"Grade or Education" = 1

CHEM 2261/01
Summer 10
Exam 1
Chapters 1-3

1. Choose the statement which **CORRECTLY** gives the degree of unsaturation of a hydrocarbon with the molecular formula specified?

__ A. A hydrocarbon with the molecular formula $C_{12}H_{20}$ has a degree of unsaturation of 3.
__ B. A hydrocarbon with the molecular formula $C_{20}H_{34}$ has a degree of unsaturation of 3.
__ C. A hydrocarbon with the molecular formula C_8H_{16} has a degree of unsaturation of 2.
__ D. A hydrocarbon with the molecular formula $C_{10}H_{16}$ has a degree of unsaturation of 6.
__ E. A hydrocarbon with the molecular formula $C_{40}H_{56}$ has a degree of unsaturation of 11.

Rationale:
Chapter 3 Problem 2

2. Water and diethyl ether are immiscible liquids. In a vessel containing both water and ether charged compounds dissolve in water, and uncharged compounds dissolve in ether. Given that $C_6H_{11}COOH$ has a pKa of 4.8 and $C_6H_{11}NH_3^+$ ion has a pKa of 10.7, which of the following statements is **TRUE**?

__ A. If the pH of the water layer is above 12.7 the amine will dissolve in the water layer and the carboxylic acid will dissolve in the ether layer.
__ B. If the pH of the water layer is below 2.8 the amine will dissolve in the water layer and the carboxylic acid will dissolve in the ether layer.
__ C. If the pH of the water layer is between 6.8 and 8.7 both compounds will dissolve in the ether layer.
__ D. If the pH of the water layer is below 2.8 both compounds will dissolve in the ether layer.
__ E. If the pH of the water layer is above 12.7 both compounds will dissolve in the water layer.

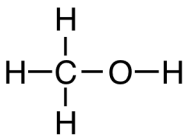
Rationale:
Chapter 1 Problem 103

3. Draw the most stable conformer of each of the disubstituted cyclohexanes named in the multiple choices and find the substance in which one of the substituents is in the **AXIAL** position in the **MOST STABLE** conformer.

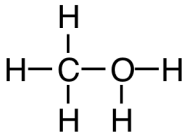
__ A. trans-1-ethyl-2-isopropylcyclohexane
__ B. trans-1-ethyl-2-methylcyclohexane
__ C. trans-1-ethyl-3-methylcyclohexane
__ D. cis-1-ethyl-3-methylcyclohexane
__ E. cis-1-ethyl-3-isopropylcyclohexane

Rationale:
similar to Chapter 2 Problem 67

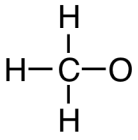
4. Add the missing lone pairs and formal charges to the four incomplete Lewis structures shown below. Choose the **CORRECT** statement about one of the completed structures from the multiple choices.



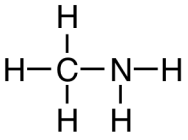
A



B



C



D

__ A. When structure **A** is completed its oxygen atom has 1 lone pair and a positive charge.

__ B. When structure **C** is completed its oxygen atom has 3 lone pairs and a negative charge.

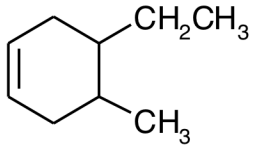
__ C. When structure **D** is completed its nitrogen atom has one lone pair and a positive charge.

__ D. When structure **A** is completed its carbon atom has no lone pairs and a positive charge.

__ E. When structure **B** is completed its oxygen atom has 1 lone pair and a negative charge.

Rationale:
Chapter 1 Problem 83

5. Choose the correct systematic name of the compound whose structure is shown below.



__ A. 1-methyl-2-ethyl-4-cyclohexene

__ B. 2-ethyl-1-methyl-4-cyclohexene

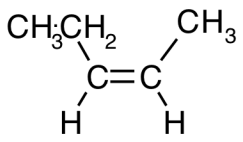
__ C. 1-ethyl-2-methyl-4-cyclohexene

__ D. 4-ethyl-5-methylcyclohexene

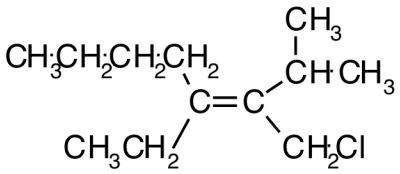
__ E. 5-ethyl-4-methylcyclohexene

Rationale:
Chapter 3 Problem 36f

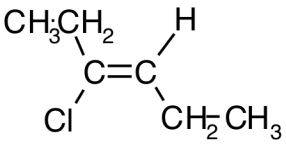
6. Which of the compounds whose structures are shown below have the Z configuration?



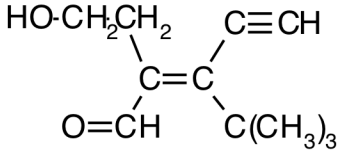
structure A



structure C



structure B



structure D

__ A. The compounds with structures C and D have the Z configuration.

__ B. The compounds with structures A and D have the Z configuration.

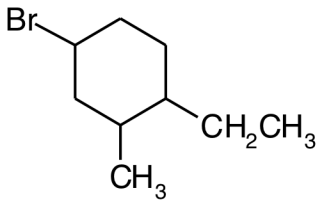
__ C. Only the compound with structure D has the Z configuration.

__ D. The compounds with structures B and C have the Z configuration.

__ E. The compounds with structures A and B have the Z configuration.

Rationale:
Chapter 3 Problem 12

7. Choose the correct systematic name of the compound whose structure is shown below.



__ A. 5-bromo-2-ethyl-1-methylcyclohexane

__ B. 5-bromo-1-methyl-2-ethylcyclohexane

__ C. 1-bromo-4-ethyl-3-methylcyclohexane

__ D. 1-bromo-3-methyl-4-ethylcyclohexane

__ E. 4-bromo-1-ethyl-2-methylcyclohexane

Rationale:
similar to Chapter 2 Problem 75g

8. Use the pKa table below to figure out which of the reactions shown below is written so that the equilibrium does **NOT** lie in the direction indicated (the equilibrium favors reactants rather than products).

ACID	pK_a	ACID	pK_a
CH_3OH	15.5	$CH_3OH_2^+$	-2.5
H_2O	15.7	CH_3NH_2	40
H_3O^+	-1.7	$CH_3NH_3^+$	10.7
NH_4^+	9.4	HCl	-7

__ A. $NH_4^+ + HO^- \rightarrow NH_3 + H_2O$

__ B. $CH_3OH + H_3O^+ \rightarrow CH_3OH_2^+ + H_2O$

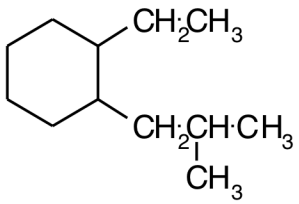
__ C. $CH_3NH_2 + H_3O^+ \rightarrow CH_3NH_3^+ + H_2O$

__ D. $CH_3NH^- + H_2O \rightarrow CH_3NH_2 + HO^-$

__ E. $CH_3OH + HO^- \rightarrow CH_3O^- + H_2O$

Rationale:
Chapter 1 Problem 48

9. How many primary, secondary, and tertiary carbons does the following compound have?



__ A. This compound has 9 primary carbons, 12 secondary carbons, and 3 tertiary carbons.

__ B. This compound has 3 primary carbons, 6 secondary carbons, and 3 tertiary carbons.

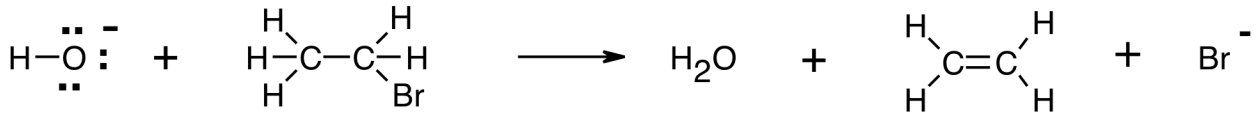
__ C. This compound has 2 primary carbons, 7 secondary carbons, and 3 tertiary carbons.

__ D. This compound has 4 primary carbons, 4 secondary carbons, and 4 tertiary carbons.

__ E. This compound has 1 primary carbons, 2 secondary carbons, and 3 tertiary carbons.

Rationale:
Chapter 2 Problem 52-1

10. Draw curved arrows to show the flow of electrons responsible for the conversion of reactants into products in the reaction shown below. Draw three curved arrows right on the figure below and choose the statement which gives a **WRONG** description of the attributes of one of these arrows.



__ A. The tail of the rightmost arrow originates at the bond betwen carbon and bromine in the bromoethane molecule.

__ B. the point of the rightmost arrow points to the valence shell on the outside of the bromine atom in the bromoethane molecule.

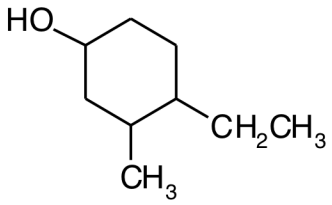
__ C. The point of the middle arrow points to the bonding area between the two carbon atoms in the bromoethane molecule.

__ D. The point of the leftmost arrow points to one of the two hydrogens attached to the same carbon that the bromine is attached to in the bromoethane molecule.

__ E. The tail of the leftmost arrow originates at one of the lone pairs on the oxygen of the hydroxide ion.

Rationale:
Chapter 3 Problem 42

11. Choose the correct systematic name of the compound whose structure is shown below.



__ A. 1-ethyl-6-methyl-4-cyclohexanol

__ B. 1-methyl-2-ethyl-5-cyclohexanol

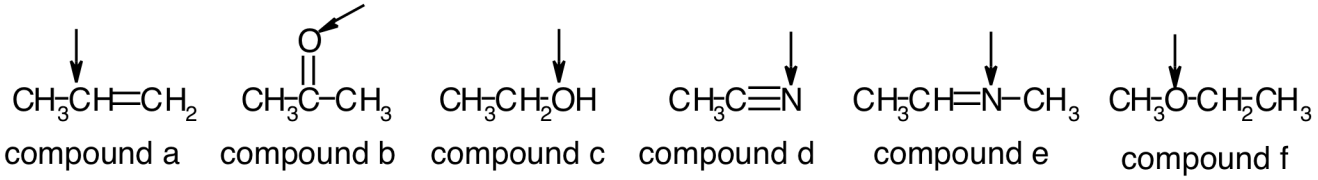
__ C. 1-ethyl-2-methyl-4-cyclohexanol

__ D. 3-methyl-4-ethylcyclohexanol

__ E. 4-ethyl-3-methylcyclohexanol

Rationale:
similar to Chapter 2 Problem 75g

12. Choose the answer which correctly gives the hybridization of the indicated atoms in the compounds below.



__ A. sp^3 in compound a, sp^3 in compound b, sp^4 in compound c, sp^2 in compound d, sp^3 in compound e, and sp^4 in compound f

__ B. sp^2 in compound a, sp in compound b, sp^2 in compound c, sp in compound d, sp^2 in compound e, and sp^2 in compound f

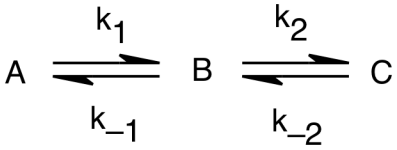
__ C. sp^2 in compound a, sp^2 in compound b, sp^3 in compound c, sp in compound d, sp^2 in compound e, and sp^3 in compound f

__ D. sp^3 in compound a, sp in compound b, sp^2 in compound c, sp in compound d, sp^2 in compound e, and sp^2 in compound f

__ E. sp^2 in compound a, sp in compound b, sp in compound c, sp in compound d, sp in compound e, and sp in compound f

Rationale:
Chapter 1 Problem 82

13. Draw a reaction-coordinate diagram for the following reaction in which C is the most stable and B is the least stable of the three species and the transition state going from A to B is more stable than the transition state going from B to C. Choose the **CORRECT** statement from the multiple choices.



__ A. The step which converts B to A is the rate-determining step in the reverse direction.

__ B. The step which converts B to C is the rate-determining step in the forward direction.

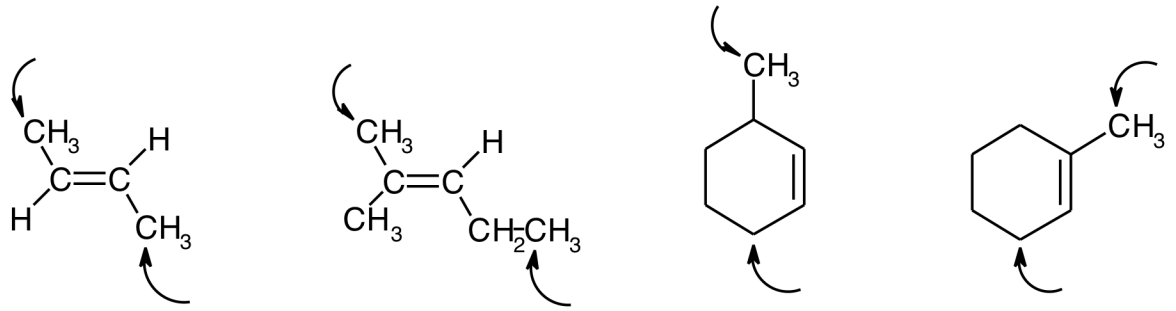
__ C. There are two intermediates in this reaction.

__ D. There are three intermediates in this reaction.

__ E. There is one transition states in this reaction.

Rationale:
Chapter 3 Problem 35

14. Shown below are structures of four compounds (compounds 1-4). In which compounds do the sp^2 carbons and the indicated carbon atoms (see arrows) **ALL** lie in the **SAME PLANE?**



__ A. compounds 1 and 4 only

__ B. compounds 1, 2, 3, and 4

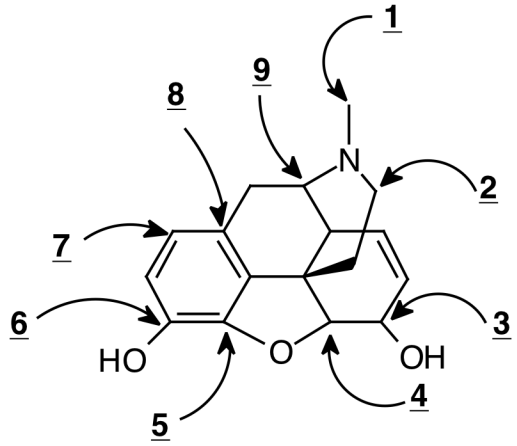
__ C. compound 1 only

__ D. None of these compounds has all of the designated carbons in the same plane.

__ E. compounds 1, 3, and 4

Rationale:
Chapter 1 Problem 89

15. Figure out the number of hydrogens attached to each of the numbered carbon atoms in the following compound. Choose the **CORRECT** statement from the multiple choices.



morphine

__ A. The carbon atom numbered **5** has 0 hydrogens attached to it.

__ B. The carbon atom numbered **3** has 2 hydrogens attached to it.

__ C. The carbon atom numbered **9** has 3 hydrogens attached to it.

__ D. The carbon atom numbered **2** has 1 hydrogen attached to it.

__ E. The carbon atom numbered **1** has 4 hydrogens attached to it.

Rationale:
Chapter 2 Problem 11

Answer Key

"Grade or Education" = 1

CHEM 2261/01
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Exam 1
Chapters 1-3

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