

國立成功大學

111學年度碩士班招生考試試題

編 號：263

系 所：生物化學暨分子生物學研究所

科 目：有機化學

日 期：0220

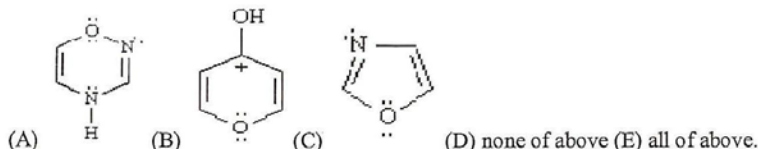
節 次：第 2 節

備 註：不可使用計算機

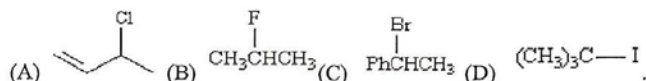
※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

一、選擇題：(單選，每題 2 分，共 28 分)

- Which of the following compounds has the highest reactivity toward electrophilic aromatic substitution?
(A) bromobenzene (B) nitrobenzene (C) benzene (D) phenol.
- Which of the following compounds is not an aromatic compound?

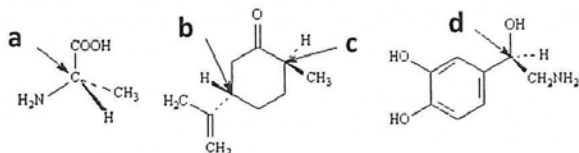


- Which of the following ^{13}C NMR and Mass spectral data does not fit with allyl bromide?
(A) $M^+ = 120$ and $(M + 2) = 122$ (B) broadband decoupled ^{13}C NMR: 32.6, 118.8, 134.3 δ (C) DEPT-90: 134.3 δ (D) DEPT-135: negative peaks at 134.3 δ ; positive peaks at 32.6, 118.8 δ (E) none of above.
- Which of the following statements is false? (A) Both mass spectrometry and infrared spectroscopy involve the interaction of molecules with electromagnetic energy (B) The amount of energy in electromagnetic radiation is related to the frequency and wavelength of the radiation. High energy radiation like gamma rays is of high frequency and short wavelength (C) The amount of energy in infrared light corresponds to the amount of energy needed to increase certain molecular motions, such as bond vibrations, in organic molecules (D) Examining the infrared spectrum of a compound allows us to determine the types of functional groups present in the compound (E) none of above.
- Which of the following regions of the infrared spectrum corresponds to the absorptions occurring for C-C, C-O, C-N, and C-X single-bond vibrations? (A) 4000 to 2500 cm^{-1} (B) 2500 to 2000 cm^{-1} (C) 2000 to 1500 cm^{-1} (D) below 1500 cm^{-1} (E) none of above.
- Which is of the following organic halides has the *least* reactivity in an $\text{S}_{\text{N}}1$ reaction?



- Which of the following statements is correct?
(A) Enantiomers are organic molecules which rotate the plane of polarization of plane-polarized light (B) Chirality is the reason for "handedness" in molecules; the property of an object that causes it to be nonsuperimposable on its mirror image (C) Meso compounds are stereoisomers that are not mirror images (D) Prochirality center is an atom in a molecule that is bonded to four different atoms or groups of atoms (E) Chirality center is an sp^3 -hybridized atom that can become a chirality center by changing one of its attached groups.
- Which of the following compounds has the lowest boiling point? (A) n-butyl chloride (B) n-butyl iodide (C) t-butyl chloride (D) t-butyl bromide.

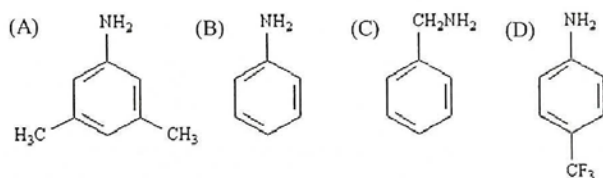
9. For assignments of *R, S* configurations to each indicated chirality center in the molecules below, which has *R* configuration? (A) a (B) b (C) c (D) d.



10. Which of the following statements is false? (A) 1,2-Dimethylcyclohexane can exist as cis-trans isomers (B) All carbon atoms are sp^3 hybridized in methylcyclohexane (C) Cyclohexane has smaller strain energy (kJ/mol) than cyclooctane (D) Camphor is an example of a bridged bicyclic molecule (E) none of above.

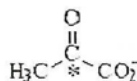
11. Which of the following statements is false? (A) Protonation of the intermediate constitutes a difference between an aldol and a Claisen condensation (B) 1,6-Diester will produce a five-membered ring via a Dieckmann cyclization (C) 1-Nitropentane would be classified as a Michael donor (D) 2-Methylbutanal will not undergo an aldol condensation reaction (E) none of above.

12. Which of the following amines is the most basic compound?



13. Which of the following compounds will be almost completely deprotonated by NaOH? (A) water (B) ethanol (C) phenol (D) ammonia (E) all of above.

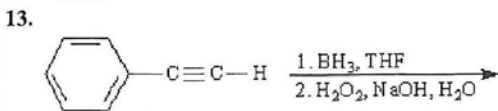
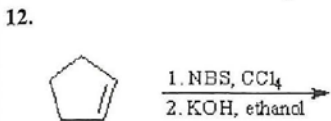
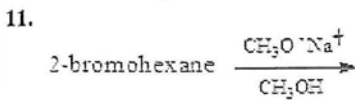
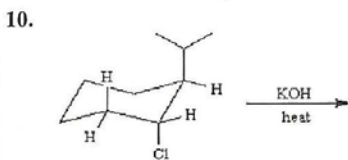
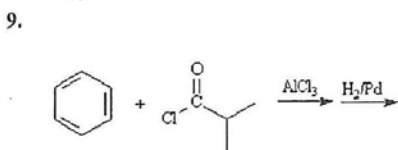
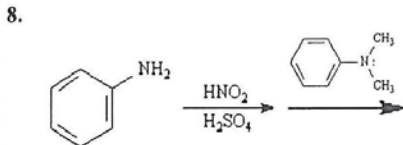
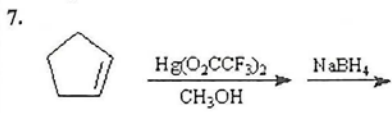
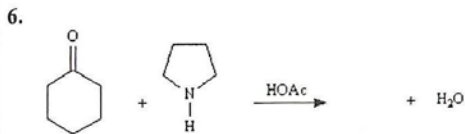
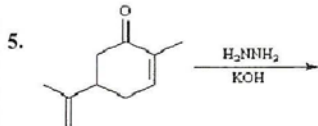
14. For the following compound, the carbon atom indicated by the asterisk is (A) chiral (B) achiral (C) prochiral (D) both achiral and prochiral (E) none of above.



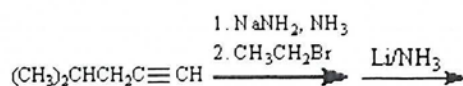
二、簡答題：(每題 3 分，共 54 分)

- For (2*R*, 3*S*)-dibromobutane, provide a Newman projection of its most stable conformation by sighting down the C2-C3 bond.
- Propose the chemical structure of the C_8H_9Br compound with the following 1H NMR data: 3H doublet at 2.0 δ , $J = 7$ Hz; 1H quartet at 5.0 δ , $J = 7$ Hz; 5H singlet at 7.3 δ .
- Provide the chemical structure of *trans*-3-isopropylcyclohexancarbaldehyde.
- Draw the chemical structure of 1-((1*S*, 3*R*)-3-methylcyclohexyl)benzene.

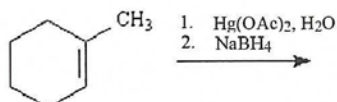
Provide the major reaction product(s) for each of the following chemical transformations (第 5-18 題).



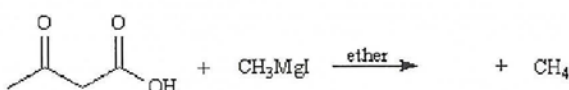
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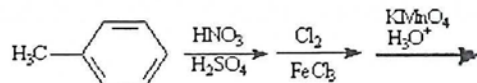
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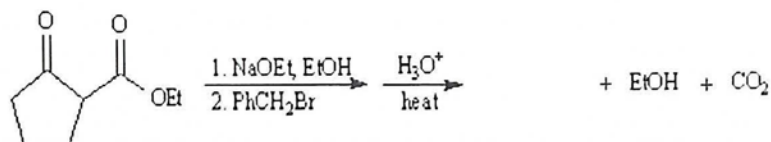
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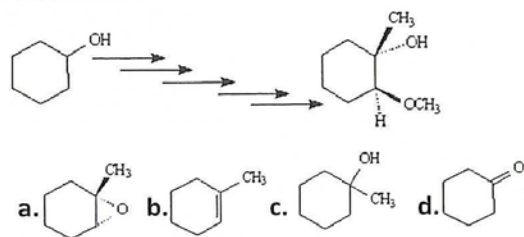
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三、問答題：(每題 6 分，共 18 分)

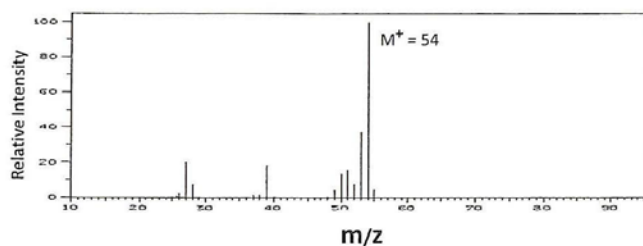
1. The following transformations have gone through the four intermediates (a, b, c, d) as listed. Answer the following two questions.

(a) Please list the most reasonable order of the intermediates from left to right of the transformations. (3%)



(b) To accomplish the above set of transformations, which of the following treatments is not needed? (A) NaH, then CH_3I (B) NaOCH_3 , CH_3OH (C) $m\text{-ClC}_6\text{H}_4\text{CO}_3\text{H}$ (D) CH_3MgBr in ether, then H_3O^+ (E) warm $\text{H}_2\text{SO}_4/\text{H}_2\text{O}$. (3%)

2. A hydrocarbon shows characteristic IR absorption at 2100 cm^{-1} and the following mass spectrum. Provide the chemical structure of this hydrocarbon. (6%)



3. Nitriles can be obtained by dehydration of an amide upon treatment of thionyl chloride. Answer the following two questions.
- (a) Provide the products for the reaction of propanamide with thionyl chloride. (3%)
- (b) Write out the mechanism of the reaction with propanamide and thionyl chloride by indicating curved electron flows and intermediates. (3%)