Exercises

20. Following are a statement containing a number of blanks and a list of words and phrases. The number of words equals the number of blanks within the statement, and all but two of the words fit correctly into these blanks. Fill in the blanks of the statement with those words that do fit, then complete the statement by filling in the remaining blanks with correct words (not in the list) in place of the two words that don't fit.

In its modern form the Periodic Table is an organization of all the known elements arranged in order of increasing atomic number, similar to the Latin alphabet which represents the same sequence. The table shows the elements' chemical symbols, atomic number, and atomic weight, which is the average mass of all the isotopes of an element. Isotopes of an element are atoms with the same number of protons but different numbers of neutrons. Each table is particularly useful for predicting the outcome of chemical reactions between elements. Each element tends to react with others in a specific way, forming compounds with certain characteristics. In molecules and ions, covalent bonds are composed of electrons that share between atoms, whereas ionic bonds are formed when atoms lose or gain electrons to form ions. Examples of elements include hydrogen, oxygen, nitrogen, carbon, and sulfur. Each of the following elements can be classified based on their properties: 

a. alkaline earth metal  
  b. ionization  
  c. binary compound  
  d. molecular formula  
  e. chemical formula  
  f. molecular weight  
  g. chemical properties  
  h. molecular bond  
  i. covalent bond  
  j. valence electron  
  k. valence electron bond  

Identify the elements and the compounds among the following: 


Identify each fact of the following, as consisting primarily of: 

- molecules, primarily of ions, or primarily of atomic (a) water, (b) sodium chloride, (c) carbon, (d) sodium bicarbonate, (e) hydrogen peroxide, (f) iron, (g) sulfur, (h) oxygen, (i) nitrogen. 

Write chemical formulas for (a) lithium bromide, (b) calcium sulfate, (c) sodium carbonate, (d) aluminum oxide, (e) magnesium fluoride, (f) silicon dioxide, (g) sulfur trioxide, (h) carbon dioxide, (i) hydrogen chloride, (j) hydrogen sulfide. 

Write the chemical formulas for the following elements: 

- Carbon, (b) Hydrogen, (c) Oxygen, (d) Chlorine, (e) Sulfur, (f) Phosphorus, (g) Bromine, (h) Iodine, (i) Fluorine, (j) Astatine. 

Write the Lewis structures of the following elements: 

- Sulfur, (b) Chlorine, (c) Oxygen, (d) Fluorine, (e) Carbon, (f) Nitrogen, (g) Phosphorus, (h) Arsenic, (i) Antimony, (j) Bismuth. 

Write the Lewis structures of the following compounds: 

- Chlorine, (b) Sodium, (c) Oxygen, (d) Carbon, (e) Hydrogen.
28. Bromine's atomic weight is 79.9. Two isotopes make up virtually all the bromine in the universe. One, with a mass number of 79, makes up 50.69% of all the bromine atoms. What is the mass number of the other isotope?

29. The permanganate ion, $\text{MnO}_4^-$, bears a single negative charge. Knowing that oxygen acquires an octet by acquiring two electrons, what do you calculate as the valence of the manganese atom in this ion?

30. What is the valence of neon?

Think, Speculate, Reflect, and Wonder

41. Many compounds, such as carbon dioxide, $\text{CO}_2$, methane, $\text{CH}_4$, water, $\text{H}_2\text{O}$, and sucrose, $\text{C}_{12}\text{H}_{22}\text{O}_{11}$, exist as molecules. Hydrogen gas, $\text{H}_2$, also exists as molecules. Does this mean that the gas $\text{H}_2$ is a compound? Explain.

42. The covalent compound acetylene, the fuel of the oxy-acetylene torch used by welders, has the molecular formula $\text{C}_2\text{H}_2$. The covalent compound benzene, a commercial solvent, has the molecular formula $\text{C}_6\text{H}_6$. Each of these compounds contains carbon and hydrogen atoms in a one-to-one ratio. Would it be correct to write the chemical formula of each as $\text{CH}$? Explain your answer.

43. Elemental oxygen exists as a diatomic gas, $\text{O}_2$. How many electrons do the two oxygen atoms have to share between them to form this diatomic molecule? How many covalent bonds unite the two oxygen atoms of the $\text{O}_2$ molecule?

44. Arranging the elements in order of increasing atomic number also places the elements in order of increasing atomic weight, with a few exceptions. One of these appears in the sequence of tellurium ($\text{Te}$) and iodine ($\text{I}$). The atomic weight of tellurium (atomic number 52) is 127.6. The atomic weight for iodine (atomic number 53) is 126.9. How do you account for this?

45. Hydrogen chloride, $\text{HCl}$, exists as a gas composed of covalent molecules. If we dissolve this gas in water, the water conducts an electric current well. If we dissolve $\text{HCl}$ in benzene, a solvent of molecular formula $\text{C}_6\text{H}_6$, the solution does not conduct an electric current. (Pure benzene does not conduct an electric current either.) What do you conclude from this observation?

46. The element carbon, as we will see later, forms the basis for all life as we know it. Science fiction writers sometimes speculate on the properties of different forms of life based on an element other than carbon. What element do you think they usually choose, and why? (Referencing to Fig. 3.2 may help you answer this question.)

47. Some forms of the periodic table show hydrogen twice, once at the top of the column of the alkali metals and once again at the top of the column of the halogens. Suggest a reason for putting hydrogen into both families. (Hint: Consider the structure of the hydrogen atom and its similarities to the other elements of each of these families.)