**Unit 3, part I: Atomic Structure Test Review**

**Matching**

*Match each item with the correct statement below.*

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

\_\_\_\_ 1. the smallest particle of an element that retains the properties of that element

\_\_\_\_ 2. a positively charged subatomic particle

\_\_\_\_ 3. a negatively charged subatomic particle

\_\_\_\_ 4. a subatomic particle with no charge

\_\_\_\_ 5. the central part of an atom, containing protons and neutrons

*Match each item with the correct statement below.*

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

\_\_\_\_ 6. atoms with the same number of protons, but different numbers of neutrons in the nucleus of an atom

\_\_\_\_ 7. the total number of protons and neutrons in the nucleus of an atom

\_\_\_\_ 8. the number of protons in the nucleus of an element

\_\_\_\_ 9. the weighted average of the masses of the isotopes of an element

\_\_\_\_ 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.*

\_\_\_\_ 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. |

\_\_\_\_ 12. What is the relative mass of an electron?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | 1/1840 the mass of a hydrogen atom | c. | 1/1840 the mass of a C-12 atom |
| b. | 1/1840 the mass of a neutron + proton | d. | 1/1840 the mass of an alpha particle |

\_\_\_\_ 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 |

\_\_\_\_ 14. The particles that are found in the nucleus of an atom are \_\_\_\_.

|  |  |  |  |
| --- | --- | --- | --- |
| a. | neutrons and electrons | c. | protons and neutrons |
| b. | electrons only | d. | protons and electrons |

\_\_\_\_ 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. |

\_\_\_\_ 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 |

\_\_\_\_ 17. The atomic number of an element is the total number of which particles in the nucleus?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | neutrons | c. | electrons |
| b. | protons | d. | protons and electrons |

\_\_\_\_ 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 | c. | 38 protons and 38 electrons |
| b. | 76 protons and 0 electrons | d. | 76 protons and 76 electrons |

\_\_\_\_ 19. The sum of the protons and neutrons in an atom equals the \_\_\_\_.

|  |  |  |  |
| --- | --- | --- | --- |
| a. | atomic number | c. | atomic mass |
| b. | nucleus number | d. | mass number |

\_\_\_\_ 20. What does the number 84 in the name krypton-84 represent?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | the atomic number | c. | the sum of the protons and electrons |
| b. | the mass number | d. | twice the number of protons |

\_\_\_\_ 21. All atoms of the same element have the same \_\_\_\_.

|  |  |  |  |
| --- | --- | --- | --- |
| a. | number of neutrons | c. | mass numbers |
| b. | number of protons | d. | mass |

\_\_\_\_ 22. Isotopes of the same element have different \_\_\_\_.

|  |  |  |  |
| --- | --- | --- | --- |
| a. | numbers of neutrons | c. | numbers of electrons |
| b. | numbers of protons | d. | atomic numbers |

\_\_\_\_ 23. Isotopes of the same element have different \_\_\_\_.

|  |  |  |  |
| --- | --- | --- | --- |
| a. | positions on the periodic table | c. | atomic numbers |
| b. | chemical behavior | d. | mass numbers |

\_\_\_\_ 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 | c. | Cs, 55 protons, 132.9 electrons |
| b. | Zn, 30 protons, 60 electrons | d. | F, 19 protons, 19 electrons |

\_\_\_\_ 25. The mass number of an element is equal to \_\_\_\_.

|  |  |
| --- | --- |
| a. | the total number of electrons in the nucleus |
| b. | the total number of protons and neutrons in the nucleus |
| c. | less than twice the atomic number |
| d. | a constant number for the lighter elements |

\_\_\_\_ 26. Using the periodic table, determine the number of neutrons in O.

|  |  |  |  |
| --- | --- | --- | --- |
| a. | 4 | c. | 16 |
| b. | 8 | d. | 24 |

\_\_\_\_ 27. How many protons, electrons, and neutrons does an atom with atomic number 50 and mass number 125 contain?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | 50 protons, 50 electrons, 75 neutrons | c. | 120 neutrons, 50 protons, 75 electrons |
| b. | 75 electrons, 50 protons, 50 neutrons | d. | 70 neutrons, 75 protons, 50 electrons |

\_\_\_\_ 28. Which of the following statements is NOT true?

|  |  |
| --- | --- |
| a. | Atoms of the same element can have different masses. |
| b. | Atoms of isotopes of an element have different numbers of protons. |
| c. | The nucleus of an atom has a positive charge. |
| d. | 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?

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1. E | | | 2. E | 3. E | | | 4. E |
| a. | 1 and 2 | | | c. | 1 and 4 | | |
| b. | 3 and 4 | | | d. | 2 and 3 | | |

\_\_\_\_ 30. Select the correct symbol for an atom of tritium.

|  |  |  |  |
| --- | --- | --- | --- |
| a. | n | c. | H |
| b. | H | d. | H |

\_\_\_\_ 31. Which of the following sets of symbols represents isotopes of the same element?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | J J J | c. | M M M |
| b. | L L L | d. | Q Q Q |

\_\_\_\_ 32. In which of the following is the number of neutrons correctly represented?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | F has 0 neutrons. | c. | Mg has 24 neutrons. |
| b. | As has 108 neutrons. | d. | U has 146 neutrons. |

\_\_\_\_ 33. How do the isotopes hydrogen-1 and hydrogen-2 differ?

|  |  |
| --- | --- |
| a. | Hydrogen-2 has one more electron than hydrogen-1. |
| b. | Hydrogen-2 has one neutron; hydrogen-1 has none. |
| c. | Hydrogen-2 has two protons; hydrogen-1 has one. |
| d. | Hydrogen-2 has one proton; hydrogen-1 has none. |

\_\_\_\_ 34. Which of the following isotopes has the same number of neutrons as phosphorus-31?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | P | c. | Si |
| b. | S | d. | Si |

\_\_\_\_ 35. What unit is used to measure weighted average atomic mass?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | amu | c. | angstrom |
| b. | gram | d. | nanogram |

\_\_\_\_ 36. Which of the following statements is NOT true?

|  |  |
| --- | --- |
| a. | Protons have a positive charge. |
| b. | Electrons are negatively charged and have a mass of 1 amu. |
| c. | The nucleus of an atom is positively charged. |
| d. | Neutrons are located in the nucleus of an atom. |

\_\_\_\_ 37. The atomic mass of an element is the \_\_\_\_.

|  |  |
| --- | --- |
| a. | total number of subatomic particles in its nucleus |
| b. | weighted average of the masses of the isotopes of the element |
| c. | total mass of the isotopes of the element |
| d. | average of the mass number and the atomic number for the element |

\_\_\_\_ 38. The atomic mass of an element depends upon the \_\_\_\_.

|  |  |
| --- | --- |
| a. | mass of each electron in that element |
| b. | mass of each isotope of that element |
| c. | relative abundance of protons in that element |
| d. | 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?

|  |  |
| --- | --- |
| a. | the atomic mass of carbon-12 |
| b. | the atomic number of the element |
| c. | the relative masses of the element’s protons and neutrons |
| d. | the masses of each isotope of the element |

**Short Response**

40. What is the relative charge carried by an electron?

41. What is the relative charge of a proton?

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

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

44. Use the periodic table to determine the number of protons in an atom of barium.

45. How many protons are present in an atom of Be-9?

46. What is the total number of subatomic particles in the nucleus of an atom of Bi?

47. Determine the number of electrons in an atom of iridium.

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

49. How many electrons are in an atom of gold?

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

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

52. Use the periodic table to determine the number of neutrons in nitrogen-14.

53. How many neutrons are present in an atom of the isotope U?

54. Calculate the number of neutrons in Pb.

**Nuclear Chemistry**

**Matching**

*Match each item with the correct statement below.*

|  |  |  |  |
| --- | --- | --- | --- |
| a. | alpha particle | c. | gamma radiation |
| b. | beta particle |  |  |

\_\_\_\_ 1. emitted helium nucleus

\_\_\_\_ 2. energetic electron from decomposed neutron

\_\_\_\_ 3. high-energy photons emitted by a radioisotope

\_\_\_\_ 4. particle of charge +1 and mass equal to that of an electron

*Match each item with the correct statement below.*

|  |  |  |  |
| --- | --- | --- | --- |
| a. | fission |  |  |
| b. | fusion |  |  |

\_\_\_\_ 5. combination of two nuclei to form a nucleus of greater mass

\_\_\_\_ 6. 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 | c. | emits energy when it decays |
| b. | increases its half-life | d. | expels all of its protons |

\_\_\_\_ 8. Which is the most susceptible to damage from ionizing radiation?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | soft tissue | c. | wood |
| b. | paper | d. | lead |

\_\_\_\_ 9. The charge on a gamma ray is \_\_\_\_.

|  |  |  |  |
| --- | --- | --- | --- |
| a. | +2 | c. | 0 |
| b. | 1 | d. | 2 |

\_\_\_\_ 10. What particle is emitted in alpha radiation?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | electron | c. | helium nucleus |
| b. | photon | d. | hydrogen nucleus |

\_\_\_\_ 11. A beta particle is a(n) \_\_\_\_.

|  |  |  |  |
| --- | --- | --- | --- |
| a. | photon | c. | helium nucleus |
| b. | electron | d. | hydrogen nucleus |

\_\_\_\_ 12. What is the change in atomic mass when an atom emits a beta particle?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | decreases by 2 | c. | remains the same |
| b. | decreases by 1 | d. | increases by 1 |

\_\_\_\_ 13. What is the change in atomic mass when an atom emits gamma radiation?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | decreases by 2 | c. | remains the same |
| b. | decreases by 1 | d. | increases by 1 |

\_\_\_\_ 14. The least penetrating form of radiation is \_\_\_\_.

|  |  |  |  |
| --- | --- | --- | --- |
| a. | beta radiation | c. | alpha radiation |
| b. | gamma radiation | d. | X rays |

\_\_\_\_ 15. Ionizing radiation that consists of helium nuclei is \_\_\_\_.

|  |  |  |  |
| --- | --- | --- | --- |
| a. | X radiation | c. | beta radiation |
| b. | gamma radiation | d. | alpha radiation |

\_\_\_\_ 16. What is the change in the atomic number when an atom emits an alpha particle?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | decreases by 2 | c. | increases by 1 |
| b. | decreases by 1 | d. | increases by 2 |

\_\_\_\_ 17. What is the change in atomic number when an atom emits a beta particle?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | decreases by 2 | c. | increases by 2 |
| b. | decreases by 1 | d. | increases by 1 |

\_\_\_\_ 18. What is the change in atomic number caused by the emission of gamma radiation?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | decreases by 2 | c. | remains the same |
| b. | decreases by 1 | d. | increases by 1 |

\_\_\_\_ 19. Which symbol is used for an alpha particle?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | He | c. | He |
| b. | He | d. | He |

\_\_\_\_ 20. Which of the following materials is necessary to stop an alpha particle?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | three feet of concrete | c. | single sheet of aluminum foil |
| b. | three inches of lead | d. | single sheet of paper |

\_\_\_\_ 21. What particle decomposes to produce the electron of beta radiation?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | proton | c. | electron |
| b. | neutron | d. | positron |

\_\_\_\_ 22. What symbol is used for beta radiation?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | e | c. | e |
| b. | e | d. | e |

\_\_\_\_ 23. Which of the following materials is necessary to stop a beta particle?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | three feet of concrete | c. | thin pieces of wood |
| b. | three inches of lead | d. | single sheet of paper |

\_\_\_\_ 24. Which of the following materials is most effective for stopping gamma radiation?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | several cm of lead | c. | single sheet of aluminum foil |
| b. | one cm of water | d. | single sheet of paper |

\_\_\_\_ 25. A neutron breaks down to form \_\_\_\_\_.

|  |  |  |  |
| --- | --- | --- | --- |
| a. | an alpha particle | c. | a proton and an electron |
| b. | two protons | d. | a helium nucleus |

\_\_\_\_ 26. What is the change in atomic mass number when an atom emits an alpha particle?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | decreases by 2 | c. | increases by 2 |
| b. | decreases by 4 | 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?

Rn  Po + \_\_\_\_\_

|  |  |  |  |
| --- | --- | --- | --- |
| a. | He | c. | H |
| b. | e | d. | n |

\_\_\_\_ 29. When radium-226 (atomic number 88) decays by emitting an alpha particle, it becomes \_\_\_\_.

|  |  |  |  |
| --- | --- | --- | --- |
| a. | polonium-222 | c. | radium-222 |
| b. | polonium-224 | d. | radon-222 |

\_\_\_\_ 30. What particle does argon-39 (atomic number 18) emit when it decays to potassium-39 (atomic number 19)?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | neutron | c. | proton |
| b. | electron | d. | alpha particle |

\_\_\_\_ 31. What particle is needed to complete the following nuclear equation?

Mn  \_\_\_\_ + e

|  |  |  |  |
| --- | --- | --- | --- |
| a. | Co | c. | Fe |
| b. | Mn | d. | Cr |

\_\_\_\_ 32. What particle is needed to complete the following equation?

N + \_\_\_\_  C + H

|  |  |  |  |
| --- | --- | --- | --- |
| a. | n | c. | He |
| b. | e | d. | e |

\_\_\_\_ 33. To what element does polonium-208 (atomic number 84) decay when it emits an alpha particle?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | Pb | c. | Pb |
| b. | Po | d. | 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 | c. | background radiation |
| b. | a chemical reaction | d. | fusion |

\_\_\_\_ 37. Nuclear fusion \_\_\_\_.

|  |  |  |  |
| --- | --- | --- | --- |
| a. | takes place in the sun | c. | can be controlled in the laboratory |
| b. | occurs at low temperatures | d. | is used in medicine |

\_\_\_\_ 38. A reaction that results in the combining of smaller atomic nuclei is \_\_\_\_.

|  |  |  |  |
| --- | --- | --- | --- |
| a. | chemical | c. | fusion |
| b. | fission | d. | ionization |

\_\_\_\_ 39. Radiation therapy is used to \_\_\_\_.

|  |  |  |  |
| --- | --- | --- | --- |
| a. | study reaction mechanisms | c. | treat cancer |
| b. | detect elements | d. | initiate neutron activation analysis |

**Short Response**

40. How many neutrons are in an alpha particle?

41. What is the approximate ratio of neutrons to protons for stable atoms below atomic number 20?

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?

43. Above which atomic number are all nuclei radioactive?