

所(組)別: 應用化學研究所碩士班

考試科目: 分析化學

1. (30%) 解釋下列專有名詞。每小題 5%

a. Nernst equation

d. Common ion effect

b. Beer's law

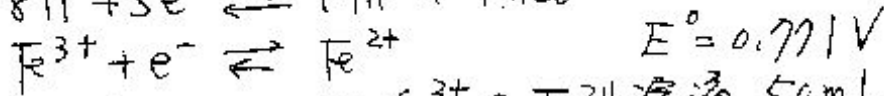
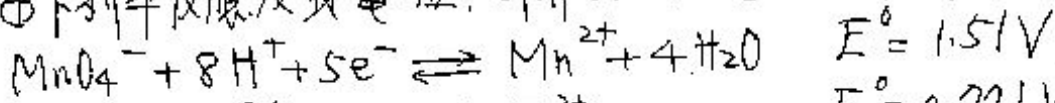
e. Standard addition method

c. Van Deemter equation

f. Standard Hydrogen electrode

2. (10%) 計算比重為 1.42 的 70.5% (w/w) HNO_3 (63.0g/mole) 溶液的莫耳濃度為何。

3. (10%) 由下列半反應及其電位, 計算全反應電位與平衡常數。



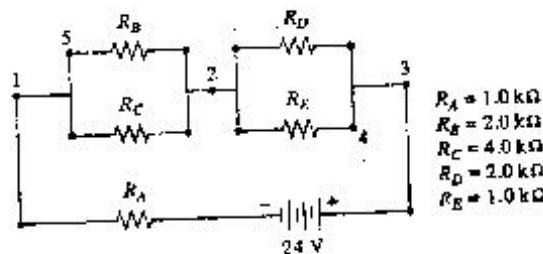
4. (10%) 混合 50.0 mL 的 0.0250 M Ce^{3+} 與下列溶液 50 mL
 (a) 水 (b) 0.040 M IO_3^- 或 (c) 0.250 M IO_3^- . 計算 Ce^{3+} 濃度為何? ($\text{Ce}(\text{IO}_3)_3$ 的 $K_{sp} = 3.2 \times 10^{-10}$)

5. (10%) 請說明 DSC 與 DTA 於設計與用途上的差別。

6. (10%) 請說明 Laser (雷射, 或激光) 產生的原理與種類。

7. (10%) 請說明 Chemical shift 與 spin-spin splitting 理論對於 NMR 上用途。

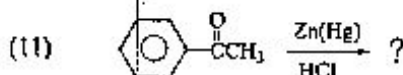
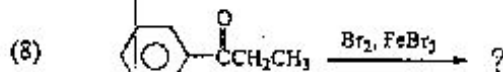
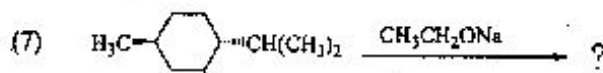
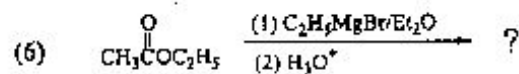
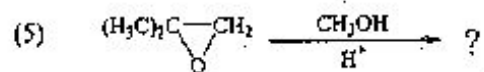
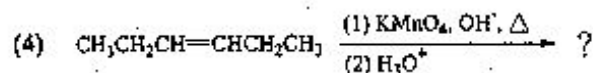
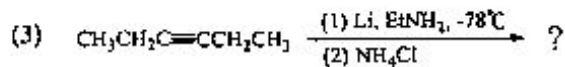
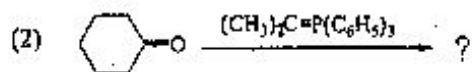
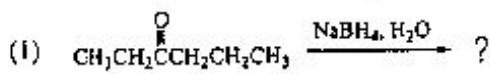
8. (10%) 請由下列電路, 計算 (a) 經 R_A 與 R_D 的電位, 與 (b) 夾 4 與 5 的電位差。



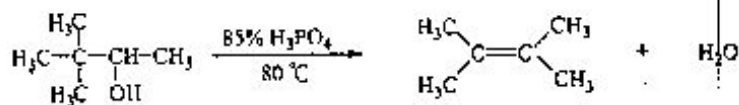
$R_A = 1.0\text{ k}\Omega$
 $R_B = 2.0\text{ k}\Omega$
 $R_C = 4.0\text{ k}\Omega$
 $R_D = 2.0\text{ k}\Omega$
 $R_E = 1.0\text{ k}\Omega$

end

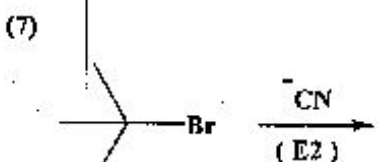
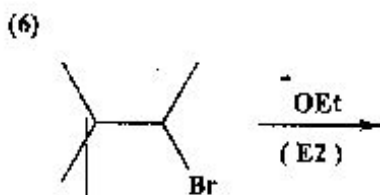
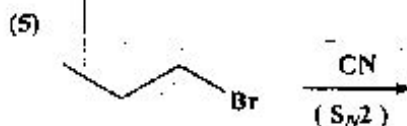
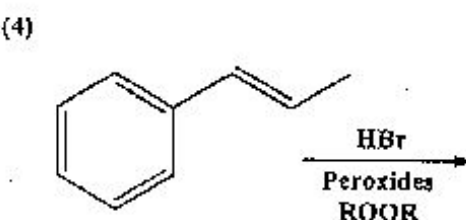
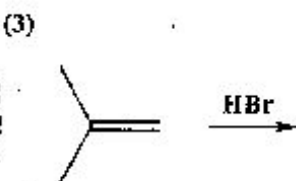
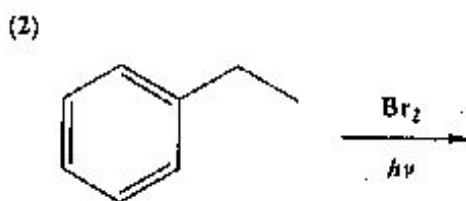
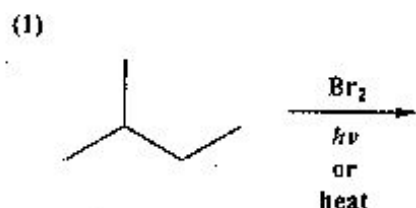
1. Give the major product for each of the following reactions. (4 points each)

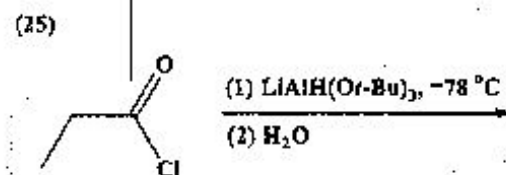
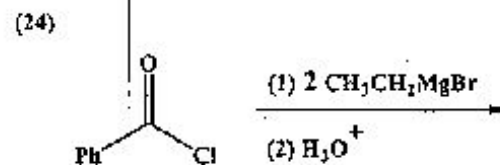
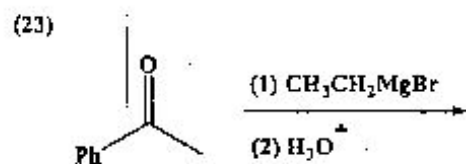
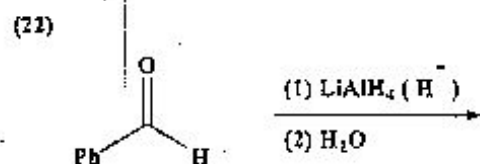
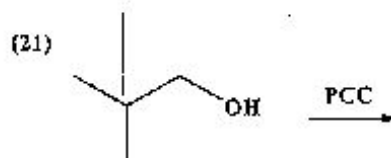
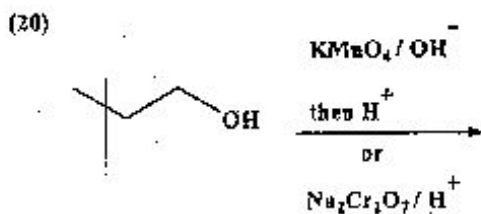
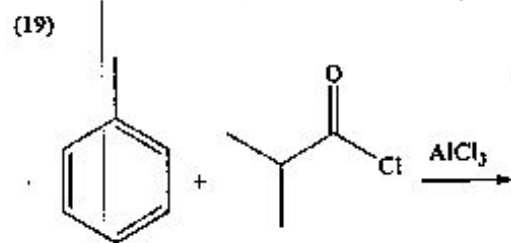
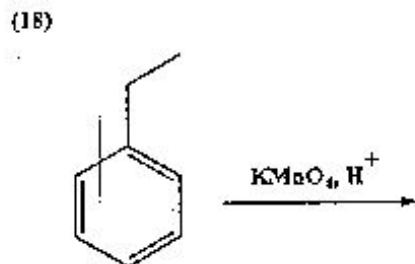
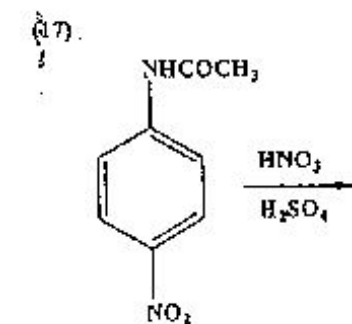
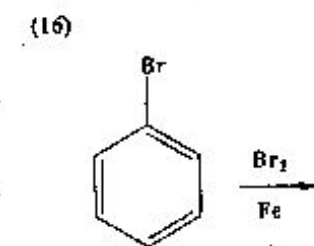
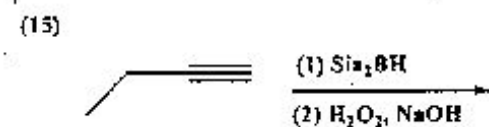
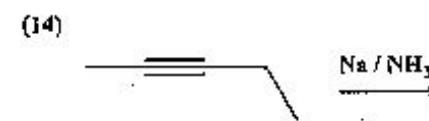
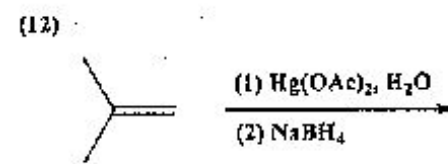
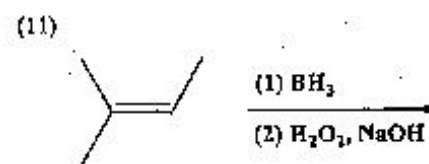
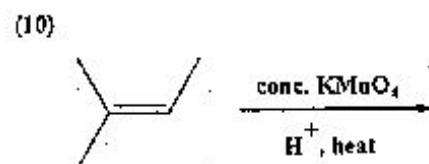
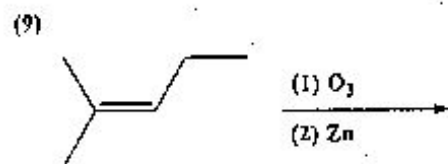
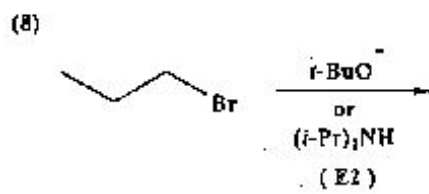


2. Propose a step-by-step mechanism for the following reaction. (6 points)



3. Give the structures of the major organic products of the following reactions : 2 points each





1. Explain the following terms: (5% for each term)

- (a). lanthanide contraction
- (b). dispersion force
- (c). VSEPR
- (d). chiral
- (e). HOMO
- (f). lattice energy (lattice enthalpy)
- (g). soft base
- (h). superacid
- (i). cubic close packing
- (j). chalcogen
- (k). chelating ligands (chelate)
- (l). ligand field theory
- (m). π -back-bonding
- (n). Jahn-Teller distortion
- (p). LMCT
- (q). trans effect
- (r). outer-sphere reaction
- (s). 18-electron rule
- (t). oxidative addition
- (u). isolobal analogy

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-(10) Explain equal volumes of gases at the same pressure and temperature containing equal numbers of molecules in terms of equations.

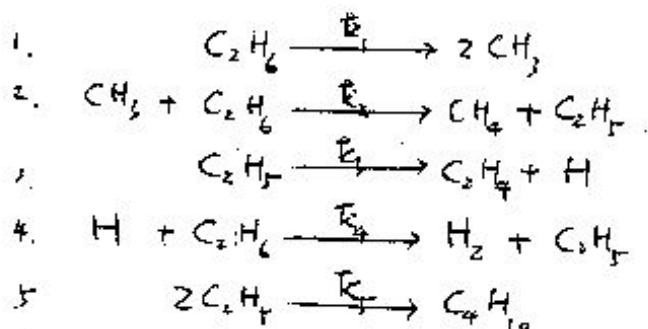
=(10) Prove $P_1 V_1^\gamma = P_2 V_2^\gamma$ by making use of the ideal gas relationship $\gamma = C_{p,m} / C_{v,m}$, $C_p =$ heat capacity at constant pressure, $C_v =$ heat capacity at constant volume.

=(5) Prove $\frac{d \ln K_p^\circ}{dT} = \frac{\Delta H^\circ}{RT^2}$ by using the Gibbs-Helmholtz equation.

$K_p^\circ =$ equilibrium constant; $T =$ temperature; $\Delta H^\circ =$ enthalpy
 $R =$ gas constant

=(15) State in detail the difference between the Arrhenius Equation and the Transition-State theory.

=(10) Work out the expression for the overall rate of the ethane decomposition according to this mechanism, on the assumption that the steady-state hypothesis applies to the free radicals CH_3 , C_2H_5 and H .



六 Illustrate the following terms:

(10 points each. Use equations, figures and diagrams as much as possible.)

1. Schrodinger equation

2. Boltzman distribution

3. Stimulated emission

4. Vibrational energy

5. Pauli exclusion principle

Answer the following questions

1. Give the chemical structures of
 - a. The components of nucleic acid and a polynucleotide of Deoxyribonucleic acid, respectively [20%]
 - b. one amino acid with hydroxylic group, aliphatic side chain, aromatic ring and sulfur atom, respectively [15%]
 - c. NADP [5%]
 - d. Heme [6%]
 - e. Cellulose [6%]
 - f. primary structure of protein [6%]
 - g. Cholesterol and testosterone [6%]
 - h. phosphatidylcholine and sphingomyelin [6%]

2. Describe briefly and give the pathway of the glycolysis [please give the chemical structure for each intermediate if possible] [30%]

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