

國立高雄大學九十四學年度轉學招生考試試題

系所組別：應用化學系

科目：普通化學

考試時間：90 分鐘

本科原始成績滿分 100 分

Part I. 選擇題 (80%) 答對每題 10 分，未作答不記分，答錯每題倒扣 5 分。

- In the reaction $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$, N_2 is
 - oxidized.
 - reduced.
 - electron donor.
 - reducing agent.
 - two of these
- Which conditions of P , T , and n , respectively, are most ideal?
 - high P , high T , high n
 - low P , low T , low n
 - high P , low T , high n
 - low P , high T , high n
 - low P , high T , low n
- Given the equation $\text{S}(\text{s}) + \text{O}_2(\text{g}) \rightarrow \text{SO}_2(\text{g})$, $\Delta H = -296 \text{ kJ}$, which of the following statement(s) is (are) true?
 - The reaction is exothermic.
 - When 0.500 mole sulfur is reacted, 148 kJ of energy is released.
 - When 32.0 g of sulfur are burned, $2.96 \times 10^5 \text{ J}$ of energy is released.
 - All are true.
 - None is true.
 - I and II are true.
 - I and III are true.
 - Only II is true.
- In Bohr's atomic theory, when an electron moves from one energy level to another energy level more distant from the nucleus
 - energy is emitted.
 - energy is absorbed.
 - no change in energy occurs.
 - light is emitted.
 - none of these
- Consider the following rate law: $\text{Rate} = k[\text{A}]^n[\text{B}]^m$ How are the exponents n and m determined?
 - By balancing chemical equation
 - By using the subscripts of the chemical formulas
 - By using the coefficients of the chemical formulas
 - By educated guess
 - By experiment
- For a certain process at 355 K, $\Delta G = -12.4 \text{ kJ}$ and $\Delta H = -9.2 \text{ kJ}$. The ΔS for the process is
 - 0
 - $9.0 \text{ J/K}\cdot\text{mol}$
 - $-9.0 \text{ J/K}\cdot\text{mol}$
 - $-21.6 \text{ J/K}\cdot\text{mol}$
 - $21.6 \text{ J/K}\cdot\text{mol}$
- Which one of the following decreases as the strength of the attractive intermolecular forces increases?
 - The heat of vaporization.
 - The normal boiling temperature.
 - The deviations from the ideal gas law.
 - The sublimation temperature of a solid.
 - The vapor pressure of a liquid.
- Atoms having greatly differing electronegativities are expected to form:
 - no bonds
 - polar covalent bonds
 - nonpolar covalent bonds
 - ionic bonds
 - covalent bonds

Part II. 簡答題 (20%) 每題 10 分，請詳細寫出過程並標示出答案。

- Give the Lewis structures, predict the molecular structures, and describe the bonding (in terms of hybrid orbitals for the central atom) of the following molecules: a) XeO_4 and b) CO_2
- Calculate the root mean square velocity (in meter/sec) for the atoms in a sample of helium gas at 25°C . (gas constant $R = 8.3145 \text{ J/K}\cdot\text{mol}$, atomic mass of Helium 4.0 g/mol).

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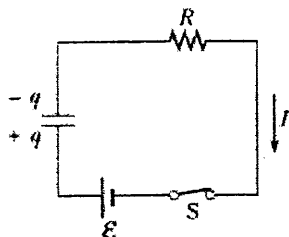
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普通物理

問答計算題：(共四題) 50%

1. 今有一串聯電路含有一電池(電動勢 \mathcal{E})、電容器(電容 C)與電阻器(電阻 R)，如圖一所示。當開關關上時電容器會充電。請計算出充電時此串聯電路中電流隨時間的關係式，並請作圖。(15 分)



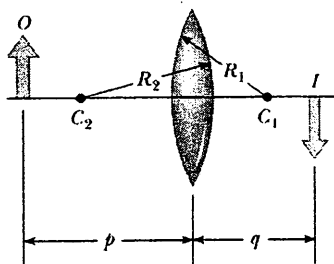
圖一

2. 對於一個平面電磁波(電場： \vec{E} ，磁場： \vec{B})而言，請回答下列問題：(15 分)
- (a). 請畫出此平面電磁波傳播方向 \vec{k} 與電場、磁場之間的關係圖。
- (b). 請問此平面電磁波的波以亨向量(Poynting vector)定義為何？
3. 由曲率半徑為 R 的透鏡所折射成像的公式為：

$$\frac{n_1}{p} + \frac{n_2}{q} = \frac{n_2 - n_1}{R}$$

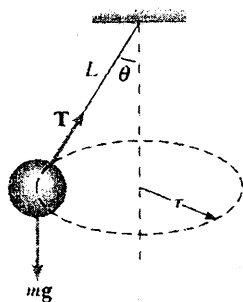
其中 p 、 q 分別為物距與像距， n_1 、 n_2 分別為物體與成像所在介質的折射率。請由此推導出薄透鏡成像(如圖二所示)的造鏡者公式(Lens maker's equation)：(10 分)

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{q} = (n-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$



圖二

4. 一個質量 m 的小球固定在一根長度 L 的繩子上，若此小球作角錐擺動(Conical pendulum)，如圖三所示。請問擺動的速率 v 為何？(10 分)



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微積分 50%

You need to show all your work.

1. (10 pts) Show that $f(x) = \int_1^{2x} \sqrt{16+t^4} dt$ has an inverse and find $(f^{-1})'(0)$.

2. (10 pts) Find $\lim_{x \rightarrow 0} \left(\frac{\sin x}{x} \right)^{1/x^2}$

3. Find or evaluate the integral.

(a) (10 pts) $\int \frac{1}{5+3\sin x} dx$

(b) (10 pts) $\int_0^1 x \ln x dx$

4. (10 pts) Find the values of p for which the series $\sum_{n=2}^{\infty} \frac{\ln n}{n^p}$ converges.