

11. How many protons are in the ${}^{14}_7\text{N}$ atom?
A. 14 B. 6 C. 7 D. 10 E. 9
12. What law did Ernest Rutherford use to estimate the size of the nucleus?
A. Conservation of nucleon number
B. Conservation of angular momentum
C. Conservation of linear momentum
D. Conservation of energy
E. Conservation of charge
13. Why are nuclear energy levels more complex than electron energy levels?
A. Nuclear energy levels depend only on attractive forces.
B. Nuclear energy levels depend on attractive and repulsive forces.
C. Nuclear energy levels are an order of one hundred times as great as electron energy levels.
D. Electron energy levels depend on the interaction between neutrons and electrons.
E. Electron energy levels have greater energy than the nuclear energy levels.
14. Which of the following about the nuclear force is true?
A. It is an attractive force between electrons and protons in an atom.
B. It is an attractive force between electrons and neutrons in an atom.
C. It is much weaker than the electromagnetic force.
D. It is much weaker than the gravitational force.
E. It is a strong, short-range, attractive force between the nucleons.
15. What force is responsible for the radioactive decay of the nucleus?
A. Gravitational force
B. Weak Nuclear force
C. Strong Nuclear force
D. Electromagnetic force
16. Isotopes of an element:
A. have the same number of protons and electrons, but a different number of neutrons.
B. have the same number of protons and neutrons, but a different number of electrons.
C. have different number of protons.
D. have different number of electrons.
E. have the same number of neutrons and protons.
17. Binding energy is:
A. the amount of energy required to break a nucleus apart into protons and neutrons.
B. the amount of energy required to break a nucleus apart into protons and electrons.
C. the amount of energy required to break a nucleus apart into electrons and neutrons.
D. the amount of energy released when neutrons change energy levels.
E. the amount of energy released when protons change energy levels.

18. If m_H is the atomic mass of Hydrogen, m_n is the mass of a neutron, and M is the atomic mass of the atom, which of the following is the mass defect formula?

- A. $\Delta m = Z \cdot m_H + N \cdot m_n - M$ B. $\Delta m = Z \cdot m_H + N \cdot m_n + M$ C. $\Delta m = Z \cdot m_H - N \cdot m_n - M$
D. $\Delta m = Z \cdot m_H - N \cdot m_n + M$ E. $\Delta m = M - Z \cdot m_H - N \cdot m_n$

19. When nucleons form a stable nucleus, binding energy is:

- A. created from nothing. B. destroyed into nothing.
C. transformed into visible light. D. absorbed as high energy photons or particles.
E. released as high energy photons or particles.

20. When a nucleus is divided into its constituents, energy is:

- A. created from nothing. B. destroyed into nothing.
C. transformed into visible light. D. absorbed by the nucleus which then breaks it apart.
E. released by the nucleus as it breaks apart.

21. An isotope with a high Binding Energy per nucleon:

- A. will decay in a short period of time. B. is very unstable.
C. is very stable D. has very few electrons.
E. has more protons than neutrons.

22. Why do heavier nuclei have a greater ratio of neutrons to protons than lighter nuclei?

- A. to add more nucleons so that the binding energy is greater.
B. to provide a greater weak nuclear force.
C. to provide more attractive electromagnetic force.
D. to provide more attractive strong nuclear force to balance the repulsive electromagnetic force.
E. to provide more repulsive strong nuclear force to balance the attractive electromagnetic force.

23. Which of the following is the alpha particle?

- A. ${}_{+1}^0e$ B. ${}_{-1}^0e$ C. ${}_{0}^1n$ D. ${}_{1}^1H$ E. ${}_{2}^4He$

24. Which of the following is the β^- particle?

- A. ${}_{+1}^0e$ B. ${}_{-1}^0e$ C. ${}_{0}^1n$ D. ${}_{1}^1H$ E. ${}_{2}^4He$

25. Which of the following is the β^+ particle?

- A. ${}_{+1}^0e$ B. ${}_{-1}^0e$ C. ${}_{0}^1n$ D. ${}_{1}^1H$ E. ${}_{2}^4He$

26. Which of the following about the gamma ray is true?

- A. It carries a positive charge. B. It carries a negative charge.
C. It can be deflected by a magnetic field. D. It can be deflected by an electric field.
E. It has zero rest mass and a neutral charge.

27. Which type of radiation is stopped by a sheet of paper?

- A. alpha particle B. beta particle C. Gamma ray
D. X-ray E. Ultraviolet radiation

28. What is the missing element from the following equation ${}^{226}_{88}\text{Ra} \rightarrow ? + {}^4_2\text{He}$?
- A. ${}^{230}_{86}\text{Rn}$ B. ${}^{220}_{86}\text{Rn}$ C. ${}^{228}_{86}\text{Rn}$ D. ${}^{222}_{86}\text{Rn}$ E. ${}^{224}_{86}\text{Rn}$
29. What is the missing element from the following equation ${}^{14}_6\text{C} \rightarrow ? + {}^0_{-1}\text{e}$?
- A. ${}^{13}_7\text{N}$ B. ${}^{12}_6\text{C}$ C. ${}^{17}_8\text{O}$ D. ${}^{16}_8\text{O}$ E. ${}^{14}_7\text{N}$
30. A 100 g sample of a radioactive element has a half-life of 5 days. How many grams of radioactive material will remain after 15 days?
- A. 100 g B. 50 g C. 25 g D. 12.5 g E. 0 g
31. A reaction that releases more energy than is put into it is called:
- A. endothermic B. exothermic C. nuclear
D. chemical E. radioactivity
32. The following reaction: ${}^1_0\text{n} + {}^{235}_{92}\text{U} \rightarrow {}^{141}_{56}\text{Ba} + {}^{92}_{36}\text{Kr} + 3{}^1_0\text{n}$ is called:
- A. Fusion B. Fission C. alpha decay D. beta decay E. gamma decay
33. The following reaction: ${}^2_1\text{H} + {}^3_1\text{H} \rightarrow {}^4_2\text{He} + {}^1_0\text{n}$ is called:
- A. Fusion B. Fission C. alpha decay D. beta decay E. gamma decay

Answer Guide

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