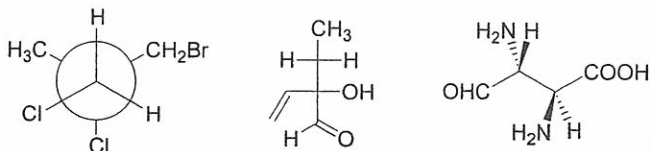


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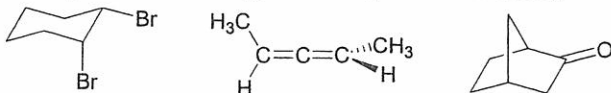
(一) 單選題 (每題 2 分, 共 40 分, 請依題號順序於『選擇題作答區』內作答。)

(1) How many of the following three compounds possess a stereogenic center of *R* configuration?



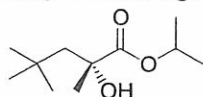
(A) 0 (B) 1 (C) 2 (D) 3

(2) How many of the following three compounds are **chiral**?



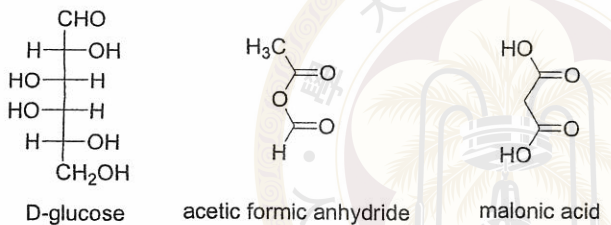
(A) 0 (B) 1 (C) 2 (D) 3

(3) How many **doublet signals** are expected for the proton NMR spectrum of the following compound?



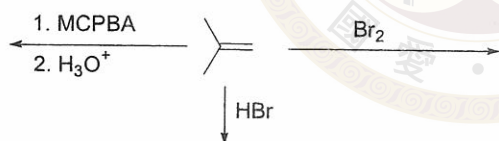
(A) 0 (B) 1 (C) 2 (D) 3

(4) How many of the following three structures have the **correct common name** given underneath?



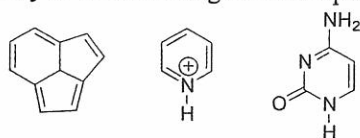
(A) 0 (B) 1 (C) 2 (D) 3

(5) How many of the following three addition reactions would favor the **syn-adduct**?



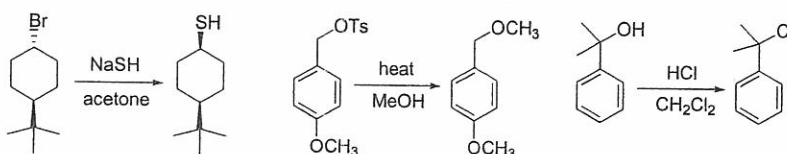
(A) 0 (B) 1 (C) 2 (D) 3

(6) How many of the following three compounds are **aromatic**?



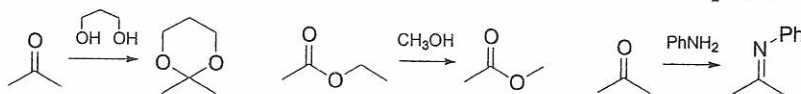
(A) 0 (B) 1 (C) 2 (D) 3

(7) How many of the following three reactions are dominated by the **S_N2 mechanism**?



(A) 0 (B) 1 (C) 2 (D) 3

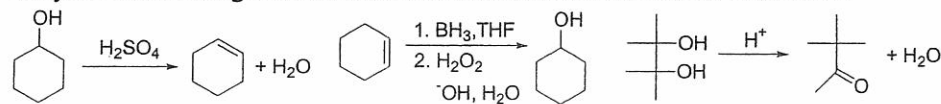
(8) How many of the following three transformations **cannot proceed without the presence of acid**?



(A) 0 (B) 1 (C) 2 (D) 3

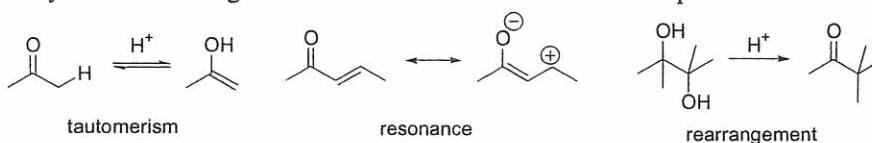
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(9) How many of the following three reactions are classified as **oxidation or reduction**?



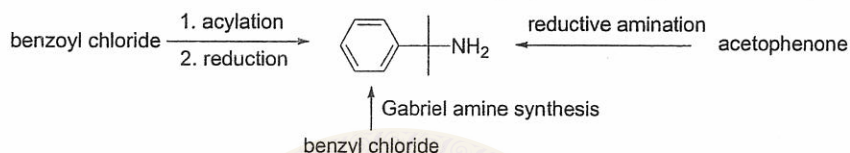
(A) 0 (B) 1 (C) 2 (D) 3

(10) How many of the following terms **CORRECTLY** describe the three phenomena?



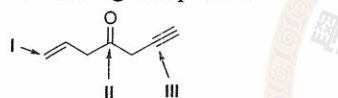
(A) 0 (B) 1 (C) 2 (D) 3

(11) How many of the following three methods **allow** one to prepare the target amine compound?



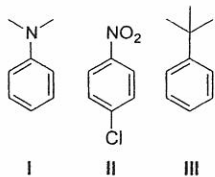
(A) 0 (B) 1 (C) 2 (D) 3

(12) Which is the **CORRECT** order in the value of chemical shift in ^{13}C NMR for the labeled carbons of the following compound?



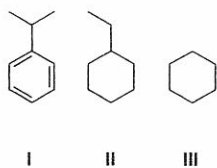
(A) I > II > III (B) I > III > II (C) II > I > III (D) II > III > I

(13) Which is the **CORRECT** order in the reactivity of the following compounds that undergo bromination reactions with Br_2 ?



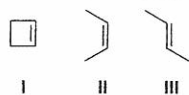
(A) I > II > III (B) I > III > II (C) II > I > III (D) II > III > I

(14) Which is the **CORRECT** order in the reactivity of the following compounds that undergo bromination reactions with Br_2 ?



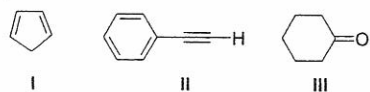
(A) I > II > III (B) I > III > II (C) II > I > III (D) II > III > I

(15) Which is the **CORRECT** order in the amount of heat released from the hydrogenation of one mole of each of the following alkenes?



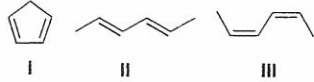
(A) I > II > III (B) I > III > II (C) II > I > III (D) II > III > I

(16) Which is the **CORRECT** order in acidity for the following compounds?



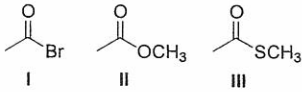
(A) I > II > III (B) I > III > II (C) II > I > III (D) II > III > I

- (17) Which is the **CORRECT** order in the reactivity of the following dienes for the Diels-Alder reaction with benzoquinone?



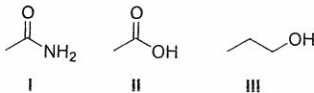
- (A) I > II > III (B) I > III > II (C) II > I > III (D) II > III > I

- (18) Which is the **CORRECT** order in the reactivity of the following compounds that undergo nucleophilic acyl substitution reactions with propylamine?



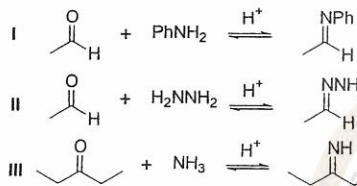
- (A) I > II > III (B) I > III > II (C) II > I > III (D) II > III > I

- (19) Which is the **CORRECT** order in boiling point for the following compounds?



- (A) I > II > III (B) I > III > II (C) II > I > III (D) II > III > I

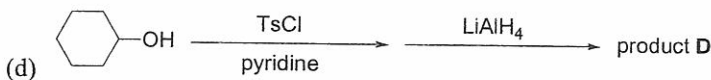
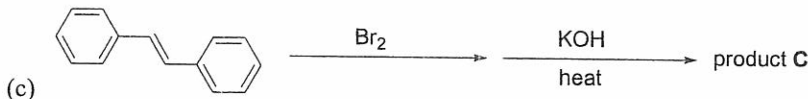
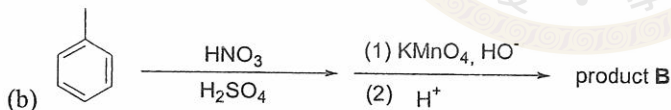
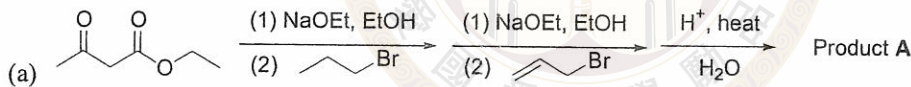
- (20) Which is the **CORRECT** order in the equilibrium constant of the following reactions?



- (A) I > II > III (B) I > III > II (C) II > I > III (D) II > III > I

(二) 簡答題 (每一小題 2 分, 共 10 分, 請於『非選擇題作答區』內作答。)

- (21) Give the **major product** for each of the following multi-step reactions:



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簡答題（請於『非選擇題作答區』內作答）

- (22) Give the term symbol of the ground state for Cu; Cu^+ and Cu^{2+} free-ions. (6 分)
- (23) Given the term symbol of ${}^3\text{G}$; ${}^4\text{F}$, determine the values of L, M_L , S, M_S for each term. (8 分)
- (24) Describe the molecular shape of each following molecules in terms of point group: BrF_5 ; PF_5 ; SF_4 ; BF_3 ; XeF_2 ; benzene; borazine($\text{C}_3\text{B}_3\text{H}_6$); naphthalene; $\text{Cr}(\eta^6\text{-C}_6\text{H}_6)_2$; ferrocene; $\text{Ni}(\text{CN})_4^{2-}$; $\text{Ni}(\text{CO})_4$. (12 分)
- (25) Ligand field strength, Δ_o , in O_h coordination is expressed as $3e_\sigma - 4e_\pi$, where e_σ and e_π is σ - and π - energy respectively for the ligand; explain the order of the magnitudes of following Δ_o values for Cr(III) complexes in terms of e_σ and e_π of the ligands:
- | Ligand | F^- | H_2O | NH_3 | en | CN^- |
|---------------------------------|--------------|----------------------|---------------|-------|---------------|
| Δ_o (cm^{-1}) | 15200 | 17400 | 21600 | 21900 | 33500 |
- (10 分)
- (26) Construct the molecular orbitals of H_4 in a linear and a square geometry respectively, which one is more stable? (10 分)
- (27) Describe different binding modes of CO in metal carbonyls, Can you tell the modes from IR spectra? (4 分)