"Grade or Education" = 1

CHEM 2060/01
Summer 13
Final Exam
Chapters 1 - 17

1. Pick the choice which **CORRECTLY** names a type of tertiary interaction that could occur between the sidechains of the two given amino acids in a protein molecule?

__ A. The sidechains in CysH and CysH could interact with one another by forming a hydrogen bond.
__ B. The sidechains in Ile and Leu could interact with one another by forming a hydrophilic interaction.
__ C. The sidechains in Ser and Thr could interact with one another by forming a hydrophobic interaction.
__ D. The sidechains in Lys and Asp could interact with one another by forming a salt bridge.
__ E. The sidechains in Met and Met could interact with one another by forming a disulfide bridge.

Rationale:
Problem 16.30

2. Which of the following procedures would be the best way to synthesize p-chloroaniline from benzene?

__ A. First react the benzene with H_2SO_4/HNO_3. Next react with $Cl_2/FeCl_3$. Finally react with H_2 and Pd/C.
__ B. First react the benzene with H_2 and Pd/C. Next react with $Cl_2/FeCl_3$. Finally react with H_2SO_4/HNO_3.
__ C. First react the benzene with $Cl_2/FeCl_3$. Next react with H_2SO_4/HNO_3. Finally react with H_2 and Pd/C.
__ D. First react the benzene with $Cl_2/FeCl_3$. Next react with H_2 and Pd/C. Finally react with H_2SO_4/HNO_3.
__ E. First react the benzene with H_2SO_4/HNO_3. Next react with H_2 and Pd/C. Finally react with $Cl_2/FeCl_3$.

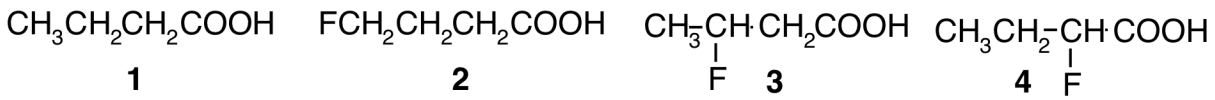
Rationale:
Problem 8.34

3. Docosahexaenoic acid is an ω3 fatty acid with the shorthand designation $C_{22:6}$. At what positions is this fatty acid unsaturated?

__ A. 4, 7, 10, 13, 16, and 19
__ B. 5, 8, 11, 14, 17, and 20
__ C. 6, 9, and 12
__ D. 3, 6, 9, 12, 15, and 18
__ E. 11, 14, and 17

Rationale:
Problem 15.17

4. Choose the answer which lists the numbers under the structures of the four carboxylic acids shown below in order of decreasing acidity of the corresponding carboxylic acids. The number under the strongest carboxylic acid should be first in the list.

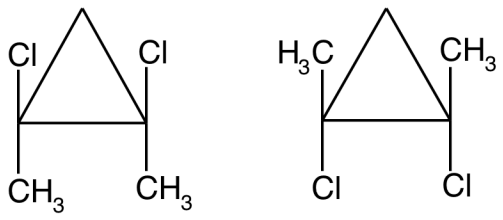


1 **2** **3** **4**

__ A. **1** > **2** > **3** > **4**
__ B. **3** > **4** > **2** > **1**
__ C. **1** > **3** > **4** > **2**
__ D. **4** > **3** > **2** > **1**
__ E. **2** > **4** > **3** > **1**

Rationale:
Problem 2.28

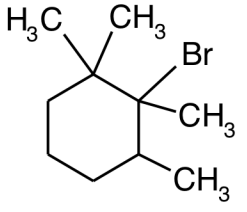
5. What is the relationship between the two structures shown below?



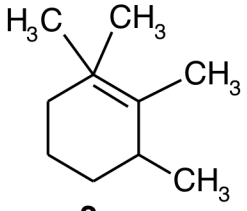
__ A. These structures represent identical compounds.
__ B. These structures represent different compounds which are not isomers of one another.
__ C. These structures represent enantiomers.
__ D. These structures represent diasteriomers.
__ E. These structures represent constitutional isomers.

Rationale:
Problem 6.36e

6. What is the structure of the major elimination product obtained from the reaction of the alkyl halide with structure **1** shown below with hydroxide ion?



1



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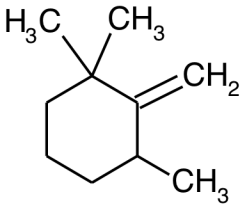

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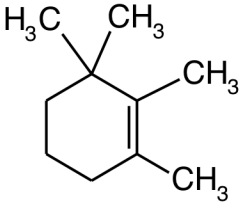

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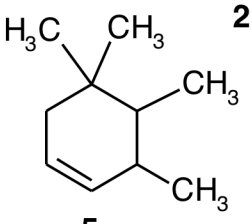

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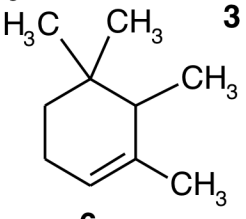


6

__ A. **2**

__ B. **4**

__ C. **6**

__ D. **3**

__ E. **5**

Rationale:
Problem 9.15

7. Pick the choice which **CORRECTLY** gives the structure of the m-RNA sequence which results from transcription of the DNA sequence 3'-...ACGTACGTACAG...-5'

__ A. 5'-...UGCAUGCAUGUC...-3'

__ B. 3'-...GACAUGCAUGCA...-5'

__ C. 5'-...GACATGCATGCA...-3'

__ D. 3'-...TGCATGCATGTC...-5'

__ E. 5'-...GACAUGCAUGCA...-3'

Rationale:
Problem 17.12

8. Pick the choice which CORRECTLY gives the primary structure of the protein which results from translation of the m-RNA sequence 5'-...ACGUGCGUACAG...-3'

__ A. ...Met-Tyr-Val-Pro...

__ B. ...Ala-Arg-Stop-Asp...

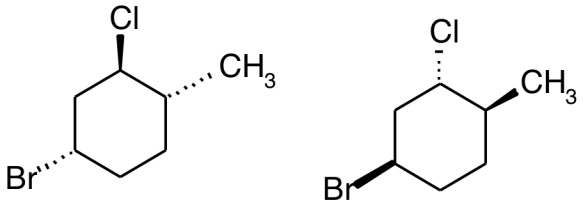
__ C. ...Asp-Stop-Arg-Ala...

__ D. ...Ala-Met-His-Val...

__ E. ...Thr-Cys-Val-Gln...

Rationale:
Problem 17.8

9. What is the relationship between the two structures shown below?



__ A. These structures represent constitutional isomers.

__ B. These structures represent diasteriomers.

__ C. These structures represent different compounds which are not isomers of one another.

__ D. These structures represent identical compounds.

__ E. These structures represent enantiomers.

Rationale:
Problem 6.36h

10. By using the amino acid tables on the rear of your exam calculate the pI of glutamic acid. What is the pI of glutamic acid?

__ A. 6.0

__ B. 7.0

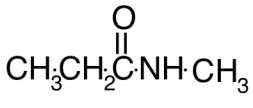
__ C. 3.3

__ D. 4.3

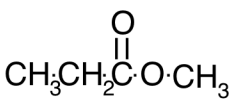
__ E. 5.7

Rationale:
Problem 16.5

11. Starting with propionyl chloride, CH_3CH_2COCl, all of the compounds with the numbered structures shown below can be produced. Which of the choices **CORRECTLY** stipulates the nucleophile which reacts with propionyl chloride to form the specified product?



1



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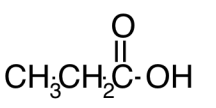

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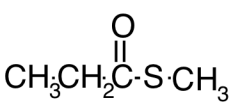

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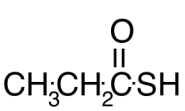


5

__ A. **4** can be made by reacting propionyl chloride with CH_3COSH.

__ B. **2** can be made by reacting propionyl chloride with CH_3COOH.

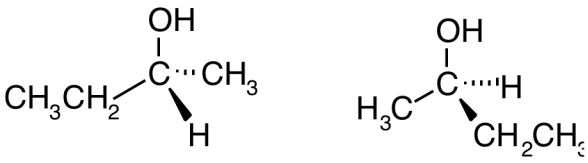
__ C. **3** can be made by reacting propionyl chloride with HOCOOH.

__ D. **1** can be made by reacting propionyl chloride with CH_3CONH_2.

__ E. **5** can be made by reacting propionyl chloride with H_2S.

Rationale:
Problem 11.10

12. What is the relationship between the two structures shown below?



__ A. These structures represent different compounds which are not isomers of one another.

__ B. These structures represent enantiomers.

__ C. These structures represent constitutional isomers.

__ D. These structures represent diasteriomers.

__ E. These structures represent identical compounds.

Rationale:
Problem 6.36(b,f)

13. Think about whether or not each of the chemicals referred to in the multiple choices would make a good soap or detergent and select the choice which is **CORRECT**.

__ A. $CH_3(CH_2)_{16}SO_3^-Na^+$ would make a good soap because it is the salt of a fatty acid.

__ B. $CH_3(CH_2)_{16}COO^-Na^+$ would make a good detergent because it is the salt of a fatty acid.

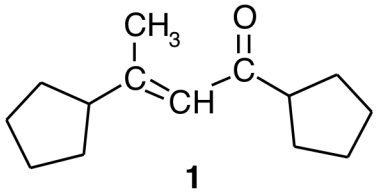
__ C. $CH_3(CH_2)_{16}SO_3^-Na^+$ would make a good detergent because has at least ten carbons and also an ionic group on one end which is not a carboxylate.

__ D. $CH_3CH_2CH_2COOH$ would make a good soap because it is a fatty acid.

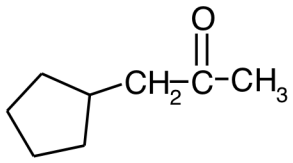
__ E. $CH_3CH_2CH_2COO^-Na^+$ would make a good soap because it is the salt of a fatty acid.

Rationale:
Problem 15.18

14. Find the structure of the starting material which could be used to prepare compound 1 shown below via an aldol condensation (ie. OH^-/H_2O followed by H_3O^+).



1



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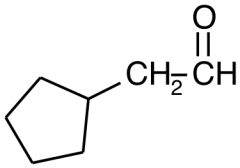

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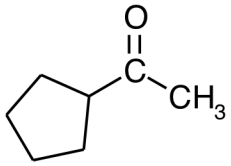

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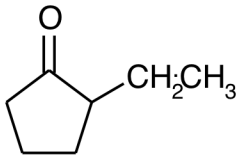

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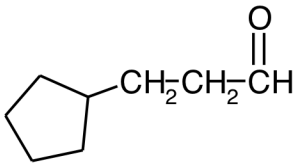


6

__ A. **4**

__ B. **3**

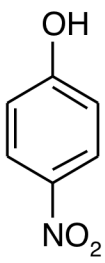
__ C. **2**

__ D. **5**

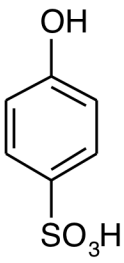
__ E. **6**

Rationale:
Problem 13.13a

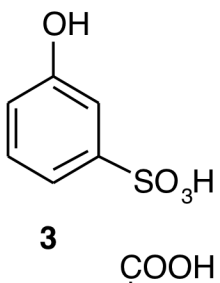
15. Find the products of the reactions given in the multiple choices among the numbered structures below and choose the answer which indicates the **CORRECT** product structure for one of these reactions.



1



2



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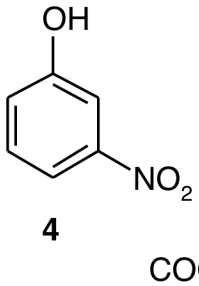

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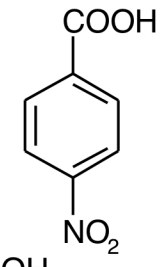

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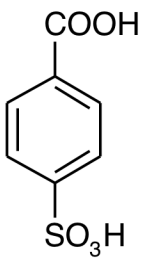

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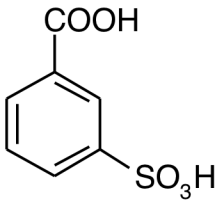

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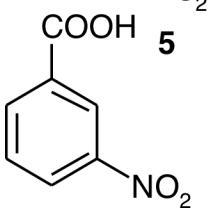


8

__ A. benzoic acid + $HNO_3/H_2SO_4 \rightarrow$ **5**

__ B. benzoic acid + $HNO_3/H_2SO_4 \rightarrow$ **7**

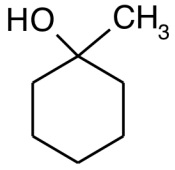
__ C. phenol + $H_2SO_4 \rightarrow$ **3**

__ D. benzoic acid + $H_2SO_4 \rightarrow$ **6**

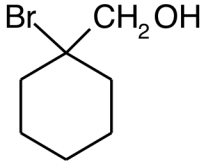
__ E. phenol + $HNO_3/H_2SO_4 \rightarrow$ **1**

Rationale:
Problem 8.28

16. What is the CORRECT structure of the product of the reaction of alcohol **1** with HBr? Use the numbered structures below for reference.



1



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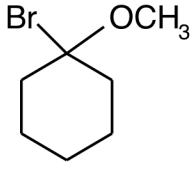

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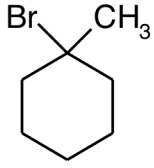

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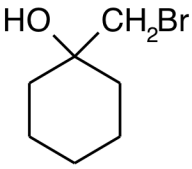

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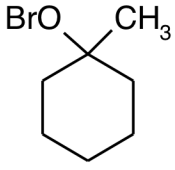


6

__ A. **3**

__ B. **5**

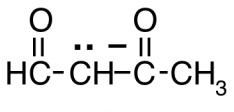
__ C. **2**

__ D. **6**

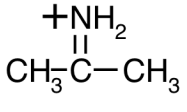
__ E. **4**

Rationale:
Problem 10.6

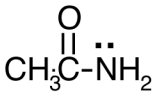
17. For each of the pairs of structures below (ie. **a1** and **a2**) figure out which species in the pair is more stable. Choose the **CORRECT** statement from the multiple choices.



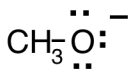
a1



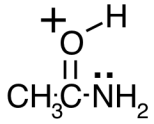
b1



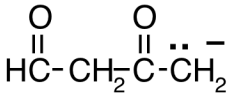
c1



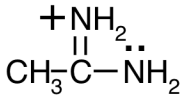
d1



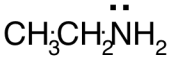
e1



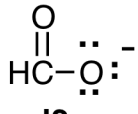
a2



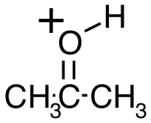
b2



c2



d2



e2

__ A. **e2** is more stable than **e1**.

__ B. **b1** is more stable than **b2**.

__ C. **c1** is more stable than **c2**.

__ D. **d1** is more stable than **d2**.

__ E. **a2** is more stable than **a1**.

Rationale:
Problem 7.31

18. Which of the choices **CORRECTLY** characterizes the hierarchy of protein structure (as 1^{O}, 2^{O}, 3^{O}, or 4^{O}) associated with the particular structural feature described in the choice?

__ A. Hydrogen bonding between N-H and carbonyl oxygen in different amino acids in the backbone (not sidechains) of a protein molecule is responsible for creating the 1^{O} structure of the protein.

__ B. The linear sequence of amino acids such as ...Ala-Pro-Leu-Val... used to characterize a protein is the 3^{O} structure of the protein.

__ C. α and β subunits of an enzyme composed of several protein molecules are held together by interactions which generate the 2^{O} structure of the protein.

__ D. Interactions between sidechains in a two or more protein molecules, like the hydrogen bonding interaction between the sidechains in serine and threonine are involved in creating the 4^{O} structure of the protein.

__ E. Interactions between sidechains in a single protein molecule, like the hydrophobic interaction between the sidechains in leucine and valine are involved in creating the 2^{O} structure of the protein.

Rationale:
Problem 16.29

19. Pick the choice which **CORRECTLY** gives the t-RNA anticodon sequences which result from m-RNA with the sequence 5'-...ACGUACGUACAG...-3'

__ A. 3'-...GACATGCATGCA...-5'

__ B. 3'-...UGCAUGCAUGUC...-5'

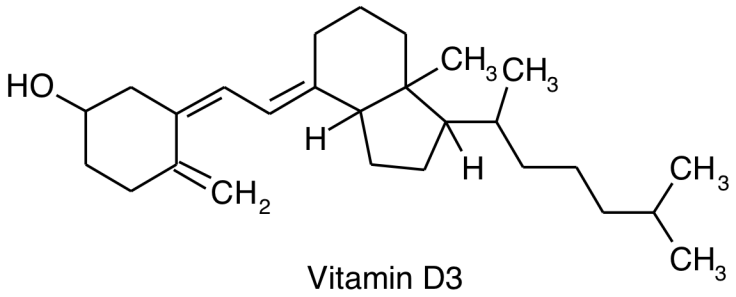
__ C. 3'-...GACAUGCAUGCA...-5'

__ D. 3'-...TGCATGCATGTC...-5'

__ E. 3'-...CUGUACGUACGU...-5'

Rationale:
Problem 17.12

20. Shown below is the structure of vitamin D3. How many asymmetric centers does vitamin D3 have?



Vitamin D3

__ A. 2

__ B. 5

__ C. 6

__ D. 3

__ E. 4

Rationale:
Problem 6.21

21. Pick the choice which **CORRECTL**Y describes an important structural **DIFFERENCE** between DNA and RNA.

__ A. The base adenine (abbreviated A) is different in DNA than it is in RNA.

__ B. RNA is generally single-stranded whereas DNA is generally double-stranded.

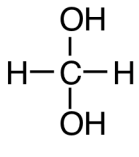
__ C. The base cytosine (abbreviated C) is different in DNA than it is in RNA.

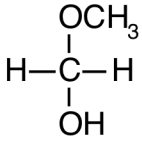
__ D. Ahthough the same sugar molecule is used to build a DNA monomer molecule as an RNA monomer molecule, the phosphate and base are attached to different places on the sugar molecule in DNA than they are in RNA.

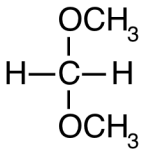
__ E. The base guanine (abbreviated G) is different in DNA than it is in RNA.

Rationale:
Problem 17.10

22. FIgure out whether each of the numbered structures below is an acetal, ketal, hemiacetal, hemiketal, or hydrate. Choose the **CORRECT** statement from the multiple choices.


1


2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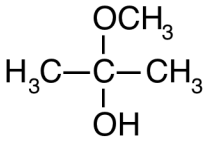
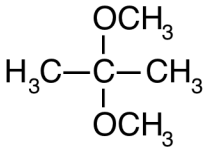

4


5

__ A. **4** is a hydrate.

__ B. **1** is a hemiketal.

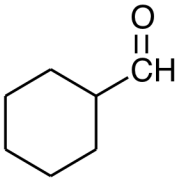
__ C. **1** is an acetal.

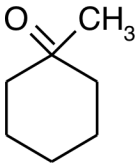
__ D. **3** is a ketal.

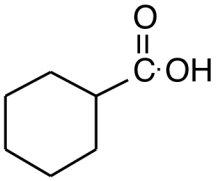
__ E. **2** is an hemiacetal.

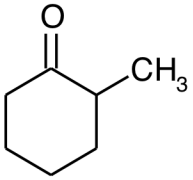
Rationale:
Problem 12.17

23. Figure out whether or not 1-methylcyclohexanol reacts with chromic acid, and if it does find the product of the reaction among the numbered structures below. Choose the **CORRECT** statement from the multiple choices.


1


2


3


4

__ A. 1-Methylcyclohexanol does not react with chromic acid.

__ B. 1-Methylcyclohexanol reacts with chromic acid to form product **1**.

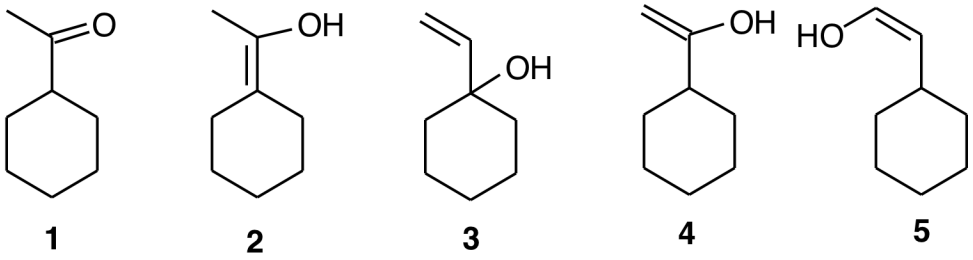
__ C. 1-Methylcyclohexanol reacts with chromic acid to form product **4**.

__ D. 1-Methylcyclohexanol reacts with chromic acid to form product **2**.

__ E. 1-Methylcyclohexanol reacts with chromic acid to form product **3**.

Rationale:
Problem 10.12

24. By referring to the numbered structures below choose the **CORRECT** statement regarding keto-enol tautomerism from the multiple choices.



__ A. **4** is not an enol tautomer of **1**.

__ B. **5** is an enol tautomer of **1**.

__ C. **2** is not an enol tautomer of **1**.

__ D. Both **2** and **4** are enol tautomers of **1**.

__ E. **3** is an enol tautomer of **1**.

Rationale:
Problem 13.6

25. Figure out which of the formulas in the multiple choices below represent nucleophiles and which represent electrophiles. Choose the **CORRECT** statement.

__ A. CH_3^+ is a nucleophile.

__ B. HO^- is an electrophile.

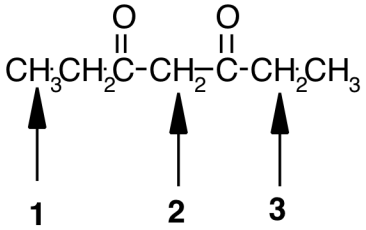
__ C. BF_3 is a nucleophile.

__ D. CH_3NH_2 is an electrophile.

__ E. Br^+ is an electrophile.

Rationale:
Problem 4.14

26. Which choice ranks the numbered hydrogen atoms in the structure below in order of **DECREASING** acidity (highest acidity listed first)?



__ A. **1** > **3** > **2**

__ B. **2** > **3** > **1**

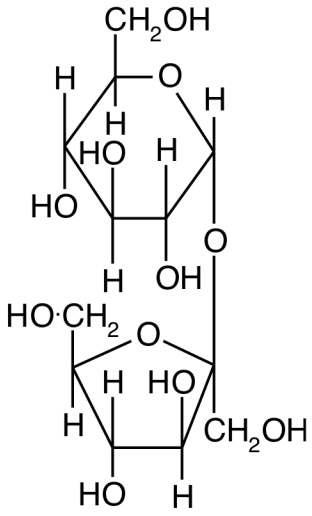
__ C. **3** > **1** > **2**

__ D. **1** > **2** > **3**

__ E. **2** > **1** > **3**

Rationale:
Problem 7.34

27. Shown below is the Haworth structure of a molecule of table sugar (a disaccharide). Pick the choice which **CORRECTLY** specifies the type of glycosidic bond that appears in this disaccharide, and which **ALSO CORRECTLY** identifies the general type of monosaccharide units that appear in this structure.



__ A. Table sugar is composed of an aldohexose linked to a ketopentose with an α,β-1,1 glycosidic bond.

__ B. Table sugar is composed of an aldohexose linked to a ketopentose with an α-1,2 glycosidic bond.

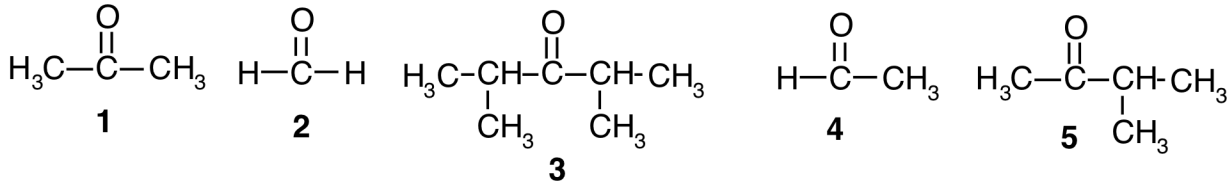
__ C. Table sugar is composed of an aldohexose linked to a ketohexose with a β,α-1,2 glycosidic bond.

__ D. Table sugar is composed of an aldohexose linked to a ketohexose with an α,β-1,2 glycosidic bond.

__ E. Table sugar is composed of an aldohexose linked to a ketohexose with an α,β-1,1 glycosidic bond.

Rationale:
Problem 14.25

28. Which of the choices lists the numbered structures below in order of **INCREASING** reactivity toward nucleophilic attack (lowest reactivity listed first)?



__ A. **1 < 3 < 5 < 2 < 4**

__ B. **3 < 5 < 1 < 4 < 2**

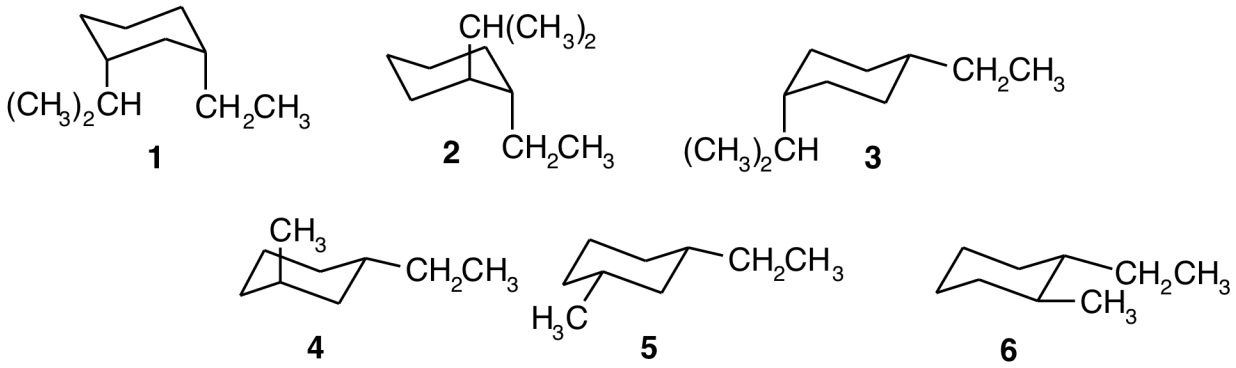
__ C. **5 < 4 < 3 < 2 < 1**

__ D. **2 < 4 < 1 < 5 < 3**

__ E. **1 < 2 < 3 < 4 < 5**

Rationale:
Problem 12.22

29. Look at the numbered strucrures of substituted cyclohexanes below and figure out which choice **CORRECTLY** describes one of them.



__ A. **4** is the structure of the less stable conformer of trans-1-ethyl-3-methylcyclohexane.

__ B. **6** is the structure of the more stable conformer of trans-1-ethyl-2-methylcyclohexane.

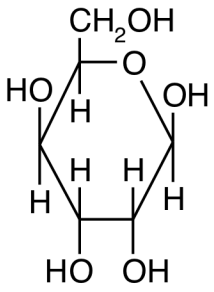
__ C. **1** is the structure of the less stable conformer of cis-1-ethyl-3-methylcyclohexane.

__ D. **3** is the structure of the more stable conformer of cis-1-ethyl-4-isopropylcyclohexane.

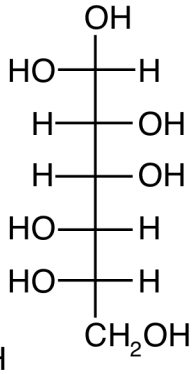
__ E. **5** is the structure of the less stable conformer of cis-1-ethyl-3-methylcyclohexane.

Rationale:
Problem 3.55

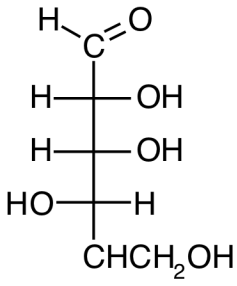
30. Choose the number below the Fischer projection of the sugar which has the same structure as the sugar shown as Haworth projection **1** below.



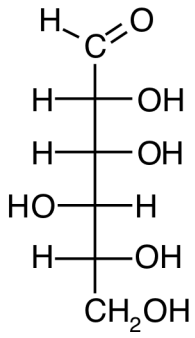
1



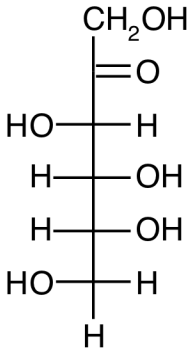
2



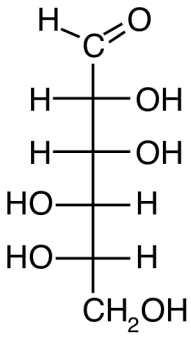
3



4



5



6

__ A. **6**

__ B. **2**

__ C. **5**

__ D. **4**

__ E. **3**

Rationale:
Problem 14.22

31. Based on the pKa values for various acids given in the table below figure out which of the reactions in the multiple choices has its position of equilibrium favoring product as indicated by the direction of its reaction arrow.

Formula	pKa	Formula	pKa	Formula	pKa
HCl	-7	CH_3OH	15.5	CH_3NH_2	40
H_3O^+	-1.7	$CH_3OH_2^+$	-2.5	$CH_3NH_3^+$	10.7
H_2O	15.7	CH_3COOH	4.8	NH_4^+	9.4

__ A. $CH_3COO^- + CH_3OH \rightarrow CH_3O^- + CH_3COOH$

__ B. $CH_3NH_3^+ + CH_3COO^- \rightarrow CH_3NH_2 + CH_3COOH$

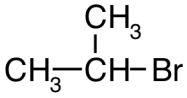
__ C. $CH_3NH_3^+ + H_2O \rightarrow H_3O^+ + CH_3NH_2$

__ D. $CH_3NH_2 + CH_3COO^- \rightarrow CH_3NH^- + CH_3COOH$

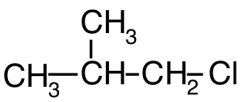
__ E. $CH_3NH^- + CH_3OH \rightarrow CH_3O^- + CH_3NH_2$

Rationale:
Problem 2.10

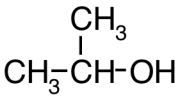
32. Figure out whether the functional group in each of the lettered structures below is primary, secondary, or tertiary. Choose the **CORRECT** statement from the multiple choices.



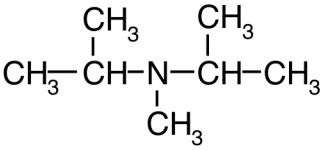
A



B



C



D

__ A. The functional group in structure **C** is tertiary.

__ B. The functional group in structure **D** is tertiary.

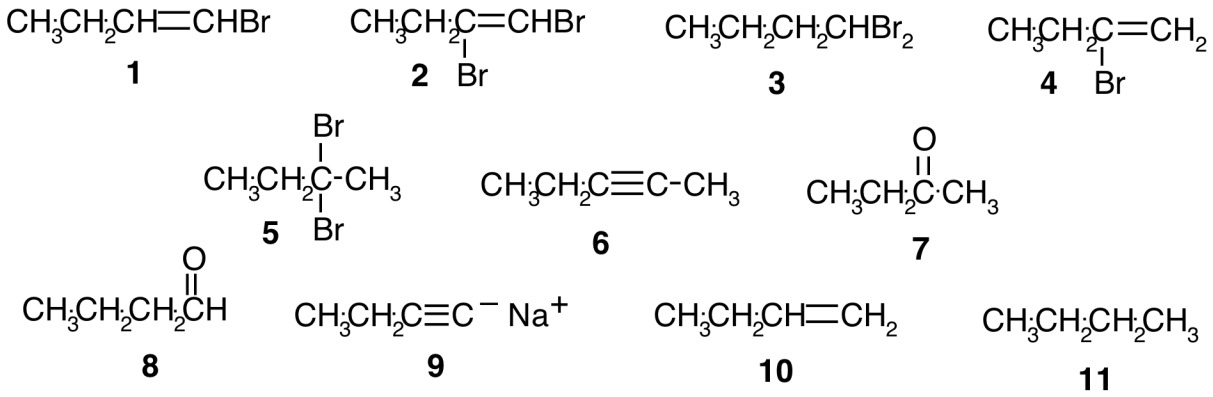
__ C. The functional group in structure **C** is primary.

__ D. The functional group in structure **B** is secondary.

__ E. The functional group in structure **D** is secondary.

Rationale:
Problem 3.15

33. Figure out the structure of major product of the reaction of 1 mol of 1-butyne with each of the reagents specified in the multiple choices. Choose the **CORRECT** statement from these choices. Use the numbered structures below for reference.



__ A. 1 mol of 1-butyne reacts with aqueous H_2SO_4 to form product with structure **8**.

__ B. 1 mol of 1-butyne reacts with H_2/Lindlar catalyst to form product with structure **11**.

__ C. 1 mol of 1-butyne reacts with 2 mol of HBr to form product with structure **3**.

__ D. 1 mol of 1-butyne reacts with 1 mol of HBr to form product with structure **4**.

__ E. 1 mol of 1-butyne reacts with excess H_2, Pt/C to form product with structure **10**.

Rationale:
Problem 5.57

34. Which of the choices gives the **CORRECT** organic product of the reaction of ethyl bromide with a nucleophile?

__ A. $CH_3CH_2Br + CH_3O^- \rightarrow CH_3CH_2OCH_3$

__ B. $CH_3CH_2Br + CH_3OH \rightarrow CH_3CH_2OH$

__ C. $CH_3CH_2Br + CH_3S^- \rightarrow CH_3SBr$

__ D. $CH_3CH_2Br + NH_3 \rightarrow NH_2Br$

__ E. $CH_3CH_2Br + CH_3NH^- \rightarrow CH_3CH_2NH_2$

Rationale:
Problem 9.30

35. What is the molecular formula of a 10-carbon hydrocarbon with 5 pi bonds and two rings?

__ A. $C_{10}H_6$

__ B. $C_{10}H_{12}$

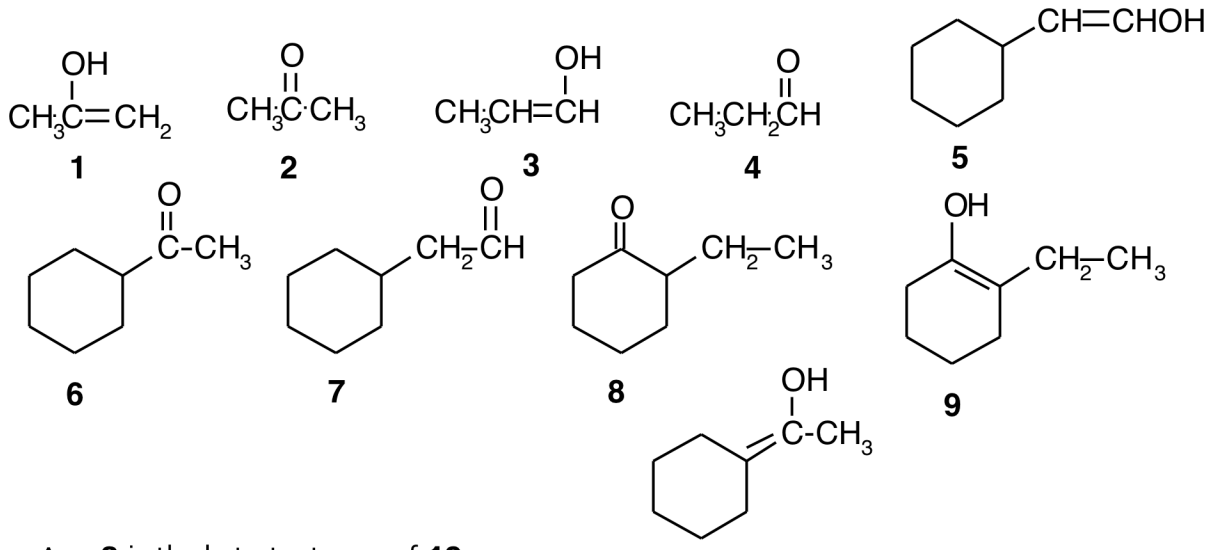
__ C. $C_{10}H_8$

__ D. $C_{10}H_4$

__ E. $C_{10}H_{10}$

Rationale:
Problem 4.32

36. Which of the choices **CORRECTLY** describes the keto-enol relationship between two of the numbered structures shown below?



__ A. **8** is the keto tautomer of **10**.

__ B. **7** is the keto tautomer of **5**.

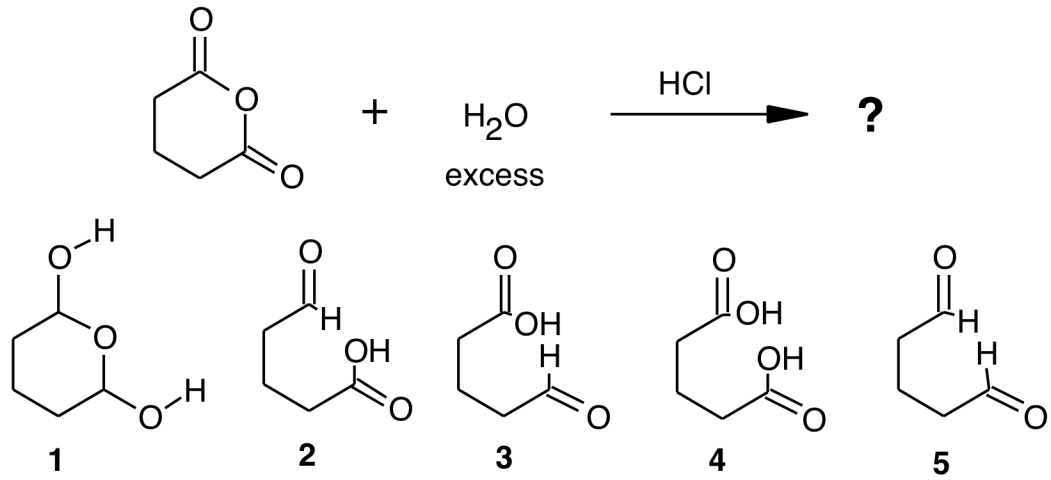
__ C. **2** is the keto tautomer of **3**.

__ D. **6** is the keto tautomer of **9**.

__ E. **4** is the keto tautomer of **1**.

Rationale:
Problem 5.64

37. Find the structure of the product of the reaction shown below among the numbered structures.



__ A. **1** is the product of this reaction.

__ B. **3** is the product of this reaction.

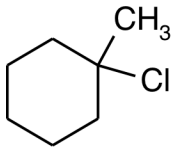
__ C. **5** is the product of this reaction.

__ D. **2** is the product of this reaction.

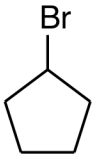
__ E. **4** is the product of this reaction.

Rationale:
Problem 11.38

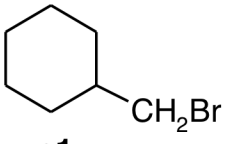
38. Examine the pairs of alkyl halide structures below (ie. **a1** and **a2**). Figure out which structure in each pair represents the compound which would react faster in an S_N1 reaction and which would react faster in an S_N2 reaction.



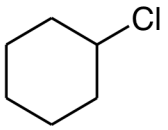
a1



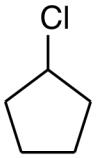
b1



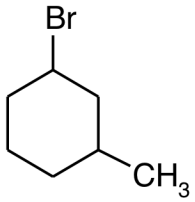
c1



a2



b2



c2

__ A. **b2** reacts faster than **b1** in an S_N2 reaction.

__ B. **b2** reacts faster than **b1** in an S_N1 reaction.

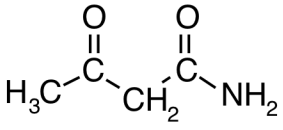
__ C. **a1** reacts faster than **a2** in an S_N1 reaction.

__ D. **a1** reacts faster than **a2** in an S_N2 reaction.

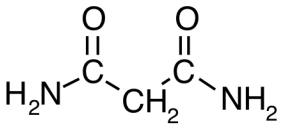
__ E. **c2** reacts faster than **c1** in an S_N2 reaction.

Rationale:
Problems 9.10 & 9.11

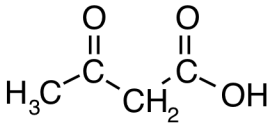
39. Pick the choice which ranks the compounds whose structures are shown below in order of **DECREASING** acidity (strongest acid first).



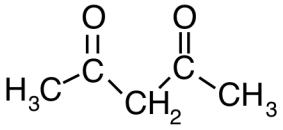
1



2



3



4

__ A. **3** > **4** > **1** > **2**

__ B. **3** > **4** > **2** > **1**

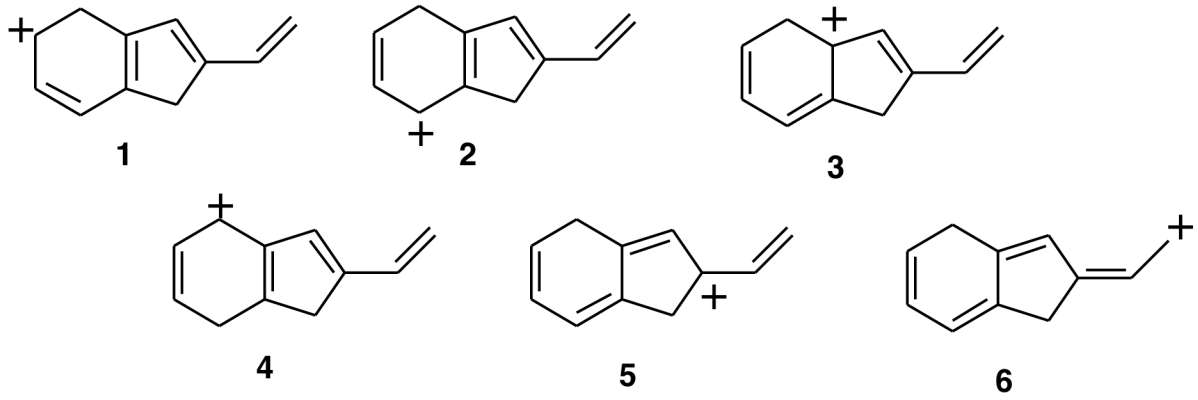
__ C. **3** > **1** > **4** > **2**

__ D. **1** > **3** > **2** > **4**

__ E. **1** > **2** > **3** > **4**

Rationale:
Problem 13.26

40. Which of the numbered structures below is **NOT** a valid resonance structure of the ion with structure **1** shown below?



__ A. **2**

__ B. **6**

__ C. **4**

__ D. **3**

__ E. **5**

Rationale:
Problem 7.23

Answer Key

"Grade or Education" = 1

CHEM 2060/01
Spring 13
Final Exam
Chapters 1 - 17

1. D
2. C
3. A
4. D
5. A
6. B
7. A
8. E
9. E
10. C
11. E
12. E
13. C
14. A
15. E
16. E
17. C
18. D

19. B

20. B

21. B

22. E

23. A

24. D

25. E

26. B

27. D

28. B

29. B

30. D

31. E

32. B

33. D

34. A

35. C

36. B

37. E

38. C

39. A

40. C