

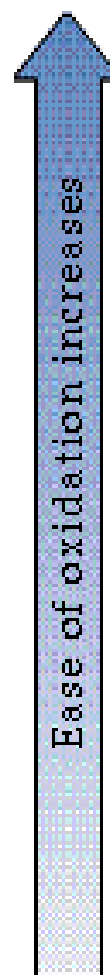


Bottle	[HCl]	[HCl] as power of 10	[H ⁺]	pH
A	1.0	10^0	10^0	0
B	0.10	10^{-1}	10^{-1}	1
C	0.010	10^{-2}	10^{-2}	2



TABLE 4.5 Activity Series of Metals in Aqueous Solution

Metal	Oxidation Reaction		
Lithium	$\text{Li}(s) \longrightarrow$	$\text{Li}^+(aq)$	$+ e^-$
Potassium	$\text{K}(s) \longrightarrow$	$\text{K}^+(aq)$	$+ e^-$
Barium	$\text{Ba}(s) \longrightarrow$	$\text{Ba}^{2+}(aq)$	$+ 2e^-$
Calcium	$\text{Ca}(s) \longrightarrow$	$\text{Ca}^{2+}(aq)$	$+ 2e^-$
Sodium	$\text{Na}(s) \longrightarrow$	$\text{Na}^+(aq)$	$+ e^-$
Magnesium	$\text{Mg}(s) \longrightarrow$	$\text{Mg}^{2+}(aq)$	$+ 2e^-$
Aluminum	$\text{Al}(s) \longrightarrow$	$\text{Al}^{3+}(aq)$	$+ 3e^-$
Manganese	$\text{Mn}(s) \longrightarrow$	$\text{Mn}^{2+}(aq)$	$+ 2e^-$
Zinc	$\text{Zn}(s) \longrightarrow$	$\text{Zn}^{2+}(aq)$	$+ 2e^-$
Chromium	$\text{Cr}(s) \longrightarrow$	$\text{Cr}^{3+}(aq)$	$+ 3e^-$
Iron	$\text{Fe}(s) \longrightarrow$	$\text{Fe}^{2+}(aq)$	$+ 2e^-$
Cobalt	$\text{Co}(s) \longrightarrow$	$\text{Co}^{2+}(aq)$	$+ 2e^-$
Nickel	$\text{Ni}(s) \longrightarrow$	$\text{Ni}^{2+}(aq)$	$+ 2e^-$
Tin	$\text{Sn}(s) \longrightarrow$	$\text{Sn}^{2+}(aq)$	$+ 2e^-$
Lead	$\text{Pb}(s) \longrightarrow$	$\text{Pb}^{2+}(aq)$	$+ 2e^-$
Hydrogen	$\text{H}_2(g) \longrightarrow$	$2\text{H}^+(aq)$	$+ 2e^-$
Copper	$\text{Cu}(s) \longrightarrow$	$\text{Cu}^{2+}(aq)$	$+ 2e^-$
Silver	$\text{Ag}(s) \longrightarrow$	$\text{Ag}^+(aq)$	$+ e^-$
Mercury	$\text{Hg}(l) \longrightarrow$	$\text{Hg}^{2+}(aq)$	$+ 2e^-$
Platinum	$\text{Pt}(s) \longrightarrow$	$\text{Pt}^{2+}(aq)$	$+ 2e^-$
Gold	$\text{Au}(s) \longrightarrow$	$\text{Au}^{3+}(aq)$	$+ 3e^-$



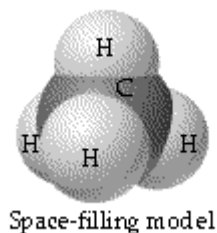
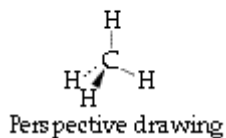
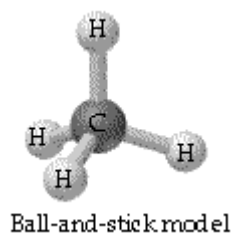
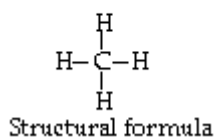
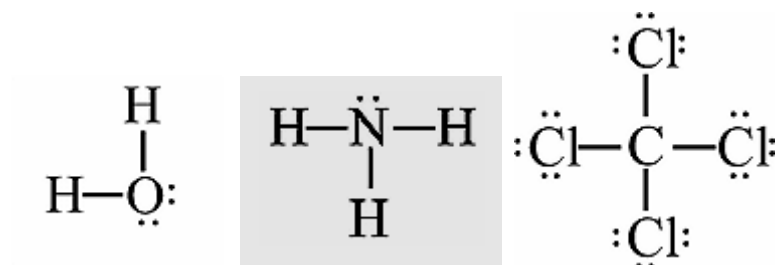
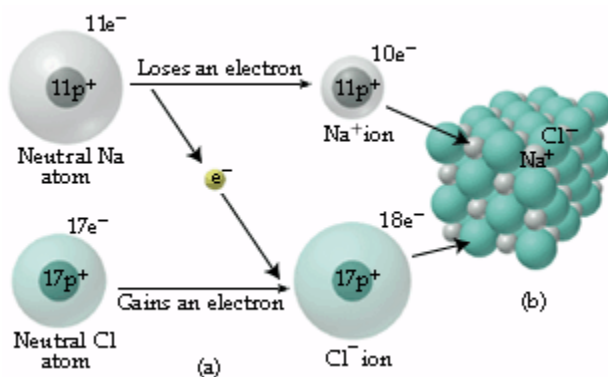


Figure 2.17.





Ionic Compounds



- 1. Mining**
- 2. Concentrating the ore**
- 3. Reducing the ore**
- 4. Purifying the ore**
- 5. Mixing the metal with other elements to modify its properties**



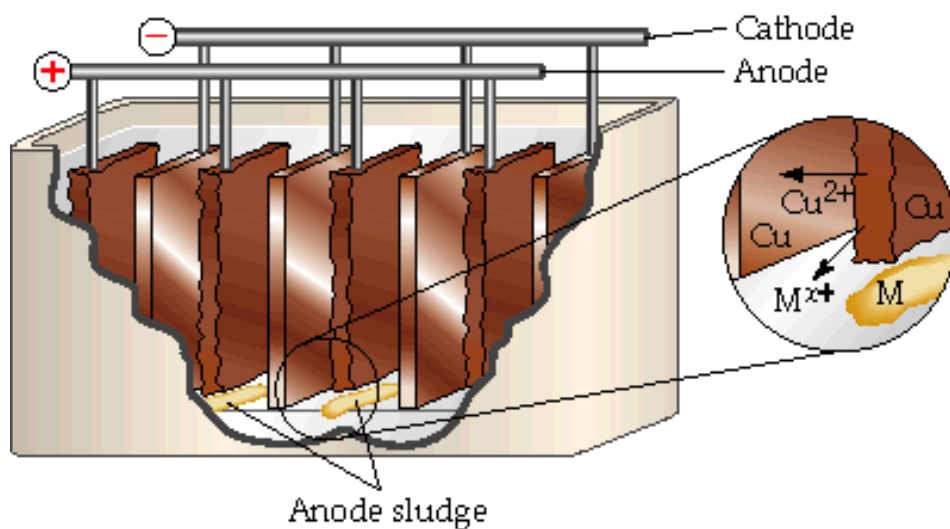
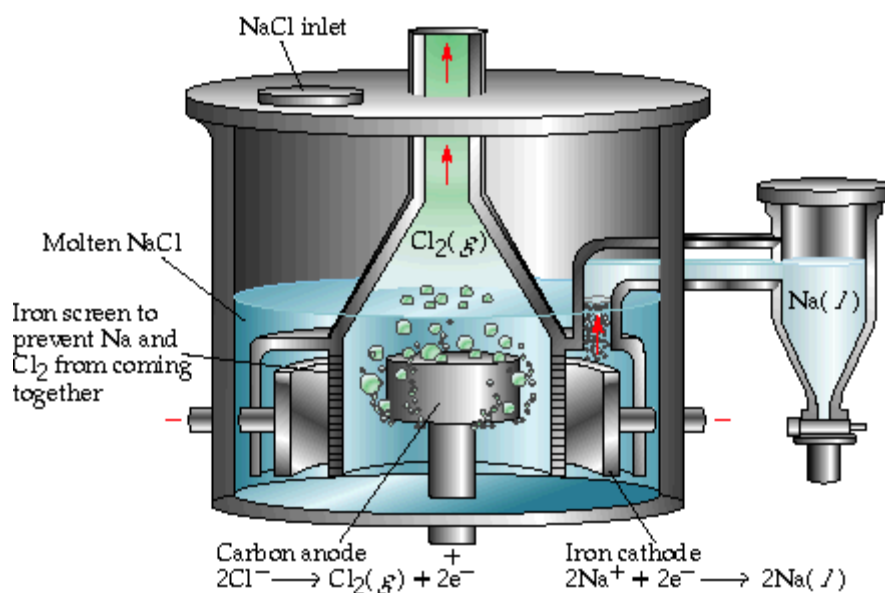
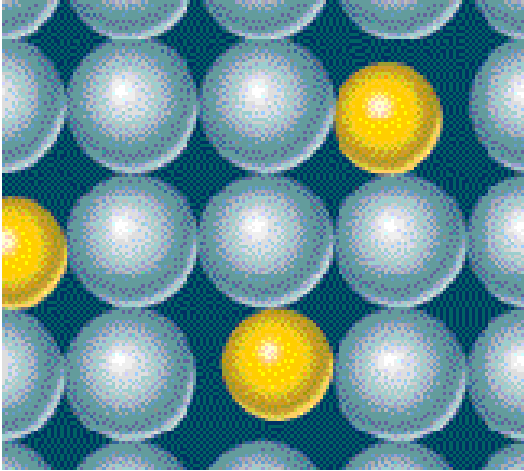
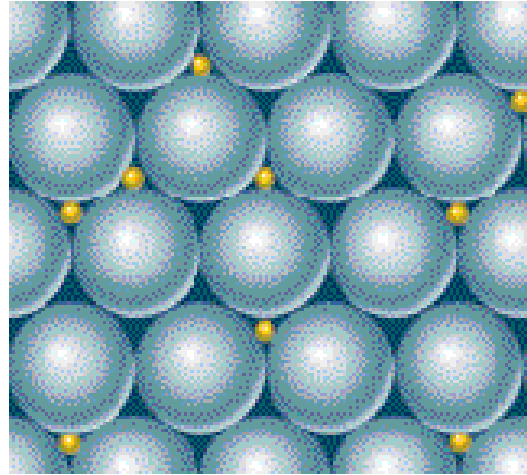


Figure 23. 11.



(a)



(b)

COMMON IONS

Positive Ions (Cations)

1+

Ammonium (NH_4^+)
 Cesium (Cs^+)
 Copper(I) or cuprous (Cu^+)
 Hydrogen (H^+)
 Lithium (Li^+)
 Potassium (K^+)
 Silver (Ag^+)
 Sodium (Na^+)

2+

Barium (Ba^{2+})
 Cadmium (Cd^{2+})
 Calcium (Ca^{2+})
 Chromium(II) or chromous (Cr^{2+})
 Cobalt(II) or cobaltous (Co^{2+})
 Copper(II) or cupric (Cu^{2+})
 Iron(II) or ferrous (Fe^{2+})
 Lead(II) or plumbous (Pb^{2+})
 Magnesium (Mg^{2+})
 Manganese(II) or manganous (Mn^{2+})
 Mercury(I) or mercurous (Hg_2^{2+})

Mercury(II) or mercuric (Hg^{2+})
 Strontium (Sr^{2+})
 Nickel(II) (Ni^{2+})
 Tin(II) or stannous (Sn^{2+})
 Zinc (Zn^{2+})

3+

Aluminum (Al^{3+})
 Chromium(III) or chromic (Cr^{3+})
 Iron(III) or ferric (Fe^{3+})

Negative Ions (Anions)

1-

Acetate ($\text{C}_2\text{H}_3\text{O}_2^-$)
 Bromide (Br^-)
 Chlorate (ClO_3^-)
 Chloride (Cl^-)
 Cyanide (CN^-)
 Dihydrogen phosphate (H_2PO_4^-)
 Fluoride (F^-)
 Hydride (H^-)
 Hydrogen carbonate or bicarbonate (HCO_3^-)

Hydrogen sulfite or bisulfite (HSO_3^-)
 Hydroxide (OH^-)
 Iodide (I^-)
 Nitrate (NO_3^-)
 Nitrite (NO_2^-)
 Perchlorate (ClO_4^-)
 Permanganate (MnO_4^-)
 Thiocyanate (SCN^-)

2-

Carbonate (CO_3^{2-})
 Chromate (CrO_4^{2-})
 Dichromate ($\text{Cr}_2\text{O}_7^{2-}$)
 Hydrogen phosphate (HPO_4^{2-})
 Oxide (O^{2-})
 Peroxide (O_2^{2-})
 Sulfate (SO_4^{2-})
 Sulfide (S^{2-})
 Sulfite (SO_3^{2-})

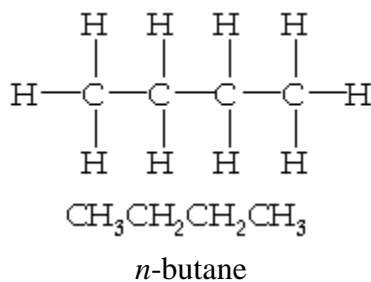
3-

Arsenate (AsO_4^{3-})
 Phosphate (PO_4^{3-})

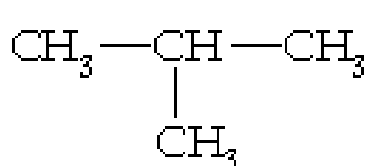
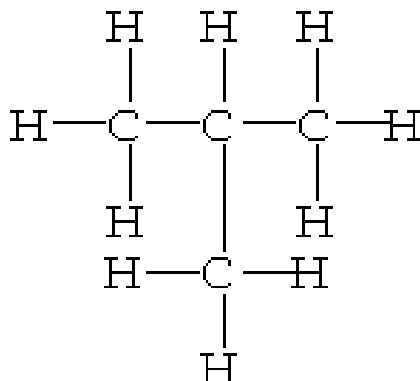
TABLE 25.1 First Several Members of the Straight-Chain Alkane Series

Molecular Formula	Condensed Structural Formula	Name	Boiling Point (°C)
CH ₄	CH ₄	Methane	-161
C ₂ H ₆	CH ₃ CH ₃	Ethane	-89
C ₃ H ₈	CH ₃ CH ₂ CH ₃	Propane	-44
C ₄ H ₁₀	CH ₃ CH ₂ CH ₂ CH ₃	Butane	-0.5
C ₅ H ₁₂	CH ₃ CH ₂ CH ₂ CH ₂ CH ₃	Pentane	36
C ₆ H ₁₄	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃	Hexane	68
C ₇ H ₁₆	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃	Heptane	98
C ₈ H ₁₈	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃	Octane	125
C ₉ H ₂₀	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃	Nonane	151
C ₁₀ H ₂₂	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃	Decane	174

n-butane

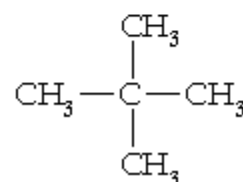
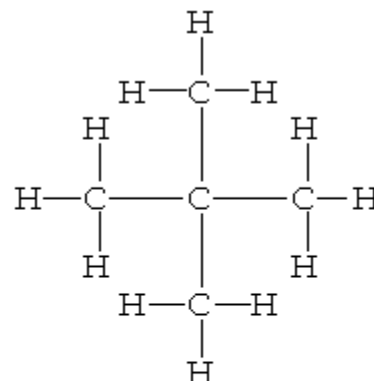


Isobutane



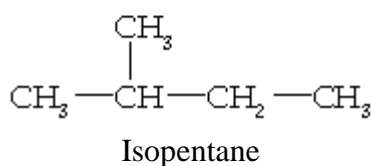
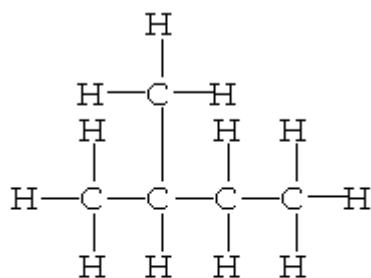
Isobutane

Neopentane



Neopentane

Isopentane



n-pentane

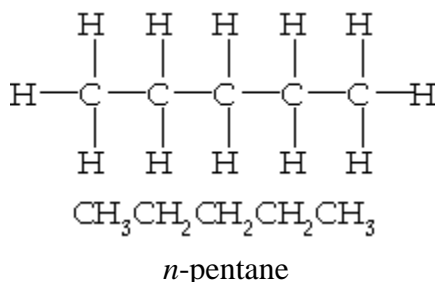
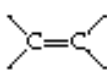
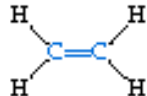
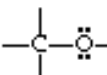
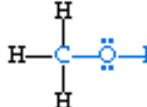
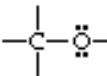
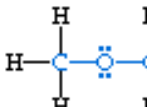
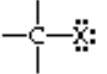
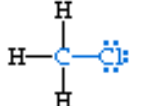
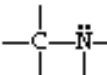
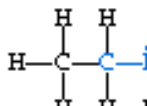
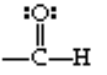
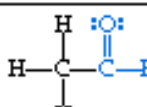
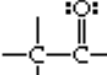
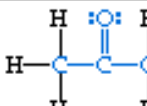
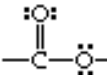
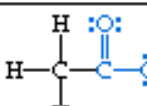
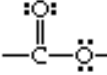
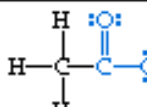
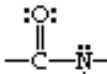
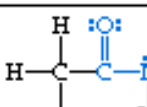


TABLE 25.2 Condensed Structural Formulas and Common Names for Several Alkyl Groups

Group	Name
CH ₃ —	Methyl
CH ₃ CH ₂ —	Ethyl
CH ₃ CH ₂ CH ₂ —	Propyl
CH ₃ CH ₂ CH ₂ CH ₂ —	Butyl
$\begin{array}{c} \text{CH}_3 \\ \\ \text{HC}— \\ \\ \text{CH}_3 \end{array}$	Isopropyl
$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_2—\text{C}— \\ \\ \text{CH}_3 \end{array}$	<i>t</i> -Butyl

TABLE 25.4 Common Functional Groups in Organic Compounds

Functional Group	Type of Compound	Suffix or Prefix	Example	Systematic Name (common name)
	Alkene	<i>-ene</i>		Ethene (ethylene)
$-\text{C}\equiv\text{C}-$	Alkyne	<i>-yne</i>	$\text{H}-\text{C}\equiv\text{C}-\text{H}$	Ethyne (acetylene)
	Alcohol	<i>-ol</i>		Methanol (methyl alcohol)
	Ether	<i>ether</i>		Dimethyl ether
 (X = halogen)	Haloalkane	<i>halo-</i>		Chloromethane (methyl chloride)
	Amine	<i>-amine</i>		Ethylamine
	Aldehyde	<i>-al</i>		Ethanal (acetaldehyde)
	Ketone	<i>-one</i>		2-Propanone (acetone)
	Carboxylic acid	<i>-oic acid</i>		Ethanoic acid (acetic acid)
	Ester	<i>-oate</i>		Methyl ethanoate (methyl acetate)
	Amide	<i>-amide</i>		Ethanamide (acetamide)

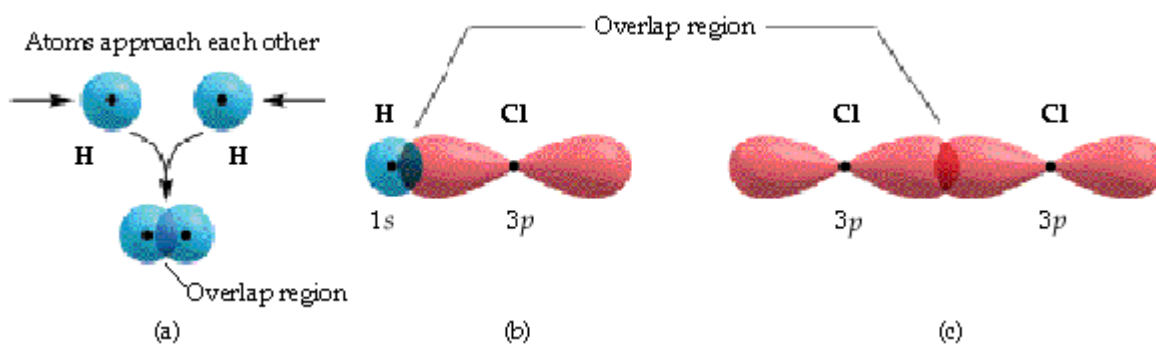
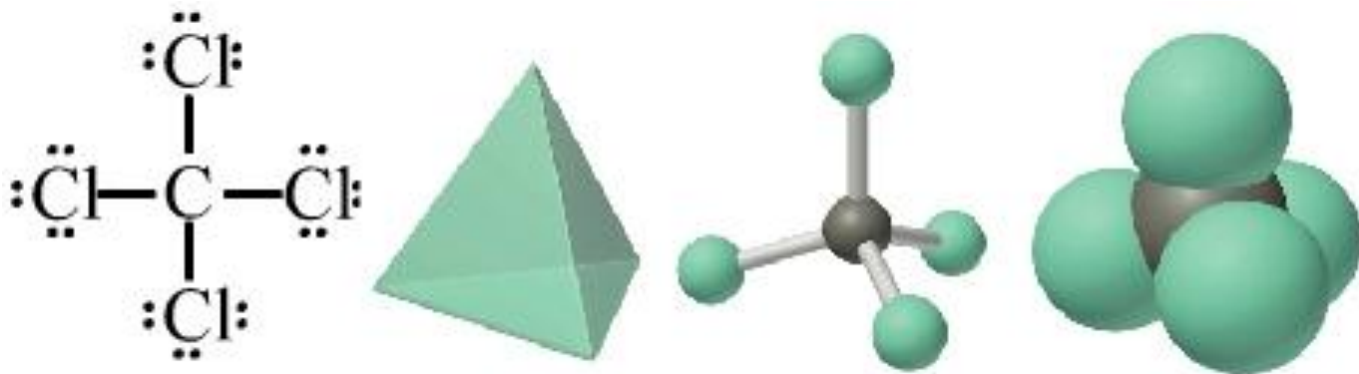


Figure 9.11. The overlap of orbitals to form covalent bonds. (a) The bond in H_2 results from the overlap of two $1s$ orbitals from two H atoms. (b) The bond in HCl results from the overlap of a $1s$ orbital of H and one of the lobes of a $3p$ orbital of Cl. (c) The bond in Cl_2 results from the overlap of two $3p$ orbitals from two Cl atoms.

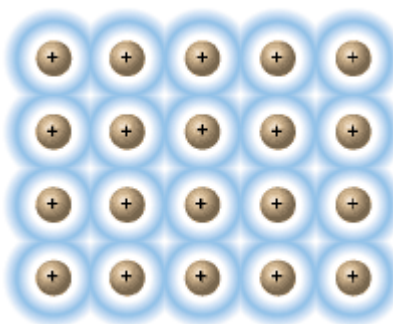


Figure 11. 45. A cross section of a metal. Each sphere represents the nucleus and inner-core electrons of a metal atom. The surrounding colored "fog" represents the mobile sea of electrons that binds the atoms together.



TABLE 13.1 Examples of Solutions			
State of Solution	State of Solvent	State of Solute	Example
Gas	Gas	Gas	Air
Liquid	Liquid	Gas	Oxygen in water
Liquid	Liquid	Liquid	Alcohol in water
Liquid	Liquid	Solid	Salt in water
Solid	Solid	Gas	Hydrogen in palladium
Solid	Solid	Liquid	Mercury in silver
Solid	Solid	Solid	Silver in gold

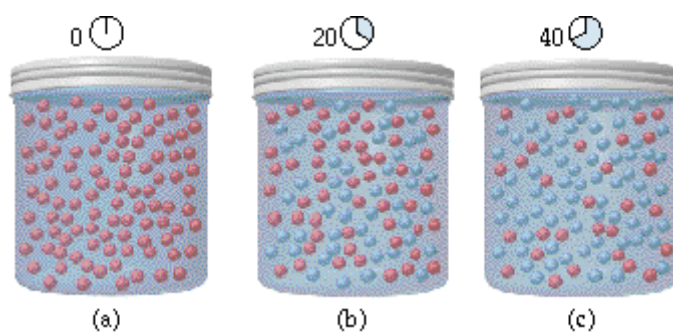


Figure 14.3. Progress of a hypothetical reaction $A \rightarrow B$, starting with 1.00 mol A. The red spheres represent A; the blue ones represent B (each 0.01 mol). (a) At time zero, the vessel contains 1.00 mol A and 0 mol B. (b) After 20 min, the vessel contains 0.54 mol A and 0.46 mol B. (c) After 40 min, the vessel contains 0.30 mol A and 0.70 mol B.

