中原大學107學年度碩士班考試入學

107/3/7 8:00 AM~9:30 AM

誠實是我們珍視的美德，
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化學系

科目：普通化學(分「普通化學(A)」及「普通化學(B)」兩部份計分，各佔100分)（共 4 頁，第 1 頁）

☑可使用計算機(僅限於四則運算、三角函數及對數等基本功能，可程式之功能不可使用)

☐不可使用計算機

----------(不可直接作答於試題，請作答於答案卷)----------

一、普通化學(A)，選擇題（10題，每題10分，共100分）

1. The element rhenium (Re) exists as two stable isotopes and 18 unstable isotopes. Rhenium-185 has in its nucleus

   a. 75 protons, 110 neutrons.

   b. 75 protons, 75 neutrons.

   c. 75 protons, 130 neutrons.

   d. 130 protons, 75 neutrons.

   e. not enough information is given.

2. The volume of a balloon is 3.02 L at 22.7°C. The balloon is heated to 43.6°C. Calculate the new volume of the balloon.

   a. 1.57 L

   b. 3.02 L

   c. 2.82 L

   d. 3.23 L

   e. 5.80 L

3. A sample of oxygen gas has a volume of 4.50 L at 27°C and 800.0 torr. How many oxygen molecules does it contain?

   a. 1.16×10^{22}

   b. 1.16×10^{23}

   c. 2.32×10^{24}

   d. 5.8×10^{22}

   e. none of these

4. Which one of the following statements is *false*?

   a. If q_p for a process is negative, the process is exothermic.

   b. A bomb calorimeter measures ΔH directly.

   c. The change in enthalpy, ΔH, for a process is equal to the amount of heat absorbed at constant pressure, q_p.

   d. The freezing of water is an example of an exothermic reaction.

   e. The change in internal energy, ΔE, for a process is equal to the amount of heat absorbed at constant volume, q_v.

5. Which of the following statements is true for a monatomic ideal gas?

a. $C_v < C_p$

b. $C_v > C_p$

c. $C_v = C_p + R$

d. $C_p = \frac{3}{2}R$

e. C_v is temperature dependent

f. B and C

g. A, D, and E

6. Consider the process A(*l*) $\rightleftharpoons$ A(*s*). An increase in temperature favors which direction?

a. to the right

b. to the left

c. More information is needed.

d. neither

7. Use the following initial rate data for the reaction in aqueous solution to determine the rate law.

$[CH_3COCH_3]_0$ (*M*)	$[Br_2]_0$ (*M*)	$[H^+]_0$ (*M*)	$\frac{\Delta[Br_2]}{\Delta t}$ (*M*/s)
1.00	1.00	1.00	4.0×10^{-3}
2.00	1.00	1.00	8.0×10^{-3}
2.00	2.00	1.00	8.0×10^{-3}
1.00	2.00	2.00	8.0×10^{-3}

a. Rate = $k[CH_3COCH_3][H^+]$

b. Rate = $k[CH_3COCH_3][Br_2][H^+]$

c. Rate = $k[Br_2][H^+]$

d. Rate = $k[CH_3COCH_3][Br_2][H^+]^2$

e. Rate = $k[CH_3COCH_3][Br_2]$

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8. The reaction

$$3NO \rightarrow N_2O + NO_2$$

is found to obey the rate law Rate = $k[NO]^2$. If the first half-life of the reaction is found to be 3.5 s, what is the length of the fourth half-life?

a. 21 s

b. 6.6 s

c. 53 s

d. 14 s

e. 56 s

9. Which of the following compounds has the lowest boiling point?

a. CH_4

b. C_2H_6

c. C_5H_{12}

d. C_3H_8

e. C_4H_{10}

10. In which of the following processes is energy evolved as heat?

a. vaporization

b. crystallization

c. melting

d. sublimation

e. none of these

二、普通化學(B)，計算題（5題，每題20分，共100分）

1. Adipic acid contains 49.32% C, 43.84% O, and 6.85% H by mass. What is the empirical formula?

2. The concentration of a 228.0-mL sample of a calcium chloride solution is 0.490 *M*. What is the mass of the solute ?

3. Air is 79% N_2 and 21% O_2 by volume. Calculate the density of air at 1.0 atm, 25°C

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4. For the reaction $2NCl_3(g) \rightleftharpoons N_2(g) + 3Cl_2(g)$, the equilibrium pressures are

$P(NCl_3) = 0.136$ atm

$P(N_2) = 2.32$ atm

$P(Cl_2) = 0.0580$ atm

Determine K_p for this reaction.

5. The balanced equation for the reaction of bromate ion with bromide in acidic solution is

$$BrO + 5Br^- + 6H^+ \rightarrow 3Br_2 + 3H_2O$$

At a particular instant in time, the value of $-\Delta[Br^-]/\Delta t$ is 2.0×10^{-3} mol/L • s. What is the value of $\Delta[Br_2]/\Delta t$ in the same units?