

# 國立成功大學

## 112學年度碩士班招生考試試題

編 號：260

系 所：生物化學暨分子生物學研究所

科 目：有機化學

日 期：0207

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。

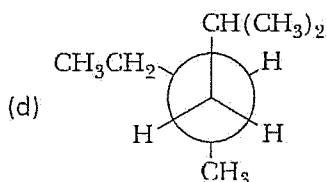
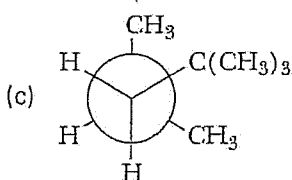
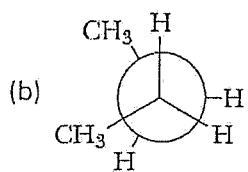
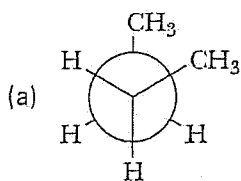
1. In each pair, select the stronger acid: (6 points)

(a) Citric acid ( $pK_{a1}$  3.08) or phosphoric acid ( $pK_{a1}$  2.10)

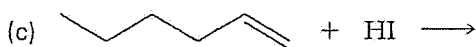
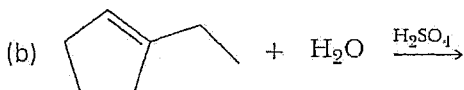
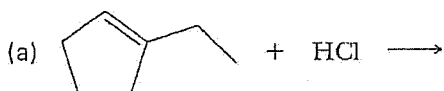
(b) Nicotinic acid (niacin,  $K_a$   $1.4 \times 10^{-5}$ ) or acetylsalicylic acid (aspirin,  $K_a$   $3.3 \times 10^{-4}$ )

(c) Phenol ( $K_a$   $1.12 \times 10^{-10}$ ) or acetic acid ( $K_a$   $1.74 \times 10^{-5}$ )

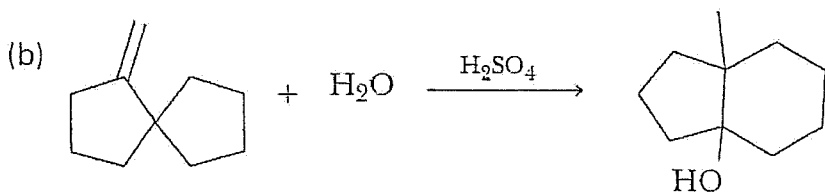
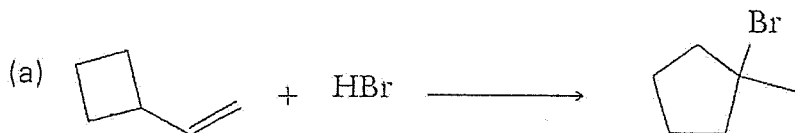
2. Please draw the most stable conformation of each of the following Newman projections of that molecule: (8 points)



3. Complete these equations by predicting the major product formed in each reaction: (6 points)

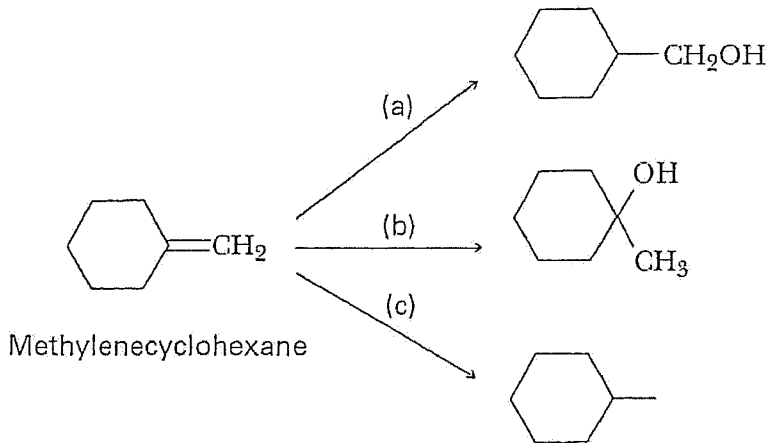


4. Propose a mechanism for each of the following transformations. (6 points)

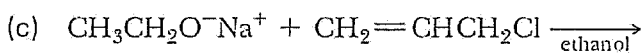
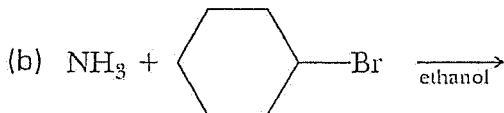
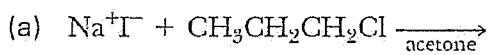


5. Lactose exists in  $\alpha$  and  $\beta$  forms, with specific rotations of  $192.6^\circ$  and  $134^\circ$ , respectively. Solutions of each isomer mutarotate to an equilibrium value of  $152^\circ$ . What is the percentage of each isomer at equilibrium? (5 points)

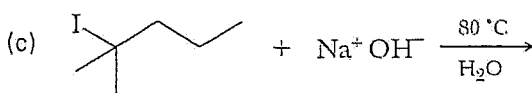
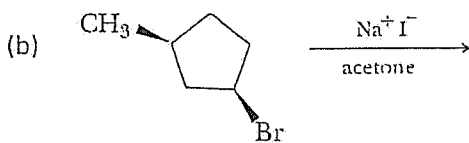
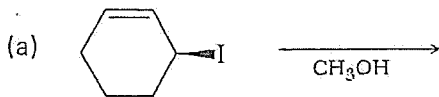
6. Show how to convert methylenecyclohexane into each of these compounds. (6 points)



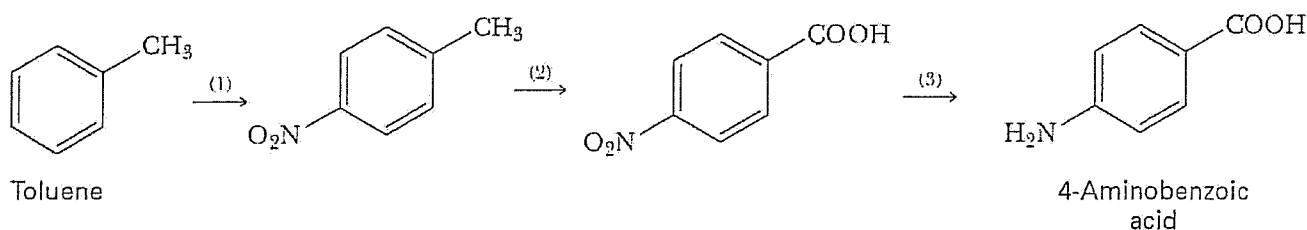
7. Complete these  $S_N2$  reactions: (6 points)



8. Complete these reactions by determining the type of reaction and mechanism ( $S_N1$ ,  $S_N2$ ,  $E_1$ , or  $E_2$ ) that they undergo. (9 points)



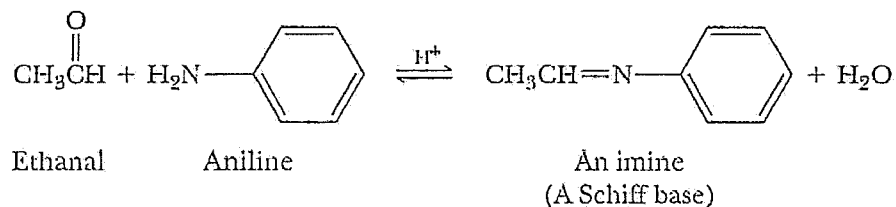
9. 4-Aminobenzoic acid is a building block in the synthesis of the topical anesthetic benzocaine. Show how this building block can be synthesized in three steps from toluene: (6 points)



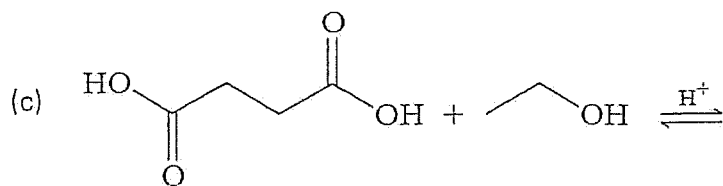
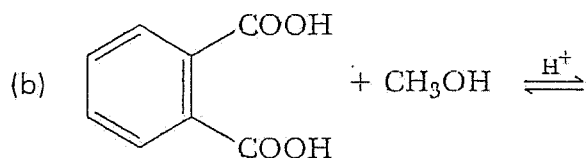
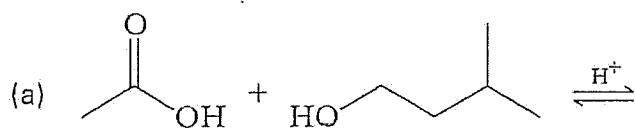
10. 5-Hydroxyhexanal forms a six-membered cyclic hemiacetal that predominates at equilibrium in aqueous solution: (6 points)

- Draw a structural formula for this cyclic hemiacetal.
- How many stereoisomers are possible for 5-hydroxyhexanal?
- How many stereoisomers are possible for the cyclic hemiacetal?

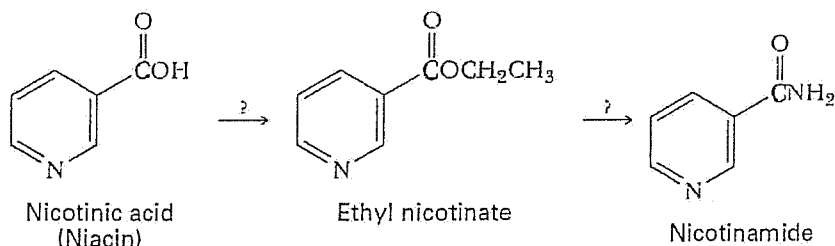
11. Please draw the mechanism of the following reaction. (4 points)



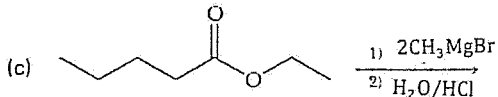
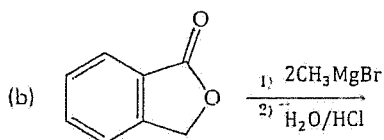
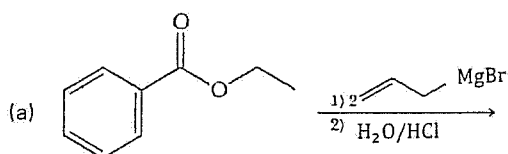
12. Complete these examples of Fischer esterification (assume an excess of the alcohol): (6 points)



13. Nicotinic acid, more commonly named niacin, is one of the B vitamins. Show how nicotinic acid can be converted to ethyl nicotinate and then to nicotinamide: (6 points)



14. Complete these reactions. (6 points)



15. Which disaccharides are reduced by  $\text{NaBH}_4$ ? (4 points)

- (a) Sucrose
- (b) Lactose
- (c) Maltose

16. Draw zwitterion forms of these amino acids. (6 points)

- (a) Valine
- (b) Phenylalanine
- (c) Glutamine

17. Do the following compounds migrate to the cathode or the anode on electrophoresis at the specified pH? (4 points)

- (a) Histidine at pH 6.8
- (b) Lysine at pH 6.8
- (c) Glutamic acid at pH 4.0
- (d) Glutamine at pH 4.0