1. Which subatomic particles are located in the nucleus of a neon atom?
A. electrons and positrons  C. protons and neutrons
B. electrons and neutrons  D. protons and electrons

2. Which statement best describes the nucleus of an aluminum atom?
A. It has a charge of +13 and is surrounded by a total of 10 electrons.
B. It has a charge of +13 and is surrounded by a total of 13 electrons.
C. It has a charge of -13 and is surrounded by a total of 10 electrons.
D. It has a charge of -13 and is surrounded by a total of 13 electrons.

3. Which statement concerning elements is true?
A. Different elements must have different numbers of isotopes.
B. Different elements must have different numbers of neutrons.
C. All atoms of a given element must have the same mass number.
D. All atoms of a given element must have the same atomic number.

4. What are the characteristics of a neutron?
A. It has no charge and no mass.
B. It has no charge and a mass of 1 amu.
C. It has a charge of +1 and no mass.
D. It has a charge of +1 and a mass of 1 amu.

5. Which sequence represents a correct order of historical developments leading to the modern model of the atom?
A. the atom is a hard sphere & most of the atom is empty space & electrons exist in orbitals outside the nucleus
B. the atom is a hard sphere & electrons exist in orbitals outside the nucleus & most of the atom is empty space
C. most of the atom is empty space & electrons exist in orbitals outside the nucleus & the atom is a hard sphere
D. most of the atom is empty space & the atom is a hard sphere & electrons exist in orbitals outside the nucleus

6. Which conclusion is based on the "gold foil experiment" and the resulting model of the atom?
A. An atom is mainly empty space, and the nucleus has a positive charge.
B. An atom is mainly empty space, and the nucleus has a negative charge.
C. An atom has hardly any empty space, and the nucleus has a positive charge.
D. An atom has hardly any empty space, and the nucleus has a negative charge.

7. Subatomic particles can usually pass undeflected through an atom because the volume of an atom is composed of
A. an uncharged nucleus & C. neutrons
B. largely empty space & D. protons

8. What is the net charge on an ion that has 9 protons, 11 neutrons, and 10 electrons?
A. 1+  C. 1.
B. 2+  D. 2.

9. What is the total charge of the nucleus of a carbon atom?
A. –6  C. +6
B. 0  D. +12

10. Which notation represents an atom of sodium with an atomic number of 11 and a mass number of 24?
A. 11Na24  C. 13Na13
B. 24Na11  D. 11Na35

11. Compared to an atom of phosphorus-31, an atom of sulfur-32 contains
A. one less neutron  C. one more neutron
B. one less proton  D. one more proton

12. Which subatomic particle has a negative charge?
A. proton  C. neutron
B. electron  D. positron

13. Compared to a proton, an electron has
A. a greater quantity of charge and the same sign
B. a greater quantity of charge and the opposite sign
C. the same quantity of charge and the same sign
D. the same quantity of charge and the opposite sign

14. How many electrons are in an Fe(2+ ) ion
A. 24  C. 28
B. 26  D. 56

15. Which two particles make up most of the mass of a hydrogen-2 atom?
A. electron and neutron  C. proton and neutron
B. electron and proton  D. proton and positron

16. Which two particles each have a mass approximately equal to one atomic mass unit?
A. electron and neutron  C. proton and electron
B. electron and positron  D. proton and neutron
17. What is the mass number of an atom that has six protons, six electrons, and eight neutrons?
   A. 6    C. 14
   B. 12   D. 20

18. What is the total number of neutrons in the nucleus of a neutral atom that has 19 electrons and a mass number of 39?
   A. 19    C. 39
   B. 20    D. 58

19. In which list are the elements arranged in order of increasing atomic mass?
   A. Cl, K, Ar    C. Te, I, Xe
   B. Fe, Co, Ni   D. Ne, F, Na

20. A student constructs a model for comparing the masses of subatomic particles. The student selects a small, metal sphere with a mass of 1 gram to represent an electron. A sphere with which mass would be most appropriate to represent a proton?
   A. 1g    C. 1/2000 g
   B. 1/2 g  D. 2000 g

21. The mass of an electron is approximately equal to 1/1836 of the mass of
   A. a positron    C. an alpha particle
   B. a proton      D. a beta particle

22. Atoms of different isotopes of the same element differ in the total number of
   A. electrons    C. protons
   B. neutrons     D. valence electrons

23. The nucleus of an atom of cobalt-58 contains
   A. 27 protons and 31 neutrons
   B. 27 protons and 32 neutrons
   C. 59 protons and 60 neutrons
   D. 60 protons and 60 neutrons

24. The stability of an isotope is based on its
   A. number of neutrons, only
   B. number of protons, only
   C. ratio of neutrons to protons
   D. ratio of electrons to protons

25. Isotopes of an element must have different
   A. atomic numbers   C. numbers of protons
   B. mass numbers    D. numbers of electrons

26. What is the total number of neutrons in an atom of an element that has a mass number of 19 and an atomic number of 9?
   A. 9    C. 19
   B. 10   D. 28

27. Which isotopic notation represents a n atom of carbon-14?
   A. $^{14}_{6}\text{C}$    B. $^{12}_{6}\text{C}$   C. $^{16}_{6}\text{C}$
   D. $^{14}_{6}\text{C}$

28. A 100.00-gram sample of naturally occurring boron contains 19.78 grams of boron-10 (atomic mass = 10.01 atomic mass units) and 80.22 grams of boron-11 (atomic mass = 11.01 atomic mass units). Which numerical setup can be used to determine the atomic mass of naturally occurring boron?
   A. (0.1978)(10.01) + (0.8022)(11.01)
   B. (0.8022)(10.01) + (0.1978)(11.01)
   C. (0.1978)(10.01)/(0.8022)(11.01)
   D. (0.8022)(10.01)/(0.1978)(11.01)

29. The atomic mass of element A is 63.6 atomic mass units. The only naturally occurring isotopes of element A are A-63 and A-65. The percent abundances in a naturally occurring sample of element A are closest to
   A. 31% A-63 and 69% A-65
   B. 50% A-63 and 50% A-65
   C. 69% A-63 and 31% A-65
   D. 100% A-63 and 0% A-65

30. The atomic mass of an element is the weighted average of the
   A. number of protons in the isotopes of that element
   B. number of neutrons in the isotopes of that element