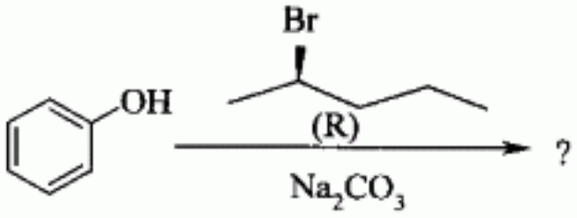
九十一學年度 原子科學 系（所） 乙 組碩士班研究生招生考試

科目 有機化學 科號 3303共 8頁第 1頁 *請在試卷【答案卷】內作答

1. Provide the structure of the major products for each of the following reactions, and include stereochemistry where appropriate. (20 %)

(a)



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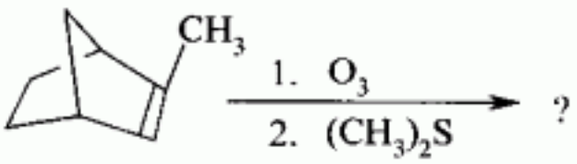

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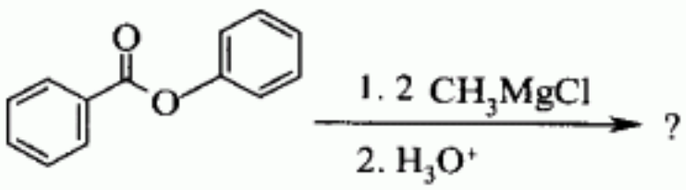

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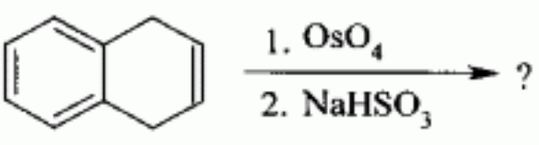

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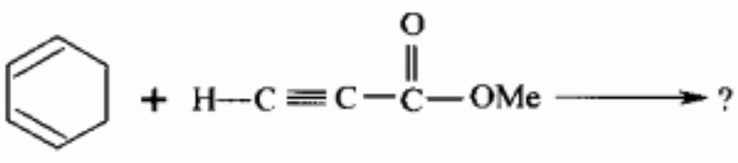

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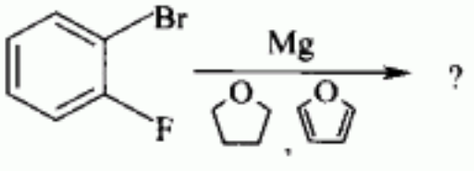
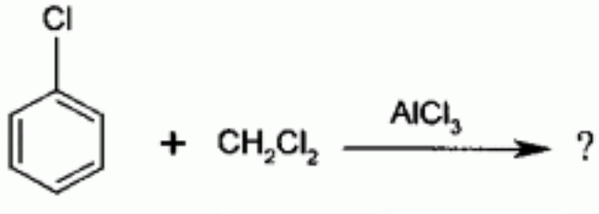
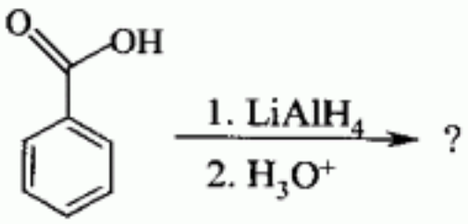


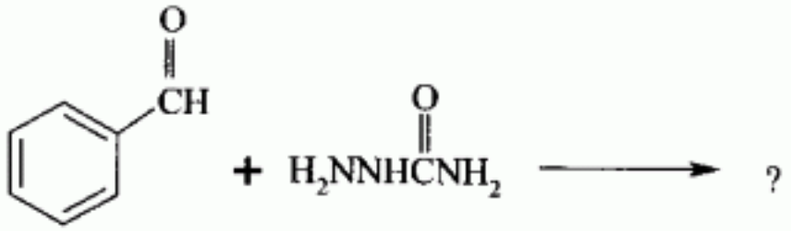
(i)



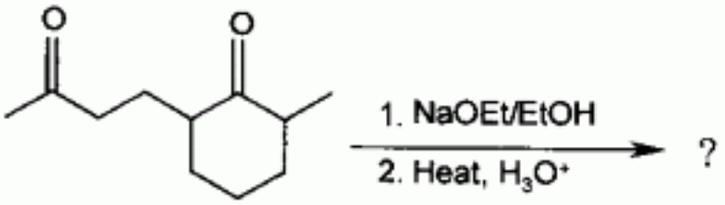
(j)



(k)

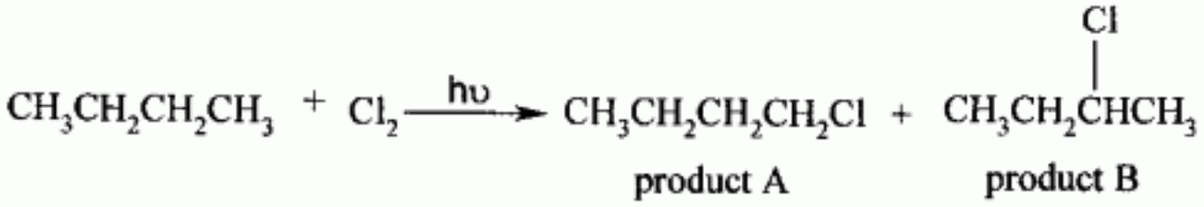


(l)



2. Multiple Choices. (40 %)

(1) What is the expected distribution of products for the following reaction:



(a) A:50, B:50 (b) A:40, B:60

(c) A:60, B:40 (d) A:30, B:70

(e) A:70, B:30

(2) Which of the following best explains why S_N1 reactions involving a neutral reactant are faster in polar solvents?

(a) The substrate is more soluble in polar solvents.

(b) The substrate is less soluble in polar solvents.

(c) The nucleophile is solvated by polar solvents.

(d) Solvation by polar solvents stabilizes the carbocation.

(e) Solvation by polar solvents stabilizes the transition state.

(3) In the boat conformation of cyclohexane, the "flagpole" hydrogen are located

(a) on the same carbon
(b) on adjacent carbons
(c) on C-1 and C-3.
(d) on C-1 and C-4.
(e) non of the above.

(4) An increase in which of the following will occur if the reaction temperature is increased.

I. Energy of activation.
II. Collosion frequency
III. Fracrion of collisions with sufficient energy
IV. Fraction of collisions with proper orientation

(a) I and II
(b) I, II, and III
(c) II and III
(d) II, III and IV
(e) All of them.

(5) Which of the following reagents gives the reaction shown below?

$$CH_3CH=CH_2 \quad + \quad ? \quad \rightarrow \quad CH_3CH_2CH_3$$

(a) H_2/HCl
(b) H_2/Ni
(c) H_2O/Ni
(d) H_2O/H_2SO_4
(e) HBr/peroxide

(6) Which of the following compounds will react most rapidly with HCl?

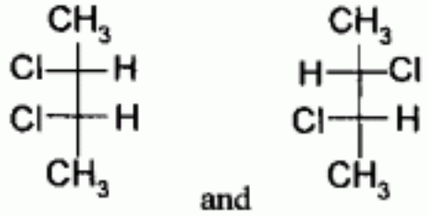
(a) 5-methyl-1-hexene.
(b) 4-methyl-1-hexene.
(c) (E)-5-methyl-2-hexene.
(d) (E)-2-methyl-3hexene.
(e) 2-methyl-2-hexene.

(7) Which is the correct order of decreasing acidity in the following compounds?

A. H_2O B. CH_3CH_3 C.NH_3 D. $CH_2=CH_2$ E. HC≡CH

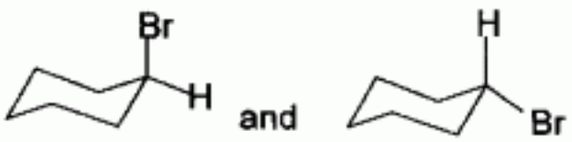
(a) A > E > C > D > B
(b) A > E > D > B > C
(c) E > A > C > B > D
(d) A > C > E > D>B
(e) E > D > B > A > C

(8) What is the relationship between the following compounds?



(a) Enantiomers
(b) Diastereomers.
(c) Constitutional isomers.
(d) Conformational isomers
(e) Identical compounds.

(9) What is the relationship between the structures shown below?



(a) Structural isomers
(b) Constitutional isomers
(c) Conformational isomers
(d) Configurational isomers
(e) Enantiomers

(10) In which of the following does resonance delocalization of electron density not play a role?
(a) Allyl cation.
(b) Benzyl anion.
(c) Carbonate ion.
(d) Ozone
(e) Cyclohexyl radical.

(11) When 1,3-cyclopentadiene reacts with the *cis*-isomer of NCCH=CHCN, the major product is
(a) optically active.
(b) a meso compound.
(c) a racemic mixture.
(d) a spirocyclic compound.
(e) a fused bicyclic compound.

(12) Which of the following compounds is the most reactive dienophile in a Diels-Alder reaction with 1,3-butadiene?
(a) CH_2=$CHOCH_3$
(b) CH_2=CHCHO
(c) CH_3CH=$CHCH_3$
(d) $(CH_3)_2C$=CH_2
(e) CH_2=CH_2

(13) What is the carbon nucleophile which attacks molecular bromine in the acid-catalyzed α-bromination of a ketone?

(a) An enolate (b) A Grignard reagent
(c) An acetylide (d) A carbocation
(e) An enol

(14) Which of the following alkyl bromide is likely to undergo rearrangement by a 1,2-methyl shift?

(a) benzyl bromide (b) 2-bromo-3-ethylpentane
(c) 3-bromo-3-methylpentane (d) 2-bromo-3,3-dimethylpentane
(e) 3-bromo-2,3-dimethylpentane

(15) What is the major product which results when (2R,3S)-2-chloro-3-phenylbutane is treated with sodium methoxide in methanol?

(a) (E)-2-phenyl-2-butene (b) (Z)-2-phenyl-2-butene
(c) (S)-3-phenyl-1-butene (d) (R)-3-phenyl-1-butene
(e) (R)-2-methyloxy-2-phenylbutane

(16) Which of the following solvent is best used in infrared spectroscopy?

(a) water (b) carbon tetrachloride (c) methanol
(d) ethanol (e) benzene

(17) Which of the following methods is most suitable for studying conjugation in molecules?

(a) Infrared (b) NMR (c) Mass spectrometry
(d) X-ray (e) UV/Visible

(18) An enolate attacks an aldehyde and the resulting product is subsequently protonated. What type of this reaction is this?

(a) A Fischer esterification.
(b) An acid-catalyzed aldol condensation
(c) A base-mediated aldol condensation
(d) A Hell-Volhard-Zelinsky reaction
(e) A Selman-Jones reaction.

(19) Which of the following is true about the base peak in mass spectrometry?

(a) The m/z value equals the molecular weight of the compound.
(b) The m/z value corresponds to a very stable carbocation.
(c) It has the largest peak height in the spectrum.

(d) It has the highest m/z value of all the peaks in the spectrum.

(e) The base peak is assigned a relative abundance equal to that of the parent ion.

(20) Which of the following statements describes the first step in the mechanism of the aldol condensation?

(a) An α-hydrogen is abstracted by the base to form an enolate anion.

(b) A nucleophilic base attacks the carbonyl carbon atom.

(c) The carbonyl oxygen is protonated by the base ion.

(d) The carbonyl oxygen of one aldehyde atacks the carbonyl carbon of another.

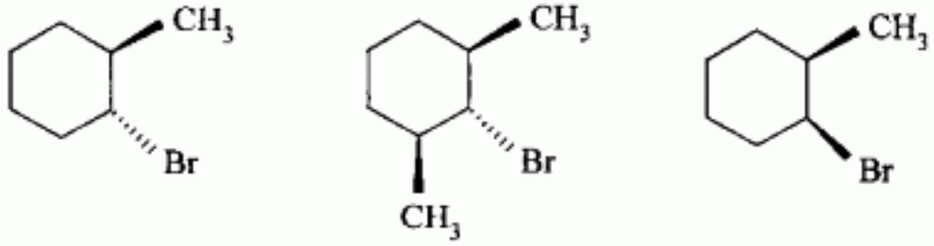
3. What is hyperconjugation? How does it affect carbocation stability ? (5 %)

4. Rank the following species in an order of decreasing reactivity. (8 %)

(a) leaving group: F^-, I^-, H_2O, NH_2

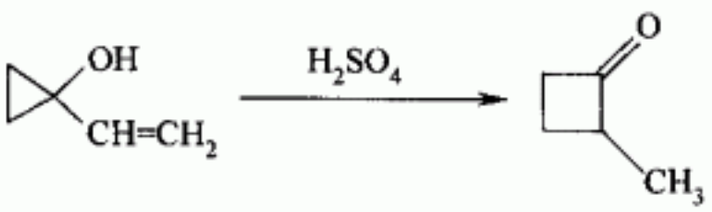
(b) nucleophile (in methanol): Br^-, H_2O, NH_3, HS^-

5. Rank the following compounds in an order of decreasing rate in an E2 reaction. (4 %)

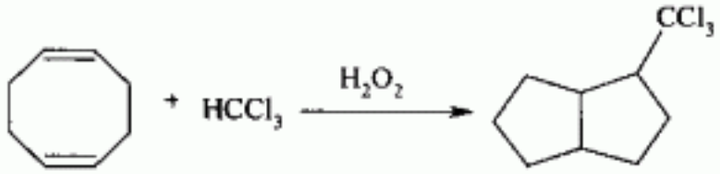


6. Propose the plausible mechanisms for each of the following reactions. (10 %)

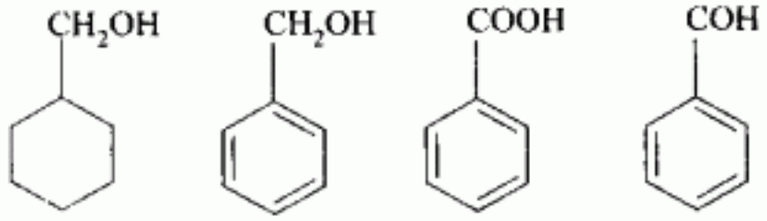
(a)



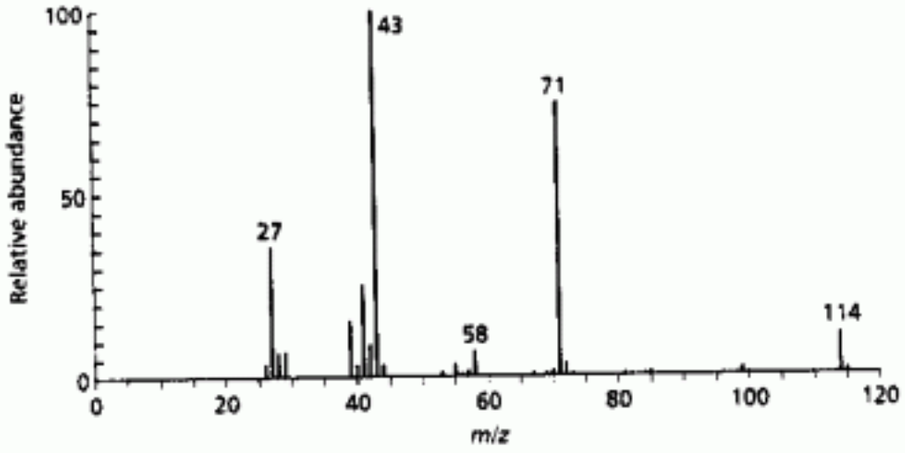
(b)

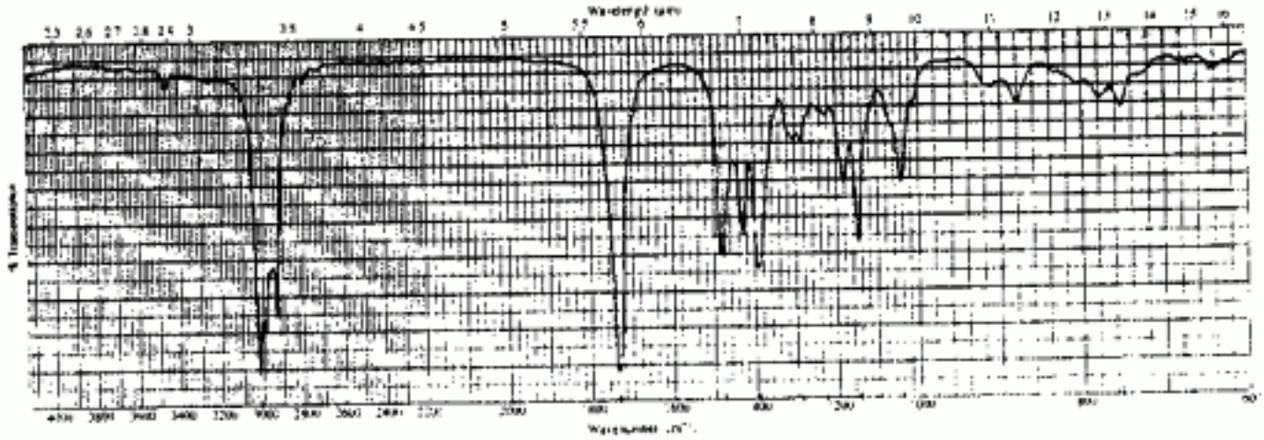


7. How could you distinguish among the following compounds using their infrared spectra and ^{1}H NMR spectra. (6%)



8. Determine the structure of the following unknown compound based on its mass, IR and ^{1}H NMR spectra. (7%)





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有機化學 科號 3303 共 8 頁第 8 頁 *請在試卷【答案卷】內作答