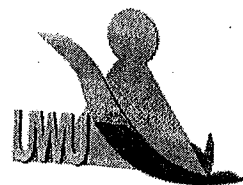
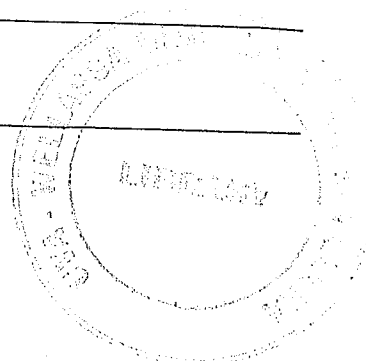


Uva Wellassa University, Sri Lanka  
End Semester Examination – August 2011  
SCT233-1 Physical Chemistry



Time: One (01) Hour

Total 03 Questions  
Answer all questions



- 1.
- a. Given the following half-cells
- |                                              |                               |
|----------------------------------------------|-------------------------------|
| $\text{Cu}^{2+}   \text{Cu}$                 | $E^{\circ} = +0.34 \text{ V}$ |
| $\text{Zn}^{2+}   \text{Zn}$                 | $E^{\circ} = -0.76 \text{ V}$ |
| $\text{Fe}^{2+}, \text{Fe}^{3+}   \text{Pt}$ | $E^{\circ} = +0.77 \text{ V}$ |

Write the reactions and potentials that have the following properties:

- a cell in which copper dissolves,
- the cell with the largest  $E^{\circ}$ .

(50 marks)

- b. Calculate the solubility product and solubility (in g/100 g water) of AgCl given following data:

$\text{Ag}^{+} / \text{Ag}$	$E^{\circ}$	0.7991 V
$\text{Cl}^{-}   \text{AgCl}, \text{Ag}$	$E^{\circ}$	0.2220 V

(50 marks)

2.

- a. Define following terms (mathematical expressions are OK):

- Ion mobility
- Transport number
- Current density
- Molar conductivity

(20 marks)

- b. Consider a general electrolyte  $M_{\nu_+}^{z_+} A_{\nu_-}^{z_-}$ . Prove that  $\Lambda = \nu_+ \lambda_+ + \nu_- \lambda_-$  where all symbols carry standard meanings.

(40 marks)

- c. The conductivity of a  $1.0 \times 10^{-4} \text{ mol.dm}^{-3}$  solution of a monobasic acid in water is  $5.0 \times 10^{-4} \text{ S.m}^{-1}$ . If the molar conductivities at infinite dilution of sodium nitrate, nitric acid, and the sodium salt of the acid are 12.1, 42.1 and  $9.10 \text{ mSm}^{-2}\text{mol}^{-1}$ , respectively, determine the acid dissociation constant and  $\text{pK}_a$  value of the acid (Hint: use Kohlrausch's law to calculate  $\Lambda(\text{organic acid})$ ).

(40 marks)

3. Cooling curves for liquid mixtures of magnesium and zinc gave following results:

Mass % Zn	Freezing start / ( $^{\circ}\text{C}$ )	Freezing end / ( $^{\circ}\text{C}$ )
0	651	651
10	623	346
20	580	346
30	520	346
40	443	346
50	360	346
60	437	346
70	520	346
80	577	346
84.3	595	595
90	557	368
95	456	368
97.5	379	368
100	419	419

- a. Draw and label phase diagram, temperature vs. composition (mass % Zn) as accurately as possible.

(60 marks)

- b. If 100g of a liquid mixture containing 75.0 mass % Zn is cooled from  $620^{\circ}\text{C}$  to  $460^{\circ}\text{C}$ , what phase(s) will be formed and in what amounts? Draw possible microscopic views where possible.

(40 marks)