2 \rightarrow 3 \text{CO}_2 + 4 \text{H}_2\text{O}$
- D)  $n\text{C}_2\text{H}_4 \xrightarrow{\text{catalyst}} (-\text{C}_2\text{H}_4-)^n$

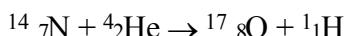
18. A change in the nucleus of an atom that converts the atom from one element to another element is called

- 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:



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)  $^{9}_4\text{Be} + ^1_1\text{H} \rightarrow ^6_3\text{Li} + ^4_2\text{He}$
- B)  $^{27}_{13}\text{Al} + ^4_2\text{He} \rightarrow ^{30}_{15}\text{P} + ^1_0\text{n}$
- C)  $^{14}_7\text{N} + ^4_2\text{He} \rightarrow ^{17}_8\text{O} + ^1_1\text{H}$
- D)  $^{235}_{92}\text{U} \rightarrow ^{231}_{90}\text{Th} + ^4_2\text{He}$

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  $^{235}\text{U}$ ?

- A)  $^{235}\text{Pa}$
- B)  $^{233}\text{Pa}$
- C)  $^{233}\text{U}$
- D)  $^{206}\text{Pb}$

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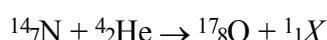
31. In which reaction is mass converted to energy by the process of fission?

- A)  $^{14}_7\text{N} + ^1_0\text{n} \rightarrow ^{14}_6\text{C} + ^1_1\text{H}$
- B)  $^{235}_{92}\text{U} + ^1_0\text{n} \rightarrow ^{87}_{35}\text{Br} + ^{146}_{57}\text{La} + 3^1_0\text{n}$
- C)  $^{226}_{88}\text{Ra} \rightarrow ^{222}_{86}\text{Ra} + ^4_2\text{He}$
- D)  $^2_1\text{H} + ^3_1\text{H} \rightarrow ^4_2\text{He}$

32. Which equation represents nuclear fusion?

- A)  $^{14}_6\text{C} \rightarrow ^{14}_7\text{N} + ^0_{-1}\text{e}$
- B)  $^{27}_{13}\text{Al} + ^4_2\text{He} \rightarrow ^{30}_{15}\text{P} + ^1_0\text{n}$
- C)  $^{235}_{92}\text{U} + ^1_0\text{n} \rightarrow ^{139}_{56}\text{Ba} + ^{94}_{36}\text{Kr} + 3^1_0\text{n}$
- D)  $^2_1\text{H} + ^3_1\text{H} \rightarrow ^4_2\text{He} + ^1_0\text{n}$

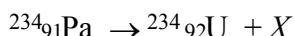
33. In the reaction:



The  $X$  represents a

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

34. In the equation:



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  $^{238}\text{U}$  and isotope

- A)  $^{206}\text{Pb}$
- B)  $^{206}\text{Bi}$
- C)  $^{214}\text{Pb}$
- D)  $^{214}\text{Bi}$

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