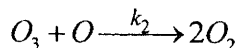
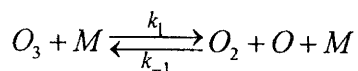


科目：物理化學

系所組：化學系碩士班甲組

- The density of air at 0.987 bar and 27°C is 1.146 kg m^{-3} . (assuming that air consists only of nitrogen and oxygen). (15 points)
 - Calculate the mole fractions of nitrogen and oxygen.
 - Calculate the partial pressures of nitrogen and oxygen.
- The pressure of 35 g of ethanol (mass density 0.789 g cm^{-3}) is increased isothermally from 1 atm to 3000 atm. (15 points)
 - Calculate the change in Gibbs energy.
 - Calculate the change in chemical potential.
 - Discuss how the pressure change affects the stability of the sample.
- Explain the meaning of state functions. (5 points)
 - Give three examples of thermodynamical state functions. (5 points)

4. The mechanism of destruction of stratospheric ozone: (10 points)



- Please write down the differential rate equations of $[O_3]$ and $[O]$.
 - Please explain the concept of steady state approximation.
 - By using steady state approximation for $[O]$, please find $[O]$ and the rate law for the destruction of ozone. ($-d[O_3]/dt$)
5. The probability that a molecule of mass m in a gas at temperature T has speed v is given by the Maxwell-Boltzmann distribution (20 points)

$$f(v) = 4\pi \left(\frac{m}{2\pi kT} \right)^{3/2} v^2 e^{-mv^2/2kT}$$

where k is Boltzmann's constant.

- Please find the mean speed.
- What is the ratio of the probability of finding a molecule moving with three times the average speed, and how does this ratio depend on the temperature ?

(hint: $\int_0^{\infty} x^3 \exp(-Bx^2) dx = \frac{1}{2} B^{-2}$)

※ 注意：1. 考生須在「彌封答案卷」上作答。

2. 本試題紙空白部份可當稿紙使用。

3. 考生於作答時可否使用計算機、法典、字典或其他資料或工具，以簡章之規定為準。

(102) 輔仁大學碩士班招生考試題目

考試日期：102年3月8日第3節

本試題共 2 頁 (本頁為第 2 頁)

科目：物理化學

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6. The wavefunction, $\Psi(\varphi)$, for the motion of a particle in a ring is of the form $\Psi = Ne^{im\varphi}$. Determine the normalization constant, N. (10 points)
7. Calculate the zero-point energy of vibration of $^{35}\text{Cl}_2$? Assuming that the vibrations of a $^{35}\text{Cl}_2$ molecule are equivalent to those of a harmonic oscillator with a force constant $k = 329 \text{ N m}^{-1}$. (b) Calculate the zero-point energy of vibration of $^{37}\text{Cl}_2$. (10 points)
8. For the ground-state of hydrogen atom, $\psi_{1s} = \frac{1}{\sqrt{\pi}} \left(\frac{Z}{a_0} \right)^{\frac{3}{2}} e^{-\frac{Zr}{a_0}}$, $Z=1$, Find the maximum in the radial distribution function of ground-state for hydrogen (hint: $\int x^2 e^{bx} dx = e^{bx} \left(\frac{x^2}{b} - \frac{2x}{b^2} + \frac{2}{b^3} \right)$) (10 points)