

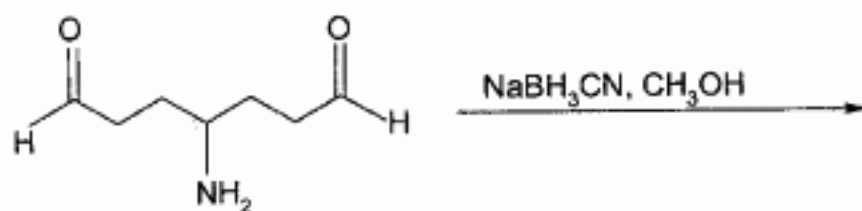
國立清華大學命題紙

九十三年學年度 原子科學 系(所) 甲、乙 組碩士班入學考試

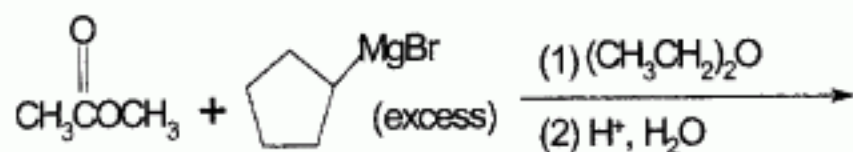
科目 有機化學 科號 3504 3603 共 7 頁第 1 頁*請在試卷【答案卷】內作答

1. Predict the structure, including stereochemistry when necessary, of the major reaction products for each of the following reactions. (40 %)

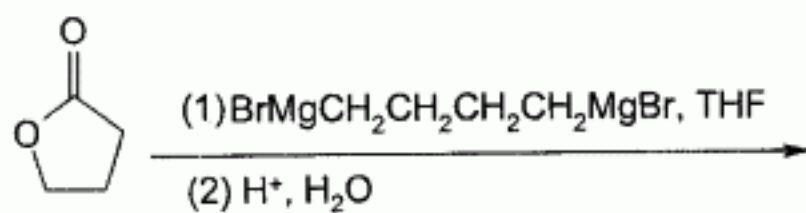
(a)



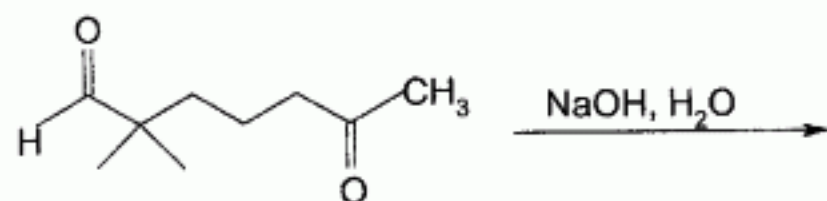
(b)



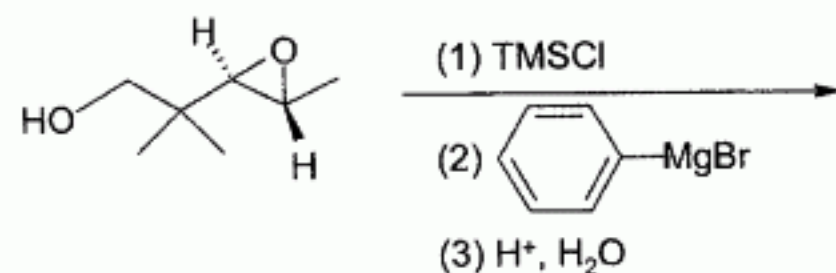
(c)



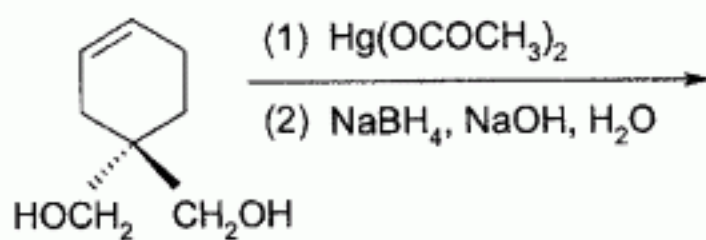
(d)



(e)



(f)



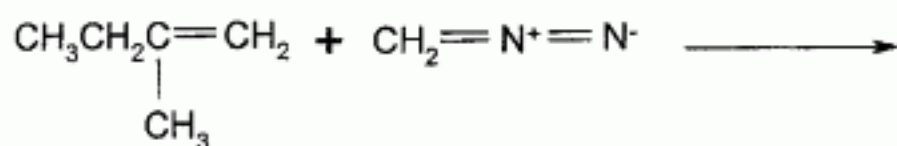
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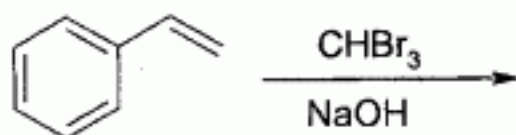
3504

科目 有機化學 科號 3603 共 7 頁第 2 頁*請在試卷【答案卷】內作答

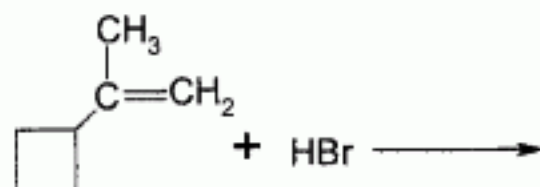
(g)



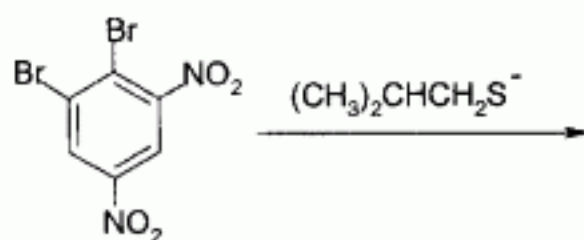
(h)



(i)



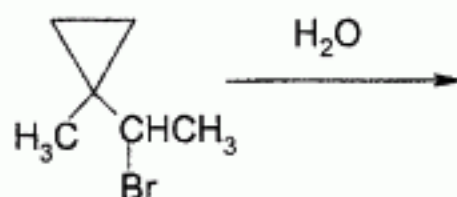
(j)



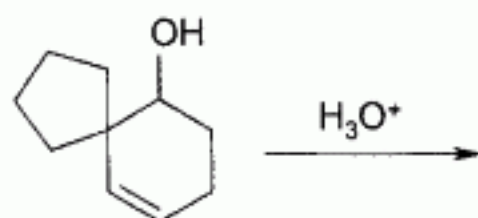
(k)



(l)



(m)

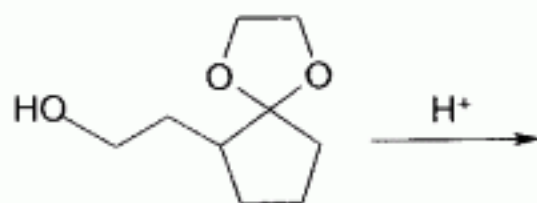


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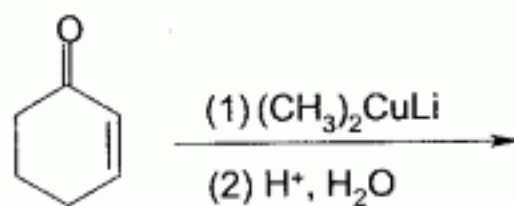
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科目 有機化學 科號 3504 3603 共 7 頁第 3 頁*請在試卷【答案卷】內作答

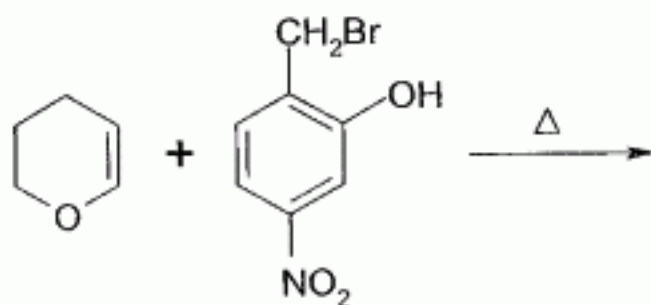
(n)



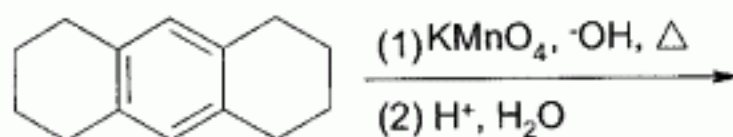
(o)



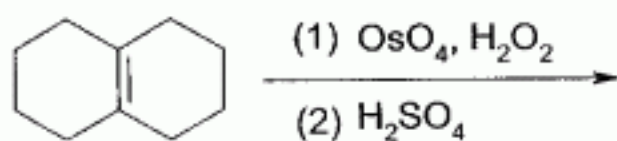
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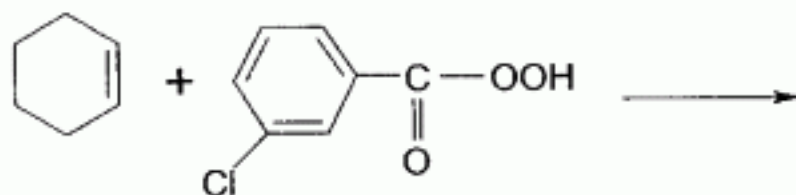
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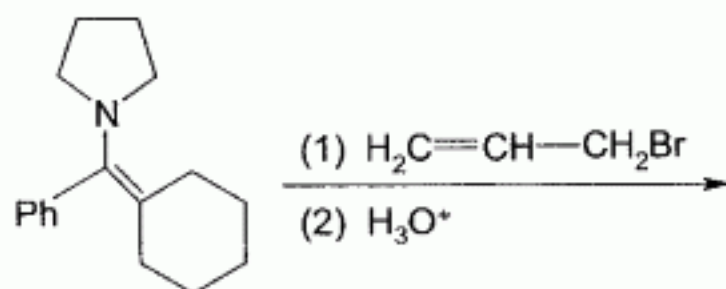
(r)



(s)



(t)



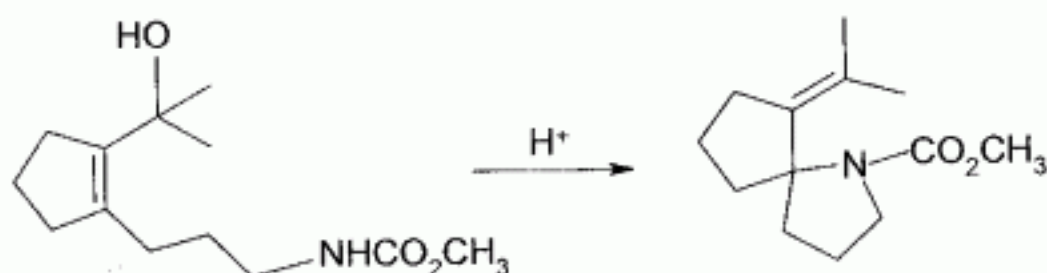
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九十三年學年度 原子科學 系(所) 甲、乙 組碩士班入學考試

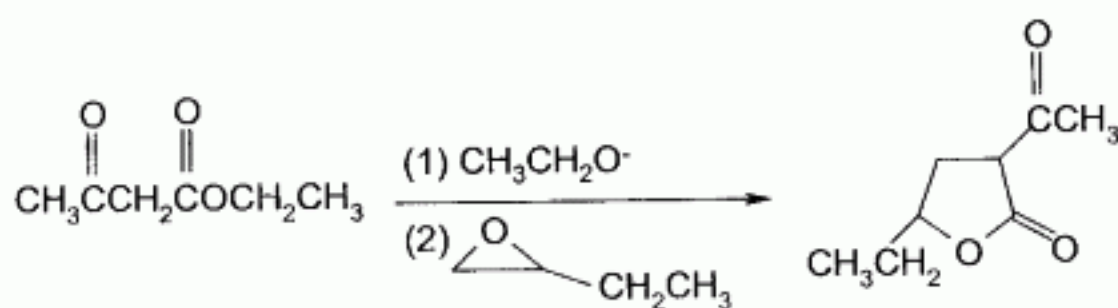
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2. Please provide a detailed, step-by-step mechanism for the following reactions. (24%)

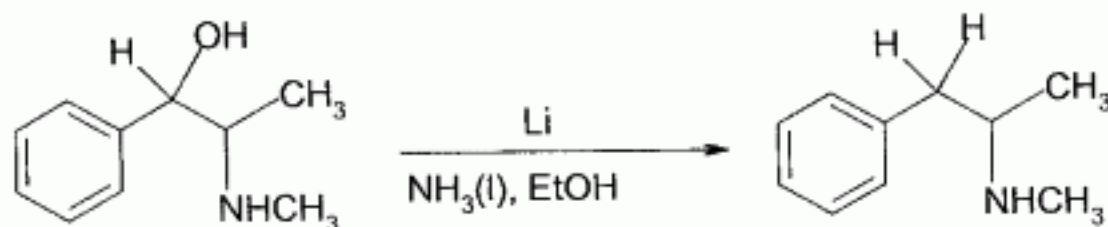
(a)



(b)

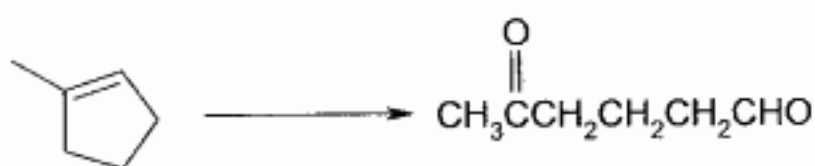


(c)



3. Indicate which reagent or combination of reagents is best suited for each of the following reactions. (10%)

(a)



(b)



(c)



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(d)



(e)



4. Deduce the identity of the compound from the data provided below. (6%)

$C_{10}H_{14}O$: IR (cm^{-1}): 3200 – 3500 (broad), 3050, 2950, 1610.

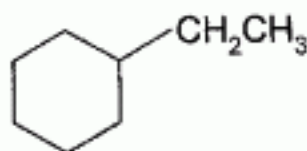
1H NMR (ppm): 1.0 (6H, singlet), 2.0 (3H, singlet), 2.8 (1H, broad singlet), 7.3 (2H, doublet), 7.6 (2H, doublet).

5. Explain why all substituents of the substituted benzenes that donate electrons by resonance are ortho/para directors and all substituents with a positive charge or a partial positive charge on the atom attached to the benzene ring are meta directors. (5 %)

6. Most of the pK_a values of organic compounds are determined in water. How would the pK_a values of the following classes of compounds change if they were determined in a solvent less polar than water: carboxylic acid, alcohols, phenols, ammonium ions (RNH_3^+), and anilinium ions ($C_6H_5NH_3^+$). (5 %)

7. Multiple choices (10%)

(a) How many products are formed from the monochlorination of ethylcyclohexane? Please ignore stereoisomers.



(1) 6

(2) 8

(3) 5

(4) 9

(5) 11

(b) Which of the following statements concerning S_N2 reaction of alkyl halide is **not** correct?

(1) The rate of reaction depends on the concentration of the nucleophile.

(2) The rate of reaction depends on the concentration of the alkyl halide.

(3) The reaction kinetics follows second order rate kinetics.

(4) All alkyl iodides react more rapidly than all alkyl chlorides.

(5) The rate of reaction depends on the relative nucleophilicity of the nucleophile.

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(c) Which of the following functional groups will exhibit no IR absorption at $1630 - 1780 \text{ cm}^{-1}$ or at $3200 - 3550 \text{ cm}^{-1}$?

- (1) an alcohol (2) an amide (3) a ketone
(4) an aldehyde (5) an ester

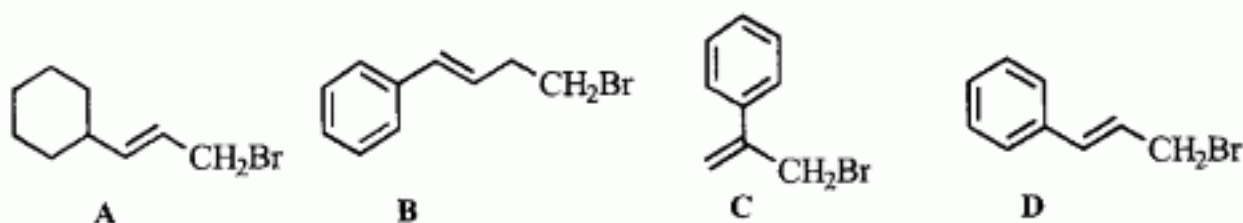
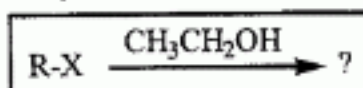
(d) Which of the following solvents could be described as polar and protic?

- (1) ethanol (2) acetonitrile (3) dimethylformamide (DMF)
(4) acetone (5) 18-crown-6

(e) Lithium aluminum hydride reduces carboxylic acid to primary alcohols via what intermediates?

- (1) a ketone (2) a methyl ester (3) an aldehyde
(4) a secondary alcohol (5) an acid chloride

(f) In order of decreasing reactivity, how would the bromides below rank in the following reaction?



- (1) $B > A > D > C$ (2) $D > B > A > C$ (3) $A > C > D > B$
(4) $D > A > C > B$ (5) $C > D > B > A$

(g) When 1,3-cyclopentadiene reacts with the cis-isomer of $\text{NCCH}=\text{CHCN}$, the major product is

- (1) optically active. (2) a meso compound. (3) a racemic mixture.
(4) a spirocyclic compound. (5) a fused bicyclic compound.

(h) Which of the following alcohols will react most rapidly with the Lucas reagent?

- (1) $(\text{CH}_3)_3\text{COH}$ (2) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$ (3) $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CH}_3$
(4) $(\text{CH}_3)_2\text{CHCH}_2\text{OH}$ (5) $(\text{CH}_3)_2\text{CHCH}(\text{OH})\text{CH}_3$

(i) Why do acetal-forming reactions that use ethylene glycol have more favorable equilibrium constants than those using methanol?

- (1) ethylene glycol reacts more rapidly.

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- (2) They are more favorable on entropy grounds.
 - (3) They are more favorable on enthalpy grounds.
 - (4) Ethylene glycol is acidic and catalyzes the reaction.
 - (5) The ethylene acetal can serve as a protecting group.
- (j) In the addition of an electrophile to acetophenone, which of the following best describes the expected mode of reaction?
- (1) The *o*, *p*-positions are most activated to attack by the electrophile.
 - (2) The *m*-positions are most activated to attack by the electrophile.
 - (3) The *o*, *p*-positions are most deactivated to attack by the electrophile.
 - (4) The *m*-positions are most deactivated to attack by the electrophile.
 - (5) All positions are equally activated to attack by the electrophile