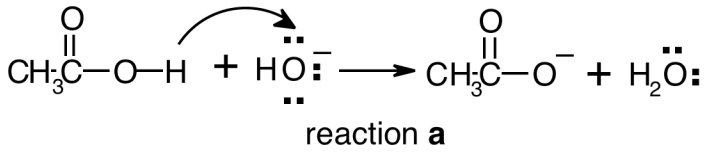
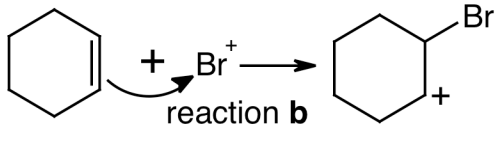
"Grade or Education" = 1

CHEM 2261/01
Summer 09
Exam 1
Chapters 1-3

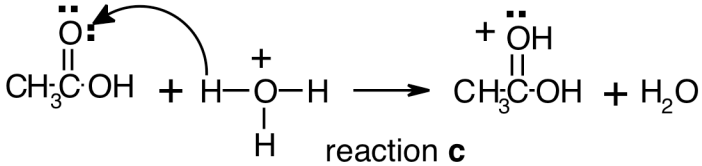
1. Look at the curved-arrow reaction mechanisms shown below. Which reactions have the curved arrows drawn **CORRECTLY**?



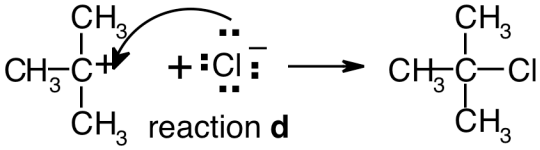
reaction **a**



reaction **b**



reaction **c**



reaction **d**

__ A. All are correct.

__ B. Only reaction **a** is correct.

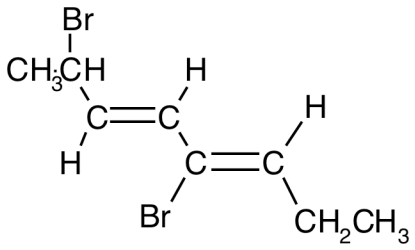
__ C. None are correct.

__ D. reaction **b** and reaction **d**

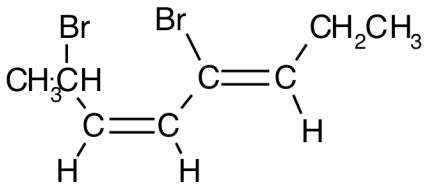
__ E. reaction **a** and reaction **c**

Rationale:
Chapter 3 Problem 20

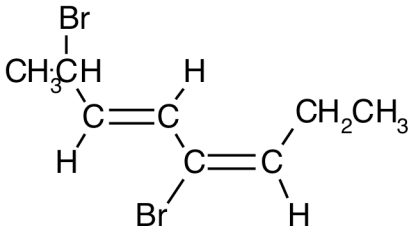
2. Which of the numbered structures shown below is (3E,5E)-2,5-dibromo-3,5-octadiene?



1



2



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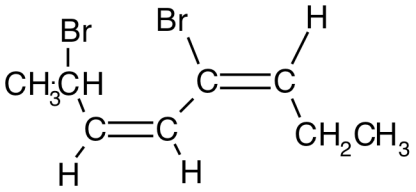


4

__ A. **2**

__ B. **1**

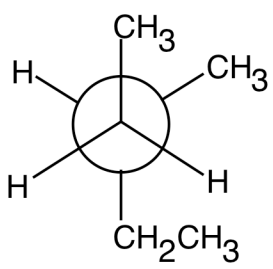
__ C. None of these structures is correct.

__ D. **4**

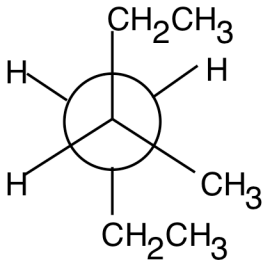
__ E. **3**

Rationale:
Chapter 3 Problem 54

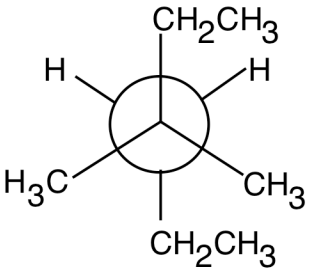
3. Look at the three Newman projections below labelled **a**, **b**, and **c**. Choose the statement which is completely **CORRECT** about one of these projections.



a



b



c

__ A. Structure **c** is the most stable conformation of 3-methylpentane, viewed along the C2-C3 bond.

__ B. Structure **a** is the most stable conformation of 3,3-dimethylhexane, viewed along the C3-C4 bond.

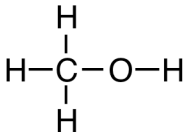
__ C. Structure **a** is the most stable conformation of 3-methylhexane, viewed along the C3-C4 bond.

__ D. Structure **b** is the most stable conformation of 3,3-dimethylhexane, viewed along the C3-C4 bond.

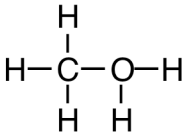
__ E. Structure **b** is the most stable conformation of 3-methylhexane, viewed along the C3-C4 bond.

Rationale:
Chapter 2 Problem 36

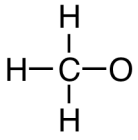
4. Add the missing lone pairs and formal charges to the four incomplete Lewis structures shown below. Choose the **CORRECT** statement about one of the completed structures from the multiple choices.



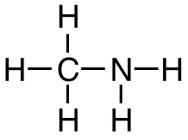
A



B



C



D

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

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

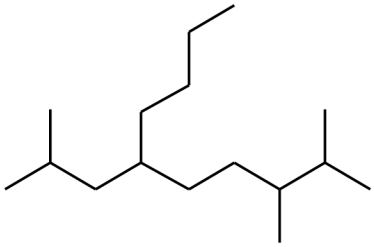
__ C. When structure **A** is completed its oxygen atom has 1 lone pair and a positive charge.

__ D. When structure **C** is completed its oxygen atom has 3 lone pairs and a negative 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 a **CORRECT** systematic name for following alkane.



__ A. 4-butyl-2,7,8-trimethylnonane

__ B. 2,3,8-trimethyl-6-butylnonane

__ C. 6-isobutyl-2,3-dimethyldecane

__ D. 2,7,8-trimethyl-4-butylnonane

__ E. 6-butyl-2,3,8-trimethylnonane

Rationale:
Chapter 2 Problem 66h

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

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

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

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

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

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

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

7. 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 below 2.8 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 both compounds will dissolve in the ether layer.

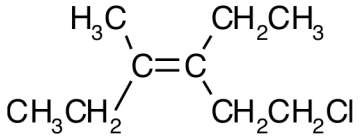
__ C. If the pH of the water layer is between 6.8 and 8.7 both compounds will dissolve in the ether layer.

__ D. If the pH of the water layer is above 12.7 the amine will dissolve in the water layer and the carboxylic acid will dissolve in the ether layer.

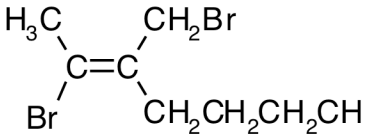
__ E. If the pH of the water layer is above 12.7 both compounds will dissolve in the water layer.

Rationale:
Chapter 1 Problem 103

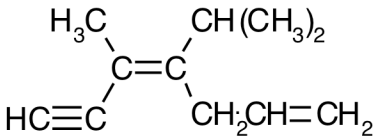
8. Which of the compounds whose structures are shown below have the E configuration?



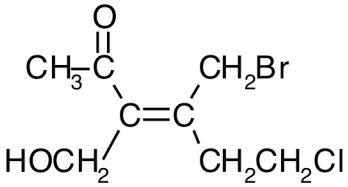
structure A



structure C



structure B



structure D

__ A. All of the above compounds have the E configuration.

__ B. Only the compound with structure D has the E configuration.

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

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

__ E. None of the above compounds have the E configuration.

Rationale:
Chapter 3 Problem 48

9. Draw the two chair conformers of cis-1-ethyl-4-isopropylcyclohexane. Circle the most stable conformer. Choose the statement which is **TRUE** about the structure of the **MOST STABLE** conformer of this compound.

__ A. Both conformers of this compound are equally stable.

__ B. Both the ethyl group and the isopropyl group are axial.

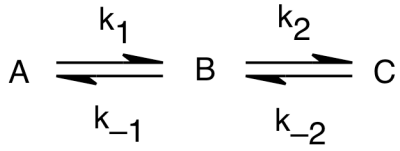
__ C. Both the ethyl group and the isopropyl group are equatorial.

__ D. The isopropyl group is axial and the ethyl group is equatorial.

__ E. The ethyl group is axial and the isopropyl group is equatorial.

Rationale:
Chapter 2 Problem 67f

10. 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. There are three intermediates in this reaction.

__ B. There are two intermediates in this reaction.

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

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

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

Rationale:
Chapter 3 Problem 35

11. 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. 12

__ C. 16

__ D. 11

__ E. 8

Rationale:
Chapter 3 Problem 46

12. 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. $CH_3OH + HO^- \rightarrow CH_3O^- + H_2O$

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

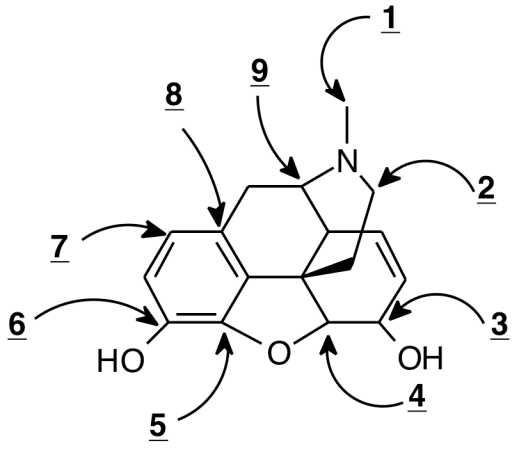
__ C. $CH_3NH^- + H_2O \rightarrow CH_3NH_2 + HO^-$

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

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

Rationale:
Chapter 1 Problem 48

13. 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 **9** has 3 hydrogens attached to it.

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

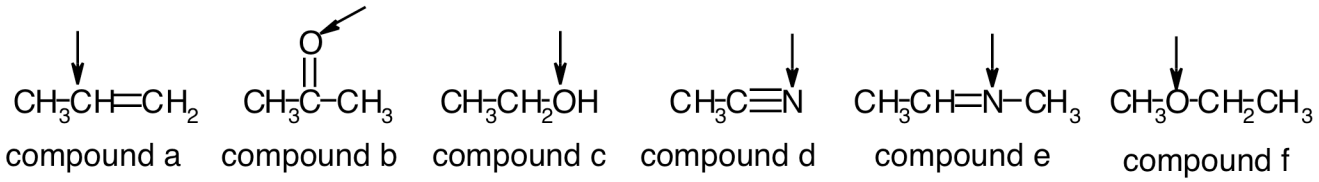
__ C. The carbon atom numbered **3** has 2 hydrogens attached to it.

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

__ E. The carbon atom numbered **9** has 1 hydrogen attached to it.

Rationale:
Chapter 2 Problem 11

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



__ A. 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

__ B. 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

__ 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^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

__ E. 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

Rationale:
Chapter 1 Problem 82

15. Draw Lewis structures for NO_3^-, NO_2^+, HCO_3^-, and H_2CO. Choose the **CORRECT** statement about one of these structures.

__ A. The Lewis structure of HCO_3^- has an O-H single bond, two C-O single bonds and a C=O double bond; one of the oxygen atoms has a negative charge.

__ B. The Lewis structure of H_2CO has 2 O-H single bonds and a C=O double bond; the O atom has 3 lone pairs.

__ C. The Lewis structure of NO_3^- has 2 N=O double bonds and 1 N-O single bond; the N atom has a negative charge.

__ D. The Lewis structure of NO_3^- has 3 N-O single bonds; each oxygen has 2 lone pairs and the nitrogen has a negative charge.

__ E. The Lewis structure of NO_2^+ has 2 N-O single bonds; each oxygen has 3 lone pairs and the nitrogen has a positive charge.

Rationale:
Chapter 1 Problem 14(a,b,g,h)

Answer Key

"Grade or Education" = 1

CHEM 2261/01
Summer 09
Exam 1
Chapters 1-3

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