DPPP 350 Organic Chemistry I Final Exam

1.

The base pairs present in DNA are:

a. A...A and T...T

b. A...T and G...C

c. A...C and G...T

d. A...D and C...T

e. A...A and C...C

2.

Which one of the following alcohols undergoes dehydration at the fastest rate on being heated with sulfuric acid?

a. 1-Hexanol

b. 1-Ethylcyclohexanol

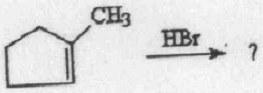
c. Cyclohexanol

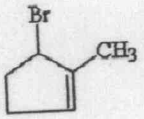
d. 4-Methyl-2-hexanol

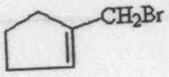
e. 4-Methyl-1-hexanol

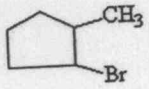
3.

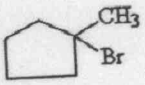
What is the <u>major</u> product of the following reaction?

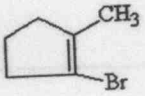


I. 

II. 

III. 

IV. 

V. 

a. I

b. II

c. III

d. IV

e. V

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4. Which of the following statements is not true about fatty acids?

a. Most naturally occurring fatty acids contain even numbers of carbons and are unbranched.

b. Fatty acids can be saturated or unsaturated.

c. The double bonds in unsaturated fatty acids are always conjugated.

d. Physical properties of fatty acids depend on the length of the hydrocarbon chain and the degree of unsaturation.

e. Fatty acids are carboxylic acids with long hydrocarbon side chains.

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5. Which pair of compounds are constitutional isomers?

a. Cyclopentane and Methylcyclopentane

b. 3-Ethylpentane and 2,2,3-Trimethylbutane

c. 3-Methylpentane and 3-Methylhexane

d. Propane and Cyclopropane

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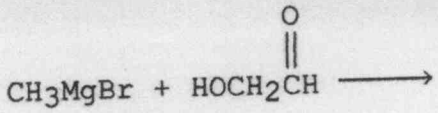
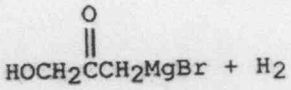
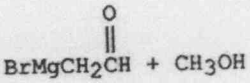
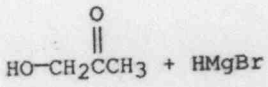
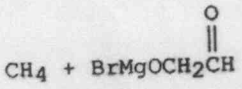
6. What is/are the <u>major</u> product(s) of the following reaction?

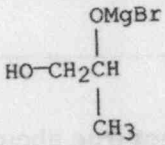


a. 

b. 

c. 

d. 

e. 

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7. To complete the conversion shown below, what reactants would be the most suitable?

a. HBr, peroxides

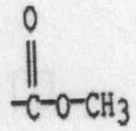
b. NaBr, H_2SO_4, heat

c. Br_2, light and heat

d. HBr, heat

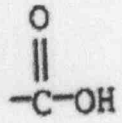
8.

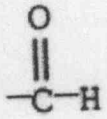
Which of the following groups has the highest priority when ranking the groups or atoms bonded to the asymmetric center?

a. 

b. -OH

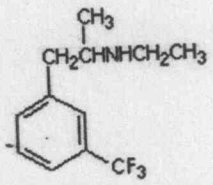
c. $-O-CH_3$

d. 

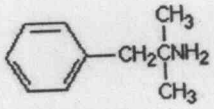
e. 

9.

Classify these compounds



Fenfluramine



Phentermine

a. Both are secondary amines.

b. *Fenfluramine* is a secondary amine; *phentermine* is a primary amine.

c. Both are primary amines.

d. *Fenfluramine* is a primary amine; *phentermine* is a tertiary amine.

e. *Fenfluramine* is a secondary amine; *phentermine* is a tertiary amine.

10.

Which one of the following reacts with methylmagnesium bromide to form a chiral alcohol?

a. Cyclobutanone

b. Acetaldehyde (ethanal) ☐

c. 2-Butanone

d. Acetone

e. Butanal

11.

How many constitutional isomers having the molecular formula C_4H_9Cl are possible?

a. One

b. Five

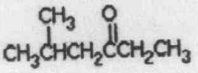
c. Four

d. Two

e. Three

12.

The best name for this compound is:



a. Ethyl isopropyl ketone

b. 2-Methyl-4-hexanone

c. 5-Methyl-3-hexanone

d. 2-Methyl-3-hexanone

e. Isobutyl propanone

13.

Choose the best synthesis of 1-octene from acetylene?

Treat acetylene with:

a. 1. H_2, Lindlar Pd 2. $NaNH_2$, NH_3 3. 1-bromohexane

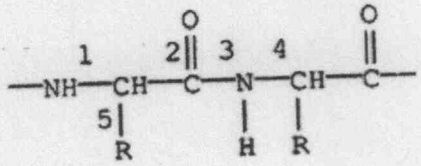
b. 1. Na, NH_3 2. 1-hexene 3. H_2, Rh

c. 1. $NaNH_2$, NH_3 2. 1-bromohexane 3. H_2, Lindlar Pd

d. 1. Na, NH_3 2. $NaNH_2$, NH_3 3. 1-bromohexane

14.

Which labeled bond in the following molecule is known as the peptide bond?



1. 1
2. 2
3. 3
4. 4
5. 5

15.

The best synthesis of 2-methyl-2-butanol is:

a. Treatment of 2-bromo-2-methylbutane with sodium hydroxide

b. Acid-catalyzed hydration of 2-methyl-2-butene

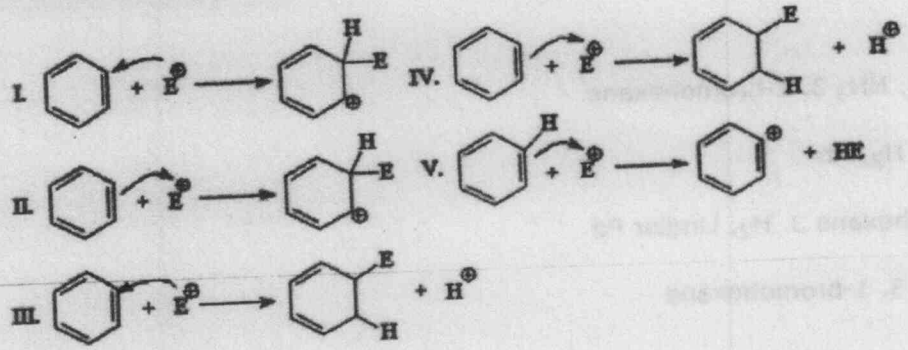
c. Treatment of 2-methylbutane with sodium hydroxide

d. Treatment of 2-methyl-1-butene with peroxyacetic acid

e. Oxidation of 2-methyl-2-butene with $Na_2Cr_2O_7$ in aqueous sulfuric acid

16.

Which of the following is most likely to be the <u>first</u> <u>step</u> in the general mechanism for electrophilic substitution reactions?



a. I

b. II

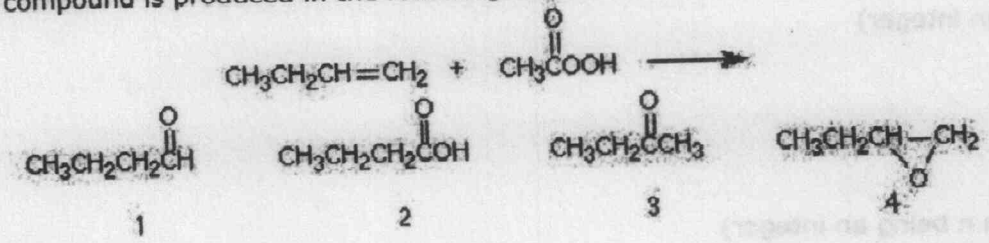
c. III

d. IV

e. V

17.

Which compound is produced in the following reaction?



a. 1

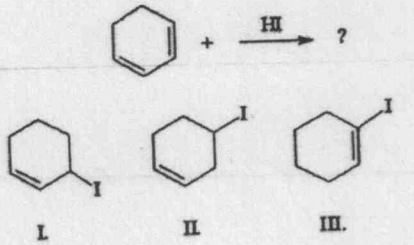
b. 2

c. 3

d. 4

18.

Which of the following is/are the major product(s) of the following reaction?



a. II

b. I and III

c. III

d. I

e. I and II

19.

Aromatic molecules contain _____ pi electrons.

a. 4n (with n an integer)

b. no

c. unpaired

d. 4n + 2 (with n being an integer)

e. 4n + 2 (with n being 0.5)

20.

An amide is formed from a carboxylic acid by reaction with:

a. $NaNH_2$ in liquid ammonia

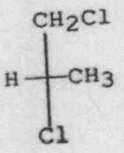
b. aqueous ammonia, 25°C

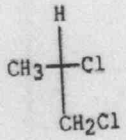
c. $SOCl_2$, followed by excess aqueous ammonia

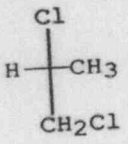
d. CH_3OH, followed by reaction with NH_2OH

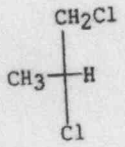
21.

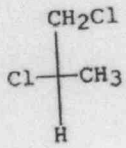
Which of the following compounds has an S configuration?

a. 

b. 

c. 

d. 

e. 

22.

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

a. An alpha hydrogen is abstracted by the base to form an enolate anion.

b. A nucleophilic base attacks the carbonyl carbon atom.

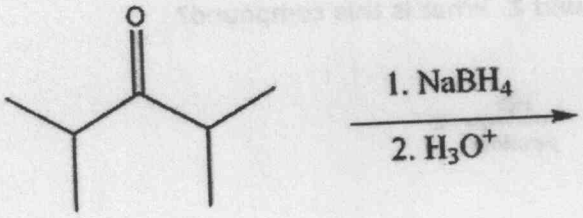
c. The carbonyl oxygen of one aldehyde attacks the carbonyl carbon of another.

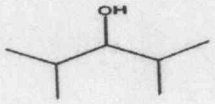
d. The alpha hydrogen is abstracted by an acid to the enolate anion.

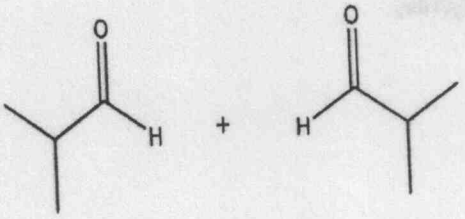
e. The carbonyl oxygen is protonated by the base ion.

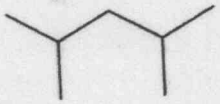
23.

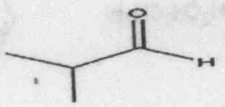
What is the major product of the following reaction?

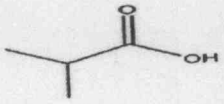


a. 

b. 

c. 

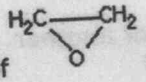
d. 

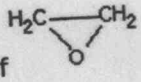
e. 

24.

The best synthesis of ethyl isopropyl ether [$(CH_3)_2CHOCH_2CH_3$)] is represented by which of the following?

a. Reaction of CH_3CH_2ONa with $(CH_3)_2CHBr$

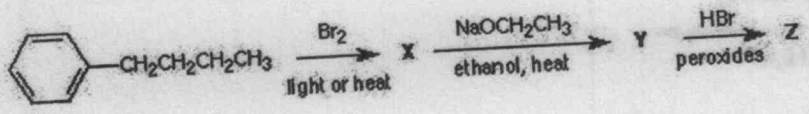
b. Reaction of  with CH_3CH_2ONa

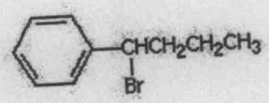
c. Reaction of  with $(CH_3)_2CHONa$

d. Reaction of CH_3CH_2Br with $(CH_3)_2CHONa$

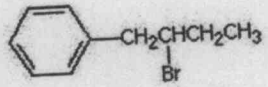
25.

The following sequence of reactions results in the compound **Z**. What is this compound?

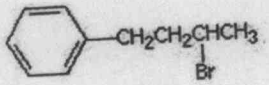




1



2



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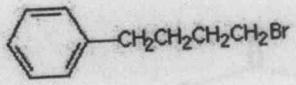
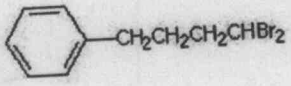


4



5

a. 1

b. 2

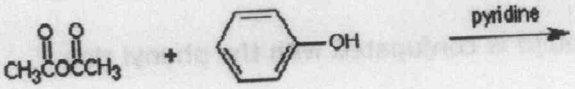
c. 3

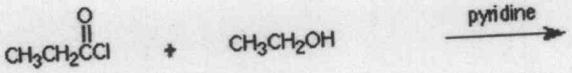
d. 4

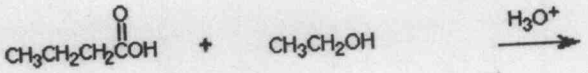
e. 5

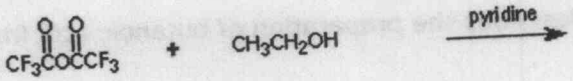
26.

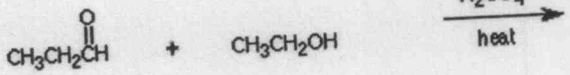
Which of the following reactions will not yield an ester?

a. 

b. 

c. 

d. 

e. 

27.

When 2-bromo-3-methyl-1-phenylbutane is treated with sodium methoxide, why is the major product 3-methyl-1-phenyl-1-butene?

a. The less substituted alkene is always more stable than the more substituted alkene.

b. The newly formed double bond in this compound is conjugated with the phenyl ring.

c. SN2 predominates over E2.

d. E1 predominates over E2.

e. The bulkiness of the methoxide results in the less substituted alkene.

28.

Which one of the following statements correctly describes the preparation of butanoic acid from 1-bromopropane (R = $CH_3CH_2CH_2$)?

Method 1: $RBr \xrightarrow[\text{diethyl ether}]{Mg} RMgBr \xrightarrow[2.\ H_3O^+]{1.\ CO_2} RCO_2H$

Method 2: $RBr \xrightarrow{NaCN} RCN \xrightarrow[\text{heat}]{H_2O, HCl} RCO_2H$

a. Method 2 will work well, but Method 1 is not appropriate.

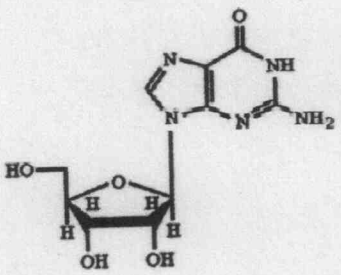
b. Method 1 will work well, but Method 2 is not appropriate.

c. Both Method 1 and Method 2 are appropriate for carrying out this conversion.

d. Neither Method 1 nor Method 2 is appropriate for carrying out this conversion.

29.

Identify the nucleoside shown below.



a. cytidine

b. adenosine

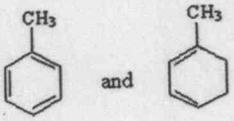
c. thymidine

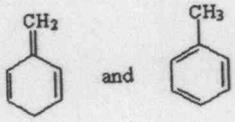
d. guanosine

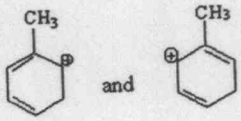
e. uridine

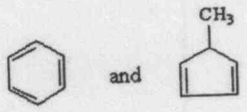
30.

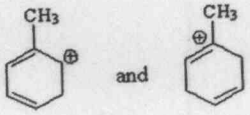
Which of the following pairs are resonance structures?

I. 

II. 

III. 

IV. 

V. 

a. I

b. II

c. III

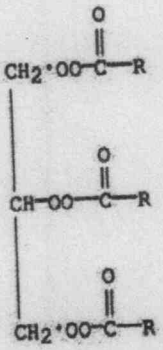
d. IV

e. V

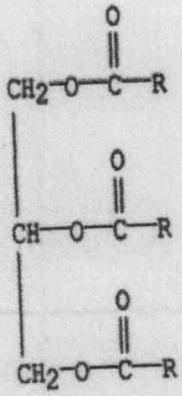
31.

Which of the following molecules is known as a triglyceride?

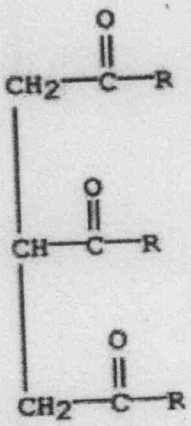
a.



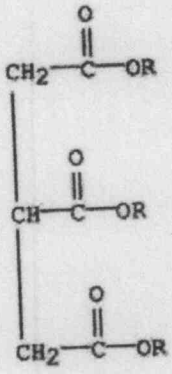
b.



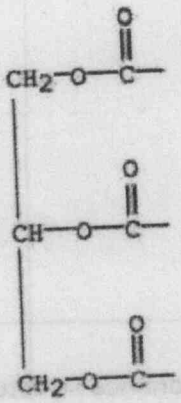
c.



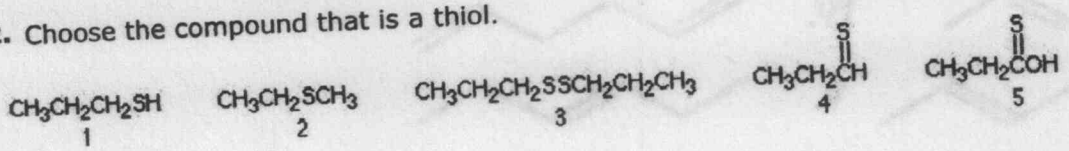
d.



e.



32. Choose the compound that is a thiol.



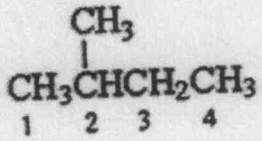
a. 1

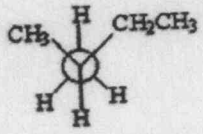
b. 2

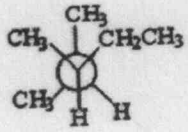
c. 3

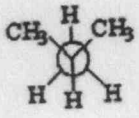
d. 4

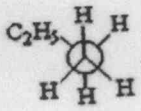
33. Which of the following is the staggered conformation for rotation about the C_2—C_1 bond in the following structure?

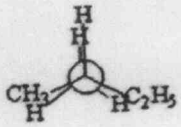


I 

II 

III 

IV. 

V. 

a. I

b. II

c. III

d. IV

e. V

34. Which of the following is a conjugated diene?

I. 

II. 

III. 

IV. 

V. 

a. I

b. II

c. III

d. IV

e. V

35. Which of the following compounds is never chiral?

a. 1,2-dichlorobutane

b. 1-bromo-2-chlorobutane

c. 1,4-dibromobutane

d. 1,3-dibromobutane

e. 2,3-dibromobutane

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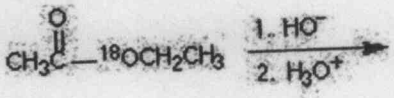
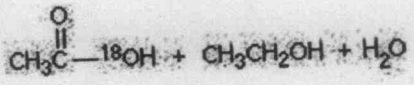
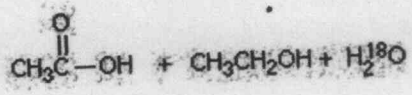
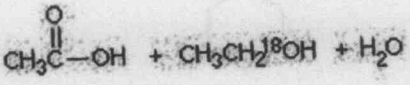
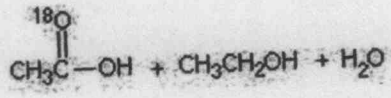
36. Ethyl acetate labeled with ^{18}O yields which of the following products upon hydrolysis?



1. 

2. 

3. 

4. 

a. 1

b. 2

c. 3

d. 4

---

37. A and B are stereoisomers. They are nonsuperimposable and are mirror images of one another. Which of the following best describes the relationship between A and B?

a. constitutional isomers

b. cis-trans isomers

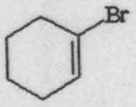
c. diastereomers

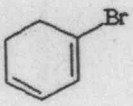
d. enantiomers

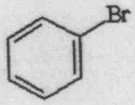
e. structural isomers

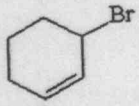
---

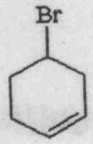
38. Which of the following alkyl halides forms the most stable carbocation when it undergoes an E1 reaction?

I. 

II. 

III. 

IV. 

V. 

a. I

b. II

c. III

d. IV

e. V

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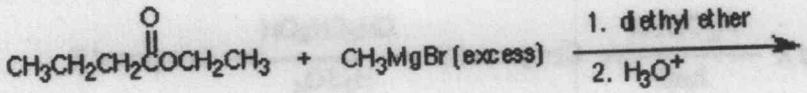
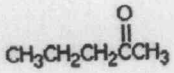
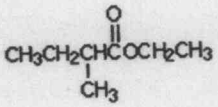
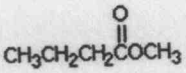
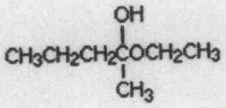
39. The major organic product of the reaction shown below is:

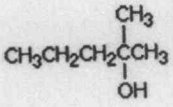


a. 

b. 

c. 

d. 

e. 

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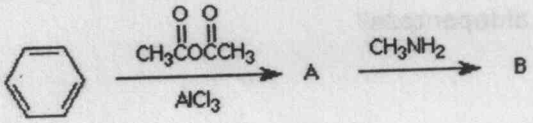
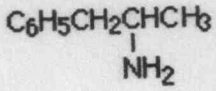
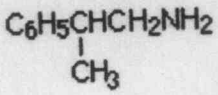
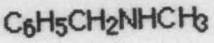
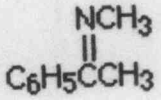
40. What is compound B in the following reaction sequence?

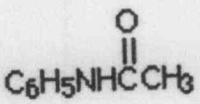


a. 

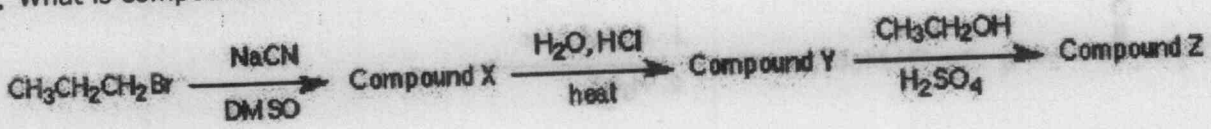
b. 

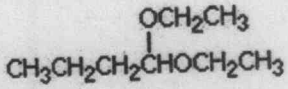
c. 

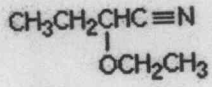
d. 

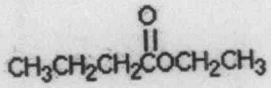
e. 

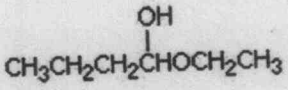
41. What is compound Z?

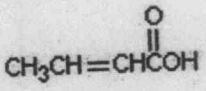


a. 

b. 

c. 

d. 

e. 

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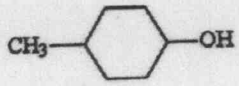
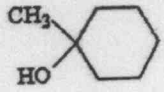
42. Which of the following corresponds to the definition of an aldopentose?

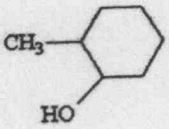
I. It is a monosaccharide.
II. It contains a CHO group
III. It is a disaccharide.
IV. It is an oligosaccharide.

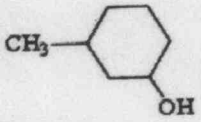
1. I and III
2. I and II
3. II and III
4. I and IV
5. I, II, and III

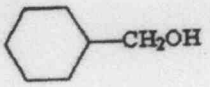
43. Which of the following alcohols dehydrates with the fastest rate?

I. 

II. 

III. 

IV. 

V. 

a. I

b. II

c. III

d. IV

e. V

---

44. Which of the following reagents gives the reaction shown below?

$CH_3CH{=}CH_2 + ? \rightarrow CH_3CH_2CH_3$

a. H_2/H_2SO_4

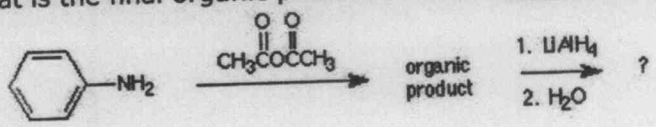
b. H_2O/Ni

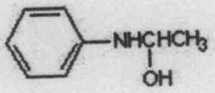
c. H_2/HCl

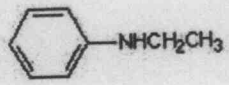
d. H_2O/H_2SO_4

e. H_2/Ni

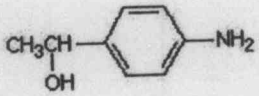
45. What is the final organic product of the following reaction sequence?

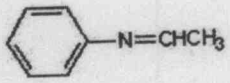


a. 

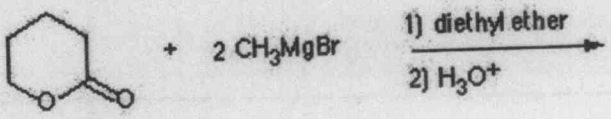
b. 

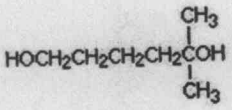
c. 

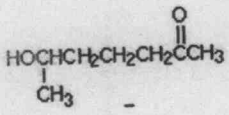
d. 

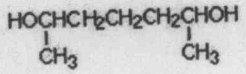
e. 

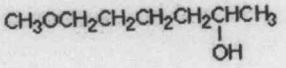
46. What is the product of the following reaction?

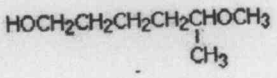


a. 

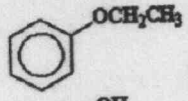
b. 

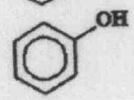
c. 

d. 

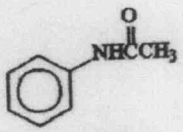
e. 

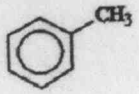
47. Which of the following compounds reacts most slowly during nitration?

I. 

II. 

III. 

IV. 

V. 

a. I

b. II

c. III

d. IV

e. V

---

48. Which of the following reactions is a termination step in the free radical chlorination of methane?

a. $\cdot CH_3 + Cl \cdot \rightarrow CH_3Cl$

b. $CH_4 + Cl \cdot \rightarrow HCl + \cdot CH_3$

c. $Cl_2 + Cl \cdot \rightarrow > Cl \cdot + Cl_2$

d. $Cl_2 \rightarrow 2\ Cl$

49. Which of the following is a true statement?

a. All achiral molecules are meso.

b. All chiral molecules possess a plane of symmetry.

c. All molecules which possess a single asymmetric center of the S configuration are levorotatory.

d. A mixture of achiral compounds will be optically inactive.

e. All molecules which possess 2 or more chirality centers will be chiral.

---

50. Which of the following constitutes the primary structure of a nucleic acid?

a. the sequence of the phosphodiesters in the strand

b. the sequence of the deoxyriboses in the strand

c. the sequence of the 5'-OH groups in the strand

d. the sequence of the riboses in the strand

e. the sequence of the bases in the strand

51. The α-carbon of all the amino acids is a chirality center except for:

a. Aspartic acid

b. Glycine

c. Arginine

d. Threonine

e. Proline

52. Which of the following structures can polypeptides have?

a. primary structure

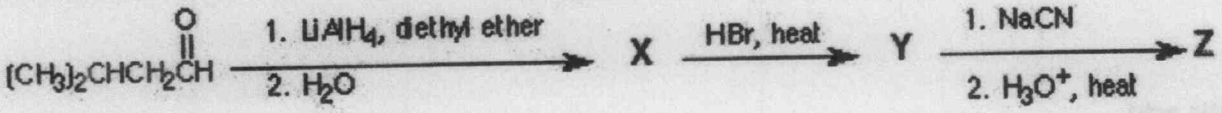
b. quaternary structure

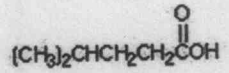
c. secondary structure

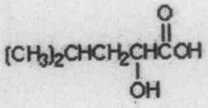
d. tertiary structure

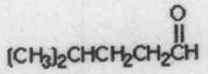
e. all of the above

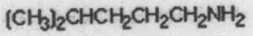
53. What is compound *Z* in the following sequence?

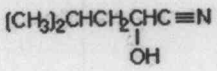


a. 

b. 

c. 

d. 

e. 

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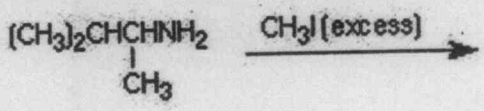
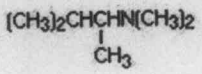
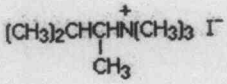
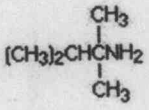
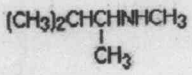
54. What is the product of the following reaction?



a. 

b. 

c. 

d. 

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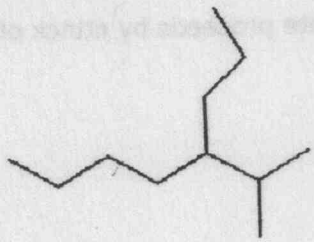
55. Give the IUPAC name for the following structure:



1. 4-Isopropyloctane
2. 5-Isopropyloctane
3. 3-ethyl-2-methylheptane
4. 2-methyl-3-ethylheptane
5. 2-methyl-3-propylheptane

---

56. Which of the following is the <u>quaternary structure</u> of proteins concerned with?

a. three-dimensional arrangement of all atoms in the protein

b. sequence of amino acids in the peptide chain

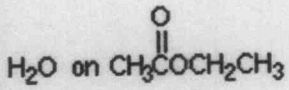
c. location of the disulfide bridges in the peptide chain

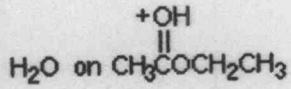
d. conformation of the protein backbone

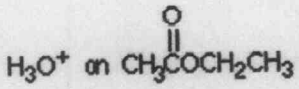
e. description of the way the peptide chains are arranged with respect to each other

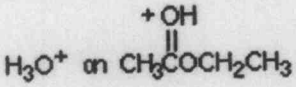
---

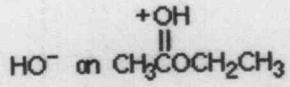
57. The nucleophilic addition step in the acid-catalyzed hydrolysis of ethyl acetate proceeds by attack of:

a. 

b. 

c. 

d. 

e. 

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58. Which of the following terms best describes the compound below?
$CH_3(CH_2)_7CH{=}CH(CH_2)_7CO_2H$

a. a micelle

b. an unsaturated fatty acid

c. a synthetic detergent

d. a triglyceride

e. isoprene

---

59. Which of the following may characterize the secondary structure of proteins?

a. conformation of the protein backbone

b. α-Helix

c. parallel β-pleated sheet

d. anti-parallel β-pleated sheet

e. all of the above

60. An imine is produced when cyclopentanone reacts with which one of the following compounds?

a. $(CH_3)_2CHNH_2$

b. $(CH_3)_3N$

c. $(CH_3)_2NH$

d. $NaNH_2$

---

61. The best synthesis of 2-methyl-2-pentene $(CH_3)_2C{=}CHCH_2CH_3$ is represented by which of the following.

a. 1. $(CH_3)_2CHCH_2CH_2CH_3 + F_2$, heat then; 2. $KOC(CH_3)_2$

b. 1. $(CH_3)_2CHCH_2CH_2CH_3 + Br_2$, heat then; 2. $NaOCH_3$

c. 1. $(CH_3)_2CHCH_2CH_2CH_3 + Cl_2$, heat then; 2. $NaOCH_2CH_3$

d. 1. $(CH_3)_2CHCH_2CH_2CH_3 + I_2$, heat then; 2. $NaOCH_2CH_3$

---

62. Which of the alkyl chlorides listed below undergoes dehydrohalogenation in the presence of a strong base to give 2-pentene as the only alkene product?

a. 3-chloropentane

b. 1-chloro-3-methylbutane

c. 2-chloropentane

d. 1-chloropentane

e. 1-chloro-2-methylbutane

63. The best method for the conversion shown is summarized by which sequence of steps:

a. (1) $(CH_3)_3CCl$, $AlCl_3$; (2) HNO_3, H_2SO_4; (3) H_2, Ni; (4) $NaNO_2$, HCl, H_2O; (5) KI

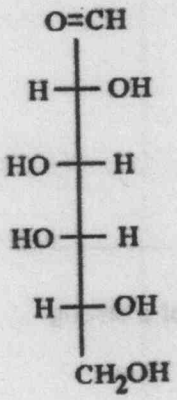
b. (1) $(CH_3)_3CCl$, $AlCl_3$; (2) I_2, FeI_3

c. (1) HNO_3, H_2SO_4; (2) $(CH_3)_3CCl$, $AlCl_3$; (3) H_2, Ni; (4) $NaNO_2$, HCl, H_2O; (5) KI

d. (1) HNO_3, H_2SO_4; (2) $NaNO_2$, HCl, H_2O; (3) KI; (4) $(CH_3)_3CCl$, $AlCl_3$

e. (1) I_2, FeI_3; (2) $(CH_3)_3CCl$, $AlCl_3$

64. Which of the following best describes the sugar D-galactose?



a. D-Ketohexose

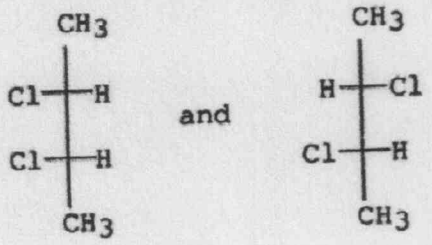
b. L-Ketohexose

c. L-Aldohexose

d. D-Aldohexose

e. D-Aldopentose

65. What is the relationship between the following compounds?



a. enantiomers

b. conformational isomers

c. diastereomers

d. identical compounds

e. constitutional isomers

---

66. The reaction $Br_2 + CH_3Br \rightarrow CH_2Br_2 + HBr$ was carried out. Which of the following mechanism steps is both productive and relatively likely to occur?

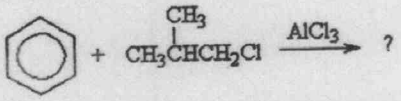
a. $Br\cdot + Br_2 \rightarrow Br_2 + Br\cdot$

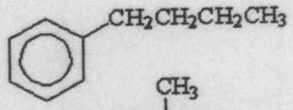
b. $Br\cdot + \cdot CH_2Br \rightarrow CH_2Br_2$

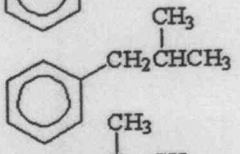
c. $Br\cdot + \cdot CH_3 \rightarrow CH_3Br$

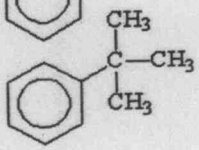
d. $Br\cdot + CH_3Br \rightarrow HBr + \cdot CH_2Br$

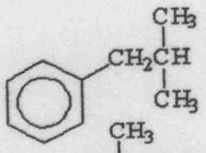
67. What is the major product of the following Friedel-Crafts alkylation?

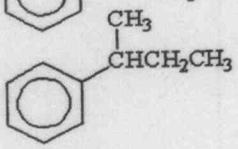


I. 

II. 

III. 

IV. 

V. 

a. I

b. II

c. III

d. IV

e. V

---

68. Which of the following bases distinguish DNA from RNA?

a. uracil and guanine

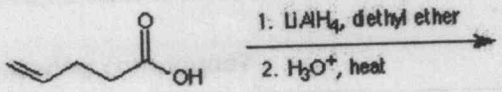
b. adenine and cytosine

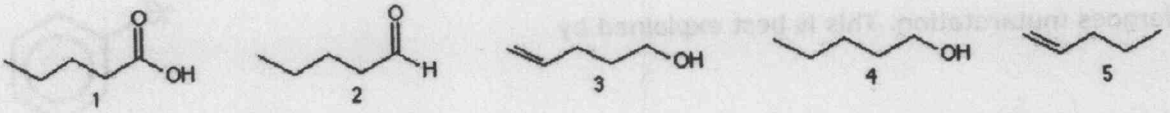
c. guanine and uracil

d. adenine and thymine

e. thymine and uracil

69. The product of the following reaction is?





a. 1

b. 2

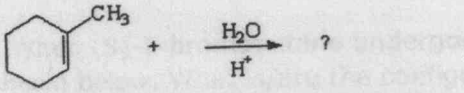
c. 3

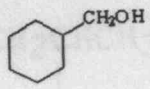
d. 4

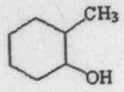
e. 5

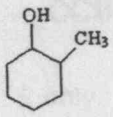
---

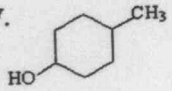
70. What is the major product of the following reaction?

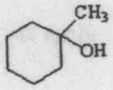


I. 

IV. 

II. 

V. 

III. 

a. I

b. II

c. III

d. IV

e. V

71. Glucose undergoes mutarotation. This is best explained by

a. interconversion of aldehyde and ketone forms.

b. interconversion of aldehyde and enol forms.

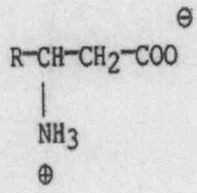
c. ring-flipping between nonequivalent chair conformations of the β-pyranose form.

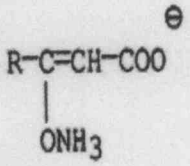
d. equilibration of hemiacetal and lactone forms.

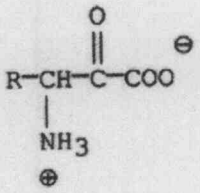
e. interconversion of the α and β pyranose forms.

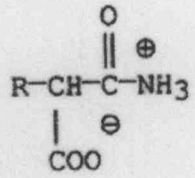
---

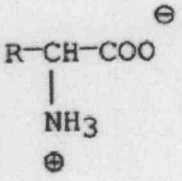
72. Which of the following molecules is the skeletal structure of an amino acid?

a. 

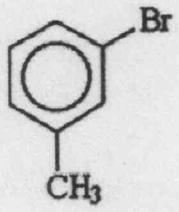
c. 

b. 

d. 

e. 

73. What is the name of the following compound?



a. *m*-Bromomethylbenzene

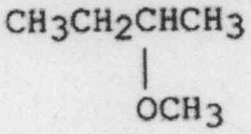
b. 3-Bromotoluene

c. *m*-Bromotoluene

d. A and B

e. B and C

74. When (S)-2-bromobutane undergoes an S_N2 reaction with CH_3O^-, the product is the compound shown below. What is/are the configuration(s) of the product(s) obtained from this reaction?



a. S only

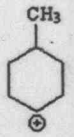
b. R only

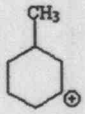
c. a mixture of enantiomers with more S than R

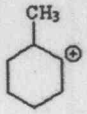
d. equal mixture of R and S

e. a mixture of enantiomers with more R than S

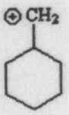
75. Which of the following is the most stable carbocation?

I. 

II. 

III. 

IV. 

V. 

a. I

b. II

c. III

d. IV

e. V

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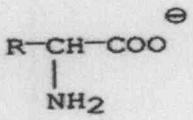
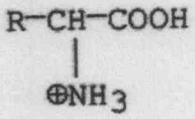
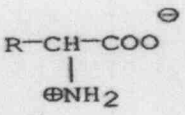
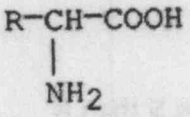
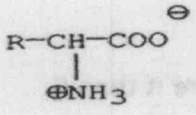
76. Which of the following best represents the structure of an amino acid in basic solution (pH = 11)?

a. 

b. 

c. 

d. 

e. 

77. Which of the following halides is most reactive in an E2 reaction with sodium methoxide?

a. $(CH_3)_2CHCH_2CH_2Cl$

b. $(CH_3)_2CHCH_2Br$

c. $(CH_3)_3CCH_2I$

d. $(CH_3)_2CHCH_2Cl$

e. $(CH_3)_2CHCHICH_3$

78. How many asymmetric centers are present in a molecule of 2,4,6-trimethylheptane?

a. 3

b. 1

c. 2

d. 0

e. 4

79. What is the major product from the acid-catalyzed hydration of 2-methyl-2-pentene?

a. 2-methyl-1-pentanol

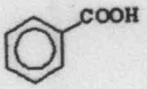
b. 1-methoxypentane

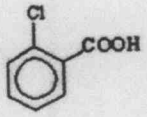
c. 2-methyl-2-pentanol

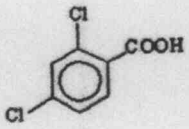
d. 2-methylpentane

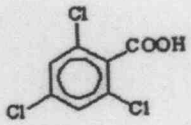
e. 2-methyl-3-pentanol

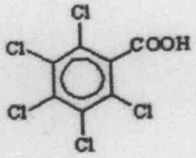
80. Which of the following is the strongest acid?

I 

II 

III 

IV. 

V. 

a. I

b. II

c. III

d. IV

e. V

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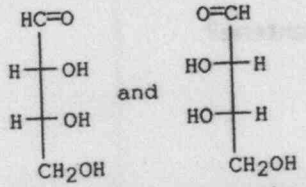
81. What is the relationship between the following compounds?



D-erythrose L-erythrose

a. diastereomers

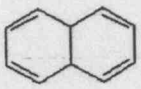
b. constitutional isomers

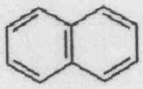
c. enantiomers

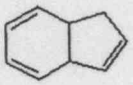
d. identical

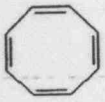
e. conformational isomers

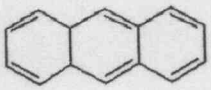
82. Which of the following is aromatic?

I. 

II. 

III. 

IV. 

V. 

a. I

b. II

c. III

d. IV

e. V