AP Chemistry
Reaction Practice
Day 9

Name Key 2011
Date _____ **Period** _____

For each of the following three reactions, in part (i) write a BALANCED equation and in part (ii) answer the question about the reaction. In part (i), coefficients should be in terms of lowest whole numbers. Assume that solutions are aqueous unless otherwise indicated. Represent substances in solutions as ions if the substances are extensively ionized. Omit formulas for any ions or molecules that are unchanged by the reaction.

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1. Liquid bromine is shaken with a 0.50 M solution of sodium iodide.

(i) $Br_2 + 2I^- \longrightarrow I_2 + 2Br^-$

(ii) What would happen if you mixed liquid iodine with sodium bromide? Explain.

Nothing would happen since Br_2 has a more positive Reduction potential than I_2. (Br_2 is more Reactive)

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2. Carbon dioxide gas is passed over hot, solid sodium oxide.

(i) $CO_2 + Na_2O \longrightarrow Na_2CO_3$

(ii) Assume that you dissolved the product of this reaction in water. Would the resulting solution be acidic, basic or neutral? Explain. Use an equation as part of your explaination.

$Na_2CO_3 \xrightarrow{H_2O} Na^+ + CO_3^{2-}$ (hydrolysis)

$CO_3^{2-} + H_2O \rightleftharpoons HCO_3^- + OH^-$

It will be BASIC !!

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3. Chlorine gas is bubbled into water.

(i) $Cl_2 + H_2O \longrightarrow H^+ + Cl^- + HClO$

Cl_2: RED (Cl^-, -1) and OX ($HClO$, $+1$)

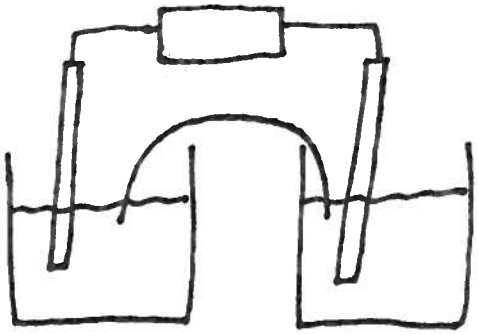
(ii) What is the oxidizing agent and what is the reducing agent?

The Cl_2 is both the oxidizing & Reducing Agent.

5. Suppose that gold and silver half cells are suitably connected in 1.0 M silver nitrate and 1.0 M gold nitrate solutions. A salt bridge made of sodium nitrate is used.

Au^{3+} 3 e- ----> Au(s) $E^\circ = 1.50$ volts

Ag^+ + e- -----> Ag(s) $E^\circ = 0.80$ volts



Label the following on the diagram at right:

Silver and gold electrodes
Direction of electron flow
Direction of ion flow through salt bridge
Cathode and anode
Signs of cathode and anode

Answer the following questions:

a) Write the reactions occurring at the anode and at the cathode. Write the overall cell reaction.

Anode (ox) $3(Ag \rightarrow Ag^+ + e^-)$

Cathode (RED) $Au^{3+} + 3e^- \rightarrow Au(s)$

$Au^{3+} + 3Ag \rightarrow 3Ag^+ + Au$

$K = \frac{[Ag^+]^3}{[Au]}$

b) Which electrode is gaining mass with time? Explain.

The cathode gains mass. Cations (Au^{3+}) goes toward the cathode te- attract

c) Calculate the E° for the cell.

$E^\circ = 1.50V + -.80V = .70V$

d) Calculate the ΔG° for the cell.

$\Delta G^\circ = -nFE^\circ = -3\left(\frac{96{,}500\ C}{mol\ e^-}\right)(.70V) = -202\ KJ$

e) Calculate the equilibrium constant for the cell reaction at 25°C.

$\Delta G^\circ = -RT\ln K \qquad -202\ KJ = -\left(.008314\frac{KJ}{mol}\right)(298K)\ln K$

$K = 2.92 \times 10^{35}$

f) Calculate the E for the cell if $[Ag^+]$ = 0.15 M and $[Au^{3+}]$ = 0.75 M.

$E = E^\circ_{cell} - \frac{RT}{nF}\ln Q \quad ; \quad E = .70V - \frac{.008314(298)}{(3)(96{,}500C)}\ln\frac{(.15)^3}{.75}$

$E = .75V$

g) In a separate experiment, how many grams of gold can be plated out onto a piece of jewelry if a 1.00 M solution of gold(III) nitrate is suitably electrolyzed for 45 minutes at 2.50 amps?

$2.50\ amps \left|\frac{C}{amp\cdot sec}\right| \frac{mole^-}{96{,}500\ C} \left|\frac{mol\ Au}{3\ mole^-}\right| \frac{60\ sec}{min} \left|\frac{45\ min}{1}\right| \frac{197.9\ g\ Au}{mol\ Au} = 4.59\ g\ Au$

h) Compare and contrast an electrolytic cell and a galvanic cell.

Electrolytic	Voltaic
(1) Anode - ox	(1) Anode - ox
(2) neg Voltage	(2) + Voltage
(3) Anode & Cathode	(3) Anode to cathode
(4) Cathode (-)	(4) ~~Anode~~ Cathode +
(5) Requires outside energy source	(5) spontaneous