

- 說明： 1. 答案一律寫在試卷上，計算題必須寫出計算過程，否則不予計分。
 2. 請依序作答，並標明題號。
 3. $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1} = 8.206 \times 10^{-2} \text{ atm L K}^{-1} \text{ mol}^{-1}$, $h = 6.626 \times 10^{-34} \text{ J s}$
 $N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$, $c = 2.998 \times 10^8 \text{ m s}^{-1}$

- Explain the following terms. (20%)
 - heat capacity
 - galvanic cell
 - Boltzmann distribution law
 - photoelectric effect
 - Born-Oppenheimer approximation
- At 100°C 1 mole of liquid water is allowed to expand isothermally into an evacuated vessel of such a volume that the final pressure is 0.5 atm. The amount of heat absorbed in the process was found to be 30 kJ mol^{-1} . What are (a) w , (b) ΔE (or ΔU), (c) ΔH , (d) ΔS , and (e) ΔG ? (15%)
- A reaction of stoichiometry $A + B \rightarrow Y + Z$ is found to be second order in A and zero order in B. Suggest a mechanism that is consistent with this behavior. (5%)
- Please draw a diagram to show the potential energy curve of the ground H_2 state. Also point out that the dissociation energy is 458 kJ mol^{-1} , the equilibrium internuclear distance is 74 pm , and the zero-point energy is $2.2 \times 10^3 \text{ cm}^{-1}$. (10%)
- A container of volume 10.0 L holds 1.00 mol N_2 and 3.00 mol H_2 at 298 K . What is the total pressure in atmospheres if each component behaves as a perfect gas? (10%)
- A chemical reaction takes place in a container of cross-sectional area 100 cm^2 . As a result of the reaction, a piston is pushed out through 10 cm against an external pressure of 1.0 atm . Calculate the work done by the system. (10%)
- Calculate the energy difference in joule between a blue photon ($\lambda = 400 \text{ nm}$) and a red photon ($\lambda = 600 \text{ nm}$). (10%)
- Give the possible term symbols for (a) $\text{Li} [\text{He}]2s^1$ and (b) $\text{Na} [\text{Ne}]3p^1$. (10%)
- The standard reaction Gibbs energy of the isomerization of *cis*-2-pentene to *trans*-2-pentene at 400 K is $-3.67 \text{ kJ mol}^{-1}$. Calculate the equilibrium constant of the isomerization. (10%)