

Unit 3, part 1: Atomic Structure Test Review

Key

Matching

Match each item with the correct statement below

- a. proton
- b. nucleus
- c. atom
- d. electron
- e. neutron

- C 1. the smallest particle of an element that retains the properties of that element
- A 2. a positively charged subatomic particle
- D 3. a negatively charged subatomic particle
- E 4. a subatomic particle with no charge
- B 5. the central part of an atom, containing protons and neutrons

Match each item with the correct statement below

- a. mass number
- b. atomic mass unit
- c. atomic number
- d. atomic mass
- e. isotope

- E 6. atoms with the same number of protons, but different numbers of neutrons in the nucleus of an atom
- A 7. the total number of protons and neutrons in the nucleus of an atom
- C 8. the number of protons in the nucleus of an element
- D 9. the weighted average of the masses of the isotopes of an element
- B 10. one-twelfth the mass of a carbon atom having six protons and six neutrons

Multiple Choice

Identify the choice that best completes the statement or answers the question

- D 11. Which of the following is true about subatomic particles?
 - a. Electrons are negatively charged and are the heaviest subatomic particle
 - b. Protons are positively charged and the lightest subatomic particle
 - c. Neutrons have no charge and are the lightest subatomic particle
 - d. The mass of a neutron nearly equals the mass of a proton.
- A 12. What is the relative mass of an electron?
 - a. $1/1840$ the mass of a hydrogen atom
 - b. $1/1840$ the mass of a neutron + proton
 - c. $1/1840$ the mass of a C-12 atom
 - d. $1/1840$ the mass of an alpha particle
- C 13. All atoms are _____.
 - a. positively charged, with the number of protons exceeding the number of electrons
 - b. negatively charged, with the number of electrons exceeding the number of protons
 - c. neutral, with the number of protons equaling the number of electrons
 - d. neutral, with the number of protons equaling the number of electrons, which is equal to the number of neutrons

- C 14. The particles that are found in the nucleus of an atom are _____.
 - a. neutrons and electrons
 - b. electrons only
 - c. protons and neutrons
 - d. protons and electrons

- C 15. As a consequence of the discovery of the nucleus by Rutherford, which model of the atom is thought to be true?
 - a. Protons, electrons, and neutrons are evenly distributed throughout the volume of the atom.
 - b. The nucleus is made of protons, electrons, and neutrons.
 - c. Electrons are distributed around the nucleus and occupy almost all the volume of the atom.
 - d. The nucleus is made of electrons and protons.

- A 16. The nucleus of an atom is _____.
 - a. the central core and is composed of protons and neutrons
 - b. positively charged and has more protons than neutrons
 - c. negatively charged and has a high density
 - d. negatively charged and has a low density

- B 17. The atomic number of an element is the total number of which particles in the nucleus?
 - a. neutrons
 - b. protons
 - c. electrons
 - d. protons and electrons

- D 18. An element has an atomic number of 76. The number of protons and electrons in a neutral atom of the element are _____.
 - a. 152 protons and 76 electrons
 - b. 76 protons and 0 electrons
 - c. 38 protons and 38 electrons
 - d. 76 protons and 76 electrons

- F 19. The sum of the protons and neutrons in an atom equals the _____.
 - a. atomic number
 - b. nucleus number
 - c. atomic mass
 - d. mass number

- M 20. What does the number 84 in the name krypton-84 represent?
 - a. the atomic number
 - b. the mass number
 - c. the sum of the protons and electrons
 - d. twice the number of protons

- B 21. All atoms of the same element have the same _____.
 - a. number of neutrons
 - b. number of protons
 - c. mass numbers
 - d. mass

- A 22. Isotopes of the same element have different _____.
 - a. numbers of neutrons
 - b. numbers of protons
 - c. numbers of electrons
 - d. atomic numbers

- D 23. Isotopes of the same element have different _____.
 - a. positions on the periodic table
 - b. chemical behavior
 - c. atomic numbers
 - d. mass numbers

- A 24. In which of the following sets is the symbol of the element, the number of protons, and the number of electrons given correctly?
 - a. In, 49 protons, 49 electrons
 - b. Zn, 30 protons, 60 electrons
 - c. Cs, 55 protons, 132.9 electrons
 - d. F, 19 protons, 19 electrons

25. The mass number of an element is equal to ____.
- the total number of electrons in the nucleus
 - the total number of protons and neutrons in the nucleus
 - less than twice the atomic number
 - a constant number for the lighter elements

26. Using the periodic table, determine the number of neutrons in ^{16}O .
- 4
 - 8
 - 16
 - 24

27. How many protons, electrons, and neutrons does an atom with atomic number 50 and mass number 125 contain?
- 50 protons, 50 electrons, 75 neutrons
 - 75 electrons, 50 protons, 50 neutrons
 - 120 neutrons, 50 protons, 75 electrons
 - 70 neutrons, 75 protons, 50 electrons

28. Which of the following statements is NOT true?
- Atoms of the same element can have different masses.
 - Atoms of isotopes of an element have different numbers of protons.
 - The nucleus of an atom has a positive charge.
 - Atoms are mostly empty space.

29. If E is the symbol for an element, which two of the following symbols represent isotopes of the same element?
- ^{20}E ^{20}E ^{21}E ^{21}E
 - ^{10}E ^{11}E ^9E ^{10}E
 - 1 and 2 3 and 4
 - 2 and 3

30. Select the correct symbol for an atom of tritium.
- ^3H ^3_1H ^1_3H ^1_1H
 - ^1_3H ^3_1H ^1_1H ^3_3H
- Handwritten: Hydrogen w/ 2 neutrons*

31. Which of the following sets of symbols represents isotopes of the same element?
- $^{91}_{42}\text{J}$ $^{92}_{42}\text{J}$ $^{93}_{40}\text{J}$ $^{84}_{38}\text{M}$ $^{86}_{38}\text{M}$ $^{87}_{38}\text{M}$
 - $^{50}_{19}\text{L}$ $^{50}_{20}\text{L}$ $^{50}_{20}\text{L}$ $^{138}_{59}\text{Q}$ $^{133}_{55}\text{Q}$ $^{133}_{54}\text{Q}$
 - $^{19}_{9}\text{F}$ has 0 neutrons. $^{24}_{12}\text{Mg}$ has 24 neutrons.
 - $^{73}_{33}\text{Ac}$ has 108 neutrons. $^{238}_{92}\text{U}$ has 146 neutrons.

32. In which of the following is the number of neutrons correctly represented?
- ^{19}F has 0 neutrons.
 - ^{73}Ac has 108 neutrons.
 - ^{24}Mg has 24 neutrons.
 - ^{238}U has 146 neutrons.

33. How do the isotopes hydrogen-1 and hydrogen-2 differ?
- Hydrogen-2 has one more electron than hydrogen-1.
 - Hydrogen-2 has one neutron; hydrogen-1 has none.
 - Hydrogen-2 has two protons; hydrogen-1 has one.
 - Hydrogen-2 has one proton; hydrogen-1 has none.

34. Which of the following isotopes has the same number of neutrons as phosphorus-31?
- ^{33}P ^{29}Si
 - ^{33}S ^{34}Si
 - ^{33}S ^{28}Si
 - ^{31}S ^{31}Si

35. What unit is used to measure weighted average atomic mass?
- amu
 - angstrom
 - gram
 - nanogram

36. Which of the following statements is NOT true?
- Protons have a positive charge.
 - Electrons are negatively charged and have a mass of 1 amu.
 - The nucleus of an atom is positively charged.
 - Neutrons are located in the nucleus of an atom.

37. The atomic mass of an element is the ____.
- total number of subatomic particles in its nucleus
 - weighted average of the masses of the isotopes of the element
 - total mass of the isotopes of the element
 - average of the mass number and the atomic number for the element

38. The atomic mass of an element depends upon the ____.
- mass of each electron in that element
 - mass of each isotope of that element
 - relative abundance of protons in that element
 - mass and relative abundance of each isotope of that element

39. Which of the following is necessary to calculate the atomic mass of an element?
- the atomic mass of carbon-12
 - the atomic number of the element
 - the relative masses of the element's protons and neutrons
 - the masses of each isotope of the element

Short Response

40. What is the relative charge carried by an electron? *-1*
41. What is the relative charge of a proton? *+1*

42. About how many more times massive is a proton than an electron? *~2000 times*

43. Use the periodic table to determine the number of electrons in a neutral atom of lithium. *3e-*

44. Use the periodic table to determine the number of protons in an atom of barium. *56 p+*

45. How many protons are present in an atom of Be-9? *4 p+*

46. What is the total number of subatomic particles in the nucleus of an atom of ^{209}Bi ? *83 p+, 126 n, 83 e-*

47. Determine the number of electrons in an atom of iridium. *79 e-*

48. What is the atomic number for an element with 41 neutrons and a mass number of 80? *39*

49. How many electrons are in an atom of gold? *79 e-*

50. What is the mass number for an oxygen atom that has 10 neutrons in its nucleus? *18*

51. How many protons are present in the nuclei of the three known isotopes of hydrogen? *1 proton*

Hydrogen
Deuterium
Tritium

52. Use the periodic table to determine the number of neutrons in nitrogen-14. **7 Neutrons (N⁰)**
53. How many neutrons are present in an atom of the isotope $^{235}_{92}\text{U}$? **235 - 92 = 143 N⁰**
54. Calculate the number of neutrons in $^{210}_{82}\text{Pb}$. **210 - 82 = 128 N⁰**

Nuclear Chemistry

Matching

Match each item with the correct statement below.

- A** alpha particle
B beta particle
C gamma radiation
1. emitted helium nucleus
 2. energetic electron from decomposed neutron
 3. high-energy photons emitted by a radioisotope
- Match each item with the correct statement below.
 a. fission
 b. fusion
- B** combination of two nuclei to form a nucleus of greater mass
A splitting of nucleus into smaller fragments

Multiple Choice

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

7. An unstable nucleus _____
 a. increases its nuclear mass by fission
 b. increases its half-life
 c. emits energy when it decays
 d. expels all of its protons
8. Which is the most susceptible to damage from ionizing radiation?
 a. soft tissue
 b. paper
 c. wood
 d. lead
9. The charge on a gamma ray is _____.
 a. +2
 b. +1
 c. 0
 d. -2
10. What particle is emitted in alpha radiation?
 a. electron
 b. photon
 c. helium nucleus
 d. hydrogen nucleus
11. A beta particle is a(n) _____.
 a. photon
 b. electron
 c. helium nucleus
 d. hydrogen nucleus

- C** 12. What is the change in atomic mass when an atom emits a beta particle?
 a. decreases by 2
 b. decreases by 1
 c. remains the same
 d. increases by 1

- C** 13. What is the change in atomic mass when an atom emits gamma radiation?
 a. decreases by 2
 b. decreases by 1
 c. remains the same
 d. increases by 1

- C** 14. The least penetrating form of radiation is _____.
 a. beta radiation
 b. gamma radiation
 c. alpha radiation
 d. X rays

- D** 15. Ionizing radiation that consists of helium nuclei is _____.
 a. X radiation
 b. gamma radiation
 c. beta radiation
 d. alpha radiation

- A** 16. What is the change in the atomic number when an atom emits an alpha particle?
 a. decreases by 2
 b. decreases by 1
 c. increases by 1
 d. increases by 2

- D** 17. What is the change in atomic number when an atom emits a beta particle?
 a. decreases by 2
 b. decreases by 1
 c. increases by 2
 d. increases by 1

- C** 18. What is the change in atomic number caused by the emission of gamma radiation?
 a. decreases by 2
 b. decreases by 1
 c. remains the same
 d. increases by 1

- D** 19. Which symbol is used for an alpha particle?
 a. ^2_1He
 b. ^2_2He
 c. ^4_2He
 d. ^4_1He

- D** 20. Which of the following materials is necessary to stop an alpha particle?
 a. three feet of concrete
 b. three inches of lead
 c. single sheet of aluminum foil
 d. single sheet of paper

- B** 21. What particle decomposes to produce the electron of beta radiation?
 a. proton
 b. neutron
 c. electron
 d. positron

- B** 22. What symbol is used for beta radiation?
 a. ^0_0e
 b. $^0_{-1}\text{e}$
 c. $^{-1}_0\text{e}$
 d. $^{-1}_{-1}\text{e}$

- C** 23. Which of the following materials is necessary to stop a beta particle?
 a. three feet of concrete
 b. three inches of lead
 c. thin pieces of wood
 d. single sheet of paper

- A** 24. Which of the following materials is most effective for stopping gamma radiation?
 a. several cm of lead
 b. one cm of water
 c. single sheet of aluminum foil
 d. single sheet of paper

25. A neutron breaks down to form _____.
 a. an alpha particle
 b. two protons
 c. a proton and an electron
 d. a helium nucleus
26. What is the change in atomic mass number when an atom emits an alpha particle?
 a. decreases by 2
 b. decreases by 4
 c. increases by 2
 d. increases by 4
27. If an isotope decays by the process of beta emission, _____.
 a. the mass number changes
 b. the atomic number changes
 c. protons are given off
 d. the number of neutrons remains the same
28. What particle is needed to complete this nuclear reaction?
 $^{222}_{86}\text{Rn} \rightarrow ^{218}_{84}\text{Po} + \underline{\hspace{1cm}}$
 a. ^4_2He
 b. $^0_{-1}\text{e}$
 c. ^1_1H
 d. ^1_0n
29. When radium-226 (atomic number 88) decays by emitting an alpha particle, it becomes _____.
 a. polonium-222
 b. polonium-224
 c. radium-222
 d. radon-222
30. What particle does argon-39 (atomic number 18) emit when it decays to potassium-39 (atomic number 19)?
 a. neutron
 b. electron
 c. proton
 d. alpha particle
31. What particle is needed to complete the following nuclear equation?
 $^{56}_{25}\text{Mn} \rightarrow \underline{\hspace{1cm}} + ^0_0\text{e}$
 a. $^{56}_{27}\text{Co}$
 b. $^{27}_{25}\text{Mn}$
 c. $^{56}_{26}\text{Fe}$
 d. $^{58}_{28}\text{Cr}$
32. What particle is needed to complete the following equation?
 $^{14}_7\text{N} + \underline{\hspace{1cm}} \rightarrow ^{14}_6\text{C} + ^1_1\text{H}$
 a. ^1_0n
 b. $^0_{-1}\text{e}$
 c. ^4_2He
 d. ^0_0e
33. To what element does polonium-208 (atomic number 84) decay when it emits an alpha particle?
 a. $^{210}_{82}\text{Pb}$
 b. $^{210}_{82}\text{Po}$
 c. $^{204}_{82}\text{Pb}$
 d. $^{214}_{86}\text{Rn}$
34. What happens in a chain reaction?
 a. Products that start a new reaction are released.
 b. Reactants that have two parts split.
 c. Products that are radioactive are lost.
 d. Radioactive reactants are deposited on control rods.

35. Controlled nuclear chain reactions _____.
 a. take place in nuclear reactors
 b. are always fusion reactions
 c. never produce radioactive by-products
 d. are characteristic of atomic bombs
36. A reaction in which small nuclei combine to form a heavier nucleus is called _____.
 a. fission
 b. a chemical reaction
 c. background radiation
 d. fusion
37. Nuclear fusion _____.
 a. takes place in the sun
 b. occurs at low temperatures
 c. can be controlled in the laboratory
 d. is used in medicine
38. A reaction that results in the combining of smaller atomic nuclei is _____.
 a. chemical
 b. fission
 c. fusion
 d. ionization
39. Radiation therapy is used to _____.
 a. study reaction mechanisms
 b. detect elements
 c. treat cancer
 d. initiate neutron activation analysis

Short Response

40. How many neutrons are in an alpha particle? **2 N⁰**
41. What is the approximate ratio of neutrons to protons for stable atoms below atomic number 20? **1 to 1 ratio**
42. The half-life of radon-222 is about four days. After how many days is the amount of radon-222 equal to one-sixteenth of its original amount?
 $1g \xrightarrow{4d} 0.5g \xrightarrow{4d} 0.25g \xrightarrow{4d} 0.125g \xrightarrow{4d} 0.0625g$
43. Above which atomic number are all nuclei radioactive?
Above 82 (Bismuth)
 $4 \times 4d = 16 \text{ days}$