

靜宜大學 103 學年度碩士班招生考試試題

學系：應用化學系

科目：有機化學

一 單選題(2 points each, 40%)

- Which of the following statements is (are) true for the compound (*R*)-2-butanol?
(A) This compound is chiral. (B) This compound is optically active.
(C) This compound has an enantiomer. (D) all of the above (E) none of the above
- Which alcohol reacts most rapidly with the Lucas reagent?
(A) benzyl alcohol (B) methanol (C) 2-propanol
(D) isobutanol (E) phenol
- What term describes the structural relationship between cis-1,2-dimethylcyclopentane and trans-1,3-dimethylcyclopentane?
(A) not isomers (B) conformers (C) constitutional isomers
(D) enantiomers (E) diastereomers
- Which of the following undergoes solvolysis in methanol most rapidly?
(A) PhCH₂Br (B) Ph₃CBr (C) PhCH₂CH₂Br
(D) PhBr (E) PhCH₂CH₂CH₂Br
- In electrophilic aromatic substitution reactions a bromine substituent:
(A) is a deactivator and a *m*-director. (B) is a deactivator and an *o,p*-director.
(C) is an activator and a *m*-director. (D) is an activator and an *o,p*-director.
(E) none of the above
- Which of the following is also known as a Schiff base?
(A) an imine (B) a cyanohydrin (C) a hydrate (D) an amine (E) an aldehyde
- An ylide is a molecule that can be described as a:
(A) carbanion bound to a negatively charged heteroatom
(B) carbocation bound to a positively charged heteroatom
(C) carbocation bound to a carbon radical
(D) carbocation bound to a diazonium ion
(E) carbanion bound to a positively charged heteroatom
- Which of the following transitions is usually observed in the UV spectra of ketones?
(A) n to π^* (B) n to π (C) σ to n (D) σ to σ^* (E) n to σ^*

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9 Which of the following compounds will react most rapidly when treated with $\text{CH}_3\text{CH}_2\text{Cl}$ and AlCl_3 ?

- (A) benzene (B) toluene (C) butane (D) anisole (E) chlorobenzene

10 The positively polarized carbon atom of a carbonyl group acts as:

- (A) an electrophile and a Lewis base (B) a nucleophile and a Lewis base
(C) an electrophile and a Lewis acid (D) a nucleophile and a Lewis acid
(E) both a Lewis acid and a Lewis base

11 Which of the following amines is most basic?

- (A) aniline (B) *N*-ethylaniline (C) *N,N*-diethylaniline
(D) piperidine (E) pyrrole

12 An unknown compound is insoluble in water but dissolves in sodium bicarbonate with a release of carbon dioxide bubbles. The compound is almost certainly:

- (A) an amine (B) an aldehyde (C) a carboxylic acid
(D) an alkyl chloride (E) an alcohol

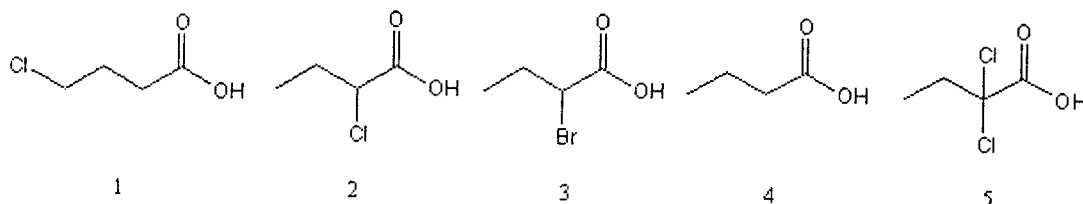
13 What alkyllithium would react with acetic acid to form 2-butanone?

- (A) methyl lithium (B) vinyl lithium (C) phenyl lithium
(D) ethyl lithium (E) propyl lithium

14 Which of the following conditions will drive the equilibrium of the Fischer esterification towards ester formation?

- (A) addition of water (B) removal of water as it is formed (C) addition of alcohol
(D) addition of an inorganic acid as a catalyst (E) both B and C

15 List the following weak acids in order of increasing acidity



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

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16 Which of the following represents the correct ranking in terms of increasing boiling point?

- (A) *n*-butane < 1-butanol < diethyl ether < 2-butanone
- (B) *n*-butane < 2-butanone < diethyl ether < 1-butanol
- (C) 2-butanone < *n*-butane < diethyl ether < 1-butanol
- (D) *n*-butane < diethyl ether < 1-butanol < 2-butanone
- (E) *n*-butane < diethyl ether < 2-butanone < 1-butanol

17 What type of product results when 3-pentanone reacts with dimethylamine?

- (A) enolate (B) enol (C) imine (D) amide (E) enamine

18 Methylamine reacts with acetophenone to yield the

- (A) iminium salt (B) imine (C) acetal (D) amide (E) enamine

19 Which of the following will alkylate a lithium enolate most rapidly?

- (A) methyl bromide (B) isopropyl bromide (C) neopentyl bromide
- (D) bromobenzene. (E) 2-methylbromobenzene

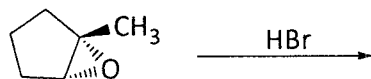
20 The relationship between ketones and their corresponding enols is one of

- (A) allotropes (B) tautomers (C) enantiomers
- (D) diastereomers. (E) *cis-trans* isomers

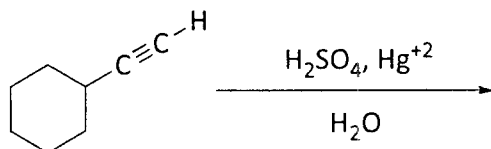
二 非選擇題(60%)

1 Provide the major organic product in the reaction below. (20%)

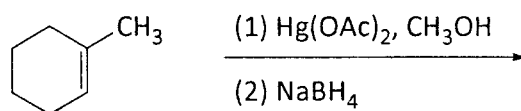
(a)



(b)



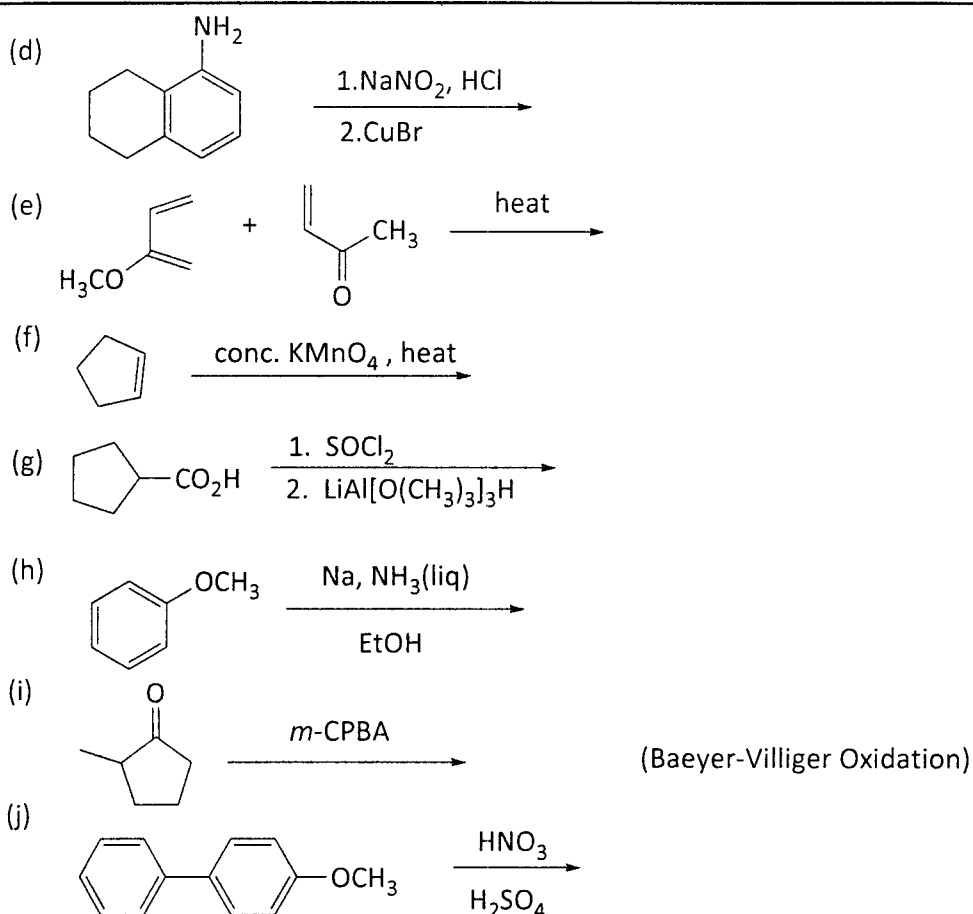
(c)



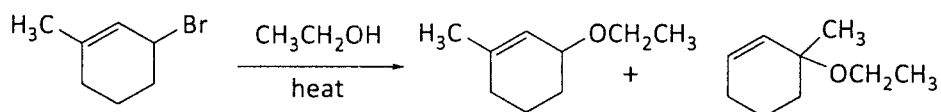
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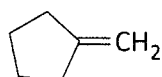
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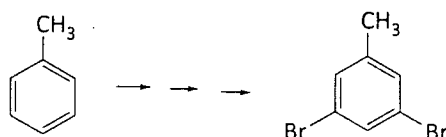
- 2 When 3-bromo-1-methylcyclohexene undergoes solvolysis in hot ethanol, two products are formed. Propose a mechanism that accounts for both of these products. (10%)



- 3 In addition to triphenylphosphine, assume that you have available as starting materials any necessary aldehydes, ketones, and organic halides. Show how you might synthesize each of the following alkenes using the Wittig reaction: (5%)



- 4 Show how you would convert toluene to 3,5-dibromotoluene in good yield? (5%)



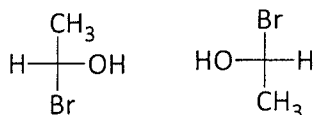
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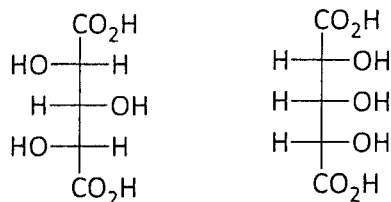
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5 For each of the following sets of structures, indicate whether they are tautomers, constitutional isomers, enantiomers, diastereomers, conformation isomers, or the same molecules? (10%)

(a)



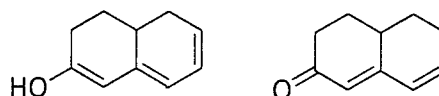
(b)



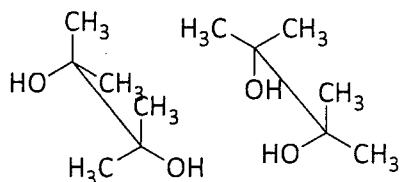
(c)



(d)



(e)



6 The proton NMR spectrum for a compound with formula $C_5H_{10}O_3$ is shown below. The normal carbon-13 NMR spectrum has four peaks. The infrared spectrum has a strong band at 1728 cm^{-1} . Draw the structure of this compound. (10%)

Normal Carbon	DEPT-135	DEPT-90
25 ppm	Positive	No peak
55	Positive	No peak
104	Positive	Positive
204	No peak	No peak

