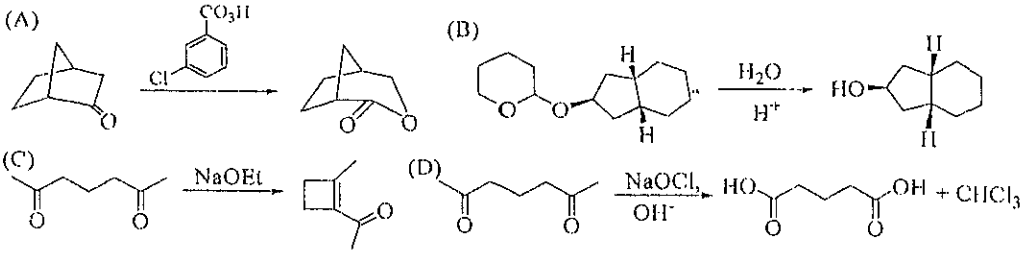
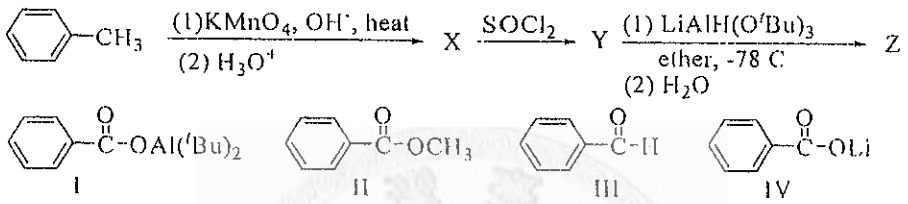
單選題（75 %）（不需抄題但請標明題號並依序作答，每題三分）

1. Which of the following reactions gives the **CORRECT** product?



2. What is the final product, Z, of the following synthesis?

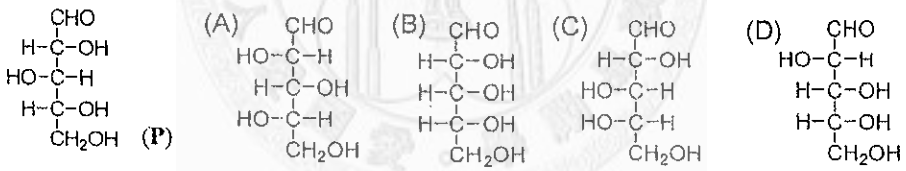


(A) I; (B) II; (C) III; (D) IV

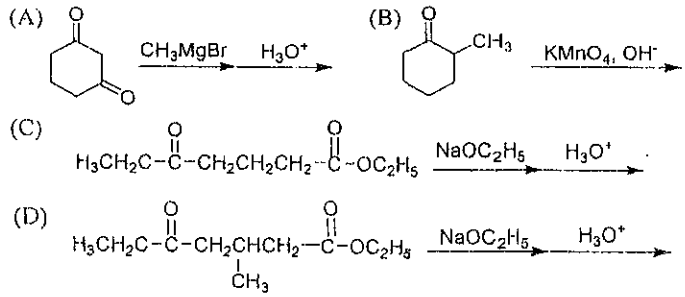
3. The ^{1}H NMR spectra of $(CH_3)_2CHI$ recorded by using 400 MHz or 100 MHz spectrometers may change:

(A) δ value of CH in Hz; (B) coupling constant; (C) splitting pattern of CH_3 (D) integration ratio of peak areas.

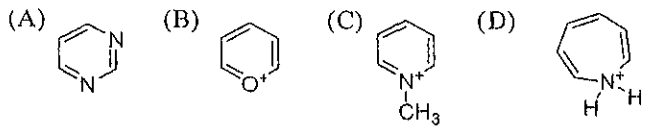
4. Which of the following compounds exhibits identical ^{1}HNMR spectrum with compound **P** ?



5. 2-Methylcyclohexane-1,3-dione can be synthesized from:



6. Which of the following compound is **NOT** an aromatic compound?



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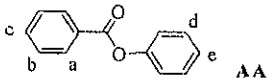
7. The mercuric-catalyzed hydration of 1-butyne with $HgSO_4/H_2SO_4$ gives a major product

(A) Butanol (B) Butanal (C) 2-Butanone (D) Butanoic acid.

8. Upon nitration of compound **AA**, the major product has the nitro group at position



AA

(A) a (B) b (C) e (D) d

9. In the reaction of 2-bromobutane with 2-aminobutane, which of the following statements is **True**?

(A) The rate of (*S*)-2-bromobutane with (*R*)-2-aminobutane equals to the rate of (*R*)-2-bromobutane with (*R*)-aminobutane.

(B) The rate of (*S*)-2-bromobutane with (*S*)-2-aminobutane equals to the rate of (*R*)-2-bromobutane with (*R*)-aminobutane.

(C) The rate of (*S*)-2-bromobutane with (*S*)-2-aminobutane equals to the rate of (*R*)-2-bromobutane with (*S*)-aminobutane.

(D) The products from the reactions of (*R*)-2-bromobutane with (*S*)-2-aminobutane and form the reaction of (*S*)-2-bromobutane with (*R*)-2-aminobutane are diaseteromeric isomers.

10. Alkaline hydrolysis of an ester involves initial attack by hydroxide ion on the carbonyl carbon. In what order should the five substituents below be arranged to represent the decreasing order of the rates of hydrolysis of ethyl *p*-substituted benzoates?

(A) $CH_3 > Cl > H > NO_2 > OCH_3$; (B) $NO_2 > Cl > H > CH_3 > OCH_3$;

(C) $OCH_3 > H > Cl > CH_3 > NO_2$; (D) $NO_2 > H > Cl > CH_3 > OCH_3$

11. What is the final product in the Curtius rearrangement of the acyl azide formed from butanoyl chloride

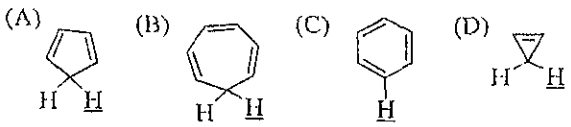
(A) $CH_3CH_2CH_2\overset{O}{\overset{\|}{C}}NHCH_2CH_2CH_3$ (B) $CH_3CH_2CH_2NH_2$

(C) $CH_3CH_2CH_2N{=}C{=}O$ (D) $CH_3CH_2CH_2CH_2NH_2$

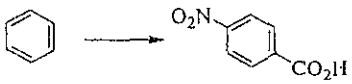
12. Rank in order of increasing vibration frequency of the following stretchings in the frame

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

13. Which of the following underlined hydrogen atom has the LOWEST *p*Ka value?



14. Show how the following conversion can be achieved



(A) 1. HNO_3, H_2SO_4; 2. Br_2, Fe; 3. Mg; 4. CO_2(s) then H^+. (B) 1. CH_3Cl, $AlCl_3$; 2. $KMnO_4$, H^+; 3. HNO_3, H_2SO_4. (C) 1. HNO_3, H_2SO_4; 2. CH_3Cl, $AlCl_3$, 3. $KMnO_4$, H^+. (D) 1. HNO_3, H_2SO_4; 2. $KMnO_4$

15. What is the product of the reaction of 1-propanol with phenyl isocyanate, $C_6H_5N{=}C{=}O$?

(A) $C_6H_5NHC(=O)OCH_2CH_2CH_3$; (B) $C_6H_5N(\text{-}CO_2H)CH_2CH_2CH_3$;

(C) $C_6H_5NO(CHO)CH_2CH_2CH_3$; (D) $C_6H_5NHC(=O)OCH(CH_3)_2$

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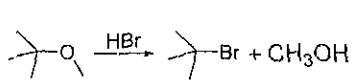
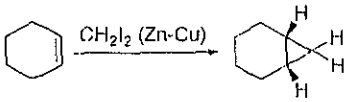
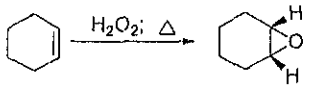
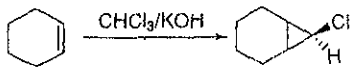
16. Which of the following transformations is **FALSE**?

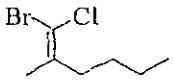
(A) 

(B) 

(C) 

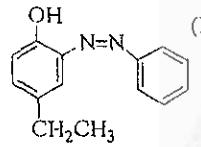
(D) 

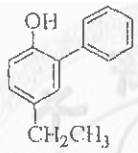
17. Which is a correct name for the following compound?

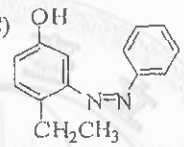


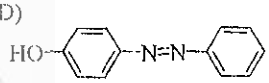
(A) (*E*)-1-Bromo-1-chloro-2-methyl-1-hexene; (B) (*Z*)-2-Bromochloromethylenehexane
(C) 2-(*E*,*Z*)-Bromochloromethyl-1-hexene; (D) (*Z*)-1-Bromo-1-chloro-2-methyl-1-hexene

18. What is the principal product (regardless of N=N configuration) when aniline is treated with sodium nitrite and hydrochloric acid at 0-5°C and this mixture is added to *p*-ethylphenol?

(A) 

(B) 

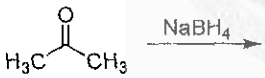
(C) 

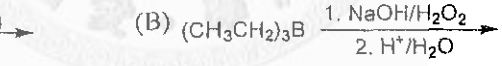
(D) 

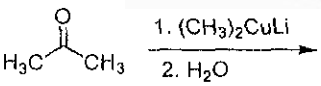
19. The IUPAC name of the following compound is

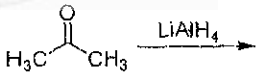
(A) 1,1-dimethylbicylco[3.2.1]octane (B) 2,2-dimethylbicyclo[3.2.1]octane
(C) 3,3-dimethylbicyclo[3.2.1]octane (D) 6,6-dimethylbicyclo[3.2.1]octane

20. Alcohols can **NOT** be prepared from

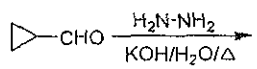
(A) 

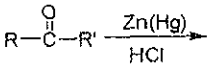
(B) 

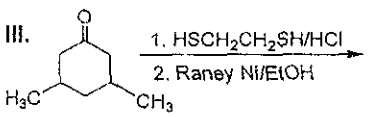
(C) 

(D) 

21. Which of the following reaction can be used for the reduction of a carbonyl group to a methylene group (-CH_2-) ?

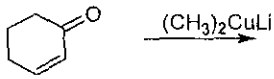
I. 

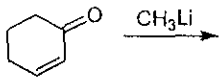
II. 

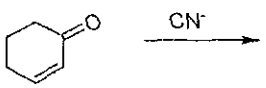
III. 

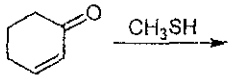
(A) **I** and **II** only (B) **I** and **III** only (C) **I**, **II**, and **III** (D) **II** and **III** only

22. Which of the following reactions gives 1,2-addition (simple addition) as the major product?

(A) 

(B) 

(C) 

(D) 

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23. The data below from the molecular ion region of the mass spectrum of a halogen-containing compound are consistent with the presence of what halogen(s) in the original compound?

	Intensity
$M^{+\bullet}$	51.0
$M^{+\bullet}+2$	100.0
$M^{+\bullet}+4$	49.0

(A) One Br (B) One Cl (C) One Br and One Cl (D) Two Br

24. Which of the following statements about the Diels-Alder reaction is **FALSE**?

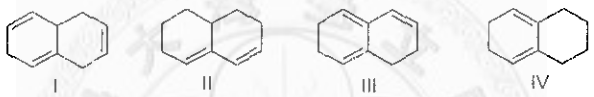
(A) The reaction is stereospecific.

(B) The most stable adduct is an exo form.

(C) The reaction only favors the diene containing e-withdrawing group regardless of the electronic property of the dienophile.

(D)The diene, of necessity, reacts in the *s*-cis conformation rather than the *s*-trans.

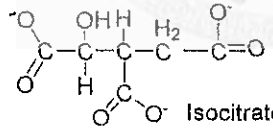
25. Arrange the order of UV absorption band of the following compounds from longest to shortest wavelength.

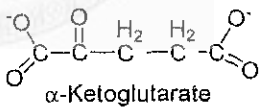


(A) I > II > IV > III (B) I > III > IV> II (C) III > I > IV > II (D) III > IV > II > I

問答題

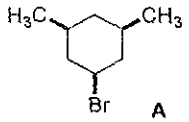
1. Explain why aldehydes are more reactive than ketone towards nucleophiles (5 %).
2. Converting Isocitrate to α-Ketoglutarate is an important step in the citric acid cycle. Explain how this transformation occurs (writing possible reagent and mechanism to account for the transformation) (5 %).

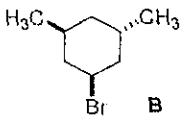

Isocitrate


α-Ketoglutarate

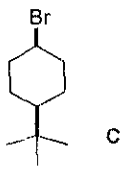
3. Explain why thioester is more reactive than ester towards nucleophiles (5 %).
4. Suggest an explanation for each of the following observations. (10%)

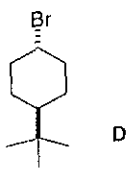
(a) Compound **A** reacts faster by the S_N2 mechanism than the compound **B**.


A


B

(b) Compound **C** reacts faster by the S_N1 mechanism than compound **D**.


C


D

試題必須隨卷繳回