

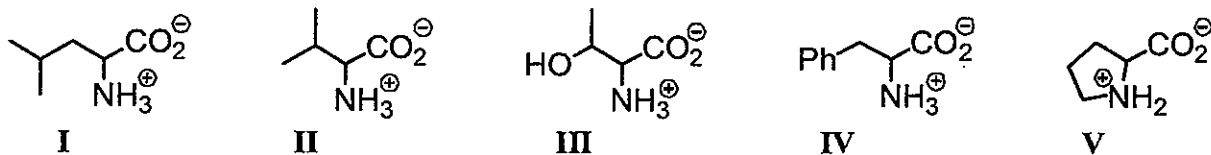
注意：本試題包含單選題及問答題兩部份

Part I. 單選題 (25 題, 共 50 分) ※ 注意：請於試卷內之「選擇題作答區」依序作答。

1. Which compound would be expected to have the lowest pK_a ?

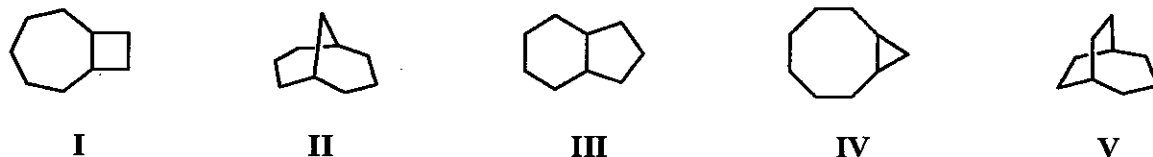
- (A) 4,4-dichlorobutanoic acid (B) 3,4-dichlorobutanoic acid (C) 3,3-dichlorobutanoic acid
(D) 2,3-dichlorobutanoic acid (E) 2,2-dichlorobutanoic acid

2. Which of the following amino acids is theoretically capable of existing in diastereomeric forms?



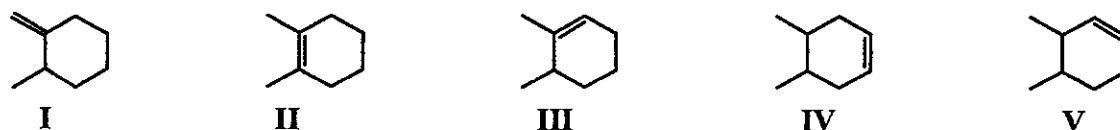
- (A) I (B) II (C) III (D) IV (E) V

3. Which of the following is bicyclo[6.1.0]nonane?



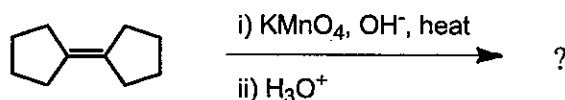
- (A) I (B) II (C) III (D) IV (E) V

4. Which molecule would have the lowest heat of hydrogenation?



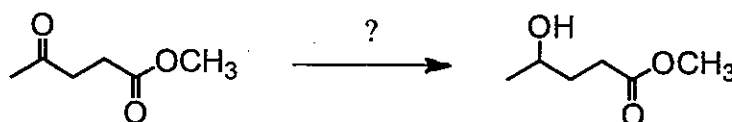
- (A) I (B) II (C) III (D) IV (E) V

5. Select the structure of the major product in the following reaction.



- (A) cyclopentanol (B) 1-cyclopentylcyclopentane (C) cyclopentanone
(D) cyclopentene (E) 1-(1-hydroxycyclopentyl)-1-hydroxycyclopentane

6. Select the correct reagent(s) for the following reaction:



- (A) LiAlH_4 /ether; then H_3O^+ (B) NaBH_4 ; then H_3O^+ (C) H_2 with Pt/C
(D) Two of these choices. (E) All of these choices.

7. Which of the compounds listed below is more acidic than 1-butanol?

- (A) Diethylmalonate (B) 2-Butanone (C) Ethyl pentanoate
(D) Two of these choices. (E) All of these choices.

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8. How many isomers, including stereoisomers, exist for the triacylglycerol which, on saponification, gives glycerol, 2 molar equivalents of palmitate and 1 molar equivalent of stearate?

- (A) 2 (B) 3 (C) 4 (D) 5 (E) 6

9. Which of the following would **NOT** undergo racemization in base?

- (A) (*R*)-3-methyl-4-heptanone (B) (*R*)-3-methyl-2-heptanone (C) (*R*)-4-methyl-2-heptanone
(D) (*R*)-2,4-dimethyl-3-heptanone (E) All of these choices will undergo racemization in base.

10. Why is CH_3ONa not used in the Claisen condensation of ethyl acetate?

- (A) CH_3O^- is a weaker base than the $\text{CH}_3\text{CH}_2\text{O}^-$ which is used.
(B) $\text{CH}_3\text{O}^-\text{Na}^+$ is more difficult to prepare than $\text{CH}_3\text{CH}_2\text{O}^-\text{Na}^+$.
(C) CH_3O^- would abstract a proton from the ethyl group of the ester.
(D) Use of $\text{CH}_3\text{O}^-\text{Na}^+$ would result in transesterification.
(E) $\text{CH}_3\text{O}^-\text{Na}^+$ can be used as well as $\text{CH}_3\text{CH}_2\text{O}^-\text{Na}^+$.

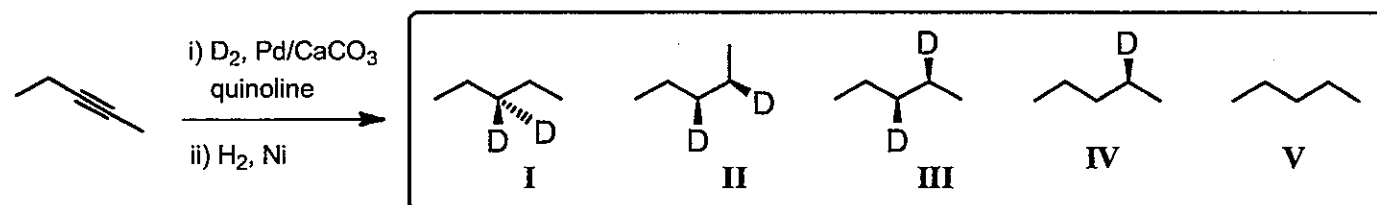
11. A glycoside is a compound which contains the structural features of these classes of organic compounds:

- (A) Aldehydes and alcohols. (B) Acetals and alcohols. (C) Hemiacetals and alcohols.
(D) Ketones and alcohols. (E) Alcohols and carboxylic acids.

12. Which compound would show optical activity?

- (A) *trans*-1,4-Dimethylcyclohexane (B) *cis*-1,4-Dimethylcyclohexane
(C) *trans*-1,4-Dimethylcycloheptane (D) *cis*-1,4-Dimethylcycloheptane
(E) More than one of these choices.

13. Which would be the *major* product of the following reaction sequence?



- (A) I (B) II (C) III (D) IV (E) V

14. In the presence of light, ethane (1 mol) reacts with chlorine (1 mol) to form which product(s)?

- (A) $\text{CH}_2\text{ClCHCl}_2$ (B) CH_3CHCl_2 (C) $\text{CH}_3\text{CH}_2\text{Cl}$
(D) $\text{ClCH}_2\text{CH}_2\text{Cl}$ (E) All of these choices.

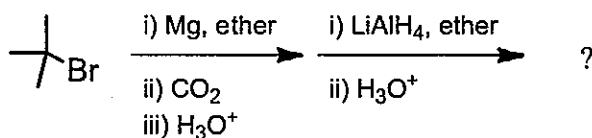
15. Which reagent would serve as the basis for a simple chemical test that would distinguish between the pair of compounds listed below?



- (A) AgNO_3 in H_2O (B) Dilute NaOH (C) Dilute NaHCO_3
(D) $\text{C}_6\text{H}_5\text{SO}_2\text{Cl}/\text{OH}^-$, then H_3O^+ (E) Dilute HCl

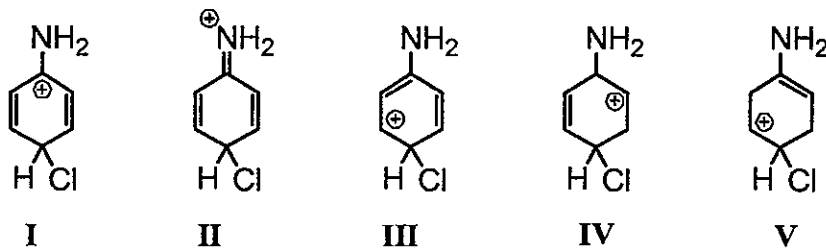
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16. What would be the final organic product of the following reaction?



- (A) $(\text{CH}_3)_3\text{CCO}_2\text{H}$ (B) $(\text{CH}_3)_3\text{CCOCH}_3$ (C) $(\text{CH}_3)_3\text{CCH}_2\text{OH}$
(D) $(\text{CH}_3)_3\text{COCH}_3$ (E) $(\text{CH}_3)_3\text{CCO}_2\text{CH}_3$

17. Which of the following contributors to the resonance stabilized hybrid formed when aniline undergoes *para*-chlorination would be exceptionally stable?

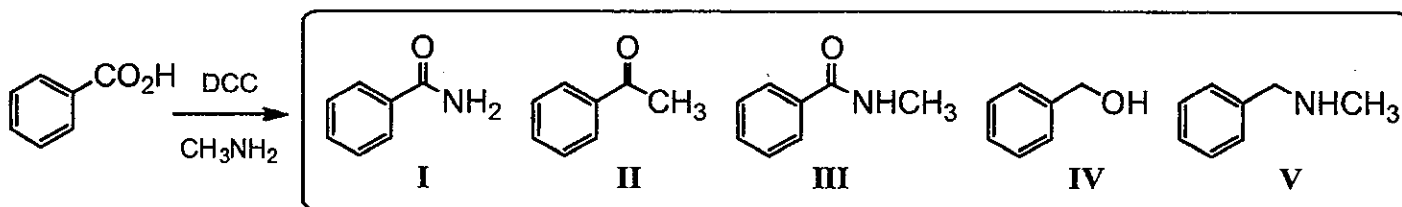


- (A) I (B) II (C) III (D) IV (E) V

18. Which would be the best method for converting 3,3-dimethyl-1-pentene into 3,3-dimethyl-2-pentanol?

- (A) $\text{Hg}(\text{OAc})_2/\text{THF}-\text{H}_2\text{O}$; then $\text{NaBH}_4, \text{OH}^-$ (B) H_3O^+ , heat
(C) concd. H_2SO_4 ; then H_2O , heat (D) $\text{BH}_3:\text{THF}$; then $\text{H}_2\text{O}_2, \text{OH}^-$
(E) HBr ; then $\text{NaOH}/\text{H}_2\text{O}$

19. What would be the final organic product of the following reaction?



- (A) I (B) II (C) III (D) IV (E) V

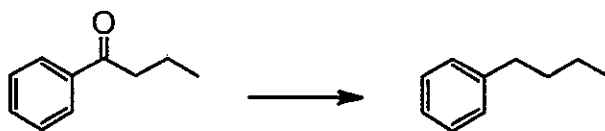
20. Which is the only one of these reagents which will react with benzene under the specified conditions?

- (A) $\text{Cl}_2, \text{FeCl}_3, \text{heat}$ (B) $\text{H}_2, 25^\circ\text{C}$
(C) $\text{Br}_2/\text{CCl}_4, 25^\circ\text{C}, \text{dark}$ (D) $\text{KMnO}_4/\text{H}_2\text{O}, 25^\circ\text{C}$
(E) $\text{H}_3\text{O}^+, \text{heat}$

21. The overall conversion $\text{RBr} \rightarrow \text{RCH}_2\text{NH}_2$ can be accomplished by successive application of which of these sets of reagents?

- (A) Mg, ether ; then NH_3 (B) NaN_3 ; then $\text{LiAlH}_4, \text{ether}$ (C) NaCN ; then $\text{LiAlH}_4, \text{ether}$
(D) $\text{H}_2\text{C}=\text{O}$; then NH_3 (E) H_2NOH ; then $\text{LiAlH}_4, \text{ether}$

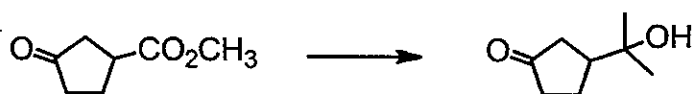
22. Which reagent(s) could be used to carry out the following transformation?



- (A) $\text{Zn}(\text{Hg}), \text{HCl}, \text{reflux}$ (B) $\text{LiAlH}_4, \text{ether}$ (C) $\text{HSCH}_2\text{CH}_2\text{SH}, \text{BF}_3$; then Raney Ni
(D) All of these choices. (E) Two of these choices.

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23. Which sequence of reactions would be utilized to achieve the following conversion?



- (A) 2 CH₃MgBr, then NH₄⁺
 (B) HOCH₂CH₂OH, H₃O⁺; LiAlH₄, ether; 2 CH₃MgBr, then NH₄⁺
 (C) HOCH₂CH₂OH, H₃O⁺; CH₃CH₂MgBr, then NH₄⁺
 (D) HOCH₂CH₂OH, H₃O⁺; H₂, Pt; CH₃OH, NH₄⁺
 (E) None of these choices.

24. The preferred conformation of *cis*-3-*tert*-butyl-1-methylcyclohexane is the one in which:

- (A) the *tert*-butyl group is axial and the methyl group is equatorial.
 (B) the methyl group is axial and the *tert*-butyl group is equatorial.
 (C) both groups are axial
 (D) both groups are equatorial.
 (E) the molecule exists in a boat conformation.

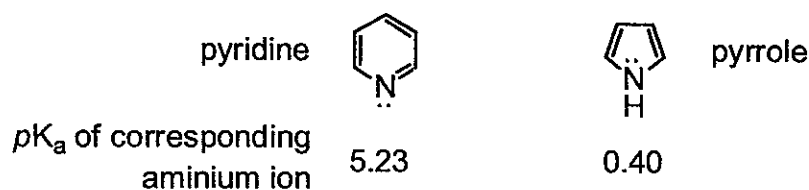
25. What is the chief product of the Friedel-Crafts alkylation of benzene with 1-butene and HF?

- (A) 2-phenylbutane (B) butylbenzene (C) 2-methyl-1-phenylpropane
 (D) *t*-butylbenzene (E) 2,2-diphenylbutane

Part II. 問答題 (5 題, 共 50 分) ※ 注意：請於試卷內之「非選擇題作答區」標明題號依序作答。

1. Please describe the following name reactions; (a) Jones oxidation (4 points), (b) Wittig reaction (4 points), and (c) Clemmensen reduction (4 points).

2. Although pyridine and pyrrole are structurally similar, they show a huge difference in their basicity. The pK_a values of the corresponding aminium ions are given below. Please indicate which one is a stronger base and provide explanation(s) for the discrepancy. (8 points)



3. What is Williamson ether synthesis? Give a specific example and provide a step-by-step mechanism to account for the conversion. (10 points)

4. What is Fischer esterification? Give a specific example and provide a step-by-step mechanism to account for the conversion. (10 points)

5. Provide structures for the following groups; (a) benzyl, (b) benzoyl, (c) methanesulfonyl, (d) isopropyl, and (e) ethoxy. (10 points)

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