b. exothermic; The energy of the reactants is greater than the energy of the products.
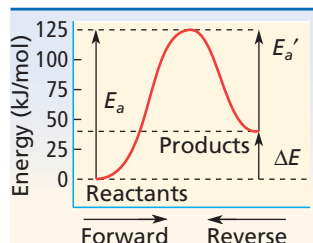
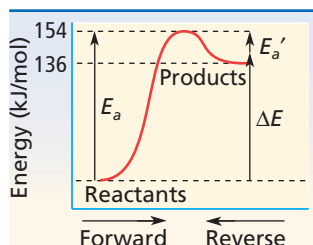**2. a.**

b. $\Delta E_{forward} = 39$ kJ/mol
$\Delta E_{reverse} = -39$ kJ/mol
c. endothermic; The energy of the products is greater that the energy of the products

3. a.

b. E_a (reverse) = 18 kJ/mol

Practice Problems B

1. rate = $k[A]^2$
2. 27

Practice Problems E

1. $R = k[L][M]^2$
2. $R = k[NO_2]^2$

Math Tutor Practice

1. $R = k[O_2][NO]_2$
2. $R = k[H_2]$; Students should observe that changing the concentration of C_2H_2 has no effect on the rate. The rate depends on only the concentration of hydrogen.

Chemical Equilibrium

Practice Problems A

1. 0.286
2. 4.9×10^{-3}
3. 4.36

Practice Problems B

1. 1.9×10^{-4}
2. 1.6×10^{-5}

Practice Problems C

1. 8.9×10^{-14} mol/L
2. 5.7×10^{-4} mol/L

Practice Problems D

1. AgBr precipitates.
2. $PbCl_2$ does *not* precipitate.

Math Tutor Practice

1. **a.** $K = \dfrac{[AB_2]}{[A][B]^2}$

   b. $K = \dfrac{[D_2][E_2]^2}{[DE_2]^2}$
2. $K = 2.6 \times 10^{-9}$

Oxidation-Reduction Reactions

Practice Problems A

1. $Cu + 2H_2SO_4 \longrightarrow CuSO_4 + SO_2 + 2H_2O$
2. $8HNO_3 + 6KI \longrightarrow 6KNO_3 + 3I_2 + 2NO + 4H_2O$

Math Tutor Practice

1. $2MnO_2 + NaClO_3 + 2NaOH \longrightarrow 2NaMnO_4 + NaCl + H_2O$
2. $N_2O + 2KClO + 2KOH \longrightarrow 2KCl + 2KNO_2 + H_2O$

Electrochemistry

Practice Problems A

1. **a.** $Cr_2O_7^{2-} + 14H^+ + 3Ni \longrightarrow 2Cr^{3+} + 3Ni^{2+} + 7H_2O$;
   $E^0 = 1.33 - (-0.23) = 1.56$ V

   b. $2Fe^{3+} + H_2 \longrightarrow 2Fe^{2+} + 2H^+$;
   $E^0 = 0.77 - 0.0 = 0.77$ V

Math Tutor Practice

1. $E^0 = 1.82$ V
2. $E^0 = 1.20$ V

Nuclear Chemistry

Practice Problems A

1. $^{253}_{99}Es + ^4_2He \longrightarrow ^1_0n + ^{256}_{101}Md$
2. $^{142}_{61}Pm + ^{0}_{-1}e \longrightarrow ^{142}_{60}Nd$

Practice Problems B

1. 0.25 mg
2. 6396 years
3. 7.648 days
4. 0.00977 mg
5. 4.46×10^9 years

Math Tutor Practice

1. 1.4×10^{-6} g chromium-51
2. 8 half-lives or 420 000 years (expressed with 2 significant figures)

Organic Chemistry

Practice Problems A

1. methylbutane
2. 3-ethyl-4-methylhexane