

國立臺北科技大學 103 學年度碩士班招生考試

系所組別：3711、3712、3713

分子科學與工程系有機高分子碩士班甲組

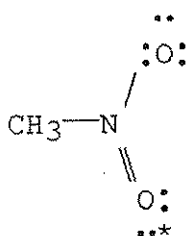
第二節 有機化學 試題

第一頁 共五頁

注意事項：

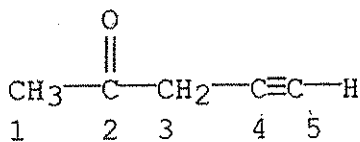
1. 本試題共【50】題，每題【2】分，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. Which of the following would have no net dipole moment ($\mu = 0$ D)?
A) CBr_4 B) cis-1,2-Dibromoethene C) trans-1,2-Dibromoethene
D) 1,1-Dibromoethene E) More than one of these
2. What are the formal charges on nitrogen and the starred oxygen atom in the following molecule?



- A) $\text{N} = -1, \text{O} = 0$
B) $\text{N} = +1, \text{O} = -1$
C) $\text{N} = +1, \text{O} = +1$
D) $\text{N} = -1, \text{O} = -1$
E) $\text{N} = +1, \text{O} = 0$

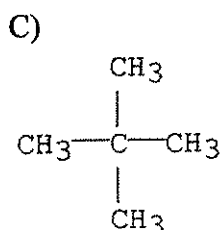
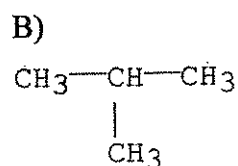
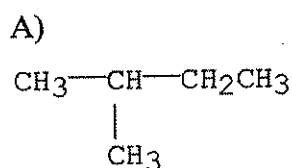
3. Which carbon(s) in the following molecule is (are) sp hybridized?



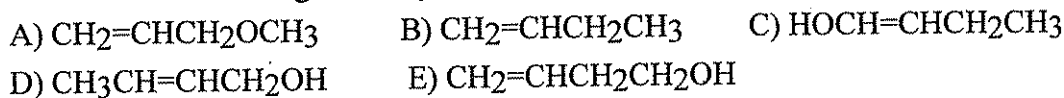
- A) carbon 1 B) carbon 2 C) carbons 1, 3 D) carbons 4 E) carbons 4, 5
4. The carbon-carbon double bond in ethene is _____ and _____ than the carbon-carbon triple bond in ethyne.
A) stronger; shorter
B) stronger; longer
C) weaker; shorter
D) weaker; longer
E) stronger; more polar

- 5 The pKa of CH₃COOH is 4.8 and the pKa of HCOOH is 3.8. Given this information, one knows that ____.
- A) CH₃COOH completely ionizes in water
 B) HCOOH is a weaker acid than CH₃COOH
 C) HCOO⁻ is a weaker base than CH₃COO⁻
 D) CH₃COOH reacts with HO⁻ while HCOOH does not
 E) HCOOH reacts with HO⁻ while CH₃COOH does not

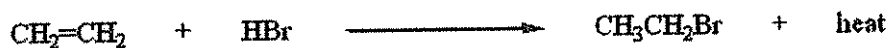
- 6 Which of the following has the greatest van der Waal's interaction between molecules of the same kind?



- 7 Which of the following is an allylic alcohol?



- 8 Which of the following correctly describes the reaction shown?



- A) $\Delta H^\circ > 0$ and $\Delta S^\circ > 0$
 B) $\Delta H^\circ > 0$ and $\Delta S < 0$
 C) $\Delta H^\circ < 0$ and $\Delta S > 0$
 D) $\Delta H^\circ < 0$ and $\Delta S < 0$
 E) $\Delta H^\circ = \Delta S = 0$
- 9 Which of the following is the best reaction sequence to use if one wants to accomplish a Markovnikov addition of water to an alkene with minimal skeletal rearrangement?
- A) water + dilute acid
 B) water + concentrated acid
 C) oxymercuration-demercuration
 D) hydroboration-oxidation
 E) none of the above
- 10 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-3-hexene E) 2-methyl-2-hexene

注意：背面尚有試題

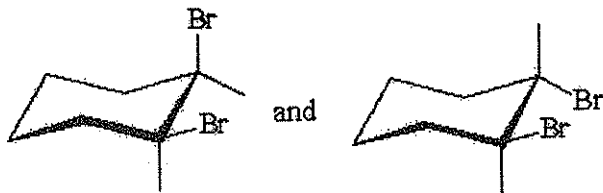
11 Give the number of asymmetric centers in limonene.

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



limonene

12 What is the relationship between the structures shown below?



- A) enantiomers
 B) diastereomers
 C) configurational isomers
 D) identical compounds
 E) constitutional isomers

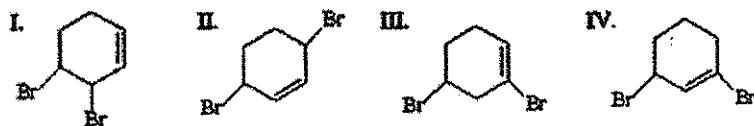
13 Give the best reagents for the reaction.




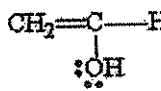
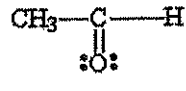
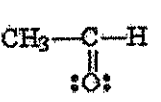
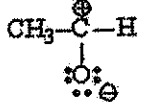
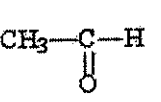
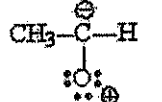

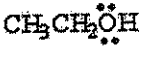
- A) H_2 , Pd
 B) 1. LiAlH_4 , 2. H_3O^+
 C) 1. NaBH_4 , 2. H_3O^+
 D) H_2 , Lindlar catalyst
 E) Na, NH_3
- 14 The carbon-carbon triple bond of an alkyne is composed of _____.
- A) three σ bonds
 B) two σ bonds and one π bond
 C) one σ bond and two π bonds
 D) three π bonds
- 15 Which of the following statements about benzene is correct?
- A) All of the carbon atoms are sp^3 hybridized.
 B) It has no delocalized electrons.
 C) The carbon-carbon bond length is longer than that of ethane.
 D) It is a planar molecule.
 E) The carbon-hydrogen bonds are not the same length.

16 What is/are the product(s) from the following reaction?

- A) I and II B) I and III C) I and IV D) II and III E) II and IV



17 Which of the following pairs are resonance structures?

- A) $\text{CH}_2=\text{CHCH}_3$ and  B)  and 
- C)  and  D)  and 
- E)  and 

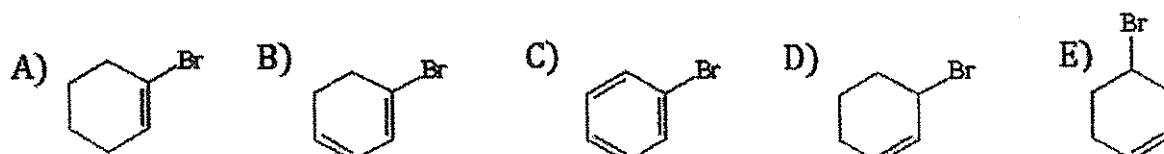
18 The hydrolysis of *tert*-butyl chloride proceeds more rapidly in a solvent mixture which is 70% water/30% acetone than in one which is 30% water/70% acetone. Why?

- A) The transition state in the carbocation formation step is better stabilized in the more polar solvent mixture.
- B) The reaction proceeds by an S_N2 mechanism wherein the rate is increased by increasing the concentration of the nucleophile water.
- C) The reaction proceeds by an S_N1 mechanism wherein the rate is increased by increasing the concentration of the nucleophile water.
- D) The solvent which contains a greater percentage of water is less polar, and this destabilizes the *tert*-butyl chloride.
- E) none of the above

19 Which of the following compounds will undergo an S_N2 reaction most readily?

- A) (CH₃)₃CCH₂I B) (CH₃)₃CCl C) (CH₃)₂CHI
- D) (CH₃)₂CHCH₂CH₂CH₂Cl E) (CH₃)₂CHCH₂CH₂CH₂I

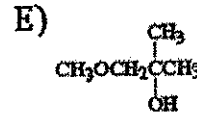
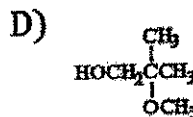
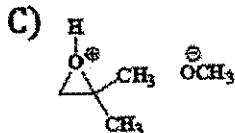
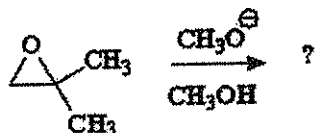
20 Which of the following alkyl halides forms the most stable carbocation when it undergoes an E1 reaction?



- 21 29) Dehydrohalogenation of 2-bromobutane in the presence of a strong base proceeds via which of the following mechanistic pathways?
 A) S_N1 B) S_N2 C) E1 D) E2 E) none of the above

- 22 Which of the following is the strongest acid?
 A) CH₃NH B) CH₃OH C) CH₃SH D) CH₃OCH₃ E) CH₃Cl

- 23 54) What is the major product for the following reaction?



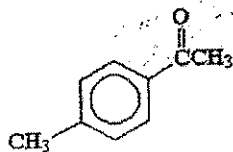
- 24 In a Grignard reagent, the carbon bonded to the magnesium has a partial _____ charge, because carbon is _____ electronegative than magnesium. This makes this carbon of the Grignard _____.
 A) negative, more, nucleophilic B) negative, less, electrophilic C) positive, more, electrophilic
 D) positive, less, nucleophilic E) positive, less, electrophilic

- 25 These data show that the carbon-bromine bond is weakest when bromine is bound to a _____.
 A) methyl carbon B) primary carbon C) secondary carbon D) tertiary carbon E) quaternary carbon

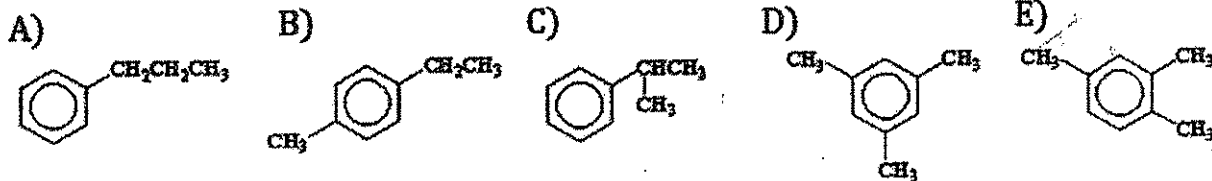
- 26 In the infrared spectrum, a compound of formula C₄H₈O gave an absorption band at 1720 cm⁻¹, but no bands at 2720 - 2830 and 3400 cm⁻¹. What is the compound?
 A) 2-butanone B) butanal C) cis-2-butenol D) trans-2-butenol E) 1-butenol

- 27 An increase in conjugation is correlated with _____ in the energy of the LUMO, _____ in the energy of the HOMO, and _____ in λ_{max}.
 A) a decrease, an increase, a decrease B) a decrease, an increase, an increase
 C) an increase, a decrease, a decrease D) an increase, a decrease, an increase
 E) an increase, an increase, a decrease

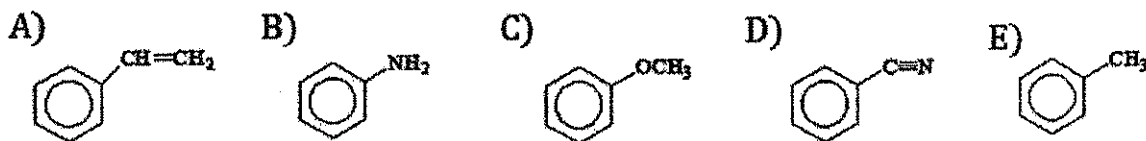
- 28 How many signals would you expect to see in the ¹H NMR spectrum of the following compound?
 A) 6 B) 3 C) 5 D) 4 E) 2



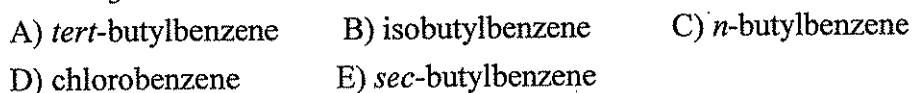
- 29 An unknown compound, C_9H_{12} , gave the following NMR spectrum:
 Triplet at 1.21 ppm (3H) Singlet at 2.30 ppm (3H) Quartet at 2.60 ppm (2H) Singlet at 7.04 ppm (4H)
 What is the structure of the compound?



- 30 What is the structure of styrene?

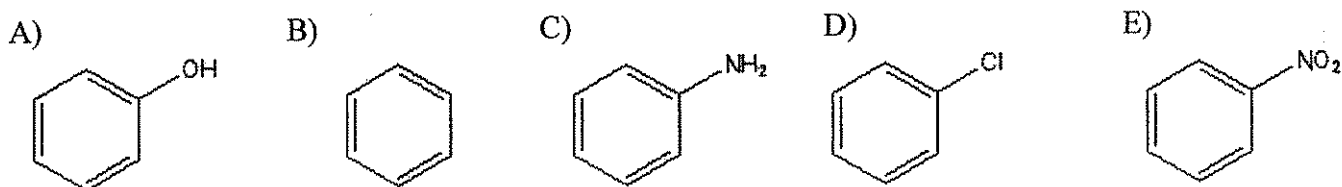
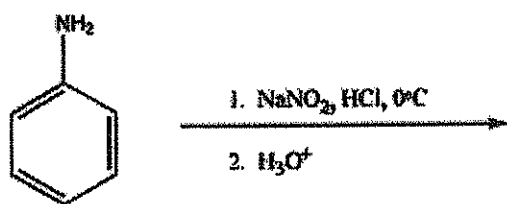


- 31 What is the major organic product of the reaction between benzene and isobutyl chloride in the presence of $AlCl_3$?

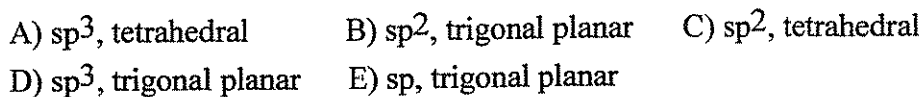


- 32 How many signals does one expect in the proton decoupled ^{13}C NMR spectrum of *o*-xylene?
 A) 8 B) 6 C) 4 D) 3 E) 2

- 33 Identify the best product for the reaction.

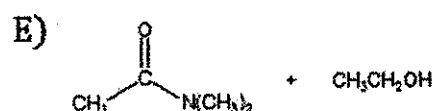
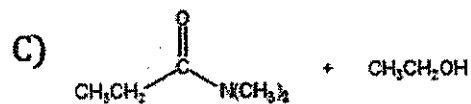
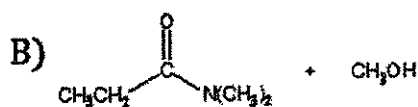
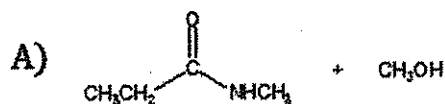
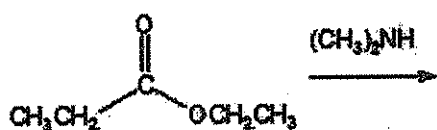


- 34 What is the hybridization and geometry of the carbonyl carbon in carboxylic acids and their derivatives?

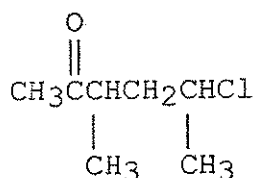


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35 Give the product of the reaction.



36 What is the IUPAC name for the following compound?



A) 5-chloro-3-methylhexanone

B) 1-chloro-1,3-dimethyl-4-pentanone

C) 5-chloro-3,5-dimethyl-2-pentanone

D) 5-chloro-3-methyl-2-hexanone

E) 2-chloro-4-methyl-5-hexanone

37 Which of the following alcohols can be prepared by the reaction of methyl formate with excess Grignard reagent?

A) 1-pentanol

B) 2-pentanol

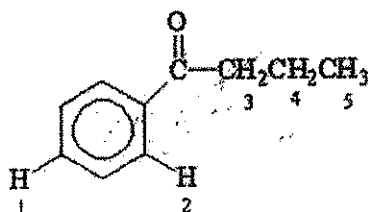
C) 3-pentanol

D) 2-methyl-2-pentanol

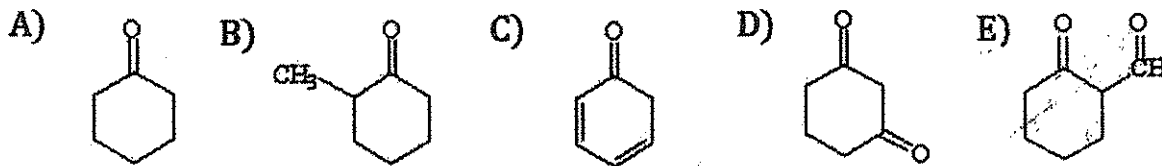
E) 3-methyl-3-pentanol

38 Which of the labeled hydrogen atoms in the following structure is the most acidic?

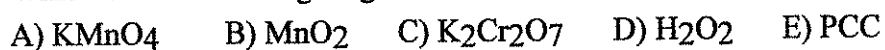
A) 1 B) 2 C) 3 D) 4 E) 5



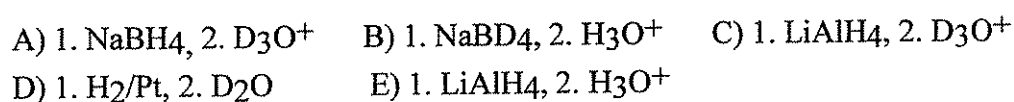
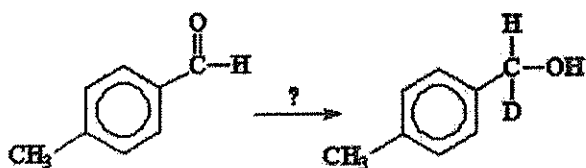
39 When compared to the keto form, the enol form of which of the following compounds is most stable?



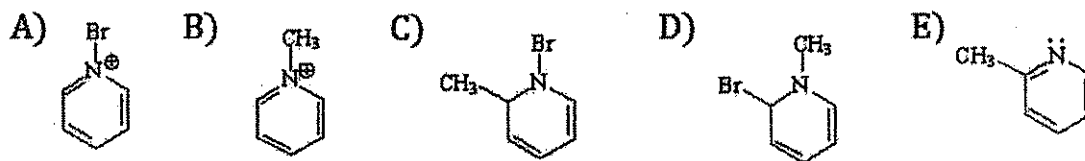
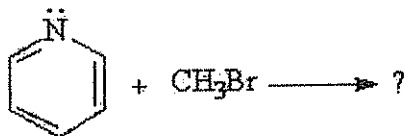
40 Which of the following reagents can be used to oxidize 1° alcohols to aldehydes?



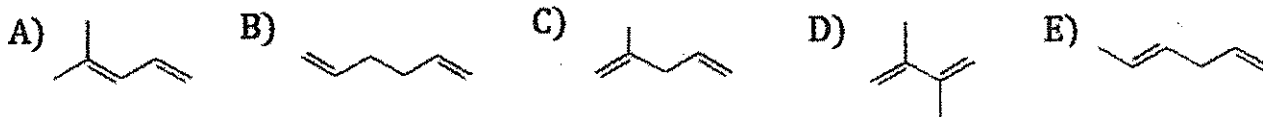
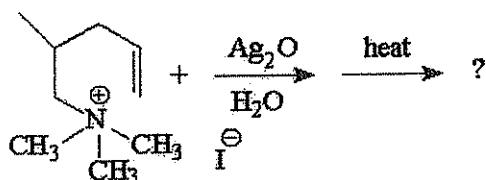
41 Which of the following reagents is best used for the conversion shown below?



42 What is the major product of the following reaction?

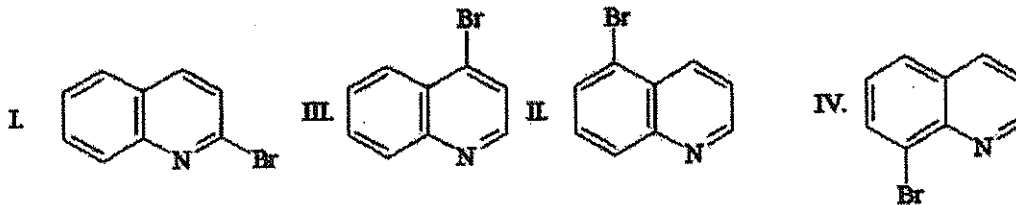
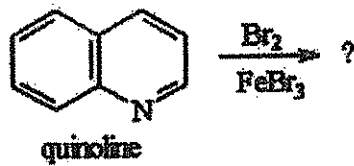


43 What is the major alkene formed in the following reaction?



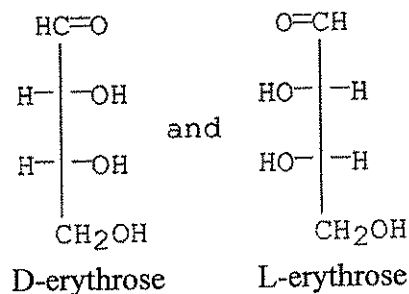
44 What are the products of the following reaction?

- A) I and II B) I and III C) II and IV D) II and III E) III and IV

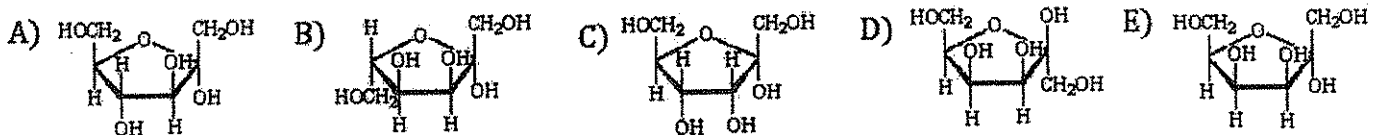
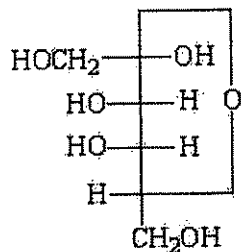


45 What is the relationship between the following compounds?

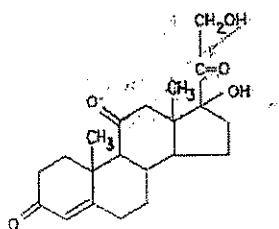
- A) conformational isomers
 B) constitutional isomers
 C) identical
 D) enantiomers
 E) diastereomers



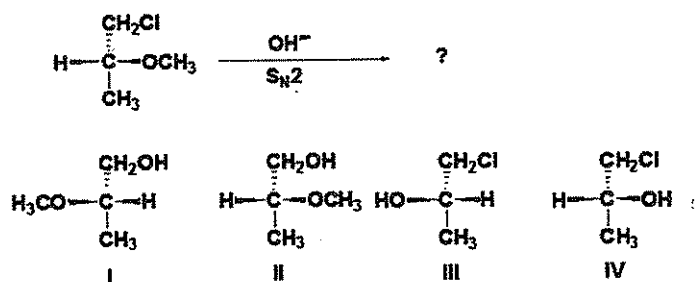
46 Which of the following is the Haworth projection of a α -D-tagatofuranose?



47 The compound below is an adrenocortical hormone called cortisone. Which functional group is not present in cortisone? A) 1° alcohol B) 2° alcohol C) 3° alcohol D) Ketone E) Alkene



48 The major product of the following reaction would be:



- A) I B) II C) III D) IV E) An equimolar mixture of I and II.

49 According to the Lewis definition, a base is a (n):

- A) Proton donor. B) Electron pair donor. C) Hydroxide ion donor.
 D) Hydrogen ion donor. E) Electron pair acceptor.

50 Which alcohol would be most easily dehydrated?

- A) $\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3\text{CH}_2\text{CCH}_2\text{CH}_3 \\ | \\ \text{OH} \end{array}$ B) $\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3\text{CH}_2\text{CHCHCH}_3 \\ | \\ \text{OH} \end{array}$ C) $\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3\text{CH}_2\text{CHCH}_2\text{CH}_2\text{OH} \end{array}$
- D) $\begin{array}{c} \text{CH}_3 \\ | \\ \text{HOCH}_2\text{CHCH}_2\text{CH}_2\text{CH}_3 \end{array}$ E) $\begin{array}{c} \text{CH}_2\text{OH} \\ | \\ \text{CH}_3\text{CH}_2\text{CHCH}_2\text{CH}_3 \end{array}$