

系別：化學學系 A 組

科目：基礎化學-無機化學 25%

准帶項目請打「V」
簡單型計算機

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INORGANIC CHEMISTRY (25%) (答錯倒扣)

Multiple choice questions: each question has one or more than one answer(s) and 5%

- How many unpaired electrons are found in each of the following complex ions?
 - $[\text{FeCl}_4]^-$ has 5
 - $[\text{Ni}(\text{CN})_4]^{2-}$ has 0
 - $[\text{Fe}(\text{CN})_6]^{4-}$ has 0
 - $[\text{PtCl}_6]^{2-}$ has 0
 - $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ has 0
- Which of the following statements concerning the complex ion is true?
 - $[\text{Co}(\text{NH}_3)_6]^{3+}$ is kinetic inert
 - $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$ is colorless
 - $[\text{PtCl}_4]^{2-}$ is paramagnetic
 - $[\text{Co}(\text{NH}_3)_5\text{Cl}]^{2+} + [\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ has outer-sphere electron transfer
 - $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ has Jahn-Teller distortion
- Which of the following statements concerning the structure of compound is true?
 - BrF_5 is trigonal bipyramidal
 - $\text{B}(\text{OH})_3$ is a C_{3v} symmetry group
 - NO_2^- is linear
 - $\text{Ru}_6(\text{CO})_{18}$ is octahedral
 - $\text{Ni}(\text{CO})_4$ is square planar
- Which of the following statements concerning the metal ion is true?
 - Cytochrome C contains copper
 - Vitamin B12 contains cobalt
 - Carbonic anhydrase contains Zn
 - Zn^{2+} exist in octahedral hole of S^{2-} in ZnS crystal
 - Cs^+ has eight coordination number in CsCl crystal
- Which of the following statements concerning the bonding is true?
 - HOMO in N_2 molecule is π^* orbital
 - O_2^+ has bond order of 2.5
 - $\text{Fe}(\text{II})\text{-CO}$ has π back-bonding
 - trigonal bipyramidal hybrid uses $d_{x^2-y^2}$ orbital
 - $\text{H}_3\text{N-BF}_3$ has donating bond

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科目：基礎化學-分析化學及儀器分析 25%

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一、有一含氮之樣品，上面標明含氮量為 59.11%。有位學生經過四次分析，實際測得之數據為 58.90, 58.43, 59.15, 59.33。求其(1)平均值；(2)中間值；(3)平均值之絕對誤差；(4)平均值之相對誤差；(5)及其分佈範圍。(10%)

二、計算 pH 為 7，0.1M 磷酸緩衝溶液 HPO_4^{2-} 和 PO_4^{3-} 的濃度。
(H_3PO_4 的 $\text{pK}_{a1}=2.15$, $\text{pK}_{a2}=7.15$, $\text{pK}_{a3}=12.40$) (5%)

三、In a reversed-phase column, a solute was found to have a retention time of 31.3 min, while an unretained species required 0.48 min for elution when the mobile phase was 30% (by volume) methanol and 70% water. Calculate (a) k' and (b) a water/methanol composition that should bring k' to a value of about 5. (10%)

註 1： P' for methanol = 5.1
 P' for water = 10.2

註 2：For a reversed-phase column,

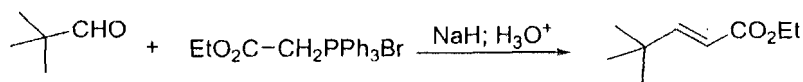
$$\frac{K_2'}{K_1'} = 10^{(P_2' - P_1')/2}$$

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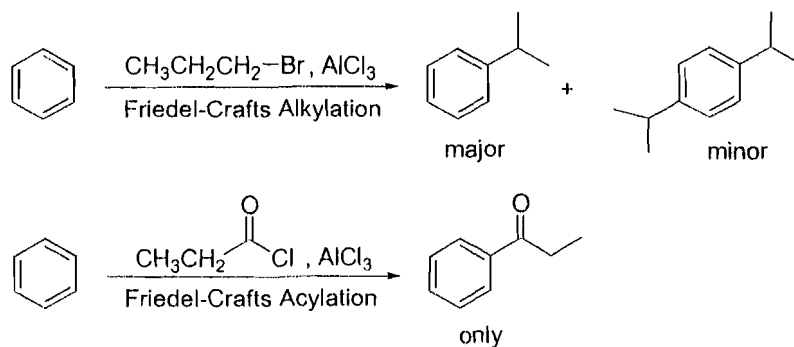
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1. Propose a reasonable mechanism of Wittig reaction (10 pts).



2. Explain the dialkylated compound is minor product of Friedel-Crafts alkylation reaction whereas no diacylated compound is observed in Friedel-Crafts acylation reaction (15 pts).



淡江大學 95 學年度碩士班招生考試試題

29-4

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- (a) Calculate the magnitude of L and L_z for 3p electron in a hydrogenlike atom.

(b) Verify that $\int_0^{2\pi} |T(\phi)|^2 d\phi = 1$, where $T(\phi) = (2\pi)^{-1/2} e^{im\phi}$ 5%
- (a) Please give the Hamiltonian operator for H_2 molecule.

(b) Please determine the $2p_x$, $2p_y$ and $2p_z$ wave-function from $2p_1$, $2p_{-1}$ and $2p_0$. 6%
- Calculation E_a for a reaction whose rate constant at room temperature is doubled by a 10°C increase in T. Then repeat the calculation for a reaction whose rate constant is tripled. 7%
- For $\text{CO}(\text{NH}_2)_2(\text{s})$, $\Delta_f H_{298}^0 = -333.51 \text{ kJ/mol}$. Find $\Delta_f U_{298}^0$ of $\text{CO}(\text{NH}_2)_2(\text{s})$. 7%

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