Physical Chemistry

Please Show your Derivation, Calculations, or Reasoning.

No points will be given with only the Answer.

I. (10%) (1) Hess Law (2) The Franck-Codon Principle, (3) The uncertainty Principle, (4) The Variation Principle(名詞解釋)

II. (10%)The Molar constant pressure heat capacity of a certain solid at 10K is 0.43 $J\ K^{-1}\ mol^{-1}$ what is the molar entropy at that temperature? Assume the heat capacity varies with temperature as aT^3.

III. (20%) The standard cell potential of $Pt|H_2(g)|HBr(g)|AgBr(s)|Ag(s)$ was measured over a range of temperatures, and the data were fitted to the following polynomial:

$$E^{\ominus}/V = 0.07131 - 4.99\times10^{-4}(T/K - 298) - 3.45\times10^{-6}(T/K-298)^2$$

Calculate the standard reaction (1) Gibbs energy, (2) enthalpy, and (3) entropy at 298K.

IV. (10%)The rate of the second-order decomposition of acetaldehyde (ethanal, CH_3CHO) was measured over the temperature range 700-1000K, and the rate constants are reported below. Find E_a and A in the Arrhenious Equation $k=Aexp(-E_a/RT)$. Show your derivation.

T/K	700	730	760	790	810	840	910	1000
$Ln(k/(Lmol^{-1}s^{-1})$	0.011	0.035	0.105	0.343	0.789	2.17	20.0	145

Analytical Chemistry

5. Define following term: (each 4 points) (total 20%)
   (a) Back titration, (b) The van Deemter equation, (c) Beer's law,
   (d) Calomel electrode, (e) Zeeman background correction.

6. Sketch the general appearance of the curve for the titration of a weak base with a strong acid. Explain what chemistry governs the pH in each of the four distinct regions of the curve (10%).

7. 請依氣相層析儀(Gas Chromatography)主要組件繪出氣相層析儀架構，並描述其中一種偵檢器(Detector)。(10%)

8. Describe two detectors used in HPLC. (10%)