Multiple Choice
*Identify the letter of the choice that best completes the statement or answers the question.*
*Each correct answer is worth 0.5 points.*

___ 1. When a particular solid sample is examined under a microscope it is observed that there are regions which are black and regions which are yellow. What type of material is this sample?
   a. a compound
   b. an element
   c. a homogeneous mixture
   d. a heterogeneous mixture

___ 2. Alloys such as bronze, brass or steel which have a uniform appearance are examples of which of the following?
   a. compounds
   b. elements
   c. homogeneous mixtures
   d. heterogeneous mixtures

___ 3. When a strong magnet is brought near to a sample which is known to contain both iron and sulfur the iron and the sulfur are not separated from one another. What type of material is this sample?
   a. a compound
   b. a homogeneous mixture
   c. a heterogeneous mixture
   d. there is insufficient information to answer

___ 4. Which of the following statements is true of a compound?
   a. a compound is a pure substance
   b. a compound obeys the Law of Constant (or Definite) Composition
   c. both (a) and (b) are true
   d. both (a) and (b) are false

___ 5. Which of the following statements is true of a mixture?
   a. a mixture does not obey the Law of Constant (or Definite) Composition
   b. chemical techniques are required to separate the components of a mixture
   c. both (a) and (b) are true
   d. both (a) and (b) are false

___ 6. Which of the following techniques would be most effective in separating the components of salt water?
   a. decantation
   b. evaporation
   c. filtration
   d. they are all equally effective

___ 7. Which of the following is not a proper symbol for an element?
   a. C
   b. Ca
   c. CO
   d. Co
8. Sodium bicarbonate has sodium, hydrogen, carbon and oxygen atoms in the ratio 1:1:1:3. What is the correct formula for sodium bicarbonate?
   a. NaBiCO$_3$
   b. NaHCO$_3$
   c. SoHCO$_3$
   d. none of these

9. The fertilizer ammonium phosphate has nitrogen, hydrogen, phosphorous and oxygen atoms in the ratio 3:12:1:4. Which of the following is a correct (but unconventional) way to write the chemical formula for ammonium phosphate?
   a. Am$_3$H$_{12}$PO$_4$
   b. Na$_3$H$_{12}$PhO$_4$
   c. N$_3$H$_{12}$PO$_4$
   d. none of these

10. Which of the following enable us characterize a compound by a specific chemical formula?
    a. The Law of Conservation of Energy
    b. The Law of Conservation of Mass
    c. The Law of Constant (or Definite) Composition
    d. all of the above

11. A number of elements occur naturally as diatomic molecules. Which of the following does not occur naturally as a diatomic molecule?
    a. chlorine
    b. hydrogen
    c. nitrogen
    d. sulfur

12. One of the postulates of Dalton's theory was incorrect. Which of the following statements is true?
    a. Since one postulate was incorrect the theory must be discarded.
    b. The theory can still be used because the erroneous postulate does not have any effect on the physical properties of the elements.
    c. The theory can still be used because the erroneous postulate does not have any effect on the chemical properties of the elements.
    d. Both (b) and (c) are true.

13. Which subatomic particle(s) is(are) found in the nucleus?
    a. electrons
    b. neutrons
    c. protons
    d. protons and neutrons

14. Which of the following correctly describes an electron?
    a. on the scale of subatomic particles it is massive; it has a +1 charge
    b. on the scale of subatomic particles it is massive; it has a -1 charge
    c. on the scale of subatomic particles it is light; it has a +1 charge
    d. on the scale of subatomic particles it is light; it has a -1 charge

15. The neutron got its name because which of the following is true?
    a. it neutralizes protons
    b. it neutralizes electrons
    c. it does not have an electrical charge
    d. it has no effect on any atomic properties
___ 16. Which element is currently used to define the atomic mass unit?
   a. hydrogen
   b. carbon
   c. oxygen
   d. none of these

___ 17. The atomic number of an atom is equal to which of the following?
   a. the number of protons in the atom
   b. the number of neutrons in the atom
   c. the total number of protons and neutrons in the atom
   d. the total number of protons, neutrons and electrons in the atom

___ 18. Which is true of isotopes of an element?
   a. they have different numbers of electrons
   b. they have different numbers of neutrons
   c. they have different numbers of protons
   d. they have different chemical properties

___ 19. Cobalt-60 is a radioactive isotope sometimes used in the treatment of cancer. Which of the following statements is true about an atom of cobalt-60?
   a. it contains 60 neutrons
   b. it contains 60 protons
   c. it contains 33 neutrons
   d. it contains 33 protons

___ 20. Cobalt-60 is a radioactive isotope sometimes used in the treatment of cancer. Which of the following statements is true about an atom of cobalt-60?
   a. it contains 27 neutrons
   b. it contains 27 protons
   c. it contains 60 neutrons
   d. it contains 60 protons

___ 21. Strontium-90 is a radioactive isotope which is particularly hazardous. Which of the following statements is true about an atom of strontium-90?
   a. it contains 52 neutrons
   b. it contains 52 protons
   c. it contains 90 neutrons
   d. it contains 90 protons

___ 22. Strontium-90 is a radioactive isotope which is particularly hazardous. Which of the following statements is true about an atom of strontium-90?
   a. it contains 38 neutrons
   b. it contains 38 protons
   c. it contains 90 protons
   d. it contains 90 protons
23. It is commonly assumed that the isotopic abundances of a particular element are independent of the source of the element. If isotopic abundance does vary with location what is the significance of that observation?
   a. nothing, the observation is totally unimportant
   b. samples of the element obtained from different locations may not result in the same value for the atomic weight of the element
   c. the chemical behavior of the element will depend on its source
   d. both (b) and (c)

24. Suppose that at some time in the future chemists produce element X with atomic number 118 and it is found that this element has two isotopes. $^{296}X$ has an abundance of 38.00% and $^{301}X$ has an abundance of 62.00%. What is the atomic weight of X?
   a. 296 amu
   b. 298.5 am
   c. 299.1 amu
   d. 301 amu

25. What are the elements in the "A" columns of the period table called?
   a. main group elements
   b. inner transition elements
   c. metalloids
   d. transition elements

26. Which of the following columns of the periodic table contains only gaseous elements?
   a. 5A
   b. 6A
   c. 7A
   d. 8A

27. Which of the following columns of the periodic table is not commonly identified by a name?
   a. 1A
   b. 4A
   c. 7A
   d. 8A

28. The properties of ductility, malleability, ability to conduct heat and electricity are characteristics of what type of material?
   a. all elements
   b. metallic elements
   c. metalloid elements
   d. nonmetallic elements

29. What is the name of the lowest possible energy state for an electron?
   a. Bohr state
   b. bottom state
   c. ground state
   d. none of the above
30. Which of the following sets of numbers could be used to designate the principal energy levels (shells) in an atom?
   a. -1, 0, 1, 2, 3
   b. 0, 1, 2, 3, 4
   c. 1, 2, 3, 4, 5
   d. all of these

31. Which of the following is true of the number of subshells associated with a particular shell?
   a. it depends only on which atom is being considered
   b. it depends only on the particular shell being considered
   c. it depends on both (a) and (b)
   d. it depends on neither (a) nor (b)

32. How many electrons can be accommodated in the fourth shell of an atom?
   a. 2
   b. 8
   c. 18
   d. 32

33. If we consider the elements C, N, and O, which types of orbitals do these elements use in bonding?
   a. only s
   b. only p
   c. both s and p
   d. s, p and d

34. Which of the following statements is true?
   a. orbitals fill in the order of increasing energy from lowest to highest
   b. each orbital can hold up to two electrons with spins paired
   c. when there is a set of orbitals of equal energy each orbital becomes half filled before any of them becomes completely filled
   d. all of the above are true

35. What is the maximum number of unpaired electrons in a Lewis structure?
   a. 1
   b. 3
   c. 4
   d. 8

36. Which of the following is the correct Lewis structure for a carbon atom?
   a. C
   b. C
   c. C
   d. C
37. How many valence electrons are there in an oxygen atom?
   a. 2
   b. 4
   c. 6
   d. 8

38. The number of valence electrons of a main group element is related to which of the following?
   a. the element's atomic number
   b. the element's atomic weight
   c. the element's column number
   d. none of the above

39. Which of the following is true of the ionization energy of the elements?
   a. ionization energy generally decreases as we move left to right and decreases as we move top to bottom in the periodic table
   b. ionization energy generally decreases as we move left to right and increases as we move top to bottom in the periodic table
   c. ionization energy generally increases as we move left to right and decreases as we move top to bottom in the periodic table
   d. ionization energy generally increases as we move left to right and increases as we move top to bottom in the periodic table

40. In comparing sodium and potassium which of the following statements is true?
   a. sodium is more likely to lose an electron than potassium because sodium has a higher ionization energy than potassium
   b. sodium is more likely to lose an electron than potassium because sodium has a lower ionization energy than potassium
   c. sodium is less likely to lose an electron than potassium because sodium has a higher ionization energy than potassium
   d. sodium is likely to lose an electron than potassium because sodium has a lower ionization energy than potassium