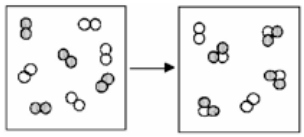
F_MT3

1. The figure below represents the spontaneous reaction of H_2 (shaded spheres) with O_2 (unshaded spheres) to produce gaseous H_2O. [**non-spontaneous at high temperatures and spontaneous at low temperatures**]



2. Find the temperature (in K) above which a reaction with a ΔH of 123.0 kJ/mol and a ΔS of 90.00 J/K mol becomes spontaneous. [**1367**]

3. Which of the following reactions will have a positive value of ΔS? [**III only**]
   I. $Pb_{(s)} + Cl_{2(g)} \rightarrow PbCl_{2(s)}$
   II. $2H_2S_{(g)} + 3O_2(g) \rightarrow 2H_2O_{(g)} + 2SO_{2(g)}$
   III. $K_2SO_{4(s)} \rightarrow 2K^+_{(aq)} + SO_4^{2-}{}_{(aq)}$

4. Calculate the value of ΔGº in kJ for the combustion of 1 mole of butane (C_4H_{10}) with molecular oxygen to form carbon dioxide and gaseous water, using the values of ΔG_f^o given below in kJ/mol. [**-2,705 ± 2**]
   $\Delta G_f^o (C_4H_{10(g)}) = -16.$
   $\Delta G_f^o (CO_{2(g)}) = -399.$
   $\Delta G_f^o (H_2O_{(g)}) = -225.$

5. The equilibrium constant for a reaction is 0.35 at 25 °C. What is the value of ΔG° (kJ/mol) at this temperature? [**2.6**]

6. Consider a voltaic cell based on the half-cells:
   $Ag^{+}_{(aq)} + e^{-} \rightarrow Ag_{(s)}$ $E^{\circ} = +0.80$ V
   $Co^{2+}_{(aq)} + 2\ e^{-} \rightarrow Co_{(s)}$ $E^{\circ} = -0.28$ V
   Identify the cathode and give the cell voltage under standard conditions: [**Ag; E°cell = 1.08 V**]

7. What is the balanced equation for the galvanic cell reaction that corresponds to the shorthand notation below?
   $Pt_{(s)} \mid Sn^{2+}_{(aq)}, Sn^{4+}_{(aq)} \mid\mid Br_{2(l)} \mid Br^{-}_{(aq)} \mid Pt_{(s)}$. [**$Sn^{2+}_{(aq)} + Br_{2(l)} \rightarrow Sn^{4+}_{(aq)} + 2\ Br^{-}_{(aq)}$**]

8. The standard cell potential for a dry cell battery is 1.56 V. What is the standard free energy change (kJ) for this cell?
   $Zn_{(s)} + 2\ MnO_{2(s)} + NH^{4+} \rightarrow 2\ NH_3 + Mn_2O_{3(s)} + Zn^{2+}_{(aq)} + H_2O_{(l)}$. [**-301**]

9. Balance the following equation in basic solution using the lowest possible integers and give the coefficient of water. $MnO_4^-{}_{(aq)} + Br^-_{(aq)} \rightarrow MnO_{2(s)} + BrO_3^-{}_{(aq)}$. [**1**]

10. How many grams of chromium metal can be plated out when a constant current of 8.00 A is passed through an aqueous solution containing Cr^{3+} ions for 40.0 minutes?. [**3.45**]

11. The half-life for beta decay of strontium-90 is 28.8 years. A milk sample is found to contain 10.3 ppm strontium-90. How many years would pass before the strontium-90 concentration would drop to 1.0 ppm? [**96.8**]

12. A freshly prepared sample of curium-243 undergoes 3312 disintegrations per second. After 6.00 yr, the activity of the sample declines to 2755 disintegrations per second. The half-life of curium-243 is _____ [**22.6**]