Monday, June 8, 2015

NOT A QUESTION ON THE EXAM!!!!!!!!!!!!!! GOOD M/C CHOICE QUESTION THOUGH (IS REACTION SPONTANEOUS OR NOT)

Batteries

over extended periods of time (several years) the chem. in the battery can break down and the amount of chem. energy available will then decrease

The power (Watts (W)) of a cell or battery

> is the rate at which it produces electrical energy. It is calculated as :

Power= Current x Voltage (NOT USED)

P=I X V

The energy density (how much mass/unit of volume) or specific energy of a battery is

> a measure of the quantity of energy stored or supplied per unit mass of the battery (joules//kilogram)

This is important measurement for technological reasons. For ex. if the energy density is low (lots of joules but a heavy mass as well) the battery would not be very good for a car. If the energy density is high (lots of joules but a low mass) it would be much more practical to be used in a car.

Batteries that are made up of cells that can be used only once are called

> Primary cells. Once the chemicals are all used up, the cells can no l longer produce any electrical current (typically one time use, short life) 1.5V (diff chem. than secondary cells that only produce 1.2 Volts)

Batteries that are made up of cells that can be reused (rechargeable) are called

> Secondary cells. The chemical process used to produce the electric current can be REVERSED by using electricity to restore the original compounds. 1.2V

F2 = 2.87 V.

Li = -3.04 V.

2.87- (-3.04) = 5.91 V.

Galvanic Cells- An electric cell adapted for scientific study of spontaneous redox reactions (two 1/2 cells connected by a porous boundary)

A half - cell consists of - 1 electrode and 1 electrolyte

There are 2 basic designs of galvanic cells. One uses a 'salt bridge' which is a u-shaped tube filled with a non-reactive electrolyte (+ and - ions that are not part of the net reaction). Cotton plugs help to prevent the mixture of the 2 reacting solutions, but allow ions to pass.

The other uses porous porcelain cup that contains one of the electrodes and electrolytes. This is immersed in a beaker that has the other electrode and its corresponding electrolyte (see page 695 in textbook)

Galvanic cells can be represented using a shorthand cell notation:

Cu (s) / Cu (NO3)2 (aq) // Zn(NO3)2 (aq) / Zn (s)

/ = phase boundary (b/w the electrode and its electrolyte)

// = physical boundary (the salt bridge or a porous porcelain cup)

In a galvanic cell, the SOA in a cell always undergoes a reduction (gain of e-) at the cathode (+)

The SRO undergoes an oxidation (loss of e-) at the anode (-)

Ex.1 : Determine which metal is the cathode and which is the anode.

Cu (s) / Cu (NO3)2 (aq) // Zn(NO3)2 (aq) / Zn (s)

SOA = Cu ^ 2+ (aq)

SRA = Zn (s) (lower on table)

Cu (s) = 0.15 (cathode)

Zn (s) = -0.76 (anode)

In this case, it would be the Cu ^ 2+ and the copper ions will GAIN en e- and become metal. (Cu (s) is the cathode).

Standard Cells and Cell Potentials

Standard Cell - a galvanic cell in which each 1/2 cell contains all entities shown in the 1/2 reaction equation at SATP conditions, with a concentration of 1.0 mol/L for the (aq) entities

Standard Reduction Potential (Er0) - The ability of a standard 1/2 cell to attract e-

- The 1/2 cell with the more positive standard reduction potential will gain e- from the 1/2 cell with the lower standard reduction potential

Standard Cell Potential- The max. electrical potential difference (voltage) between the cathode and the anode

-The chromate reaction remains the same (6e-)

- The lead reaction is multiplied by 3 (2e- x 3 = 6e-)
- NOTE: The value of the standard reduction potential (Er0) is NOT changed
- Cr2O7 ^2- (aq) + 14 H+ (aq) + 6e- -> 2Cr ^3+ (aq) + 7H2O (l)
- 3Pb (s) -> 3Pb ^2+ (aq) + 6e-
- *** red 6e- cancel out

Ex. 2: A voltmeter indicates that in a standard copper-scandium galvanic cell (using Cu 2+), copper is the cathode and the standard cell potential is 2.36 V.

Since copper is the cathode, the 1/2 reaction for copper is:

Cu ^2+ (aq) +2e- —> Cu (s) (i.e. written as a reduction)

Write the 1/2 reaction for the scandium as an OXIDATION (opposite)

COMMON ION EFFECT

PbCl2 (s) added to NaCl (aq)

[NaCl] = 0.5 mol/L

Solubility of PbCl2? (How much will dissolve in the solution)

PbCl2 (s) —> Pb ^2+ +2Cl- (aq)

0.5 of 2Cl-

I	-	0	0.5
C	-	+x	+2x
E	-	x	2x + 0.5

Ksp = [Pb ^2+] [Cl-] ^2

6.2 x 10 ^-12 = (x) (2x + 0.5) ^2

Verify x is small

* mole ratios
* [ ] are pressure
* make an ICE table
* 4 - 5 questions
* entropy is M/C (DELTA G BIGGER THAN 0 = NOT SPONTANEOUS)
* Delta G = 0 @ EB
* Delta G = - (not spontaneous)

TO DO

- PRACTICE QUESTIONS FROM TEXTBOOK
- Review Units 3-6

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