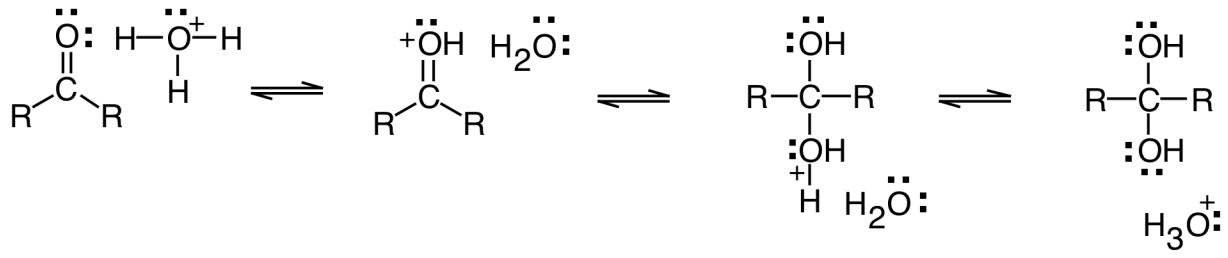
"Grade or Education" = 1

CHEM 2261/01
Summer 12
Exam 1
Chapters 1-3

1. Draw curved arrows on the figure below to complete the mechanism implied by the structures. Choose the **CORRECT** statement from the multiple choices about these curved arrows.



__ A. There are a total of 3 curved arrows in the mechanism whose tails originate at a bond, and whose arrowheads point to an oxygen atom.

__ B. There are a total of 2 curved arrows in the mechanism whose tails originate at a lone pair on an oxygen atom, and whose arrowheads point to a carbon atom.

__ C. None of the other choices in this problem is correct.

__ D. There are a total of 3 curved arrows in the mechanism whose tails originate at a lone pair on an oxygen atom, and whose arrowheads point to a hydrogen atom.

__ E. There are a total of 2 curved arrows in the mechanism whose tails originate at a hydrogen atom, and whose arrowheads point to the lone pair on an oxygen atom.

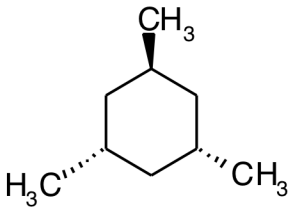
Rationale:
Chapter 3 Problem 57

2. For rotation about the C3 - C4 bond of 2-methylhexane draw and label the Newman projections of the most stable and the least stable conformers. Choose the **CORRECT** statement about one or both of your drawings.

__ A. The least stable conformer has an ethyl group on one carbon situated anti to an isopropyl group on the other carbon.
__ B. The most stable conformer has a methyl group on one carbon situated anti to an butyl group on the other carbon.
__ C. The least stable conformer has a methyl group on one carbon eclipsing an isobutyl group on the other carbon.
__ D. The most stable conformer has an ethyl group on one carbon situated anti to an isopropyl group on the other carbon.
__ E. The most stable conformer has a propyl group on one carbon situated anti to an isobutyl group on the other carbon.

Rationale:
Chapter 2 Problem 64(a,b)

3. Draw the most stable conformer of the molecule whose structure is shown below. Choose the statement which is **CORRECT** about this conformer.



__ A. All three of the methyl groups are equatorial in this conformer.
__ B. Two of the methyl groups are axial and one of the methyl groups is equatorial in this conformer.
__ C. All three of the methyl groups are axial in this conformer.
__ D. Two of the methyl groups are equatorial and one of the methyl groups is axial in this conformer.
__ E. There are no axial hydrogen atoms in this conformer.

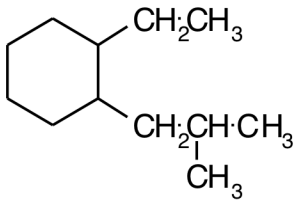
Rationale:
Chapter 2 Problem 71

4. Which of the choices lists a set of substituents in order of **INCREASING** priority in the E, Z priority system (lowest-priority substituent listed first)?

__ A. $-CH_3 < -CH_2CH_2CH_3 < -CH{=}CH_2 < -CH(CH_3)_2$
__ B. $-C(=O)CH_3 < -CH{=}CH_2 < -Cl < -C{\equiv}N$
__ C. $-CH_3 < -CH_2CH_2CH_3 < -CH(CH_3)_2 < -CH{=}CH_2$
__ D. $-CH_2NH_2 < -NH_2 < -OH < -CH_2OH$
__ E. $-CH_2OH < -NH_2 < -OH < -CH_2NH_2$

Rationale:
Chapter 3 Problem 50

5. 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 1 primary carbons, 2 secondary carbons, and 3 tertiary carbons.

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

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

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

Rationale:
Chapter 2 Problem 52

6. Several studies have shown that β-carotene, a precursor of vitamin A, may play a role in preventing cancer. β-Carotene has a molecular formula of $C_{40}H_{56}$ and contains two rings and no triple bonds. How many double bonds does it have?

__ A. 22

__ B. 8

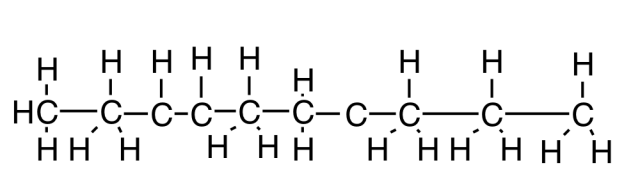
__ C. 12

__ D. 16

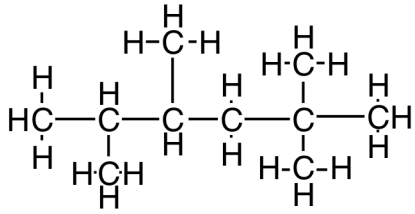
__ E. 11

Rationale:
Chapter 3 Problem 46

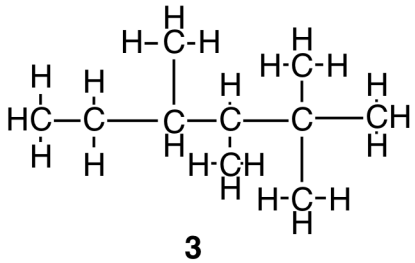
7. Choose the numbered structure from the figure below which shows the correct Kekule structure of the compound with the formula $(CH_3)_2CHCH(CH_3)CH_2C(CH_3)_3$.



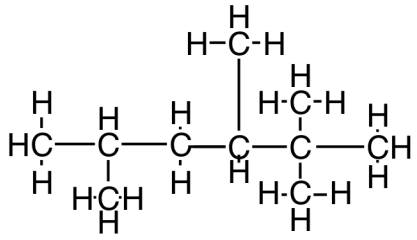
1



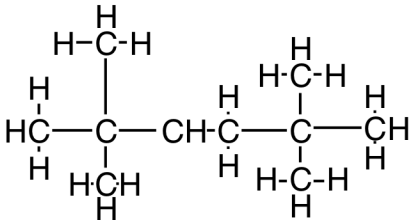
2



3



4



5

__ A. Structure 2 is correct.

__ B. Structure 1 is correct.

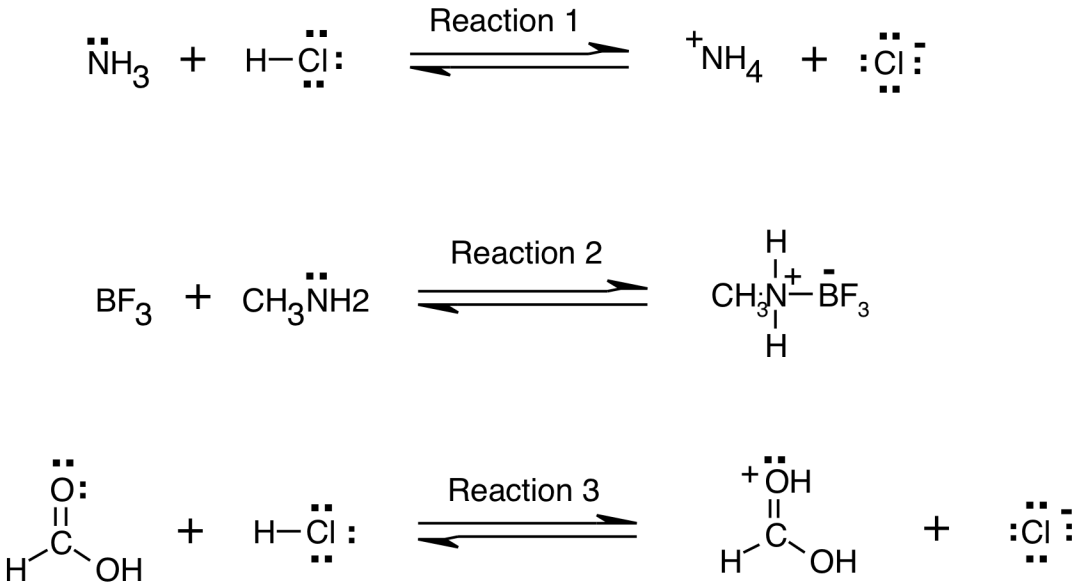
__ C. Structure 5 is correct.

__ D. Structure 3 is correct.

__ E. Structure 4 is correct.

Rationale:
Chapter 1 Problem 79f

8. Draw curved arrows to show the electron flow in the three reactions shown in the figure below. Draw the curved arrows right on the figure itself rather than redrawing it. Pick the **CORRECT** statements about your drawing from the multiple choices.



__ A. In reaction 3 the tail of a curved arrow originates at the bond between H and Cl in H-Cl and the arrowhead points to the topmost O atom in the leftmost structure in this reaction.

__ B. In reaction 2 the tail of a curved arrow originates at B in BF_3 and the arrowhead points to N in CH_3NH_2.

__ C. In reaction 3 the tail of a curved arrow originates at a lone pair on oxygen and the arrowhead points to H in HCl. The tail of a second curved arrow originates from the bond between H and Cl and the arrowhead points to Cl.

__ D. In reaction 1 the tail of a curved arrow originates at the bond between H and Cl in H-Cl and the arrowhead points to N in NH_3.

__ E. In reaction 1 the tail of a curved arrow originates at H in HCl and the arrowhead points to N in NH_3.

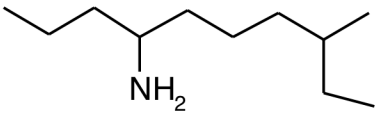
Rationale:
Chapter 1 Problem 80

9. Figure out the hybridization used by the central atom to make bonds in each of the species whose formulas are given in the multiple choices. Figure out whether the bonds and lone pairs around these central atoms have a linear, trigonal planar, or tetrahedral geometry. Pick the **CORRECT** statement from the multiple choices.

__ A. The central atom in H_3O^+ uses sp^2 hybridization, and the bonds and lone pairs around it have trigonal planar geometry.
__ B. The central atom in HCN uses sp^2 hybridization, and the bonds and lone pairs around it have trigonal planar geometry.
__ C. The central atom in $H_2C{=}O$ uses sp hybridization, and the bonds and lone pairs around it have linear geometry.
__ D. The central atom in BH_3 uses sp^3 hybridization, and the bonds and lone pairs around it have tetrahedral geometry.
__ E. The central atom in H_3O^+ uses sp^3 hybridization, and the bonds and lone pairs around it have tetrahedral geometry.

Rationale:
Chapter 1 Problem 72

10. Pick the choice which is an acceptable systematic name for the compound with the structure shown below.



__ A. 8-ethyl-4-nonanamine
__ B. 3-methyl-7-decanamine
__ C. 2-ethyl-6-propyl-6-hexanamine
__ D. 5-methyl-1-propyl-heptanamine
__ E. 8-methyl-4-decanamine

Rationale:
Chapter 2 Problem 66i

11. By looking at the pKa values of the three weak acids shown below determine what form of these substances will predominate in aqueous solutions having the pH values given in the multiple choices. Pick the choice which is **CORRECT** base on your reasoning.

CH_3COOH	$CH_3CH_2NH_3^+$	CF_3CH_2OH
pKa = 4.8	pKa = 11.0	pKa = 12.4

__ A. At pH 10.0 the acid the acid shown on the right will be in the form $CF_3CH_2OH_2^+$.

__ B. At pH 14.0 the acid the acid shown in the middle will be in the form $CH_3CH_2NH_2$.

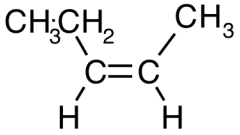
__ C. At pH 3.0 the acid the acid shown on the left will be in the form CH_3COO^-.

__ D. At pH 10.0 the acid the acid shown on the right will be in the form $CF_3CH_2O^-$.

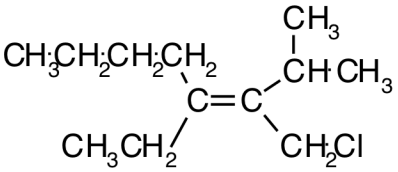
__ E. At pH 6.0 the acid the acid shown on the left will be in the form $CH_3COOH_2^+$.

Rationale:
Chapter 1 Problem 88

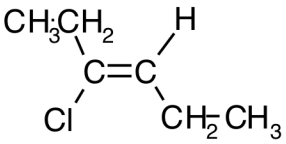
12. Which of the compounds whose structures are shown below have the Z configuration?



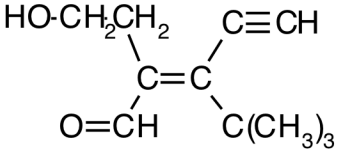
structure A



structure C



structure B



structure D

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

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

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

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

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

Rationale:
Chapter 3 Problem 12

13. Which of the following statements is **CORRECT**?

__ A. 1-bromopentane has a higher boiling point than 1-bromohexane.

__ B. Isopentyl chloride has a higher boiling point than pentyl chloride.

__ C. 1-Methoxypentane has a higher boiling point than 1-hexanol.

__ D. Hexylamine has a higher boiling point than dipropylamine.

__ E. 1-Pentanol has greater solubility in water than 1-butanol.

Rationale:
Chapter 2 Problem 56(a,b,c,d,k)

14. 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. $NH_3 + H_2O \rightarrow NH_4^+ + HO^-$

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

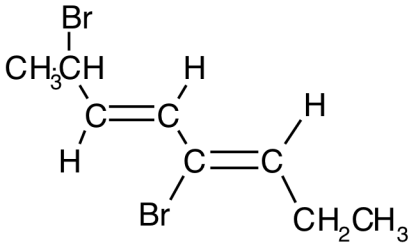
__ C. $CH_3NH^- + H_2O \rightarrow CH_3NH_2 + HO^-$

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

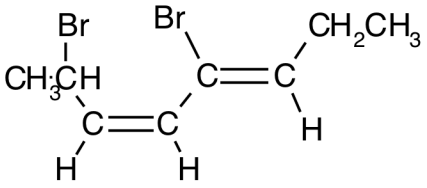
__ E. $CH_3OH_2^+ + H_2O \rightarrow CH_3OH + H_3O^+$

Rationale:
Chapter 1 Problem 48

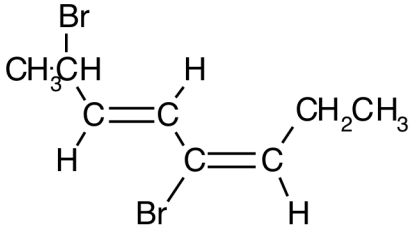
15. Which of the numbered structures shown below is (3E,5E)-2,5-dibromo-3,5-octadiene?



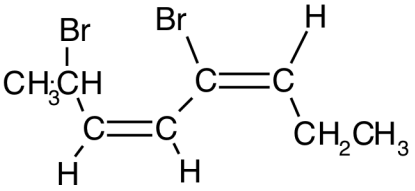
1



2



3



4

__ A. None of these structures is correct.

__ B. 1

__ C. 4

__ D. 2

__ E. 3

Rationale:
Chapter 3 Problem 54d

Answer Key

"Grade or Education" = 1

CHEM 2261/01
Summer 12
Exam 1
Chapters 1-3

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