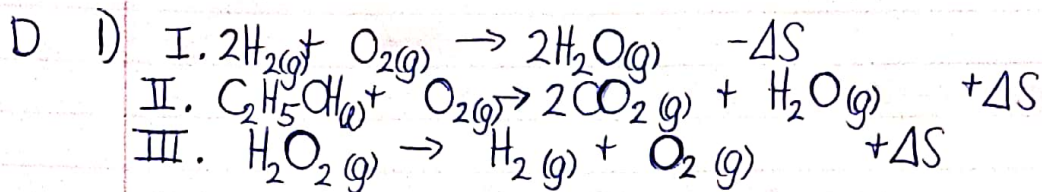
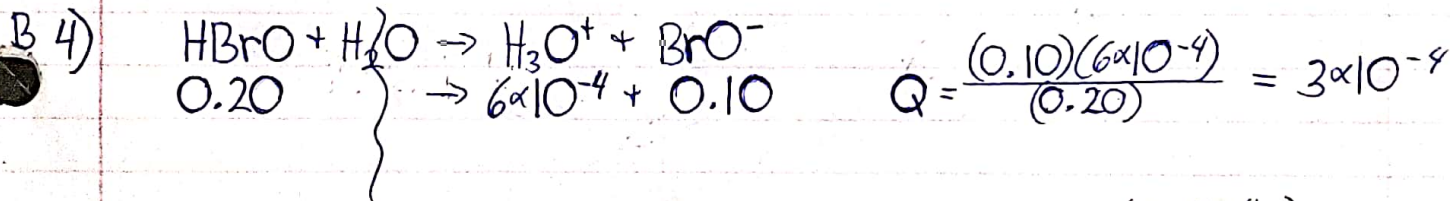


CHM 2046 Exam 3 Spring 2021



B 2) * need enough energy from one rxn to power the other *
 $\Delta G = -31 \text{ kJ/mol}$ provides free energy for $\Delta G^\circ = +14.3 \text{ kJ/mol}$ to use \therefore B is the answer

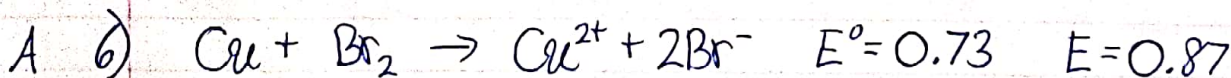
A 3) $\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$
 $\Delta G^\circ = (-90.79 \times 10^3 \frac{\text{J}}{\text{mol}}) - (1020 + 273\text{K})(70.27 \frac{\text{J}}{\text{mol}\cdot\text{K}})$
 $\Delta G^\circ = -181649 \frac{\text{J}}{\text{mol}} \rightarrow$ spontaneous, provides energy



$$\Delta G = RT \ln\left(\frac{Q}{K}\right) = (8.314 \frac{\text{J}}{\text{mol}\cdot\text{K}})(298) \ln\left(\frac{3 \times 10^{-4}}{2.3 \times 10^{-9}}\right)$$

$$\Delta G = 29182 \frac{\text{J}}{\text{mol}} \rightarrow$$
 nonspontaneous

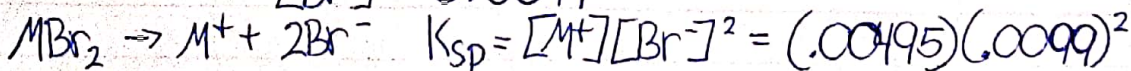
- B 5) I. anode loses mass
 II. true, cations flow into the cathode
 III. false, e^- flow from anode to cathode



$$0.87 = 0.75 - \frac{0.0592}{2} \log Q$$

$$Q = 8.83 \times 10^{-5} = [\text{Cu}^{2+}][\text{Br}^-]^2 = (0.9)[\text{Br}^-]^2$$

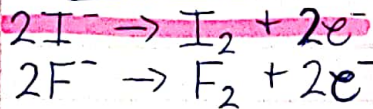
$$[\text{Br}^-] = 0.0099$$



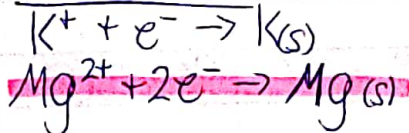
$$K_{\text{sp}} = 4.9 \times 10^{-7}$$

A 7)

anode



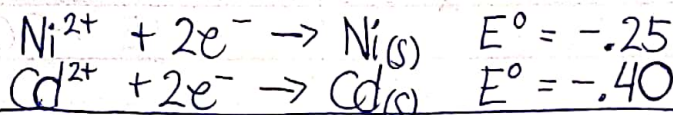
cathode



use periodic trends for molten salts

- F has larger EN, therefore does not want to get oxidized and I_2 would form
- Mg is smaller, has larger pull on e^-

E 8)



$$E^\circ = -.25 - (-.40) = 0.15$$

$$0.2 = 0.15 - \frac{.0592}{2} \log Q$$

$$Q = 0.02 = \frac{[\text{Cd}^{2+}]}{[\text{Ni}^{2+}]} = \frac{(0.10)}{[\text{Ni}^{2+}]}$$

$$[\text{Ni}^{2+}] = 4.9\text{M}$$

A 9)

$$E^\circ = 0\text{V} \quad Q = \left(\frac{\text{dilute}}{\text{concentrated}} \right)$$

$$E = 0 - \frac{.0592}{3} \log \left(\frac{0.01}{1.0} \right)$$

$$E = 0.039\text{V}$$

$$\Delta G = -nFE = -(3)(96485)(0.039) = -11423.8 \frac{\text{J}}{\text{mol}} = \boxed{-11.4 \text{ kJ/mol}}$$

10) concentration cell: $E^{\circ} = 0V$

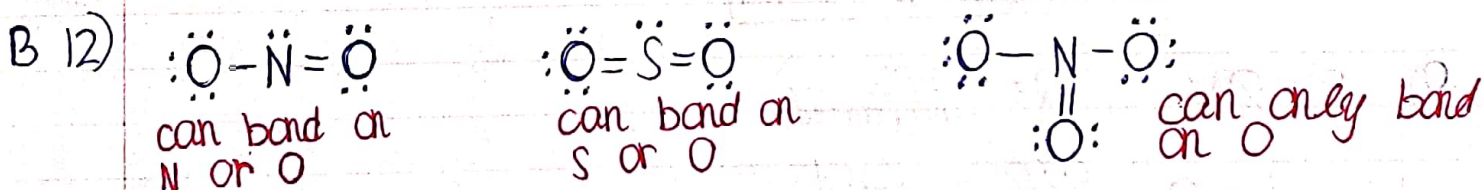
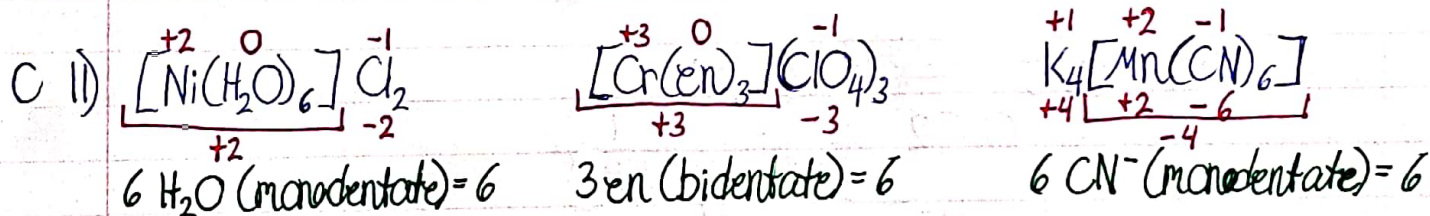
$$\Delta G^{\circ} = -nFE^{\circ} = -(2)(96485)(0) = 0 \text{ kJ/mol}$$

$$\Delta G^{\circ} = -RT \ln K \quad 0 = -(8.314)(298) \ln K \rightarrow K = 1$$

$$Q = \frac{\text{dilute}}{\text{concentrated}} = \frac{0.01}{1} = 0.01$$

$$E = E^{\circ} - \frac{0.0592}{n} \log Q \quad E = 0 - \frac{0.0592}{2} \log(0.01) \quad \begin{matrix} E = 0.0592V \\ E = 0.06V \end{matrix}$$

$$\Delta G = -nFE = -(2)(96485)(0.06) = -11578.2 \text{ J/mol} = -11.6 \text{ kJ/mol}$$



D 13) strong ligand = absorbs high energy = absorbs yellow, is violet

B 14) $1.56 \times 10^6 \frac{\text{disintegrations}}{\text{second}}$

$$(1.56 \times 10^6 \frac{\text{dis}}{\text{s}}) \left(\frac{1 \text{ Ci}}{3.70 \times 10^{10} \text{ dis/s}} \right) \left(\frac{1}{1.65 \times 10^{-3} \text{ g}} \right) = 0.0255$$

$$= \boxed{2.56 \times 10^{-2} \text{ Ci/g}}$$

C 15)

$$t_{\frac{1}{2}} = \frac{\ln 2}{K} = 1.01 \rightarrow K = 0.686 \text{ yr}^{-1}$$

$$3.75 \times 10^3 \text{ hr} = 0.4281 \text{ years}$$

$$\ln A_2 = -(0.686)(0.4281) + \ln(2)$$

$$\ln A_2 = 0.399$$

$$\boxed{A_2 = 1.49 \text{ mg}}$$

16)

gamma: ${}^0\gamma$

alpha: ${}^4_2\text{He}$

beta: ${}^0_{-1}\beta$

[e⁻ capture: ${}^0_{-1}e^-$

positron: ${}^0_{+1}\beta$

emitting positive element is the same as capturing a negative one

A 17)

${}^{15}\text{C}$ VS ${}^{12}\text{C}$ is too heavy \therefore ${}^0_{-1}\beta$ decay
 ${}^{120}\text{Xe}$ VS ${}^{131}\text{Xe}$ is too light \therefore ${}^0_{+1}\beta$ emission / ${}^0_{-1}e^-$ capture
 ${}^{224}\text{Th}$ has $Z > 83$ \therefore alpha decay