

編號： 16 系所：化學系、生命科學系、醫技系 科目：普通化學

說明：答案一律寫在答案卷上，請標明題號依序作答。計算題需寫出計算過程，否則不予計分

一、Answer each of the following questions (60%)

1. Rank the following according to the indicated properties.

(a) Melting point: (1) NaF (2) LiI (3) MgO

(b) Radioactivity: (1)  $\text{Tc}^{99}$  ( $t_{1/2} = 6 \text{ h}$ ) (2)  $\text{Mo}^{99}$  ( $t_{1/2} = 335 \text{ h}$ ) (3)  $\text{U}^{238}$  ( $t_{1/2} = 4.5 \times 10^9 \text{ y}$ )

(c) Solubility in water: (1)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$  (2)  $\text{CH}_3(\text{CH}_2)_3\text{CH}_2\text{OH}$  (3)  $\text{CH}_3(\text{CH}_2)_3\text{CHO}$

(d) First ionization energy: (1) N (2) O (3) F

(e) Mass number: (1)  ${}_{19}\text{K}^{39}$  (2)  ${}_{17}\text{Cl}^{37}$  (3)  ${}_{18}\text{Ar}^{40}$

2. (a) What is the oxidation number of Co in  $[\text{Co}(\text{NH}_3)_5\text{Br}]\text{Cl}_2$

(b) How many  $\pi$  bonds does 3-buten-1-one have?

(c) What is the bond order of  $\text{CN}^+$ ?

(d) What is the formal charge of N in  $\text{CH}_3\text{NO}_2$ ?  $\left( \begin{array}{c} \text{H} \\ | \\ \text{H}-\text{C}-\text{N} \\ | \quad // \\ \text{H} \quad \text{O} \end{array} \right)$

(e) What is the meaning of "The third law of thermodynamics"?

3. Complete the following table.

	Hybrid orbital of central atom	Geometry of molecule	Number of pairs of unshared valence electrons
$\text{CH}_4$	$\text{sp}^3$	tetrahedral	0
$\text{AlCl}_3$		trigonal planar	9
$\text{NO}_2^-$	X		
$\text{BrF}_3$			X

4. For the following reaction profiles, indicated:

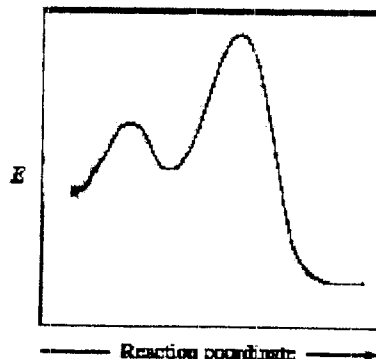
(a) The position of reactants

(b) The position of products

(c) The transition state

(d) The activation energy of the forward reaction

(e) The reaction enthalpy of the reversed reaction

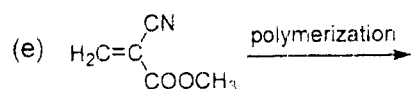
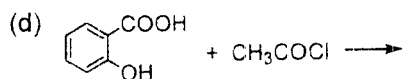
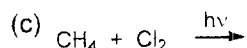
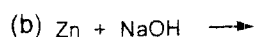
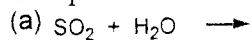


5. (a) Explain why a solution of  $\text{HCl}_{(\text{g})}$  in benzene does not conduct electricity but in water it does.  
 (b) Explain why  $\text{FeCl}_6^{4-}$  is paramagnetic but  $\text{Fe}(\text{CN})_6^{4-}$  is not. (atomic number of Fe = 26)

(背面仍有題目,請繼續作答)

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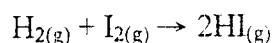
6. Complete and balance the following reactions.



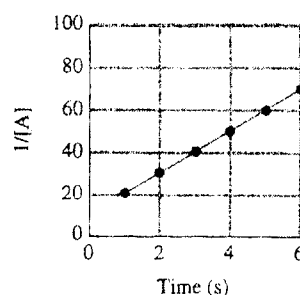
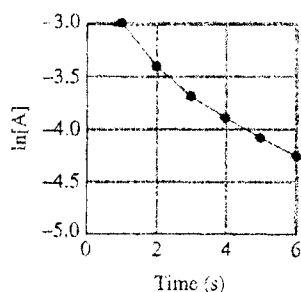
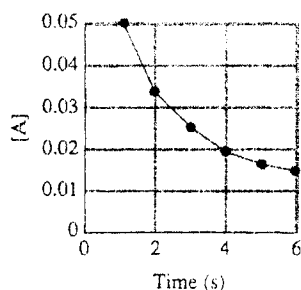
二、Calculation (40%)

1. A 200 mL flask contains 3.30 g of carbon dioxide and 0.10 g of helium, and it has a temperature of 27 °C. What is the total pressure exerted by the gas mixture? What is the partial pressure of carbon dioxide? (Atomic weight: He = 4.0, C = 12.0, O = 16.0)

 2. Calculate the molar solubility of  $\text{Ca}(\text{OH})_2$  (a) in pure water and (b) in a solution of pH = 14.0? (The  $K_{sp}$  of  $\text{Ca}(\text{OH})_2$  is  $4.0 \times 10^{-6}$ )

 3. Use the following data to calculate  $\Delta H^\circ$ ,  $\Delta S^\circ$ ,  $\Delta G^\circ$ , and equilibrium constant K for the reaction:


	$\Delta H_f^\circ$ (kJ/mol)	$S^\circ$ (J/K mol)
$\text{H}_{2(g)}$	0	130.6
$\text{I}_{2(s)}$	0	116.1
$\text{I}_{2(g)}$	62.4	260.6
$\text{HI}_{(g)}$	26.4	206.5

 4. Experimental data for the reaction:  $\text{A} \rightarrow 2\text{B} + \text{C}$  have been plotted in the following three different ways (with concentration units in M):


- (a) What is the order of the reaction with respect to A and what is the initial concentration of A?  
 (b) What is the concentration of A after 9 seconds?