Chemistry 106 A   Grade 1 ___ 90

Name *TOOLE   JOHN K.*
Last (PRINT)   First

2 ___ 20

3 ___ 26

This quiz is conducted under the Honor System.
SHOW ALL WORK ON PROBLEMS.

4 ___ 28

94

I.(a) 10 min. In the electrolytic refining of copper what weight
of copper will be deposited on the cathode in 24 hours by a
current of 5 amperes flowing through the cell?

$Cu - 63.54$ $60 \times 60 = 3600$ 86400
            $\times 24$ $\times 5$
$2)\overline{63.54}$ $\overline{17400}$ $+3\overline{2,000}$
            7200
31.77 $\overline{86400}$

$\frac{31.8}{97} = \frac{x}{432}$

141.6
$97)\overline{13738}$
$\underline{97}$
403
388
158
97
610

864 432
31.8 31.8
6912 3456
864 432
2592 1296
$\overline{27475.2}$ $\overline{13737.6}$ $97)\overline{432}$

$97 x = 13737.6$

$\boxed{x = 141.6}$

(b) What weight of Cu would be dissolved from the anode assuming
100% efficiency? ___ 141.6 only - not more - not less

II. 10 min. The solubility of $PbSO_4$ is 0.0303 grams per liter.
At. wts: Pb = 207; S = 32.

(a) Find the Ksp. $PbSO_4$ $.0303 g/l$

207
32
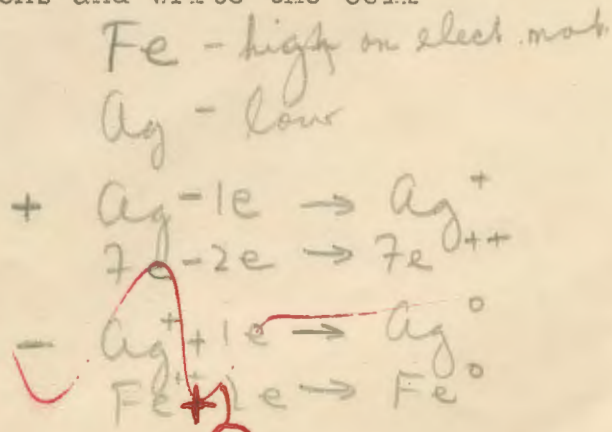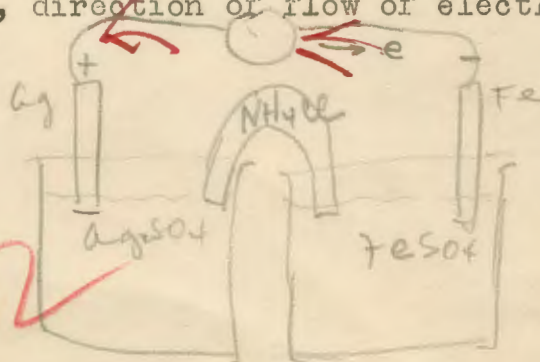$\overline{239}$

$K_{SP} = (.0001)(.0001)$

$\boxed{K_{SP} = 1 \times 10^{-8}}$

$239)\overline{1.0303}$
239
$.0481$

$703)\overline{.0303}$

(b) If sulfuric acid were added slowly to a 0.01 M solution of
Pb^{+2} at what concentration of SO_4^{-2} would $PbSO_4$ barely
precipitate?

$1 \times 10^{-8} = .01 \times$ $1 \times 10^{-6} g/l$
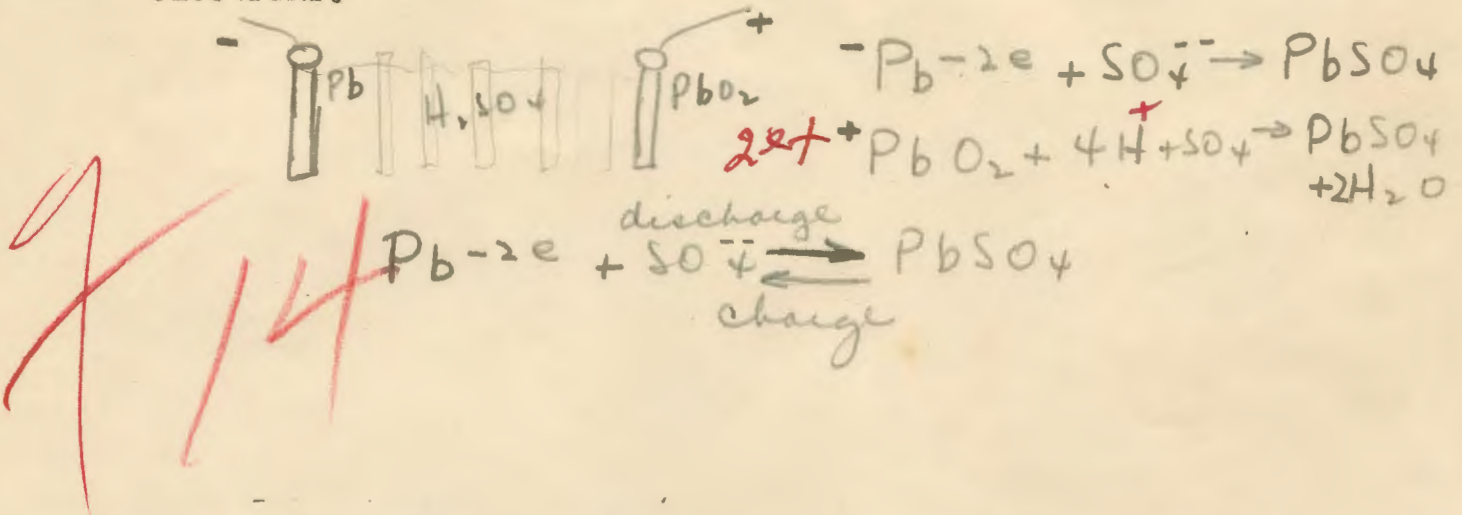
$\boxed{x = 1 \times 10^{-6}}$

III. (a) 15 Min. Using the standard electrode potentials, sketch a
galvanic cell in which: the metals are Fe and Ag; solutions
are $FeSO_4$ and Ag_2SO_4; salt bridge. Show the sign of each
electrode, direction of flow of electrons and write the cell
reaction.

Fe - high on elect. mot.
Ag - low

$+ \quad Ag - 1e \rightarrow Ag^+$
$Fe - 2e \rightarrow Fe^{++}$

$- \quad Ag^+ + 1e \rightarrow Ag^0$
$Fe^{++} + 2e \rightarrow Fe^0$
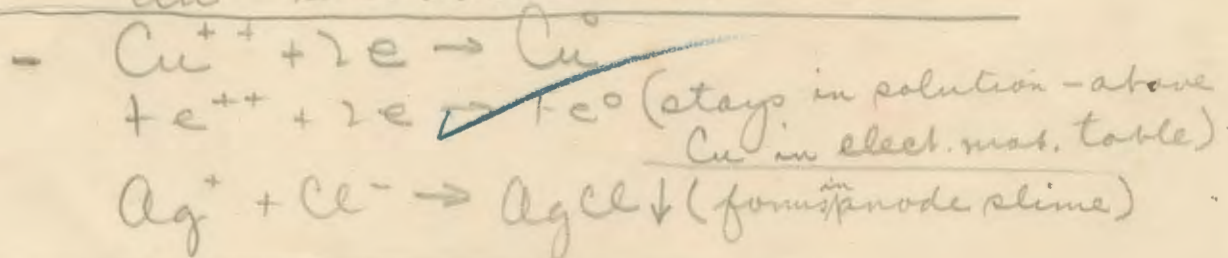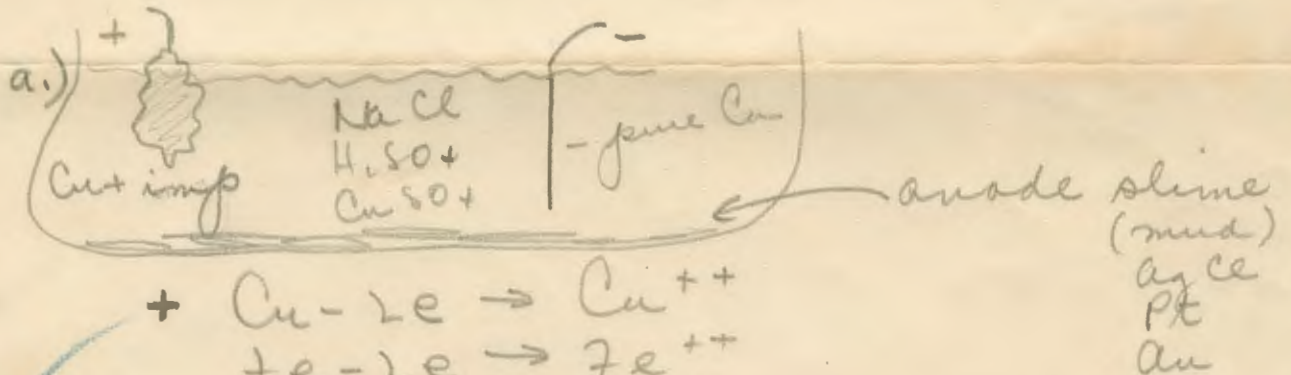
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III. (cont)

b) Describe the lead storage cell, showing the reactions occurring at each electrode while discharging and indicating the flow of electrons.

$$^- Pb - 2e + SO_4^{--} \rightarrow PbSO_4$$

$$2e^+ \quad ^+ PbO_2 + 4H^+ + SO_4 \rightarrow PbSO_4 + 2H_2O$$

$$Pb - 2e + SO_4^{--} \xrightarrow[charge]{discharge} PbSO_4$$

IV. 15 Min. Answer two parts only.

a) Describe in detail the purification of copper when the impurities are Fe, Ag, Pt and Au.

b) Describe with equations the purification of bauxite.

c) Cu^{+2} ion forms a complex ion with NH_3. Show the electronic configuration and structure of the ion.

a.)

NaCl
H₂SO₄
Cu SO₄

Cu + imp   – pure Cu   anode slime (mud)
Ag Cl
Pt
Au

$$+ \quad Cu - 2e \rightarrow Cu^{++}$$
$$+ Fe - 2e \rightarrow Fe^{++}$$
$$Ag + e - Ag^+$$

Pt – would go into anode slime
Au – into anode slime

$$- \quad Cu^{++} + 2e \rightarrow Cu^0$$
$$+ Fe^{++} + 2e \nrightarrow Fe^0 \text{ (stays in solution – above } Cu \text{ in elect. mot. table)}$$
$$Ag^+ + Cl^- \rightarrow AgCl \downarrow \text{ (forms anode slime)}$$

b.) $Al_2O_3 \cdot (H_2O)_x$ – digestion

$$Al_2O_3 + 2NaOH \rightarrow 2NaAlO_2 + H_2O \quad ^{+ impurities}_{filter}$$
$$NaAlO_2 + 5H_2O \rightarrow Al(OH)_3 \cdot 3H_2O + NaOH$$
$$\downarrow \text{dehydrates into pure substance}$$