1. Calculate E° at 25°C for the cell $Cd|Cd^{2+}||Cu^{2+}|Cu$ and determine the cell reaction and its equilibrium constant!
Here $\frac{1}{2}Cd^{2+}+e^- = \frac{1}{2}Cd \quad E^\circ/V = -0.402$
$\frac{1}{2}Cu^{2+}+e^- = \frac{1}{2}Cu \quad E^\circ/V = +0.3394$.

2. Show the isoelectric point of glycine. ($NH_2-\overset{H}{\underset{H}{C}}-COOH$), Here. $pK_1 = 2.35$, $pK_2 = 9.78$.

3. For any process in a closed system of constant composition that can only perform pressure-volume work, the first ~~order~~ and second laws of thermodynamics may be combined to obtain
$$dU = TdS - pdV \quad (\text{where } U \text{ is internal energy})$$
In addition, there are three properties; H, A. G defined in terms of Enthalpy, Helmholtz energy, Gibbs energy, respectively. From the above equation we may express in three other ways by use of
$$H = U + PV$$
$$A = U - TS$$
$$G = U + pV - TS$$
Please show that
$$\left(\frac{\partial U}{\partial S}\right)_V = \left(\frac{\partial H}{\partial S}\right)_p, \quad \left(\frac{\partial H}{\partial p}\right)_S = \left(\frac{\partial G}{\partial p}\right)_T$$

4. Derive the integrated rate equation for a reversible first-order reaction. (Assume; only A is present initially)
$$A \underset{k_2}{\overset{k_1}{\rightleftharpoons}} B$$

5. Calculate the value of the ionic strength of these solutions:
(a) 0.10M Na_3PO_4 (b) 0.50M KCl
(c) a 1M Na_3PO_4 + 0.50M KCl.

(五題擇四題作答. 每題25分)