

科目：物理化學

適用：應化系

考生注意：

1. 依次序作答，只要標明題號，不必抄題。
2. 答案必須寫在答案卷上，否則不予計分。
3. 限用藍、黑色筆作答；試題須隨卷繳回。

本 試 題

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1. Explain the following terms (a) Statistical entropy, (b) Clausius inequality, (c) Space quantization, (d) Born-Oppenheimer approximation, and (e) Langmuir isotherm. (20 %).
2. What is the maximum amount of non-expansion work that can be done by the reaction at 300K:
 $2A + B \rightarrow 2C$ if the molar Gibbs energy of formation for the compound A, B, and C are 0, -50, and -100 kJ/mol, respectively. (10 %)
3. Calculate the changes in (a) work, (b) heat, (c) internal energy, and (d) enthalpy, when 2 mol of argon at 300 K in a container of 0.5 dm^3 is allowed to expand to 1.0 dm^3 . (20 %) Hint: $\ln 2 = 0.69$
4. Evaluate $(\partial S / \partial V)_T$ for (a) a perfect gas and (b) a van der Waals gas (10%). For an isothermal expansion, for which kind of gas will ΔS be greater? Explain your conclusion (10 %).
5. For a particle in a state having the wavefunction $\Psi = \sqrt{\frac{2}{a}} \sin(2\pi x/a)$ in the range $x = 0$ to a , which of the following intervals has the highest probability that the particle exists. (a) $x = 0$ to $0.02a$, (b) $x = 0.2a$ to $0.22a$, (c) $x = 0.49a$ to $x = 0.51a$, and (d) $x = 0.8a$ to $0.82a$. Explain your answer (10%)
6. Show the term symbols for (a) the ground state of O_2 with configuration $\dots 1\pi_x^1 \pi_y^1$, and for (b) the excited configuration $\dots 1\pi^2$ (10 %).
7. Which of the following electronic transitions are allowed in O_2 ? (Justify your answers in details).
 (a) ${}^3\Sigma_g^- \leftrightarrow {}^1\Delta_g$, (b) ${}^3\Sigma_g^- \leftrightarrow {}^1\Sigma_g^+$, (c) ${}^3\Sigma_g^- \leftrightarrow {}^3\Delta_u$, (d) ${}^3\Sigma_g^- \leftrightarrow {}^3\Sigma_u^+$, and (e) ${}^3\Sigma_g^- \leftrightarrow {}^3\Sigma_u^-$. (10 %).