

科目：物理化學

適用：應化系

編號：374

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。

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1. Explain the following terms (a) Gibbs-Helmholtz equation, (b) Nernst equation, (b) Lifetime broadening, (c) Born-Oppenheimer approximation, and (d) Langmuir isotherm. (20 %).
2. For a particle in a state having the wavefunction $\Psi = \sqrt{\frac{2}{a}} \sin(3\pi x/a)$ in the range $x = 0$ to a , Arrange the following intervals from the highest to the lowest probability that the particle exists. (a) $x = 0$ to $0.02a$, (b) $x = 0.32a$ to $0.34a$, (c) $x = 0.49a$ to $x = 0.51a$, and (d) $x = 0.8a$ to $0.82a$. Explain your answers (10%)
3. Calculate the work done when 100.0 g of calcium carbonate reacts with hydrochloric acid to produce carbon dioxide and Calcium oxide in (a) a closed vessel of fixed volume, and (b) an open beaker at 300 K. (20%)
4. (a) Derive the thermodynamic equation of state $\left(\frac{\partial H}{\partial p}\right)_T = V - T\left(\frac{\partial V}{\partial T}\right)_p$, and (b) derive an expression for $\left(\frac{\partial H}{\partial p}\right)_T$ for a perfect gas. (20%)
5. A certain atom has a threefold degenerate ground level, a non-degenerate electronically excited level at 3000 cm^{-1} , and a twofold degenerate level at 4500 cm^{-1} . Calculate the relative population of the electron in the first excited level at (a) absolute temperature and (b) infinite temperature (20%)
6. Find the terms that can arise from the p^2 configuration (10%)