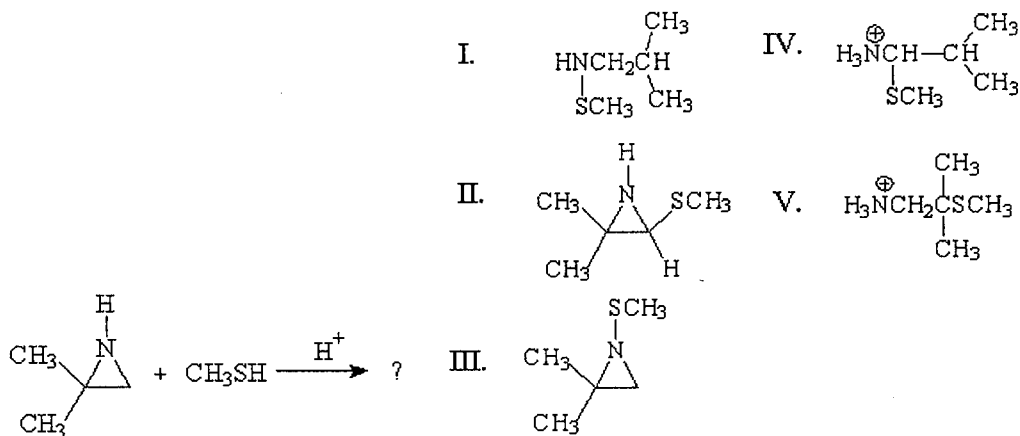


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※請在答案卷內作答

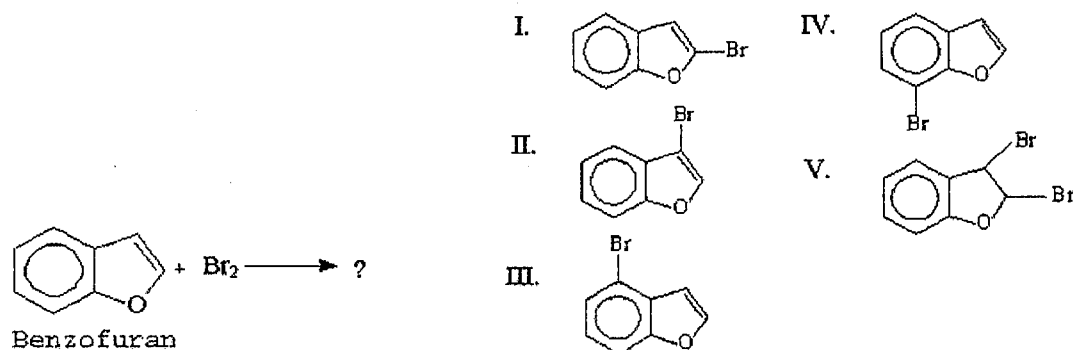
I. Choose the correct answer (2% for each, total 40%)

1. What is the major product of the following reaction?



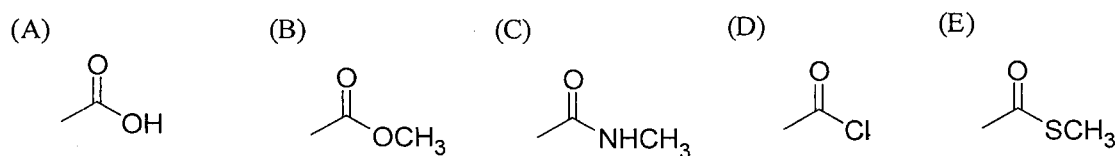
(A) I (B) II (C) III (D) IV (E) V

2. What is the major product of the following reaction?

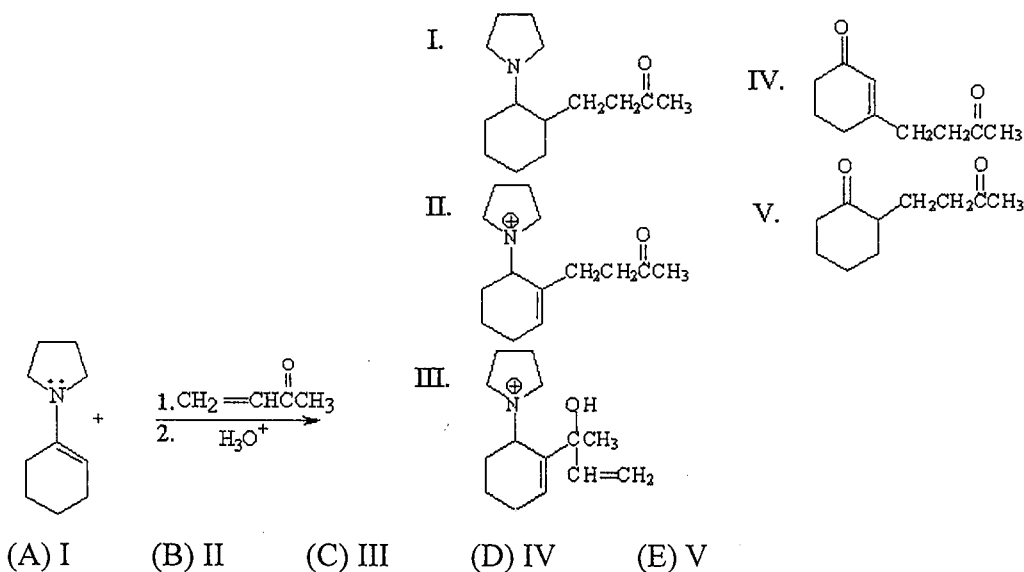


(A) I (B) II (C) III (D) IV (E) V

3. Which of the following carbonyl compounds can be reduced by  $\text{H}_2/\text{Raney Ni}$ ?



4. What is the major organic product from the following reaction?



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

參考用

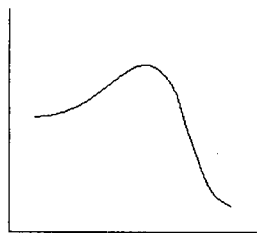
注意：背面有試題

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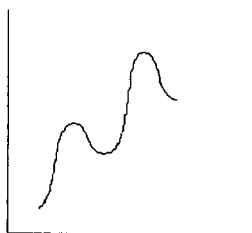
※請在答案卷內作答

5. Which reaction coordinate diagram best represents the reaction that occurs when  $\text{NaNH}_2$  reacts with  $\text{CH}_3\text{COCl}$  to form acetamide?

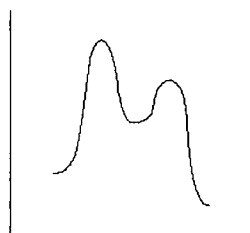
(A)



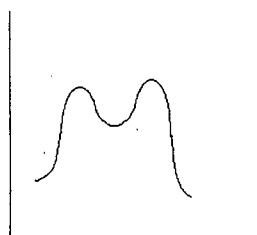
(B)



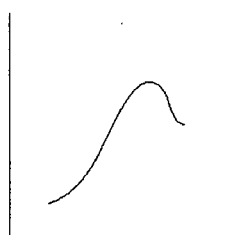
(C)



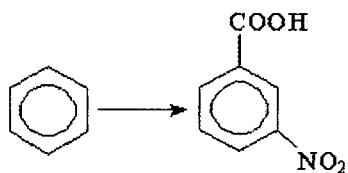
(D)



(E)



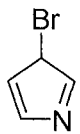
6. Which is the best method for carrying out the following reaction?



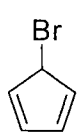
- (A)  $+\text{COOH}$ ;  $\text{HNO}_3/\text{H}_2\text{SO}_4$   
 (B)  $\text{CH}_3\text{Cl}/\text{AlCl}_3$ ;  $\text{KMnO}_4/\text{H}^+$ , heat;  $\text{HNO}_3/\text{H}_2\text{SO}_4$   
 (C)  $\text{CH}_3\text{Cl}/\text{AlCl}_3$ ;  $\text{HNO}_3/\text{H}_2\text{SO}_4$ ;  $\text{KMnO}_4/\text{H}^+$ , heat  
 (D)  $\text{HNO}_3/\text{H}_2\text{SO}_4$ ;  $\text{CH}_3\text{Cl}/\text{AlCl}_3$ ;  $\text{KMnO}_4/\text{H}^+$ , heat  
 (E)  $\text{HNO}_3/\text{H}_2\text{SO}_4$ ;  $+\text{COOH}$

7. Which of the following undergoes solvolysis in water more rapidly?

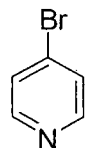
(A)



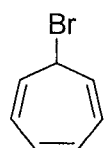
(B)



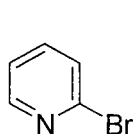
(C)



(D)

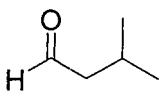


(E)

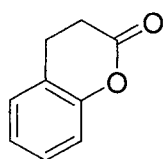


8. Which of the following compounds has a triplet at  $\delta$  9.8 ppm in its  $^1\text{H}$  NMR spectrum?

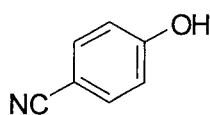
(A)



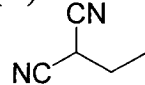
(B)



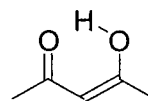
(C)



(D)



(E)



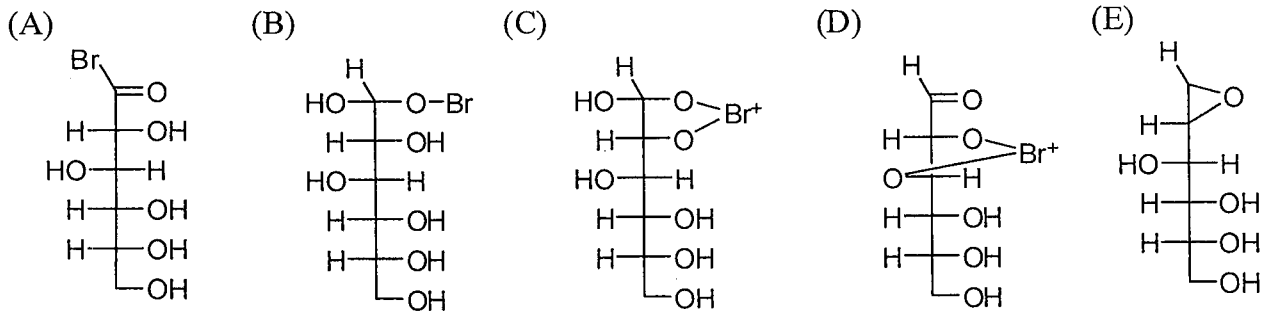
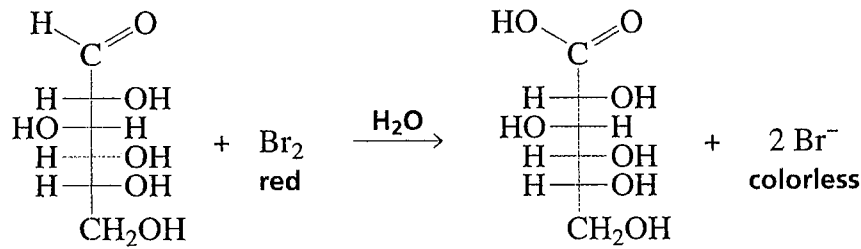
參考用

注意：背面有試題

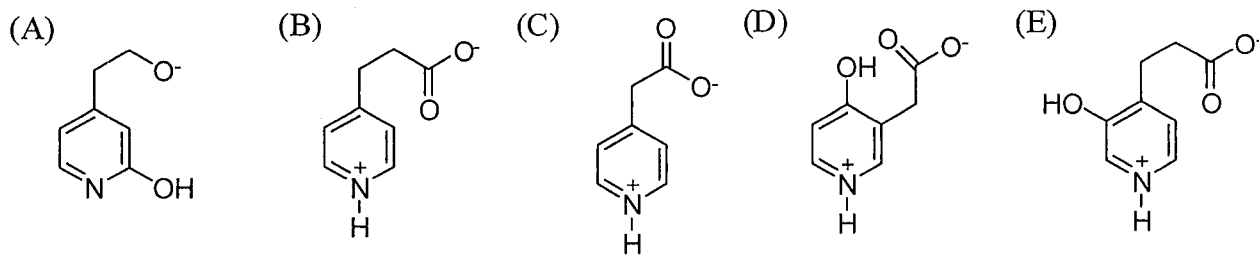
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※請在答案卷內作答

9. What is the intermediate for the following oxidation?

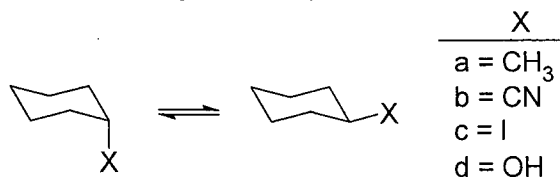


10. Which compound is more easily decarboxylated?



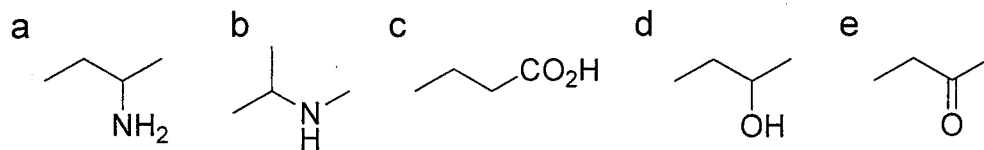
11. Order the  $K_{eq}$ s of the following compounds from the largest one to the smallest one.

$$K_{eq} = \frac{[\text{X at equatorial position}]}{[\text{X at axial position}]}$$



(A) a > d > c > b (B) a > d > b > c (C) a > b > d > c (D) a > c > d > b (E) d > a > b > c

12. List the following compounds from highest boiling point to lowest boiling point.



(A) c > a > d > b > e (B) a > c > d > e > b (C) c > a > e > d > b  
(D) a > d > c > b > e (E) c > d > a > b > e

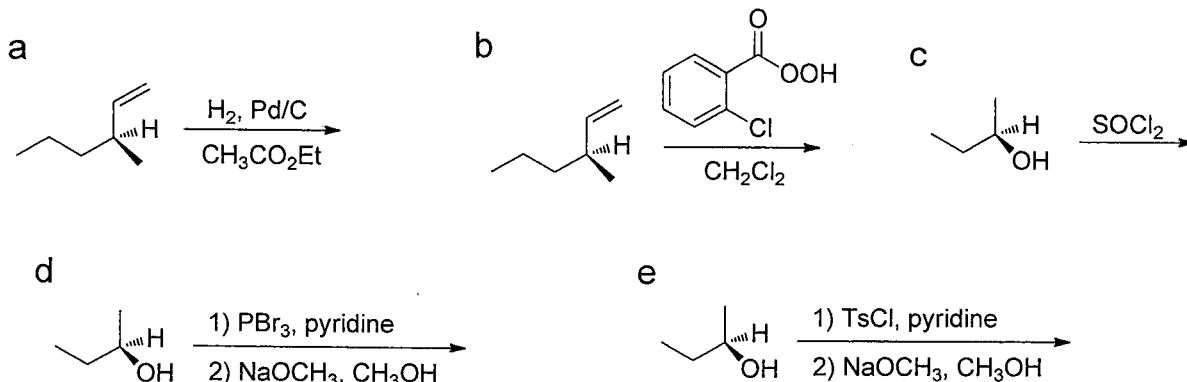
參考用

注意：背面有試題

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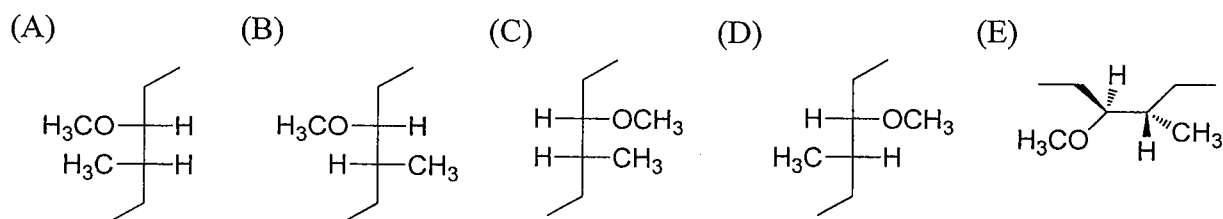
※請在答案卷內作答

13. In the following reactions, the product of which **does not** show the same configuration as reactant.

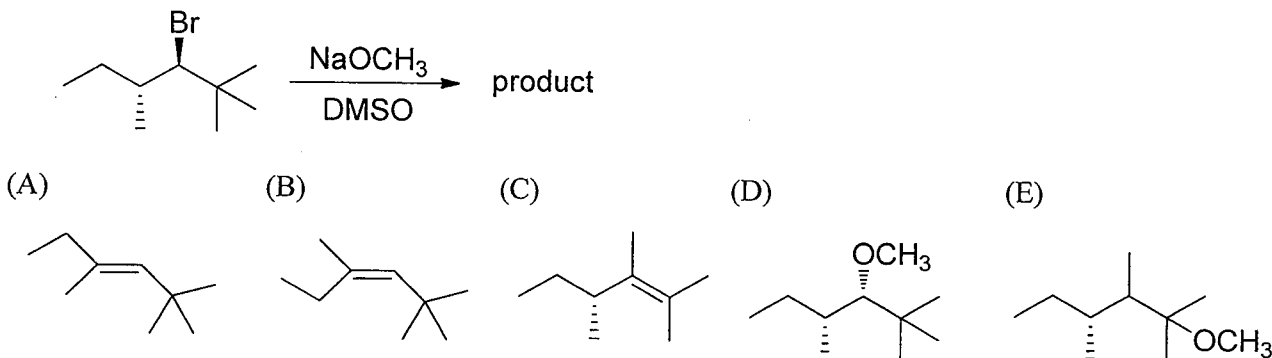


- (A) a, b, d      (B) a, d      (C) d, e      (D) a, d, e      (E) b, d

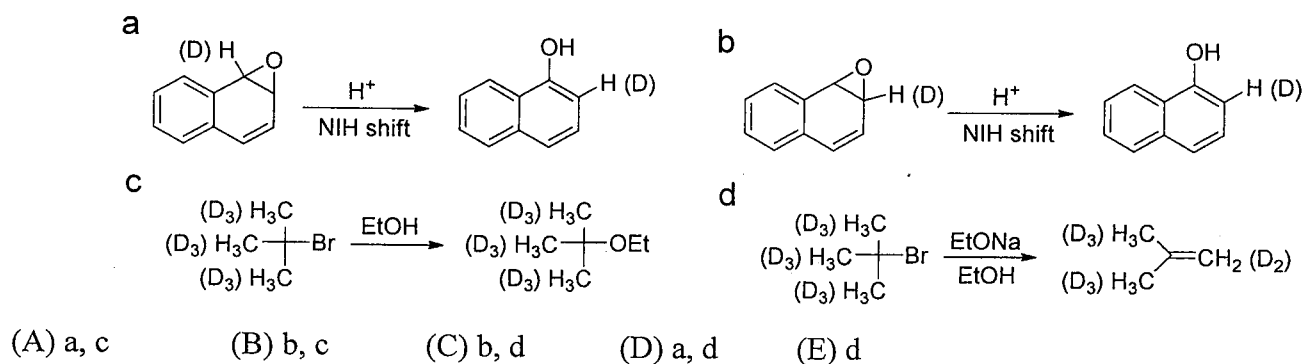
14. The product of  $S_N2$  reaction of (3*S*,4*S*)-3-bromo-4-methylhexane with  $CH_3O^-$  is



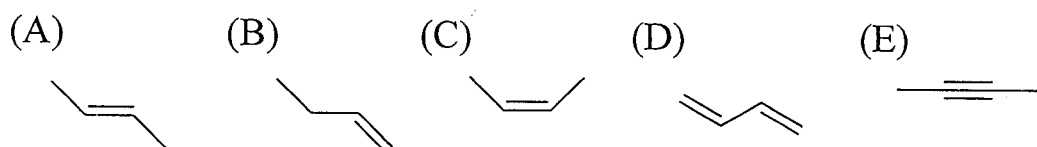
15. Which is the **most possible** reaction product of the following reaction?



16. Which reaction will give  $k_H/k_D > 1$  (showing isotope effect)? ( $k$ : rate constant)



17. Which of the following compound reacts the **fastest** with HBr?



注意：背面有試題

參考用

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※請在答案卷內作答

18. When 3,3-dimethyl-1-butene is respectively treated with the following reagents, which reagent set will give the same product?

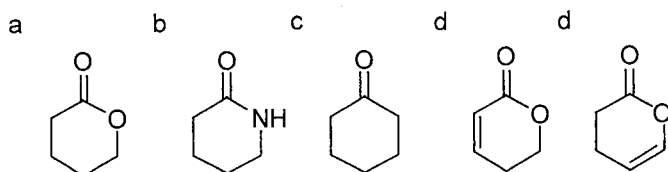
- a. 1)  $\text{Hg}(\text{OAc})_2, \text{H}_2\text{O}/\text{THF}$ ; 2).  $\text{NaBH}_4$
- b.  $\text{H}_2\text{O}, \text{H}_2\text{SO}_4(\text{cat})$
- c. 1).  $\text{BH}_3/\text{THF}$ ; 2).  $\text{H}_2\text{O}_2, \text{NaOH}, \text{H}_2\text{O}$
- d. 1).  $\text{H}_3\text{CCO}_3\text{H}$ ; 2).  $\text{NaH}$  then  $\text{H}^+$
- e 1).  $\text{O}_3, \text{CH}_2\text{Cl}_2, -78^\circ\text{C}$ ; 2).  $\text{Me}_2\text{S}$

- (A) a, b, d      (B) d, e      (C) a, d      (D) a, c, d      (E) b, d

19. Which of the following contributes to make  $\Delta G^\circ$  more negative?

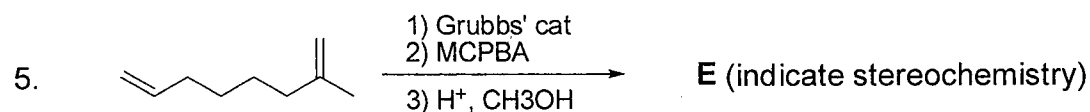
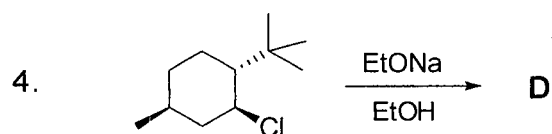
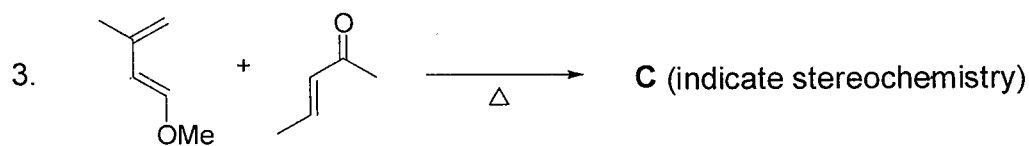
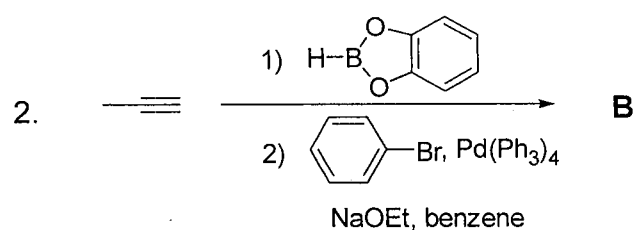
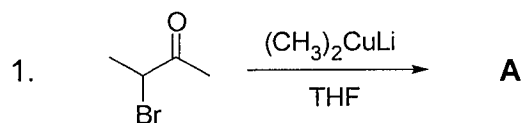
- (A) use of a catalyst
- (B) a more positive  $\Delta H^\circ$
- (C) a more positive  $\Delta S^\circ$
- (D) a larger rate constant
- (E) none of the above

20. Order the C=O stretching vibration of the following compounds from large wavenumber to small wavenumber



- (A)  $a > c > d > e > b$       (B)  $e > a > d > c > b$       (C)  $a > b > d > c > e$   
 (D)  $e > c > b > a > d$       (E)  $d > a > b > c > e$

II. Please provide the major products of the following reactions (3% for each answer, total 33%)



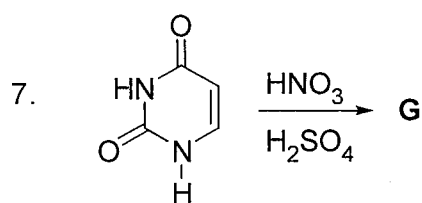
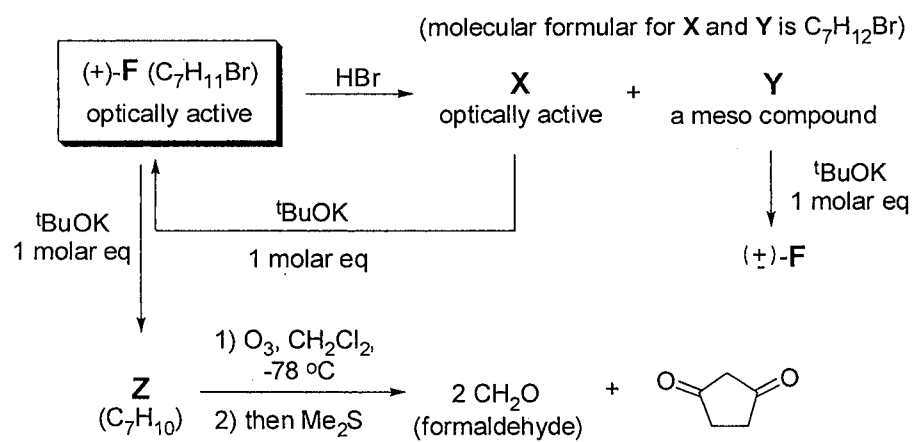
參考用

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※請在答案卷內作答

6. Compound **F** is respectively treated with reagents and the resulting products are shown in the following. Please provide the stereo-structure of compound **F**.



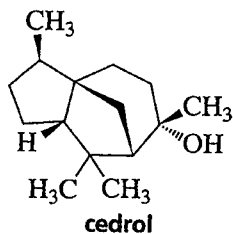
8. (a) An unknown compound-**H** has the formula C<sub>8</sub>H<sub>10</sub>OS, and is known to contain a thiophene ring. The proton NMR spectrum of this compound is:

d 0.98, triplet, 3H; d 1.74, sextet, 2H; d 2.80, triplet, 2H; d 7.04, multiplet, 1H; d 7.55, multiplet, 2H.

What is the structure of this unknown **H**?

(b) How can the unknown **H** be prepared from thiophene?

9. Cedrol-**I** is a terpene that is isolated from essential oils. (a) What class of terpene is it? (b) Mark off the isoprene units in **I**.



10. A decapeptide-**J** undergoes partial hydrolysis to give peptides whose amino acids are shown below. Reaction of the decapeptide with Edman's reagent releases PTH-leu. What is the sequence of the decapeptide-**J**?

- |                   |                        |
|-------------------|------------------------|
| (1) Pro, Ser      | (5) Glu, Ser, Val, Pro |
| (2) Gly, Gly      | (6) Glu, Pro, Gly      |
| (3) Met, Ala, Leu | (7) Met, Leu           |
| (4) Gly, Ala      | (8) His, Val           |

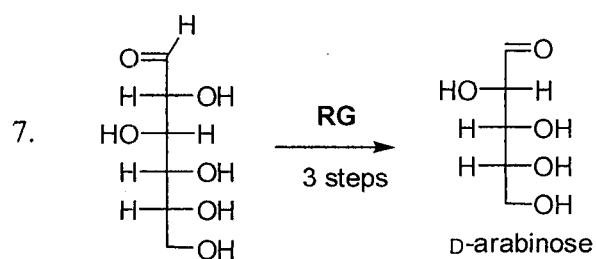
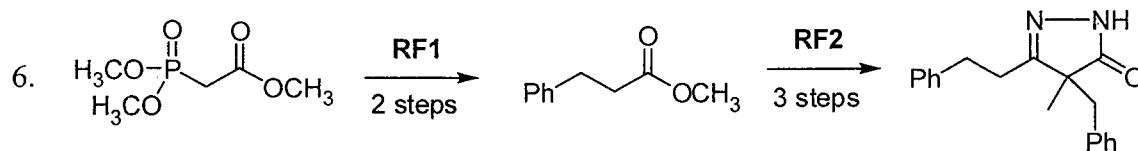
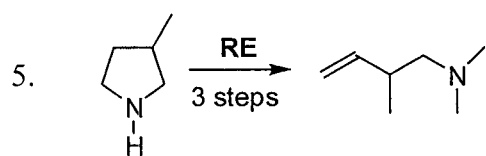
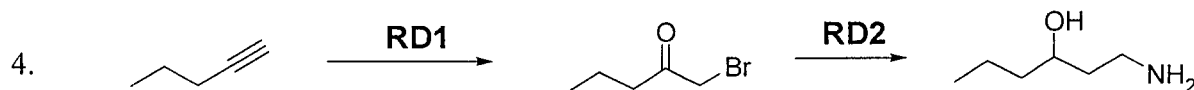
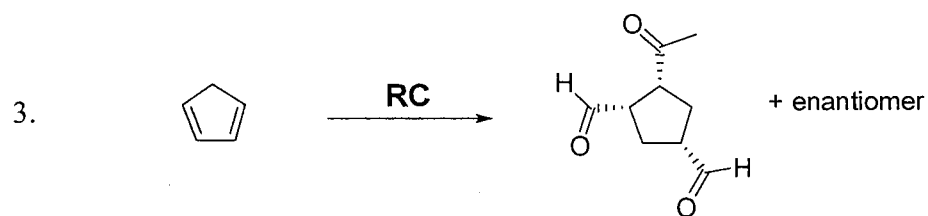
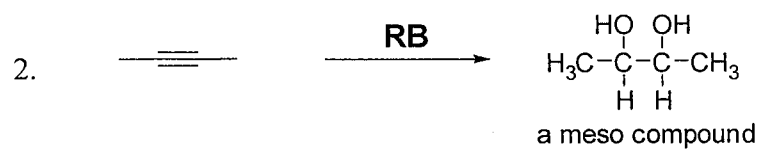
參考用

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III. Please provide a suitable reagent or a set of reagents for the following transformations (3% for each answer, total 27%)



參考用