

國立臺灣師範大學 103 學年度碩士班招生考試試題

科目：普通化學

適用系所：科學教育研究所

注意：1.本試題共 1 頁，請依序在答案卷上作答，並標明題號，不必抄題。2.答案必須寫在指定作答區內，否則不予計分。

1. A calorimeter temperature increases by 0.45°C when 30 J of energy is added to it by electrical heating. When 0.10 grams of HCl is neutralized in the same calorimeter, the temperature increased by 7.3°C . What is the ΔH of neutralization of HCl in units of kJ/mol? (10 points)
2. What is the wavelength, in meters, of an alpha particle with a kinetic energy of 8.0×10^{-13} J. The mass of an alpha particle = 4.00150 amu. Given $1 \text{ amu} = 1.67 \times 10^{-27}$ kg. (10 points)
3. Which molecules below that do not follow the octet rule? (10 points)
(1) H_2S (2) BCl_3 (3) PH_3 (4) SF_4
4. Palladium crystallizes in a face-centered cubic unit cell. Its density is 12.0 g/cm^3 at 27°C . Calculate the atomic radius of Pd (Pd = 106.4). (10 points)
5. Consider the following equilibria:
 $2 \text{SO}_3(\text{g}) \rightarrow 2 \text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \quad K_c = 2.3 \times 10^{-7}$
 $2 \text{NO}_3(\text{g}) \rightarrow 2 \text{NO}_2(\text{g}) + \text{O}_2(\text{g}) \quad K_c = 1.4 \times 10^{-3}$
What is the equilibrium constant for the reaction? (10 points)
 $\text{SO}_2(\text{g}) + \text{NO}_3(\text{g}) \rightarrow \text{SO}_3(\text{g}) + \text{NO}_2(\text{g})$
6. A solution of 8.0 M formic acid (HCOOH) is 0.47% ionized. What is the K_a of formic acid? (10 points)
7. In which one of the following substances will the individual molecules experience both London forces and dipole-dipole forces? (5 points)
(A) HCl (B) BCl_3 (C) Br_2 (D) H_2 (E) CO_2
8. Which should have the longest O-O bond, O_2 , O_2^- or O_2^+ ? (5 points)
9. The complex, $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$, is octahedral. Is $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$ diamagnetic or paramagnetic, and how many unpaired electrons the complex has? (10 points)
10. The thermal decomposition of acetaldehyde is a second-order reaction.
 $\text{CH}_3\text{CHO} \rightarrow \text{CH}_4 + \text{CO}$

The following data were obtained at 518°C .

time (s)	Pressure CH_3CHO (mmHg)
0	364
42	330
105	290
720	132

- (a) Calculate the rate constant for the decomposition of acetaldehyde from the above data. (10 points)
- (b) What is the half-life of acetaldehyde from the above data? (10 points)