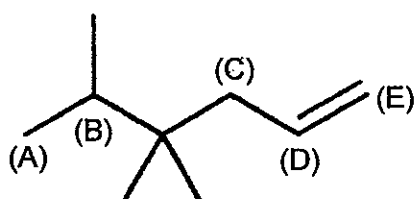
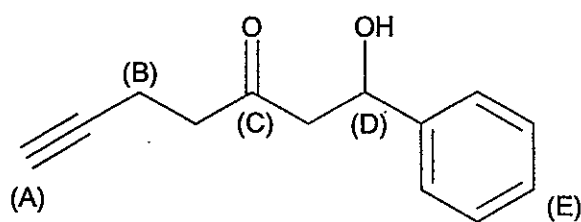


第一部分：單選題（每題 2 分，共 60 分）注意：考生應作答於「答案卡」，並先詳閱答案卡上之「畫記說明」。

1. Which of the following carbons has the weakest C-H bond?



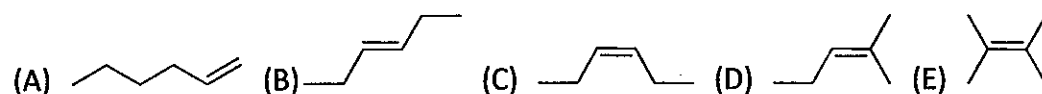
2. Which of the following carbons has the largest  $^{13}\text{C}$  NMR chemical shift?



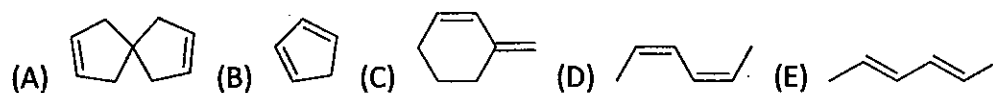
3. Which of the following compounds has the lowest pKa value?

(A) acetone (B) phenol (C) toluene (D) DMF (E) chloroform

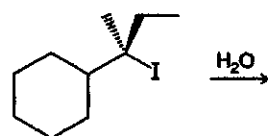
4. Which of the following compounds would release the largest amount of heat per mole from hydrogenation reaction?



5. Which of the following compounds has the highest reactivity in the Diels-Alder reaction with benzoquinone?



6. What type of reaction mechanism would dominate the following reaction?

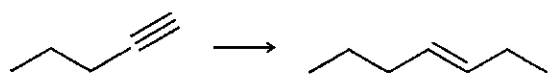


(A)  $\text{S}_{\text{N}}1$  (B)  $\text{S}_{\text{N}}2$  (C)  $\text{E}1$  (D)  $\text{E}2$  (E)  $\text{E}1\text{cb}$

7. Which of the following compounds could not function as a nucleophile?

(A) NaOH (B) NaCN (C)  $\text{NaBH}_4$  (D) NaCl (E) NaH

8. Which of the following is the best set of reagents to carry out the transformation shown below?



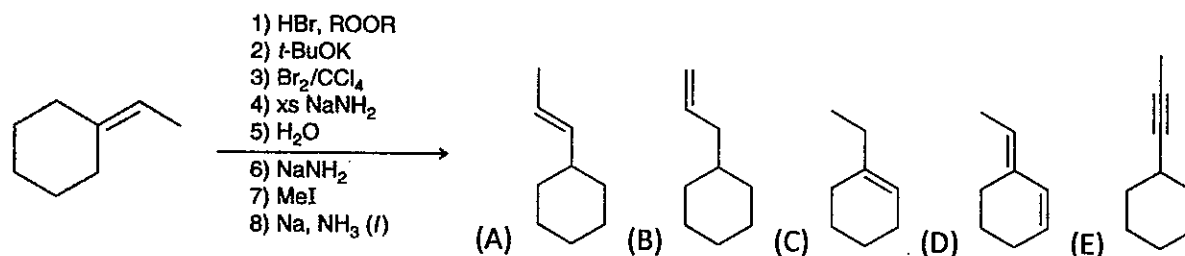
(A) 1) NaOH; 2) EtBr; 3)  $\text{H}_2$ , Pt (B) 1)  $\text{NaNH}_2$ ; 2) EtBr; 3)  $\text{H}_2$ , Lindlar's catalyst (C) 1) EtMgBr; 2) Na,  $\text{NH}_3(\text{liq})$  (D) 1)  $\text{O}_3$ ; 2)  $\text{Et}_2\text{S}$ ; 3)  $\text{H}_2$ , Lindlar's catalyst (E) 1)  $\text{NaNH}_2$ ; 2) EtBr; 3) Na,  $\text{NH}_3(\text{liq})$

見背面

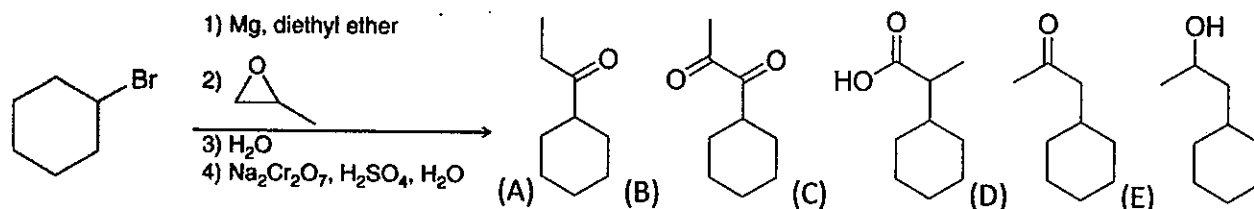
9. Which of the following types of reactions could be either acid-catalyzed or base-catalyzed?

- (A) acetal formation (B) hemiacetal formation (C) enamine formation (D) imine formation  
(E) ether hydrolysis

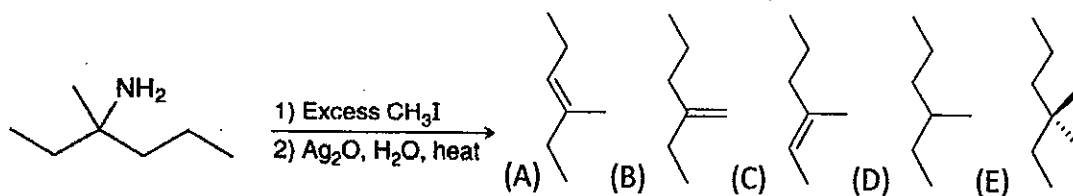
10. What is the major final organic product of the following sequential reactions? (xs = excess)



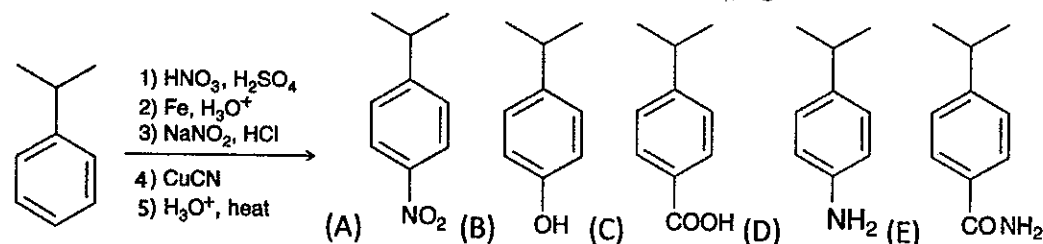
11. What is the major final organic product of the following reactions?



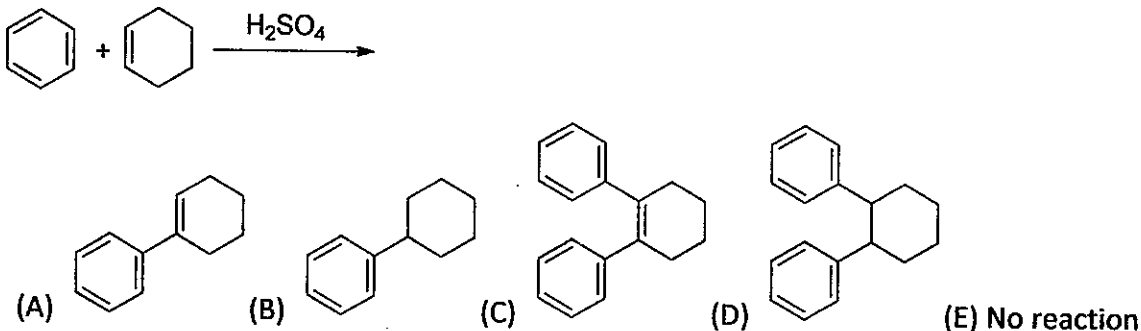
12. What is the major final organic product of the following reactions?



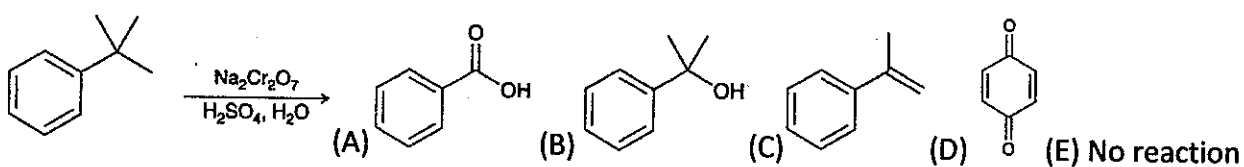
13. What is the major final organic product of the following reactions?



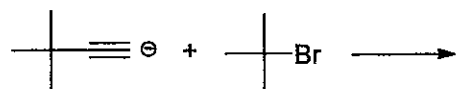
14. What is the major organic product of the following reaction?


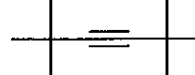
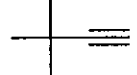


15. What is the major organic product of the following reaction?

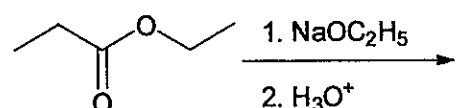


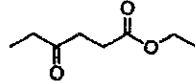
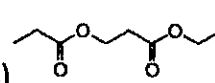
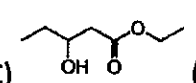
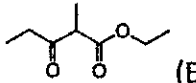
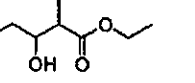
16. What is the major organic product of the following reaction?



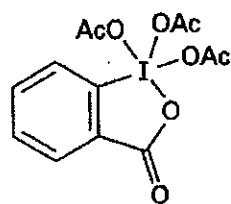
- (A)  (B)  (C)  (D) Both A and C (E) No reaction

17. What is the major organic product of the following reaction?



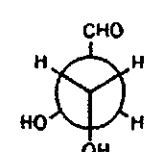
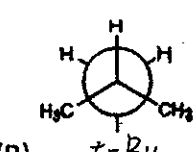
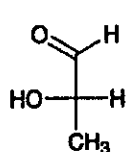
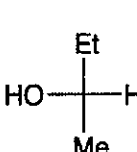
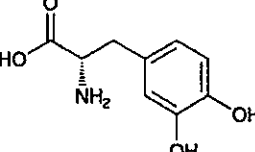
- (A)  (B)  (C)  (D)  (E) 

18. Which of the following reagents could not oxidize ethanol?

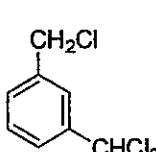
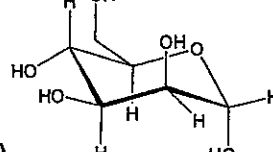
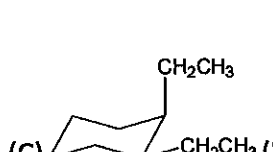
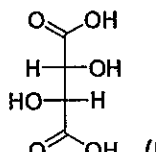
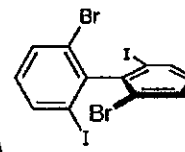


- (A) 1) DMSO, (COCl)<sub>2</sub>; 2) Et<sub>3</sub>N (B) (C) PCC (D) Na<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>, H<sub>2</sub>SO<sub>4</sub> (E) SOCl<sub>2</sub>

19. Which of the following compounds has a chirality center with the *R* configuration?

- (A)  (B)  (C)  (D)  (E) 

20. Which of the following is a *meso* compound?

- (A)  (B)  (C)  (D)  (E) 

21. Which of the following types of compounds could not afford carboxylic acid product upon hydrolysis?

- (A) nitrile (B) triglyceride (C) thioester (D) enamine (E) imide

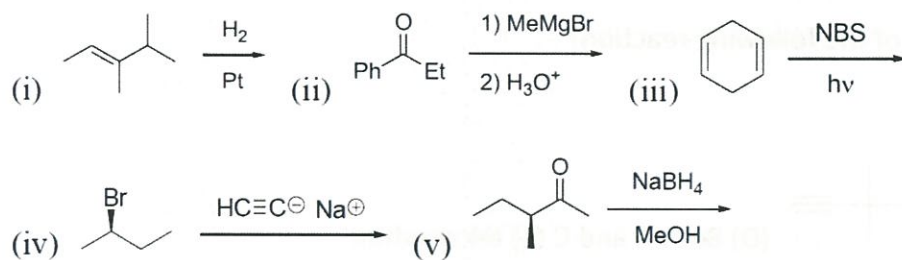
22. Which of the following thermal reactions does not need a catalyst?

- (A) hydrogenation of isopropylene (B) hydration of acetylene (C) cis-trans isomerization of 2-butene  
(D) Wolff-Kishner reduction of acetone hydrazone (E) Cope rearrangement of 3-methyl-1,5-hexadiene

23. Which of the following reagents would not convert an alkene to an alcohol?

- (A) Br<sub>2</sub>, H<sub>2</sub>O (B) (1) Hg(OAc)<sub>2</sub>, H<sub>2</sub>O; (2) NaBH<sub>4</sub> (C) 1) MCPBA; 2) H<sub>3</sub>O<sup>+</sup>  
(D) 1) O<sub>3</sub>; 2) CH<sub>3</sub>SCH<sub>3</sub> (E) 1) BH<sub>3</sub>-THF; 2) H<sub>2</sub>O<sub>2</sub>, NaOH

24. How many of the following reactions give enantiomeric pairs as major products?

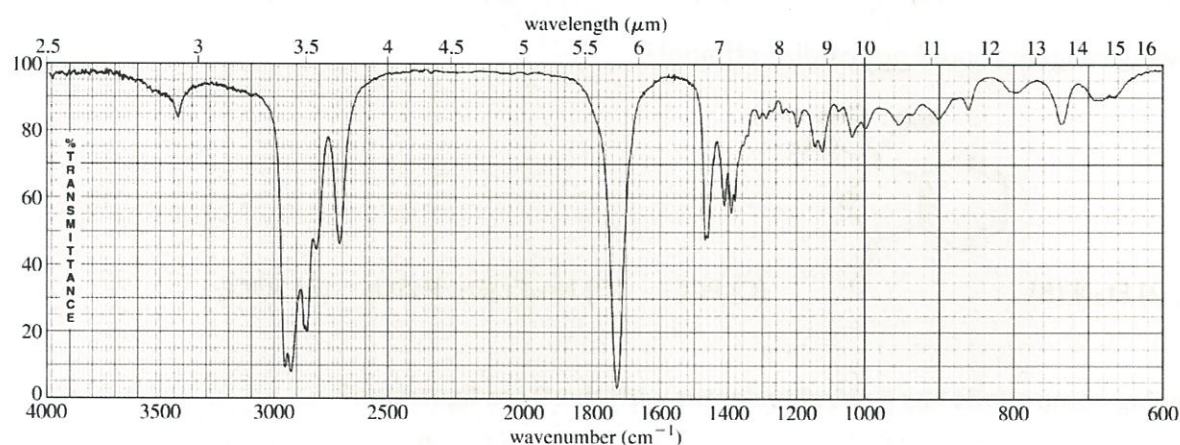


(A) 1 (B) 2 (C) 3 (D) 4 (E) 5

25. Which type of reaction accounts for the oxidation of a primary alcohol to an aldehyde?

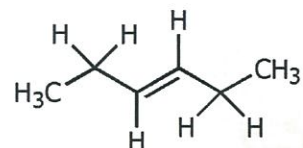
(A) Substitution (B) Addition (C) Elimination (D) Rearrangement (E) Chain reaction

26. What type of compound would best fit the following IR spectrum?



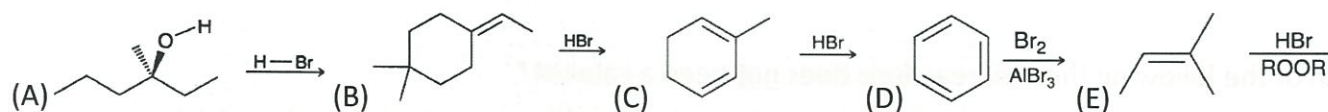
(A) Alkene (B) Alkyne (C) Phenol (D) Aldehyde (E) Amide

27. How many triplet signals are expected for the following compound in <sup>1</sup>H NMR?



(A) 0 (B) 1 (C) 2 (D) 3 (E) 4

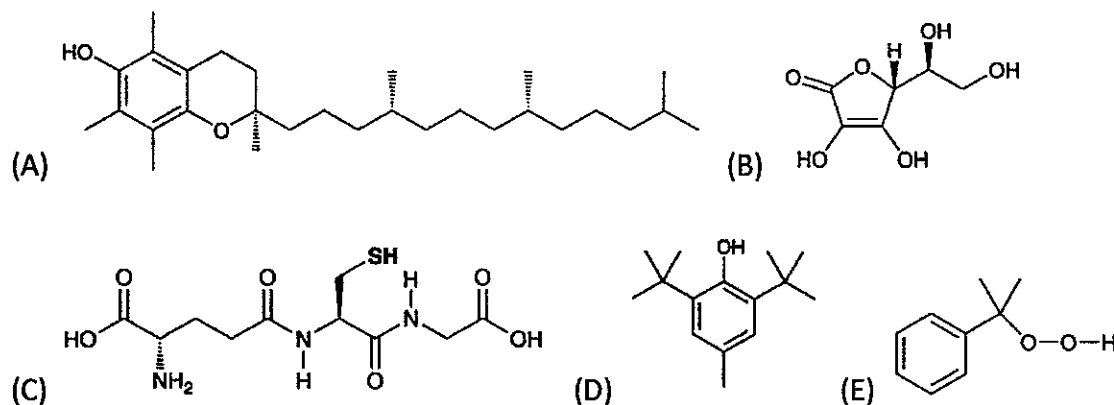
28. Which of the following conditions does not generate carbocation intermediates?



29. Which of the following is the LUMO of 1,3,5-hexatriene?

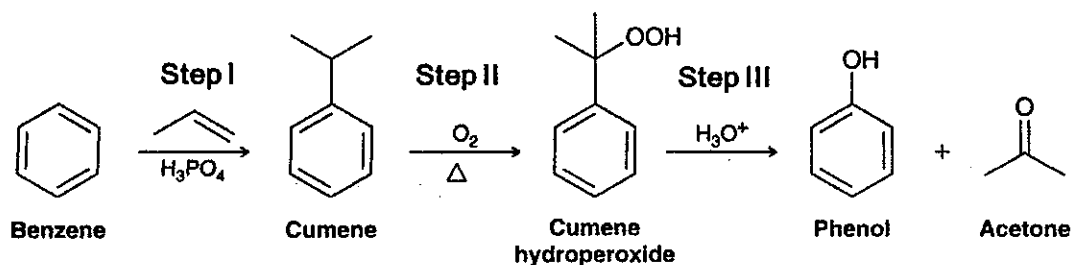


30. Which of the following compounds is not considered as an antioxidant?



第二部分：問答題（2 大題，共 40 分）注意：請於答案卷內之「非選擇題作答區」標明題號依序作答。

31. The cumene process (cumene-phenol process, Hock process) is an industrial process for synthesizing phenol and acetone from benzene and propylene. It consists of three steps of reactions, as shown below:



Answer the following questions:

- Give the IUPAC name of cumene. (2 pts)
- Draw the reaction mechanism (with curved arrows) for step I. (6 pts)
- Draw the reaction mechanism (with curved arrows) for step II. (6 pts)
- Draw the reaction mechanism (with curved arrows) for step III. (hint: a rearrangement that is associated with the leaving of a water molecule occurs) (6 pts)

32. Define (with a couple of sentences) and give a specific example (with chemical structures) for each of the following terms:

- tautomerization (5 pts)
- optically active compound (5 pts)
- radical chain reaction (5 pts)
- antiaromatic compound (5 pts)

(End)

試題隨卷繳回