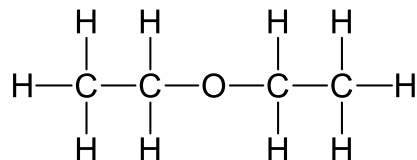


Klein, Organic Chemistry 3e  
Chapter 2

1. What is the molecular formula for the following compound?



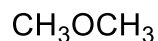
- A. C<sub>2</sub>H<sub>6</sub>O
- B. C<sub>4</sub>H<sub>6</sub>O
- C. C<sub>4</sub>H<sub>10</sub>O
- D. C<sub>2</sub>H<sub>4</sub>O
- E. None of these

Answer: C

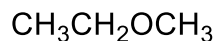
Learning Objective: 2.1 Convert molecular representations from one drawing style to another, including Lewis structures, partially condensed structures, condensed structures, and molecular formulas

Difficulty: Easy

2. Which of the following compounds have a molecular formula of C<sub>2</sub>H<sub>6</sub>O?



I



II



III



IV

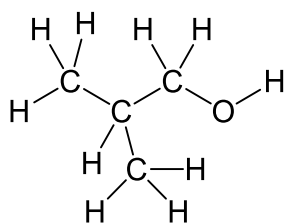
- A. I
- B. II
- C. III
- D. IV
- E. Both I and III

Answer: E

Learning Objective: 2.1 Convert molecular representations from one drawing style to another, including Lewis structures, partially condensed structures, condensed structures, and molecular formulas

Difficulty: Easy

3. Which of the following is the correct condensed structure for the following compound?



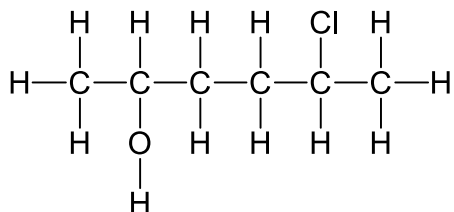
- A.  $\text{CH}_3\text{CHCH}_3\text{CH}_2\text{OH}$
- B.  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
- C.  $(\text{CH}_3)_2\text{CHCH}_2\text{OH}$
- D.  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OCH}_3$
- E.  $\text{CH}_3\text{CH}_3\text{CHCH}_2\text{OH}$

Answer: C

Learning Objective: 2.1 Convert molecular representations from one drawing style to another, including Lewis structures, partially condensed structures, condensed structures, and molecular formulas

Difficulty: Easy

4. Which of the following is the correct condensed structure for the following compound?



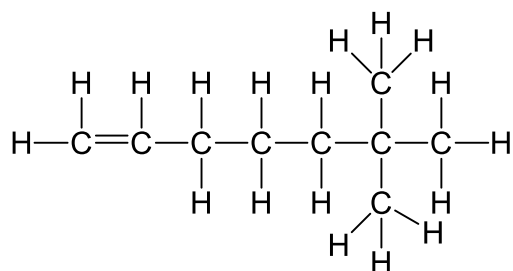
- A.  $\text{CH}_3\text{CHOHCH}_2\text{CHClCH}_3$
- B.  $\text{CH}_3\text{CHOH}(\text{CH}_2)_2\text{CHClCH}_3$
- C.  $(\text{CH}_3)_2\text{CHOHCH}_2\text{CH}_2\text{Cl}$
- D.  $\text{HOCH}_3\text{CHCH}_2\text{CH}_2\text{CH}_3\text{CHCl}$
- E.  $\text{CH}_3\text{C}_2\text{H}_4\text{CH}_3\text{OHCl}$

Answer: B

Learning Objective: 2.1 Convert molecular representations from one drawing style to another, including Lewis structures, partially condensed structures, condensed structures, and molecular formulas

Difficulty: Easy

5. Which of the following is the correct condensed structure for the following compound?



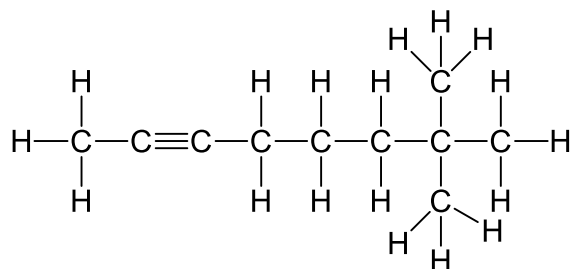
- A.  $\text{CH}_2=\text{CH}(\text{CH}_2)_3\text{C}(\text{CH}_3)_3$
- B.  $\text{CH}(\text{CH}_2)_4\text{C}(\text{CH}_3)_3$
- C.  $(\text{CH}_3)_2\text{CH}(\text{CH}_2)_4\text{CH}_3$
- D.  $\text{CH}_2\text{CH}(\text{CH}_2)_3\text{C}(\text{CH}_3)_3$
- E.  $(\text{CH})_3(\text{CH}_2)_3\text{C}(\text{CH}_3)_3$

Answer: A

Learning Objective: 2.1 Convert molecular representations from one drawing style to another, including Lewis structures, partially condensed structures, condensed structures, and molecular formulas

Difficulty: Medium

6. Which of the following is the correct condensed structure for the following compound?



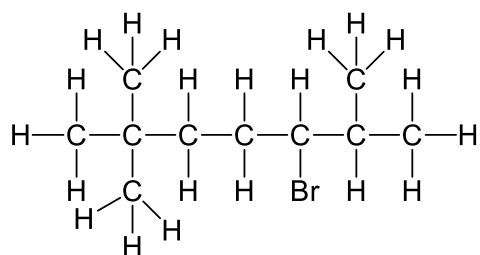
- A.  $\text{CH}_3\text{C}_2(\text{CH}_2)_3\text{C}(\text{CH}_3)_3$
- B.  $\text{CH}_3\text{CC}(\text{CH}_2)_3\text{C}(\text{CH}_3)_2\text{CH}_3$
- C.  $(\text{CH}_3)_3\text{C}_2(\text{CH}_2)_3\text{CH}_3$
- D.  $\text{CH}_3\text{C}\equiv\text{C}(\text{CH}_2)_3\text{C}(\text{CH}_3)_3$
- E.  $\text{CH}_3\text{CC}(\text{CH}_2)_3\text{C}(\text{CH}_3)_3$

Answer: D

Learning Objective: 2.1 Convert molecular representations from one drawing style to another, including Lewis structures, partially condensed structures, condensed structures, and molecular formulas

Difficulty: Medium

7. Which of the following is the correct condensed structure for the following compound?



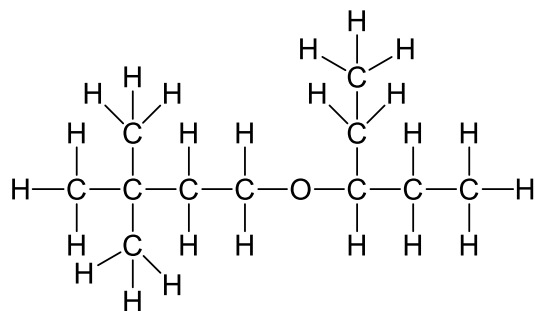
- A.  $\text{CH}_3\text{C}(\text{CH}_3)_2(\text{CH}_2)_2(\text{CH})\text{BrC}(\text{CH}_3)_2$   
 B.  $\text{CH}_3\text{CH}_3\text{CH}_3\text{C}(\text{CH}_2)_2\text{C}(\text{CH}_3)_2\text{CHBr}$   
 C.  $(\text{CH}_3)_3\text{C}(\text{CH}_2)_3\text{BrCHCH}_3\text{CH}_3$   
 D.  $\text{CH}_3\text{CH}_3\text{CH}_3\text{C}(\text{CH}_2)_2\text{CHBrCHCH}_3\text{CH}_3$   
 E.  $(\text{CH}_3)_3\text{C}(\text{CH}_2)_2\text{CHBrCH}(\text{CH}_3)_2$

Answer: E

Learning Objective: 2.1 Convert molecular representations from one drawing style to another, including Lewis structures, partially condensed structures, condensed structures, and molecular formulas

Difficulty: Medium

8. Provide the correct condensed structure for the following compound.

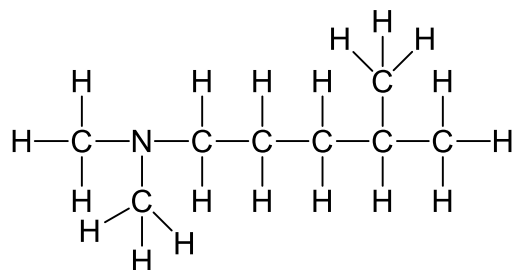


Answer:  $(\text{CH}_3)_3\text{C}(\text{CH}_2)_2\text{OCH}(\text{CH}_2\text{CH}_3)_2$

Learning Objective: 2.1 Convert molecular representations from one drawing style to another, including Lewis structures, partially condensed structures, condensed structures, and molecular formulas

Difficulty: Hard

9. Provide the correct condensed structure for the following compound.



Answer:  $(\text{CH}_3)_2\text{N}(\text{CH}_2)_3\text{CH}(\text{CH}_3)_2$

Learning Objective: 2.1 Convert molecular representations from one drawing style to another, including Lewis structures, partially condensed structures, condensed structures, and molecular formulas

Difficulty: Hard

10. Which of the following is the correct molecular formula for  $(\text{CH}_3\text{CH}_2)_4\text{C}$ ?

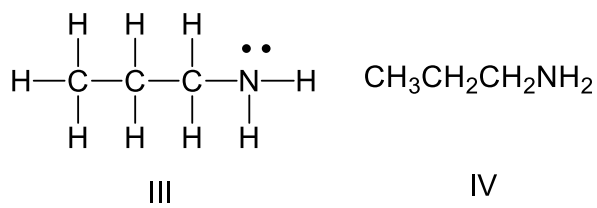
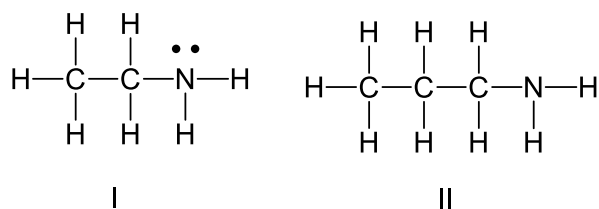
- A.  $\text{C}_8\text{H}_{20}$
- B.  $\text{C}_5\text{H}_{20}$
- C.  $\text{C}_9\text{H}_{20}$
- D.  $\text{C}_6\text{H}_5$
- E.  $\text{C}_3\text{H}_{20}$

Answer: C

Learning Objective: 2.1 Convert molecular representations from one drawing style to another, including Lewis structures, partially condensed structures, condensed structures, and molecular formulas

Difficulty: Easy

11. Which of the following is the correct Lewis structure for  $\text{CH}_3(\text{CH}_2)_2\text{NH}_2$ ?



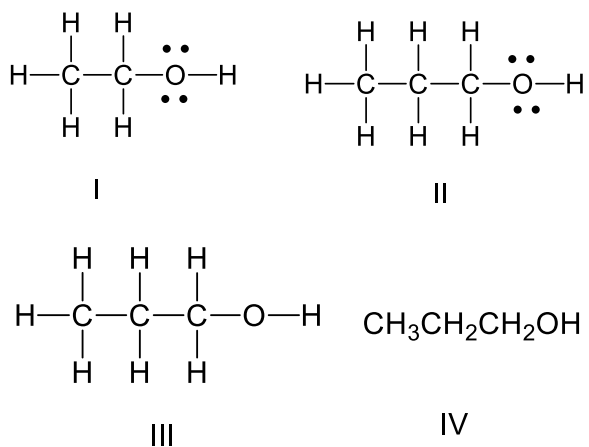
- A. I
- B. II
- C. III
- D. IV
- E. Both II and III

Answer: C

Learning Objective: 2.1 Convert molecular representations from one drawing style to another, including Lewis structures, partially condensed structures, condensed structures, and molecular formulas

Difficulty: Easy

12. Which of the following is the correct Lewis structure for  $\text{CH}_3(\text{CH}_2)_2\text{OH}$ ?



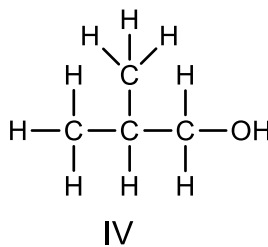
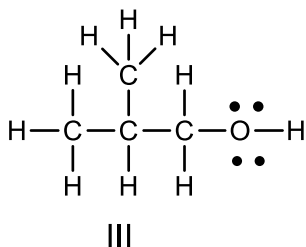
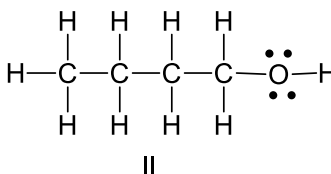
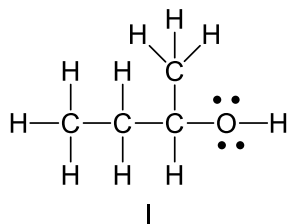
- A. I
- B. II
- C. III
- D. IV
- E. Both II and III

Answer: B

Learning Objective: 2.1 Convert molecular representations from one drawing style to another, including Lewis structures, partially condensed structures, condensed structures, and molecular formulas

Difficulty: Easy

13. Which of the following is the correct Lewis structure for  $(\text{CH}_3)_2\text{CHCH}_2\text{OH}$ ?



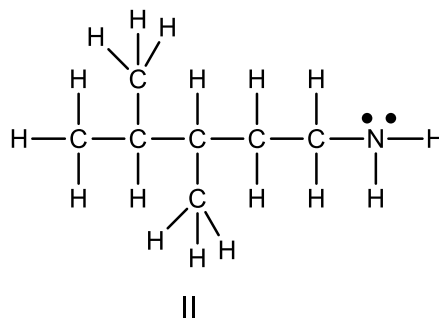
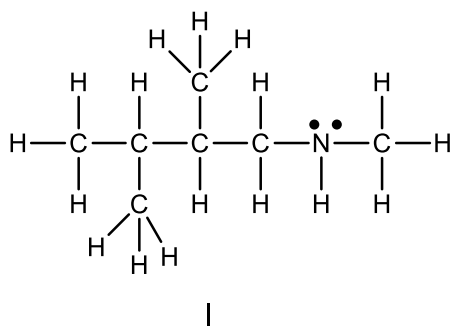
- A. I
- B. II
- C. III
- D. IV
- E. Both III and IV

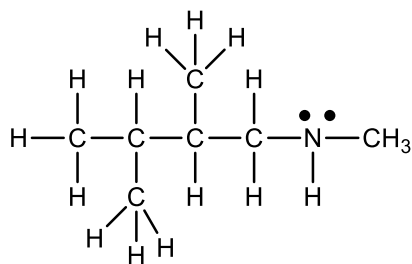
Answer: C

Learning Objective: 2.1 Convert molecular representations from one drawing style to another, including Lewis structures, partially condensed structures, condensed structures, and molecular formulas

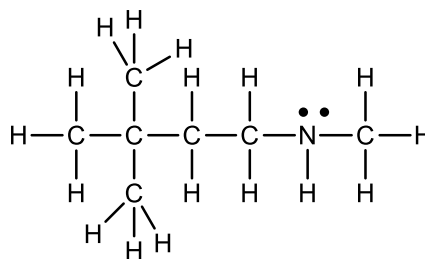
Difficulty: Easy

14. Which of the following is the correct Lewis structure for  $(\text{CH}_3)_3\text{C}(\text{CH}_2)_2\text{NHCH}_3$ ?

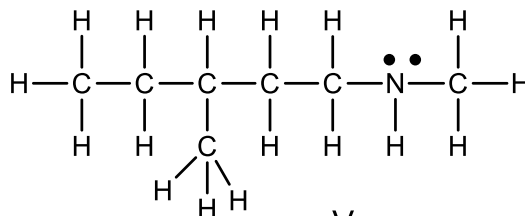




III



IV



V

- A. I
- B. II
- C. III
- D. IV
- E. V

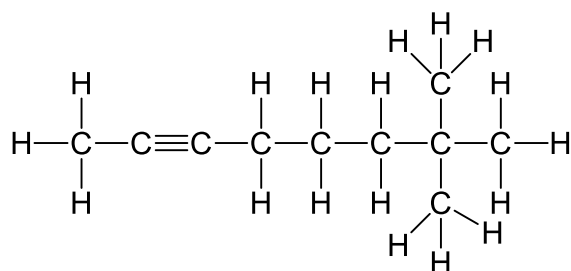
Answer: D

Learning Objective: 2.1 Convert molecular representations from one drawing style to another, including Lewis structures, partially condensed structures, condensed structures, and molecular formulas

Difficulty: Medium

15. Draw the Lewis structure for  $\text{CH}_3\text{C}\equiv\text{C}(\text{CH}_2)_3\text{C}(\text{CH}_3)_3$ .

Answer:



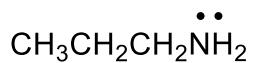
Learning Objective: 2.1 Convert molecular representations from one drawing style to another, including Lewis structures, partially condensed structures, condensed structures, and molecular formulas

Difficulty: Medium

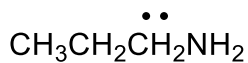




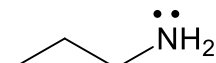
18. Identify the partially condensed structure for  $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$ .



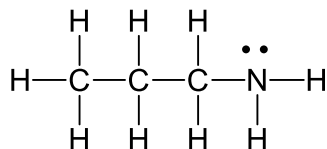
I



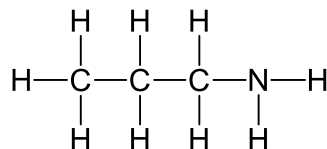
II



III



IV



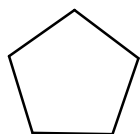
V

Answer: A

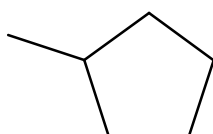
Learning Objective: 2.1 Convert molecular representations from one drawing style to another, including Lewis structures, partially condensed structures, condensed structures, and molecular formulas

Difficulty: Easy

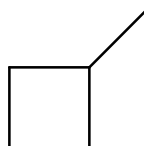
19. Which of the following bond-line structures are of the same compound?



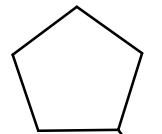
I



II



III



IV

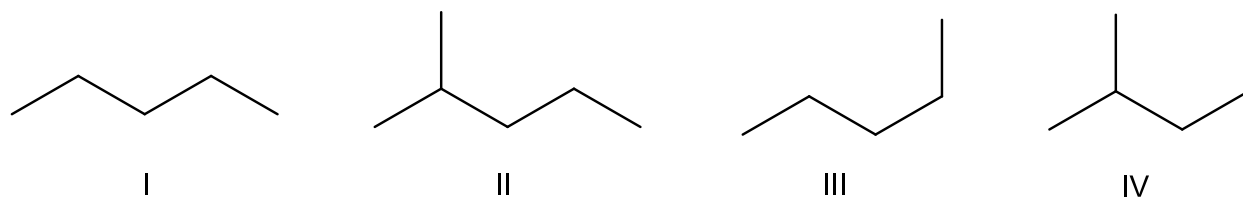
- A. I and II
- B. II and III
- C. III and IV
- D. II and IV
- E. None of these

Answer: D

Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Easy

20. Which of the following bond-line structures are of the same compound?



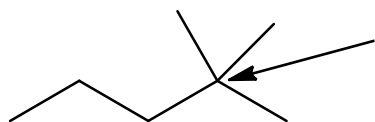
- A. I and III
- B. II and III
- C. III and IV
- D. II and IV
- E. None of these

Answer: A

Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Easy

21. How many hydrogen atoms are connected to the indicated carbon atom?



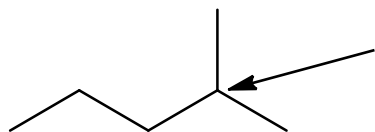
- A. one
- B. two
- C. three
- D. four
- E. none

Answer: E

Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Easy

22. How many hydrogen atoms are connected to the indicated carbon atom?



- A. one
- B. two

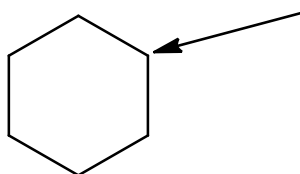
- C. three
- D. four
- E. none

Answer: A

Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Easy

23. How many hydrogen atoms are connected to the indicated carbon atom?



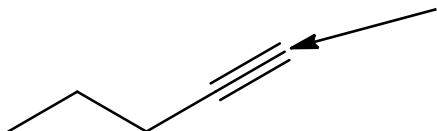
- A. one
- B. two
- C. three
- D. four
- E. none

Answer: B

Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Easy

24. How many hydrogen atoms are connected to the indicated carbon atom?



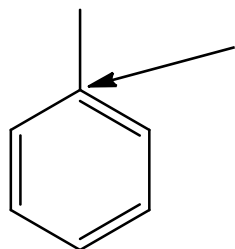
- A. one
- B. two
- C. three
- D. four
- E. none

Answer: A

Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Easy

25. How many hydrogen atoms are connected to the indicated carbon atom?



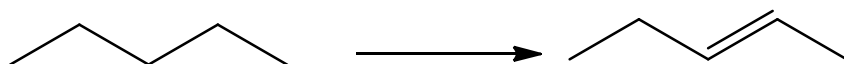
- A. one
- B. two
- C. three
- D. four
- E. none

Answer: E

Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Easy

26. For the following equation, how many hydrogen atoms are added or lost?



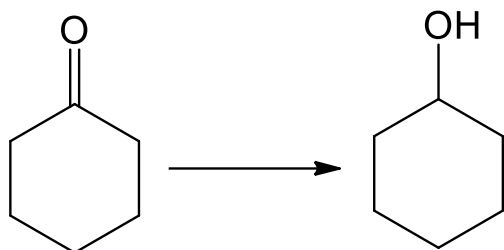
- A. added one
- B. added two
- C. lost one
- D. lost two
- E. no change

Answer: D

Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Easy

27. For the following equation, how many hydrogen atoms are added or lost?



- A. added one
- B. added two
- C. lost one
- D. lost two
- E. no change

Answer: B

Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Easy

28. For the following equation, how many hydrogen atoms are added or lost?



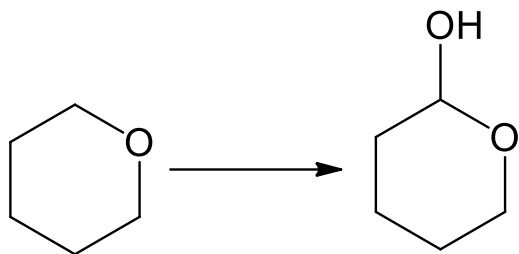
- A. added one
- B. added two
- C. lost one
- D. lost two
- E. no change

Answer: E

Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Easy

29. For the following equation, how many hydrogen atoms are added or lost?



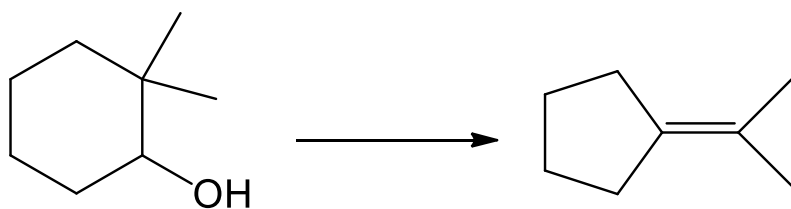
- A. added one
- B. added two
- C. lost one
- D. lost two
- E. no change

Answer: E

Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Easy

30. For the following equation, how many hydrogen atoms are added or lost?



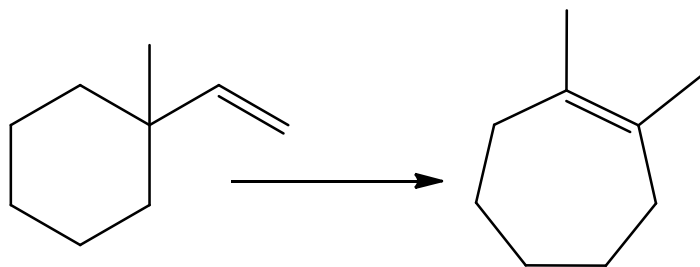
- A. added one
- B. added two
- C. lost one
- D. lost two
- E. no change

Answer: D

Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Medium

31. For the following equation, how many hydrogen atoms are added or lost?



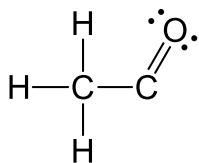
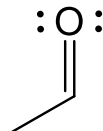
- A. added one
- B. added two
- C. lost one
- D. lost two
- E. no change

Answer: E

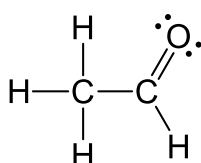
Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Medium

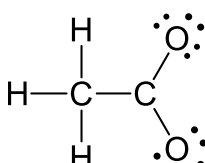
32. Which of the following is the correct Lewis structure for the following compound?



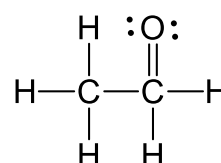
I



II



III



IV

- A. I
- B. II
- C. III
- D. IV
- E. none of these

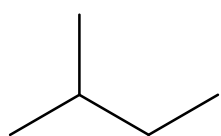
Answer: B

Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

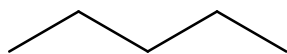
Difficulty: Easy



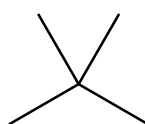
33. Which of the following is the correct bond-line structure for  $(\text{CH}_3)_4\text{C}$ ?



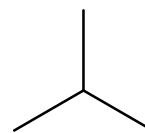
I



II



III



IV

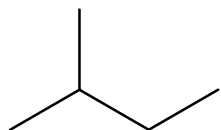
- A. I
- B. II
- C. III
- D. IV
- E. None of these

Answer: C

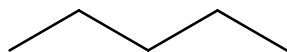
Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Easy

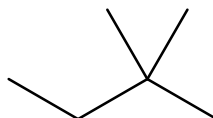
34. Which of the following is the correct bond-line structure for  $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_3$ ?



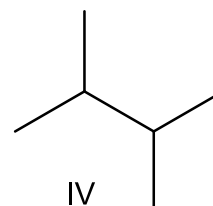
I



II



III



IV

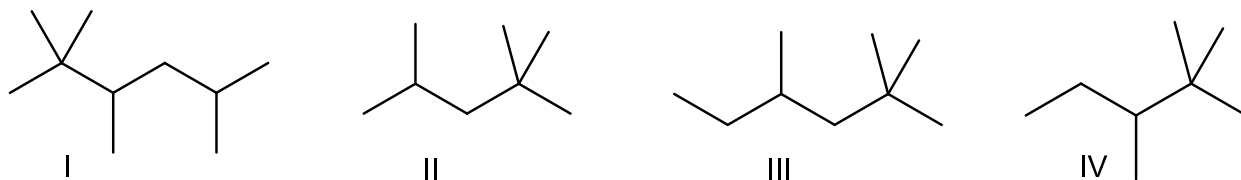
- A. I
- B. II
- C. III
- D. IV
- E. None of these

Answer: A

Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Easy

35. Which of the following is the correct bond-line structure for  $(\text{CH}_3)_2\text{CHCH}_2\text{C}(\text{CH}_3)_3$ ?



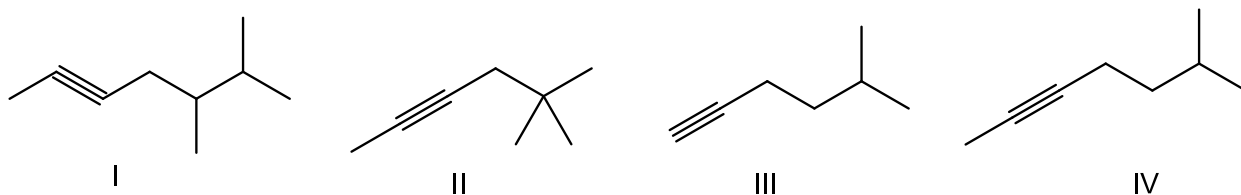
- A. I
- B. II
- C. III
- D. IV
- E. None of these

Answer: B

Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Medium

36. Which of the following is the correct bond-line structure for  $\text{CH}_3\text{C}\equiv\text{C}(\text{CH}_2)_2\text{CH}(\text{CH}_3)_2$ ?



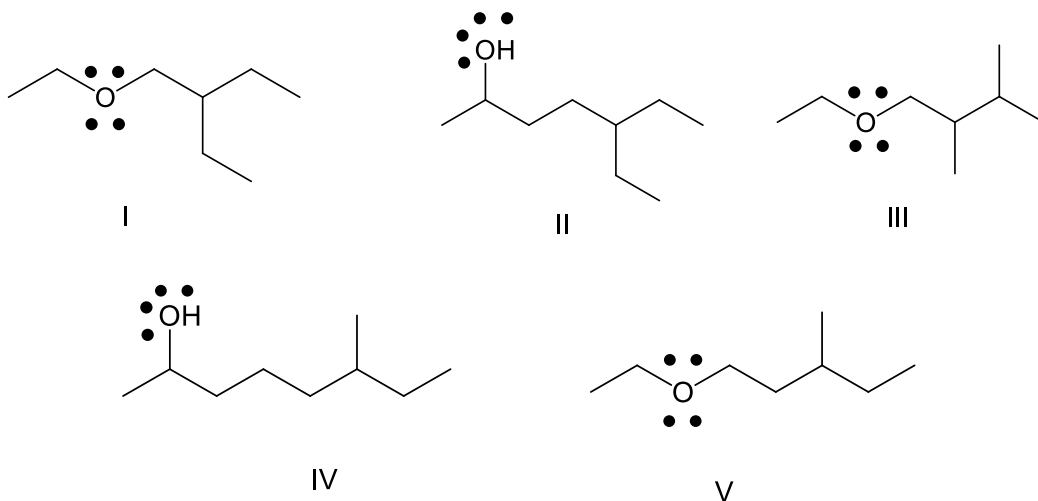
- A. I
- B. II
- C. III
- D. IV
- E. None of these

Answer: D

Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Medium

37. Which of the following is the correct bond-line structure for  $\text{CH}_3\text{CHOH}(\text{CH}_2)_2\text{CH}(\text{CH}_2\text{CH}_3)_2$ ?



- A. I
- B. II
- C. III
- D. IV
- E. V

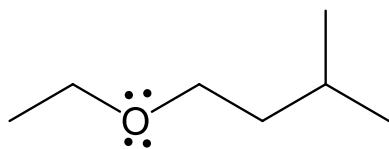
Answer: B

Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Medium

38. Draw a bond-line structure for  $\text{CH}_3\text{CH}_2\text{O}(\text{CH}_2)_2\text{CH}(\text{CH}_3)_2$ .

Answer:

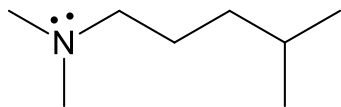


Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Hard

39. Draw a bond-line structure for  $(\text{CH}_3)_2\text{N}(\text{CH}_2)_3\text{CH}(\text{CH}_3)_2$ .

Answer:

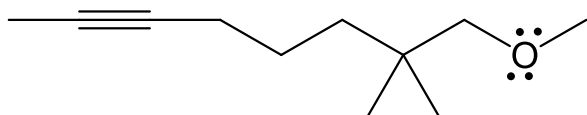


Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Hard

40. Draw a bond-line structure for  $\text{CH}_3\text{C}\equiv\text{C}(\text{CH}_2)_3\text{C}(\text{CH}_3)_2\text{CH}_2\text{OCH}_3$ .

Answer:

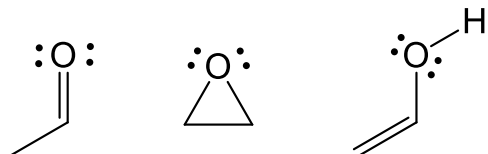


Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Hard

41. Draw a bond-line structure for each constitutional isomer with a molecular formula of  $\text{C}_2\text{H}_4\text{O}$ .

Answer:

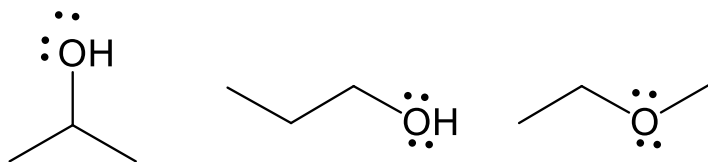


Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Hard

42. Draw a bond-line structure for each constitutional isomer with a molecular formula of  $\text{C}_3\text{H}_8\text{O}$ .

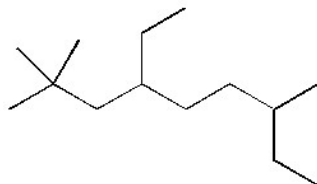
Answer:



Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Hard

43. Provide a condensed structure for the following compound.

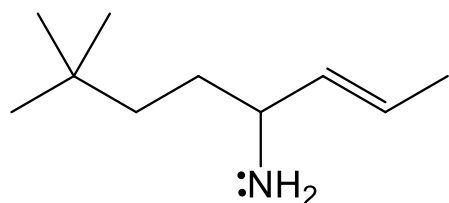


Answer:  $(\text{CH}_3)_3\text{CCH}_2\text{CH}(\text{CH}_2\text{CH}_3)(\text{CH}_2)_2\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_3$

Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Hard

44. Provide a condensed structure for the following compound.



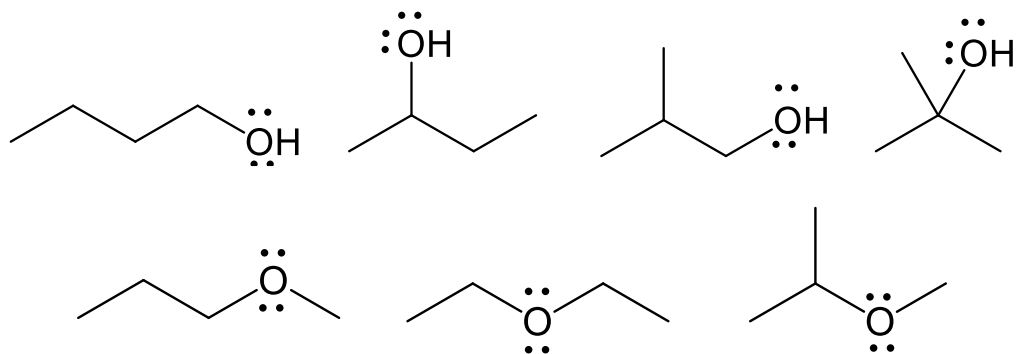
Answer:  $(\text{CH}_3)_3\text{C}(\text{CH}_2)_2\text{CH}(\text{NH}_2)\text{CH}=\text{CHCH}_3$

Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Hard

45. Draw a bond-line structure for each constitutional isomer with molecular formula  $C_4H_{10}O$ .

Answer:

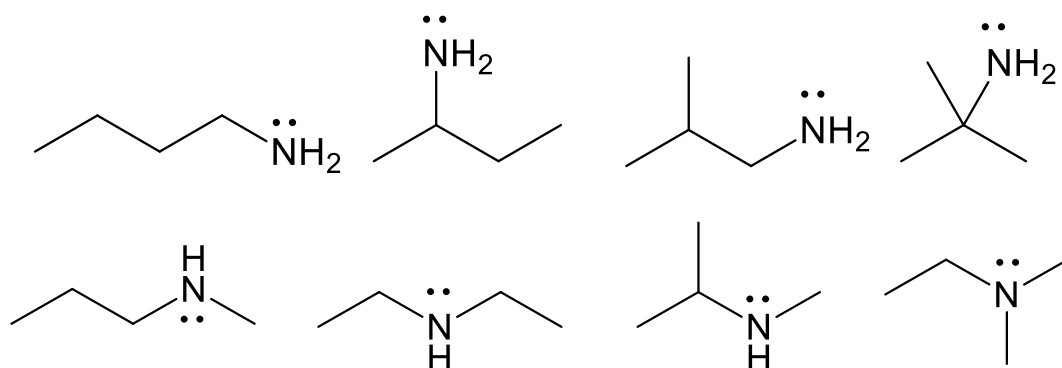


Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Hard

46. Draw a bond-line structure for each constitutional isomer with molecular formula  $C_4H_{11}N$ .

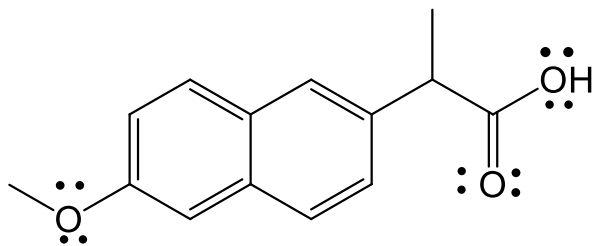
Answer:



Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Medium

47. Naproxen, sold under the trade name Aleve, has the following structure. What is the molecular formula for naproxen?

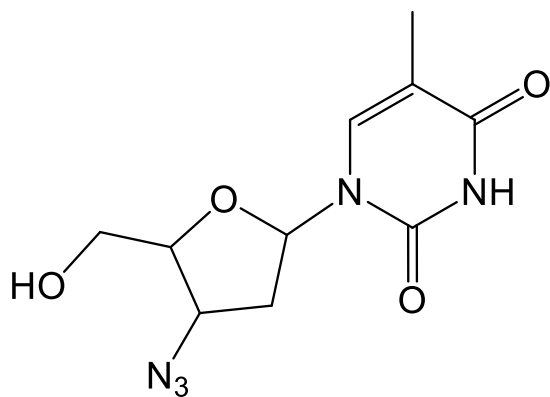


Answer:  $C_{14}H_{14}O_3$

Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Hard

48. AZT, used in the treatment of AIDS, has the following structure. What is the molecular formula for AZT?

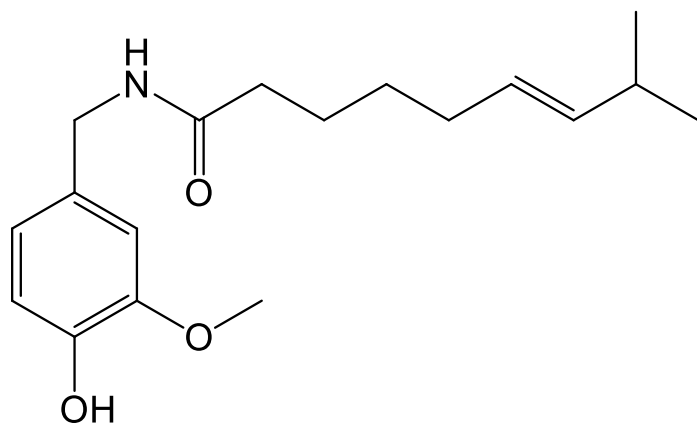


Answer:  $C_{10}H_{13}N_5O_4$

Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Hard

49. Capsaicin, found in peppers, has the following structure. What is the molecular formula for capsaicin?

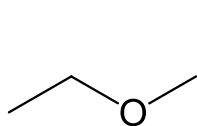


Answer:  $C_{18}H_{27}NO_3$

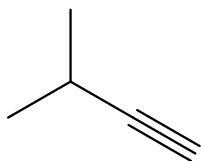
Learning Objective: 2.2 Demonstrate how to read and draw bond-line structures through converting other styles of molecular representation into bond-line structures and vice versa

Difficulty: Hard

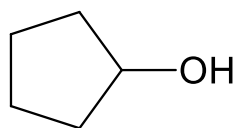
50. Which of the following compounds contain an alcohol functional group?



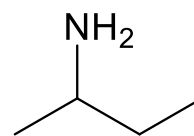
I



II



III



IV

- A. I
- B. II
- C. III
- D. IV
- E. None of these

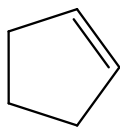
Answer: C

Learning Objective: 2.3 Identify and draw the functional groups

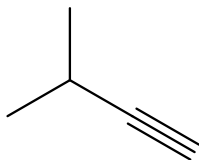
Difficulty: Easy

51. Which of the following compounds contain an alkene functional group?

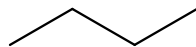




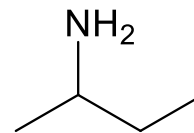
I



II



III



IV

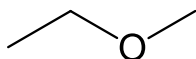
- A. I
- B. II
- C. III
- D. IV
- E. None of these

Answer: A

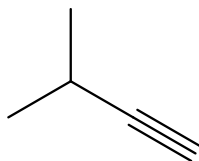
Learning Objective: 2.3 Identify and draw the functional groups

Difficulty: Easy

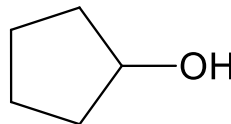
52. Which of the following compounds contain an amine functional group?



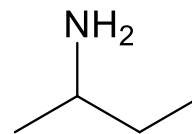
I



II



III



IV

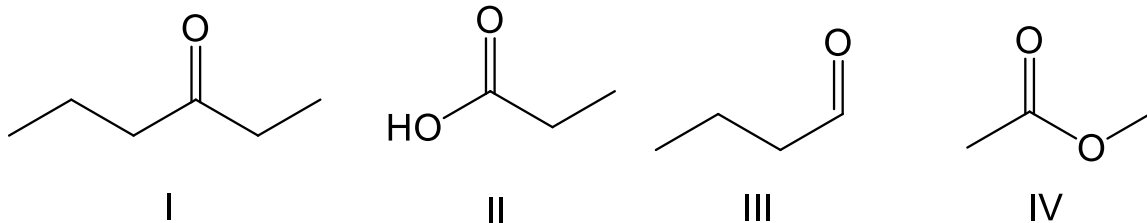
- A. I
- B. II
- C. III
- D. IV
- E. None of these

Answer: D

Learning Objective: 2.3 Identify and draw the functional groups

Difficulty: Easy

53. Which of the following compounds contain a ketone functional group?



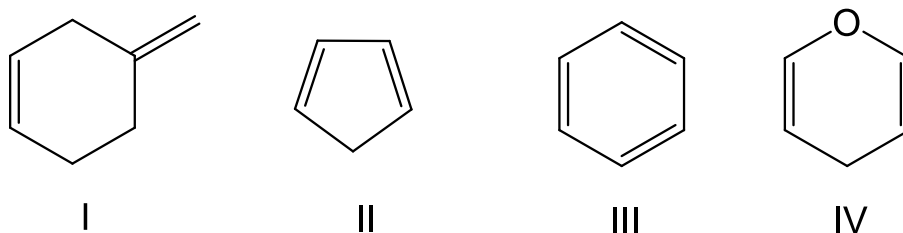
- A. I
- B. II
- C. III
- D. IV
- E. All of these

Answer: A

Learning Objective: 2.3 Identify and draw the functional groups

Difficulty: Easy

54. Which of the following compounds contain an aromatic ring?



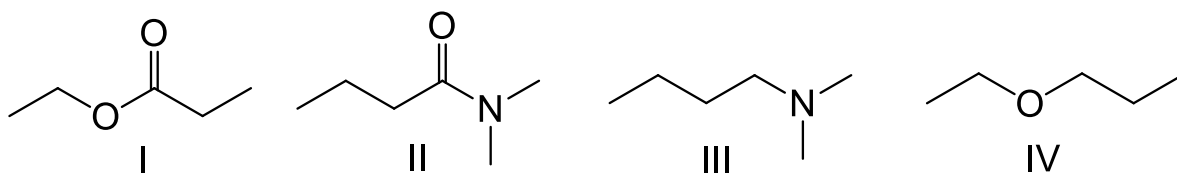
- A. I
- B. II
- C. III
- D. IV
- E. Both III and IV

Answer: C

Learning Objective: 2.3 Identify and draw the functional groups

Difficulty: Easy

55. Which of the following compounds contain an ester functional group?



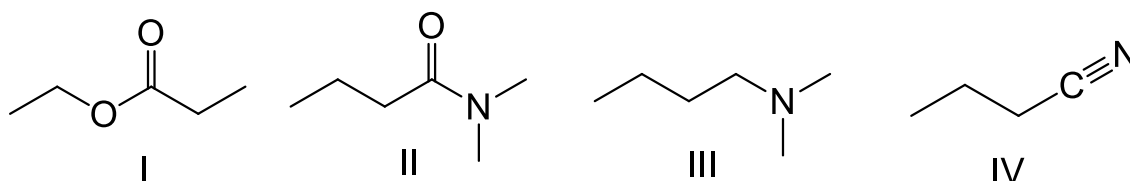
- A. I
- B. II
- C. III
- D. IV
- E. Both I and IV

Answer: A

Learning Objective: 2.3 Identify and draw the functional groups

Difficulty: Easy

56. Which of the following compounds contain an amide functional group?



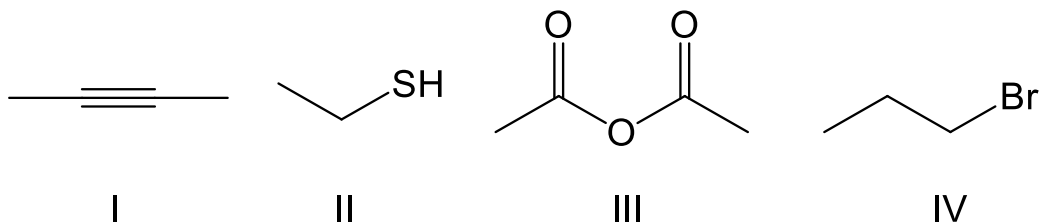
- A. I
- B. II
- C. III
- D. IV
- E. Both II and III

Answer: B

Learning Objective: 2.3 Identify and draw the functional groups

Difficulty: Easy

57. Which of the following compounds contain an anhydride functional group?



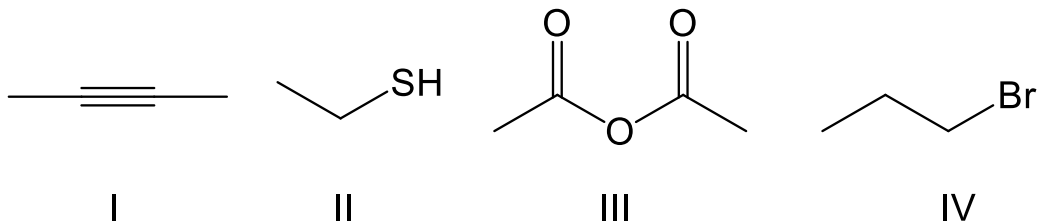
- A. I
- B. II
- C. III
- D. IV
- E. none of the above

Answer: C

Learning Objective: 2.3 Identify and draw the functional groups

Difficulty: Easy

58. Which of the following compounds contain an alkyne functional group?



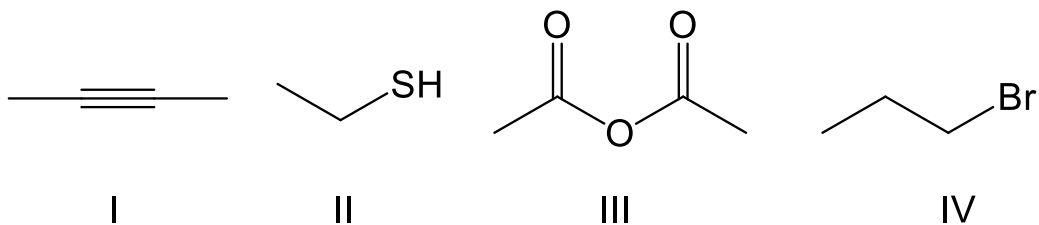
- A. I
- B. II
- C. III
- D. IV
- E. none of the above

Answer: A

Learning Objective: 2.3 Identify and draw the functional groups

Difficulty: Easy

59. Which of the following compounds contain a thiol functional group?



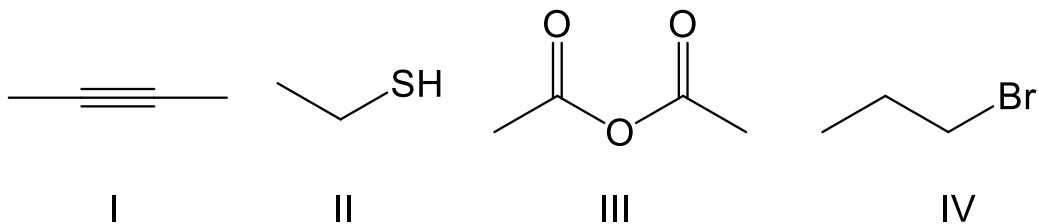
- A. I
- B. II
- C. III
- D. IV
- E. none of the above

Answer: B

Learning Objective: 2.3 Identify and draw the functional groups

Difficulty: Easy

60. Which of the following compounds contain an alkyl halide functional group?



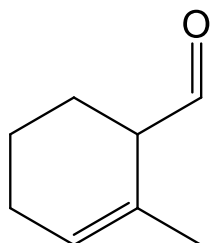
- A. I
- B. II
- C. III
- D. IV
- E. none of the above

Answer: D

Learning Objective: 2.3 Identify and draw the functional groups

Difficulty: Easy

61. What functional group(s) is (are) present in the following compound?



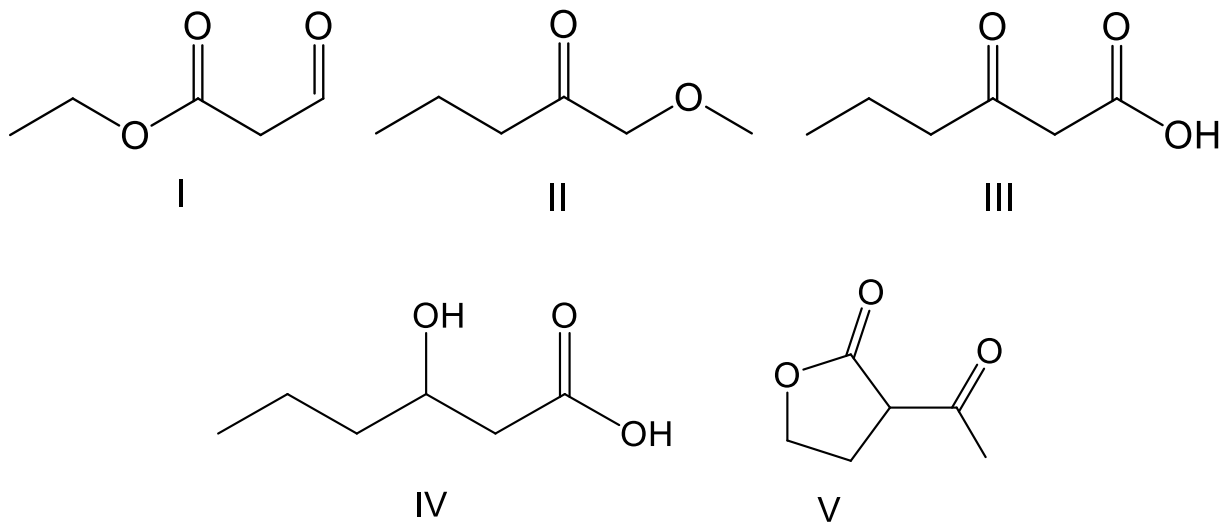
- A. ketone and alkene
- B. ketone and alkyne
- C. aldehyde and alkene
- D. aldehyde and alkyne
- E. ester and alkene

Answer: C

Learning Objective: 2.3 Identify and draw the functional groups

Difficulty: Medium

62. Which of the following compounds have both a ketone and an ester functional group?



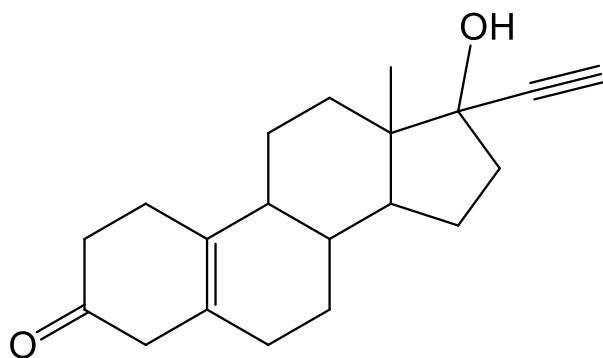
- A. I
- B. II
- C. III
- D. IV
- E. V

Answer: E

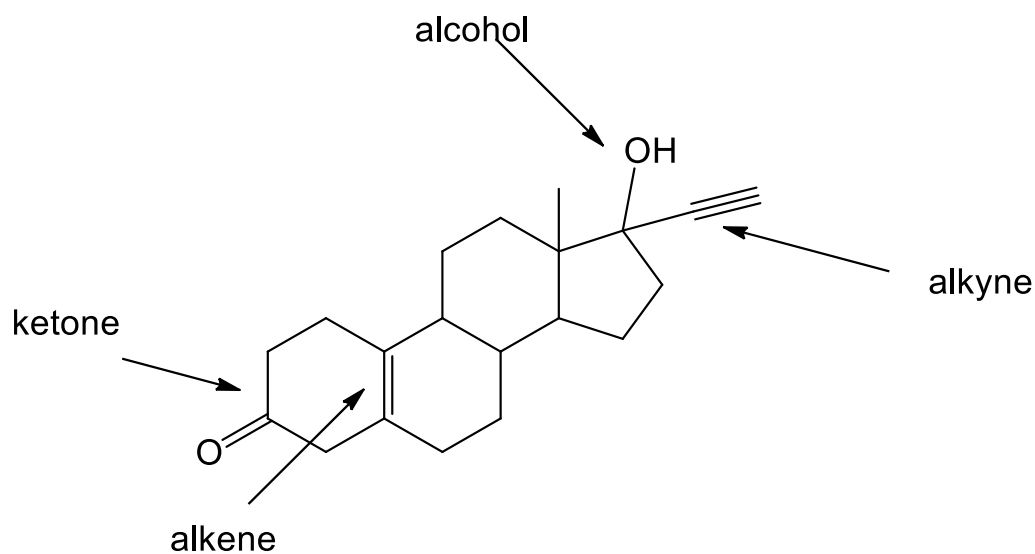
Learning Objective: 2.3 Identify and draw the functional groups

Difficulty: Medium

63. Norethynodrel, a component of the first combined oral contraceptive, has the following structure. Identify the functional groups in Norethynodrel.

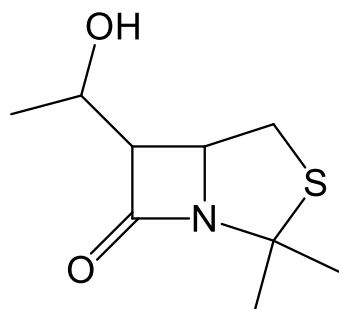


Answer:

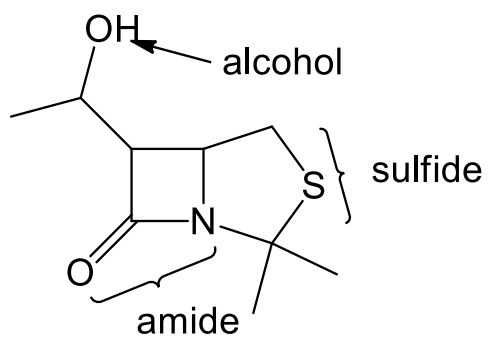


Learning Objective: 2.3 Identify and draw the functional groups  
 Difficulty: Medium

64. Identify the functional groups in the following compound.



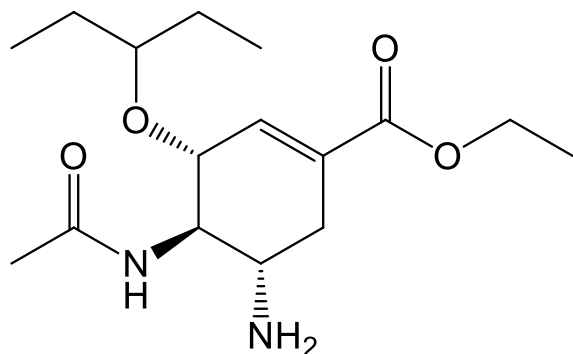
Answer:



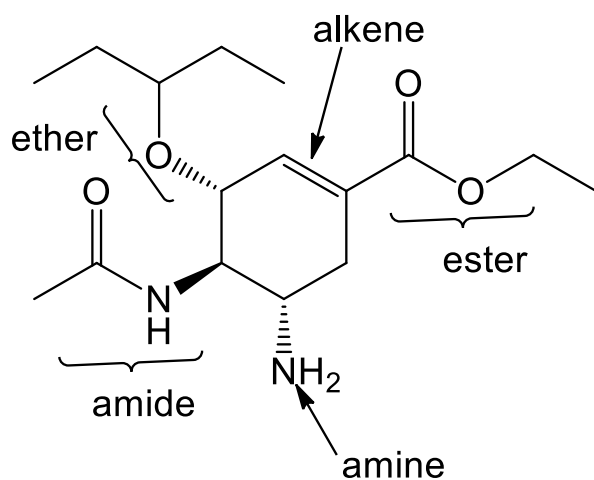
Learning Objective: 2.3 Identify and draw the functional groups

Difficulty: Medium

65. Tamiflu<sup>®</sup>, the most effective antiviral drug used to treat avian influenza, has the following structure. Identify the functional groups in Tamiflu<sup>®</sup>.



Answer:

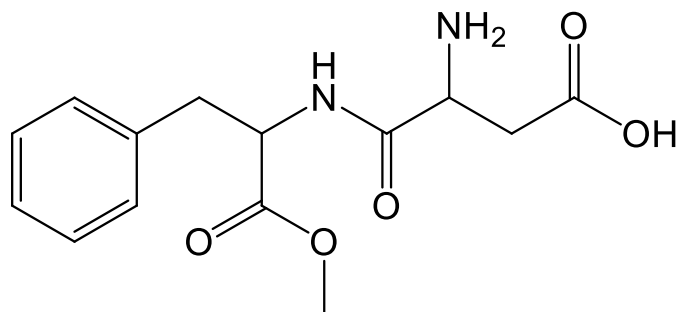


Learning Objective: 2.3 Identify and draw the functional groups

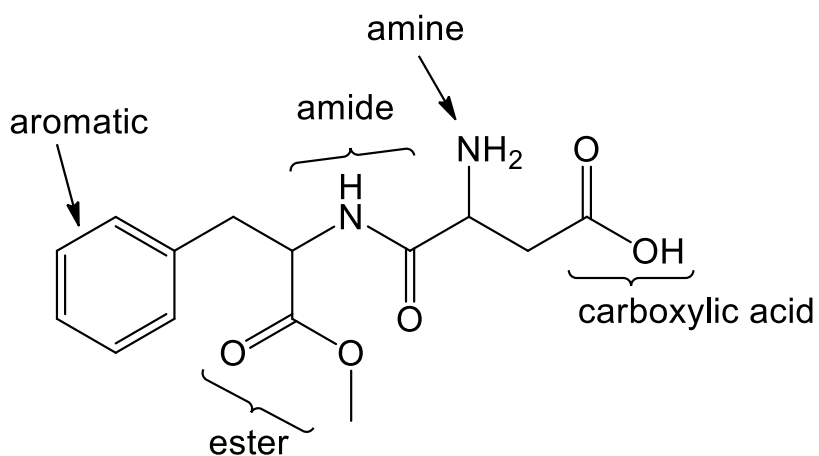
Difficulty: Hard

66. Aspartame, an artificial sweetener used in Equal<sup>®</sup> and diet beverages, has the following structure. Identify the functional groups in Aspartame.





Answer:

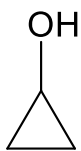


Learning Objective: 2.3 Identify and draw the functional groups

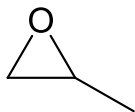
Difficulty: Hard

67. Draw all the constitutional isomers with a molecular formula of  $C_3H_6O$  and label the functional groups in each isomer.

Answer:



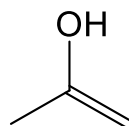
alcohol



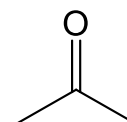
ether



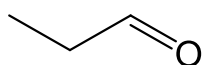
ether



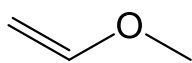
alcohol + alkene



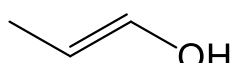
ketone



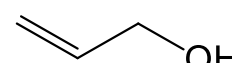
aldehyde



alkene + ether



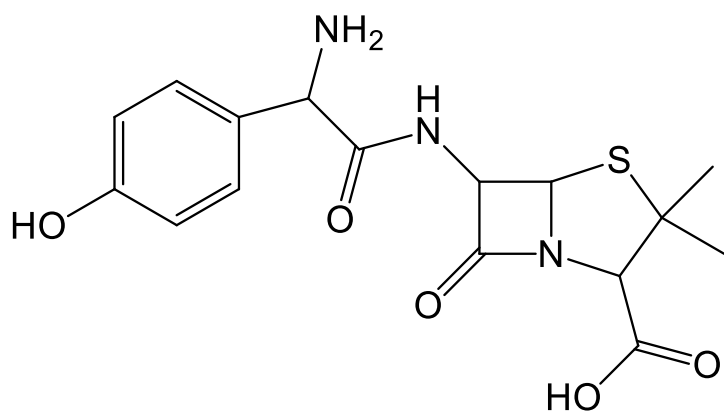
alkene + alcohol



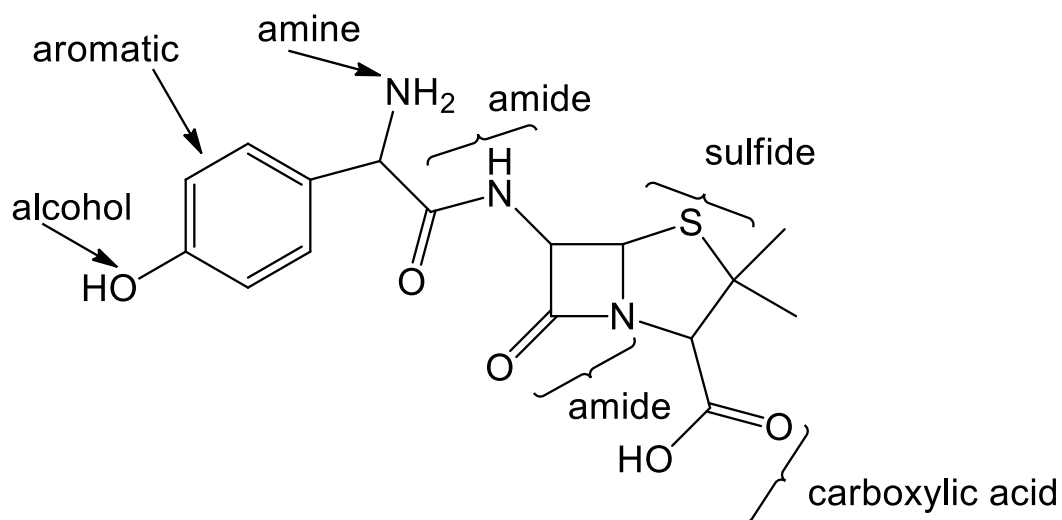
alkene + alcohol

Learning Objective: 2.3 Identify and draw the functional groups  
Difficulty: Hard

68. Amoxicillin, an antibiotic, has the following structure. Identify the functional groups in amoxicillin.

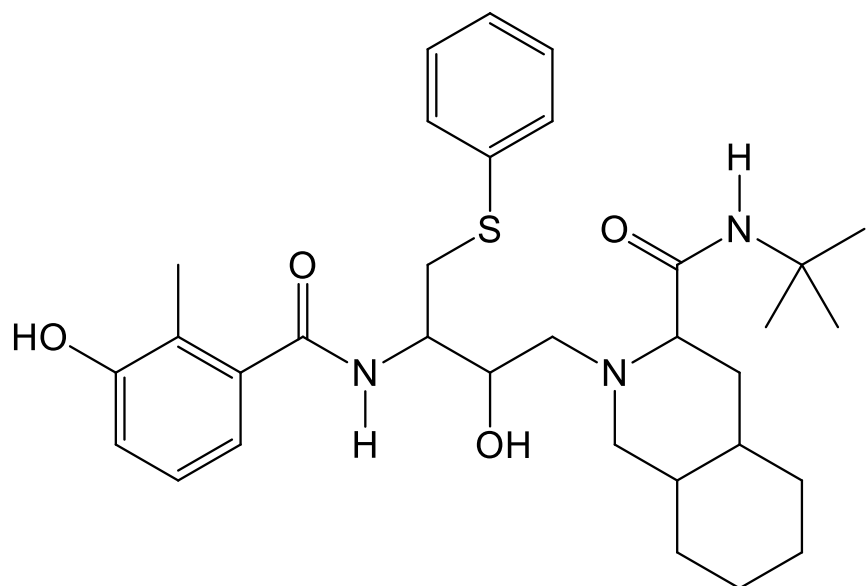


Answer:

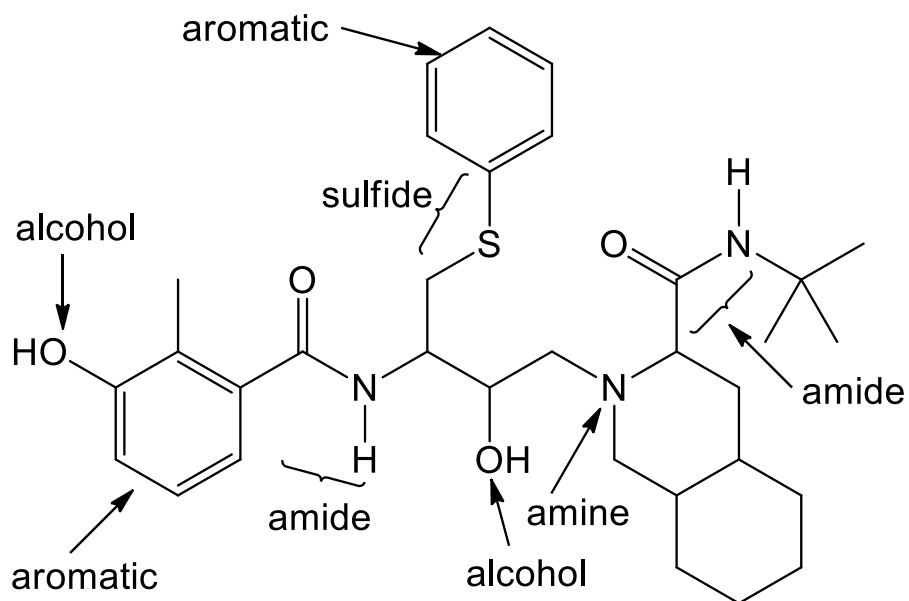


Learning Objective: 2.3 Identify and draw the functional groups  
Difficulty: Hard

69. Viracept, used in the treatment of HIV, has the following structure. Identify the functional groups in Viracept.

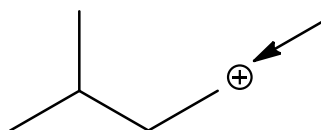


Answer:



Learning Objective: 2.3 Identify and draw the functional groups  
 Difficulty: Hard

70. How many hydrogen atoms are connected to the indicated carbon atom?



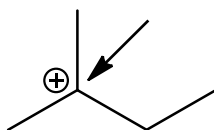
- A. one
- B. two
- C. three
- D. four
- E. none

Answer: B

Learning Objective: 2.4 Identify formal charges on carbon

Difficulty: Easy

71. How many hydrogen atoms are connected to the indicated carbon atom?



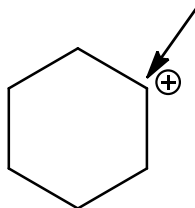
- A. one
- B. two
- C. three
- D. four
- E. none

Answer: E

Learning Objective: 2.4 Identify formal charges on carbon

Difficulty: Easy

72. How many hydrogen atoms are connected to the indicated carbon atom?



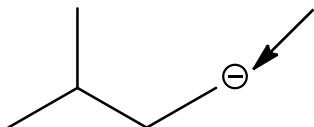
- A. one
- B. two
- C. three
- D. four
- E. none

Answer: A

Learning Objective: 2.4 Identify formal charges on carbon

Difficulty: Easy

73. How many hydrogen atoms are connected to the indicated carbon atom?



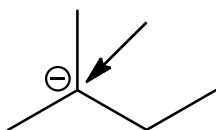
- A. one
- B. two
- C. three
- D. four
- E. none

Answer: B

Learning Objective: 2.4 Identify formal charges on carbon

Difficulty: Easy

74. How many hydrogen atoms are connected to the indicated carbon atom?



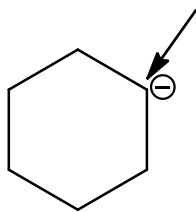
- A. one
- B. two
- C. three
- D. four
- E. none

Answer: E

Learning Objective: 2.4 Identify formal charges on carbon

Difficulty: Easy

75. How many hydrogen atoms are connected to the indicated carbon atom?



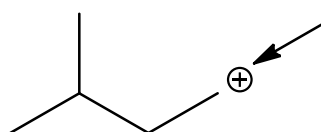
- A. one
- B. two
- C. three
- D. four
- E. none

Answer: A

Learning Objective: 2.4 Identify formal charges on carbon

Difficulty: Easy

76. What is the formal charge on the indicated carbon atom?



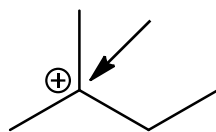
- A. -2
- B. -1
- C. 0
- D. +1
- E. +2

Answer: D

Learning Objective: 2.4 Identify formal charges on carbon

Difficulty: Easy

77. What is the formal charge on the indicated carbon atom?



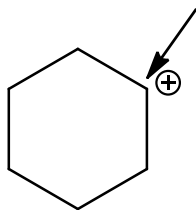
- A. -2
- B. -1
- C. 0
- D. +1
- E. +2

Answer: D

Learning Objective: 2.4 Identify formal charges on carbon

Difficulty: Easy

78. What is the formal charge on the indicated carbon atom?



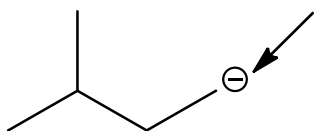
- A. -2
- B. -1
- C. 0
- D. +1
- E. +2

Answer: D

Learning Objective: 2.4 Identify formal charges on carbon

Difficulty: Easy

79. What is the formal charge on the indicated carbon atom?



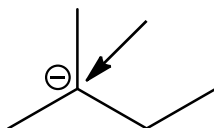
- A. -2
- B. -1
- C. 0
- D. +1
- E. +2

Answer: B

Learning Objective: 2.4 Identify formal charges on carbon

Difficulty: Easy

80. What is the formal charge on the indicated carbon atom?



- A. -2

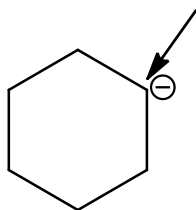
- B. -1
- C. 0
- D. +1
- E. +2

Answer: B

Learning Objective: 2.4 Identify formal charges on carbon

Difficulty: Easy

81. What is the formal charge on the indicated carbon atom?



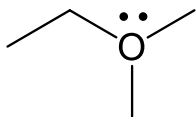
- A. -2
- B. -1
- C. 0
- D. +1
- E. +2

Answer: B

Learning Objective: 2.4 Identify formal charges on carbon

Difficulty: Easy

82. What is the formal charge on the oxygen atom in the following compound?



- A. +1
- B. +2
- C. -1
- D. -2
- E. 0

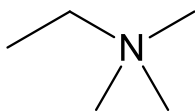
Answer: A

Learning Objective: 2.5 Describe the relationship between the number of bonds, the number of lone pairs, and formal charge for oxygen and nitrogen atoms

Difficulty: Easy



83. What is the formal charge on the nitrogen atom in the following compound?



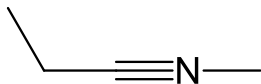
- A. -1
- B. -2
- C. +1
- D. +2
- E. 0

Answer: C

Learning Objective: 2.5 Describe the relationship between the number of bonds, the number of lone pairs, and formal charge for oxygen and nitrogen atoms

Difficulty: Easy

84. What is the formal charge on the nitrogen atom in the following compound?



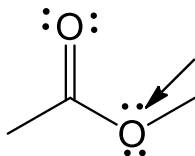
- A. +1
- B. +2
- C. -1
- D. -2
- E. 0

Answer: A

Learning Objective: 2.5 Describe the relationship between the number of bonds, the number of lone pairs, and formal charge for oxygen and nitrogen atoms

Difficulty: Easy

85. What is the formal charge on the indicated oxygen atom in the following compound?



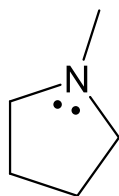
- A. +1
- B. +2
- C. -1
- D. -2
- E. 0

Answer: E

Learning Objective: 2.5 Describe the relationship between the number of bonds, the number of lone pairs, and formal charge for oxygen and nitrogen atoms

Difficulty: Easy

86. What is the formal charge on the nitrogen atom in the following compound?



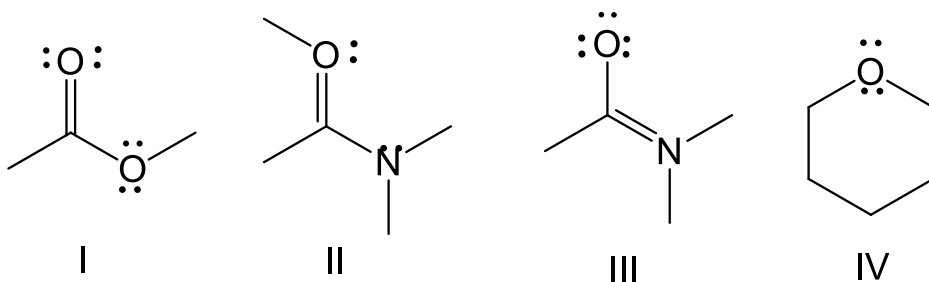
- A. +1
- B. +2
- C. -1
- D. -2
- E. 0

Answer: E

Learning Objective: 2.5 Describe the relationship between the number of bonds, the number of lone pairs, and formal charge for oxygen and nitrogen atoms

Difficulty: Easy

87. Which of the following compounds have +1 as a formal charge on an oxygen atom?



- A. I
- B. II

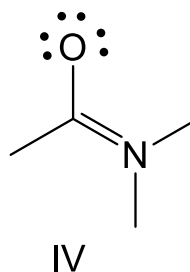
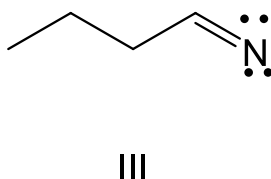
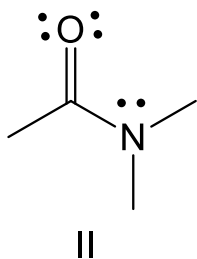
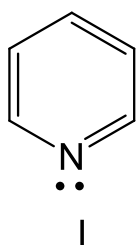
- C. III
- D. IV
- E. Both I and IV

Answer: B

Learning Objective: 2.5 Describe the relationship between the number of bonds, the number of lone pairs, and formal charge for oxygen and nitrogen atoms

Difficulty: Medium

88. Which of the following compounds have +1 as a formal charge on the nitrogen atom?



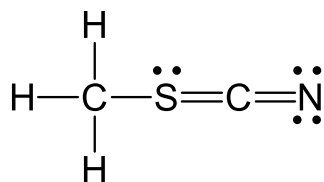
- A. I
- B. II
- C. III
- D. IV
- E. Both I and II

Answer: D

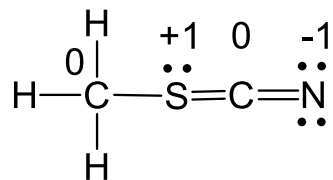
Learning Objective: 2.5 Describe the relationship between the number of bonds, the number of lone pairs, and formal charge for oxygen and nitrogen atoms

Difficulty: Medium

89. Determine the formal charges on each atom except hydrogen.



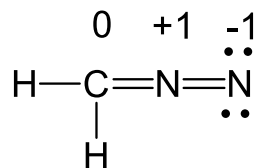
Answer:



Learning Objective: 2.5 Describe the relationship between the number of bonds, the number of lone pairs, and formal charge for oxygen and nitrogen atoms  
 Difficulty: Medium

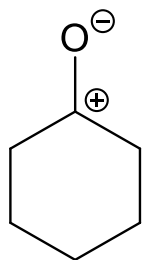
90. Diazomethane has the molecular formula  $\text{CH}_2\text{N}_2$ . Draw the preferred Lewis structure for diazomethane and assign formal charges to all atoms except hydrogen.

Answer:

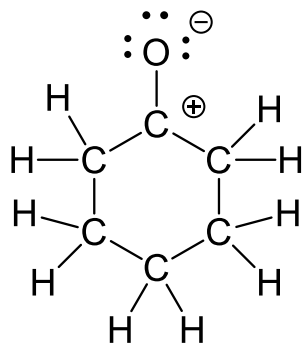


Learning Objective: 2.5 Describe the relationship between the number of bonds, the number of lone pairs, and formal charge for oxygen and nitrogen atoms  
 Difficulty: Hard

91. Draw Lewis structure for the following compound.



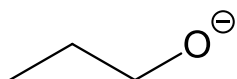
Answer:



Learning Objective: 2.5 Describe the relationship between the number of bonds, the number of lone pairs, and formal charge for oxygen and nitrogen atoms

Difficulty: Medium

92. How many lone pairs of electrons are on the oxygen atom?



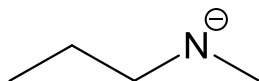
- A. one
- B. two
- C. three
- D. four
- E. none

Answer: C

Learning Objective: 2.5 Describe the relationship between the number of bonds, the number of lone pairs, and formal charge for oxygen and nitrogen atoms

Difficulty: Easy

93. How many lone pairs of electrons are on the nitrogen atom?



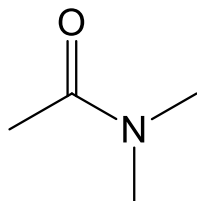
- A. one
- B. two
- C. three
- D. four
- E. none

Answer: B

Learning Objective: 2.5 Describe the relationship between the number of bonds, the number of lone pairs, and formal charge for oxygen and nitrogen atoms

Difficulty: Easy

94. How many lone pairs of electrons are on the oxygen atom?



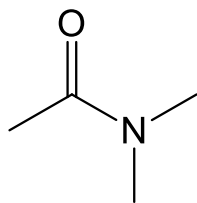
- A. one
- B. two
- C. three
- D. four
- E. none

Answer: B

Learning Objective: 2.5 Describe the relationship between the number of bonds, the number of lone pairs, and formal charge for oxygen and nitrogen atoms

Difficulty: Easy

95. How many lone pairs of electrons are on the nitrogen atom?



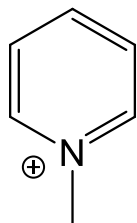
- A. one
- B. two
- C. three
- D. four
- E. none

Answer: A

Learning Objective: 2.5 Describe the relationship between the number of bonds, the number of lone pairs, and formal charge for oxygen and nitrogen atoms

Difficulty: Easy

96. How many lone pairs of electrons are on the nitrogen atom?



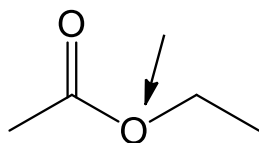
- A. one
- B. two
- C. three
- D. four
- E. none

Answer: E

Learning Objective: 2.5 Describe the relationship between the number of bonds, the number of lone pairs, and formal charge for oxygen and nitrogen atoms

Difficulty: Easy

97. How many lone pairs of electrons are on the indicated oxygen atom?



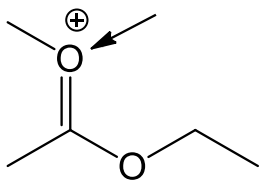
- A. one
- B. two
- C. three
- D. four
- E. none

Answer: B

Learning Objective: 2.5 Describe the relationship between the number of bonds, the number of lone pairs, and formal charge for oxygen and nitrogen atoms

Difficulty: Easy

98. How many lone pairs of electrons are on the indicated oxygen atom?



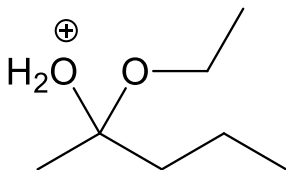
- A. one
- B. two
- C. three
- D. four
- E. none

Answer: A

Learning Objective: 2.5 Describe the relationship between the number of bonds, the number of lone pairs, and formal charge for oxygen and nitrogen atoms

Difficulty: Medium

99. How many total lone pairs of electrons are in the following compound?



- A. one
- B. two
- C. three
- D. four
- E. none

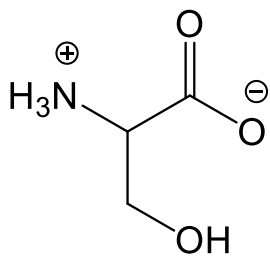
Answer: C

Learning Objective: 2.5 Describe the relationship between the number of bonds, the number of lone pairs, and formal charge for oxygen and nitrogen atoms

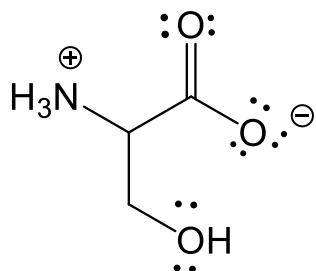
Difficulty: Easy

100. Draw all lone pairs of electrons for the following compound.



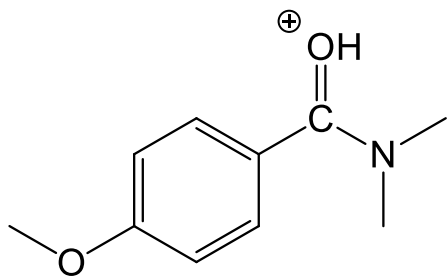


Answer:

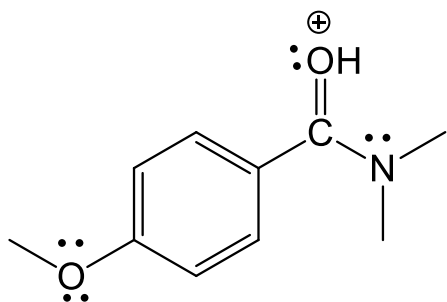


Learning Objective: 2.5 Describe the relationship between the number of bonds, the number of lone pairs, and formal charge for oxygen and nitrogen atoms  
 Difficulty: Medium

101. Draw all lone pairs of electrons for the following compound.



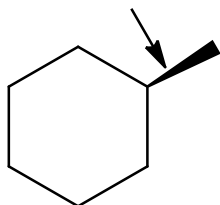
Answer:



Learning Objective: 2.5 Describe the relationship between the number of bonds, the number of lone pairs, and formal charge for oxygen and nitrogen atoms

Difficulty: Medium

102. The indicated bond in the following compound is\_\_\_\_\_ of the paper.



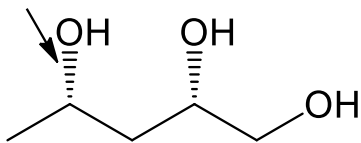
- A. in the plane
- B. out of the plane
- C. behind the plane
- D. None of these

Answer: B

Learning Objective: 2.6 Describe how wedges and dashes are used to indicate three-dimensional molecular structure

Difficulty: Easy

103. The indicated bond in the following compound is\_\_\_\_\_ of the paper.



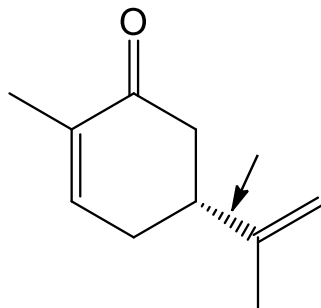
- A. in the plane
- B. out of the plane
- C. behind the plane
- D. None of these

Answer: C

Learning Objective: 2.6 Describe how wedges and dashes are used to indicate three-dimensional molecular structure

Difficulty: Easy

104. The indicated bond in the following compound is\_\_\_\_\_ of the paper.



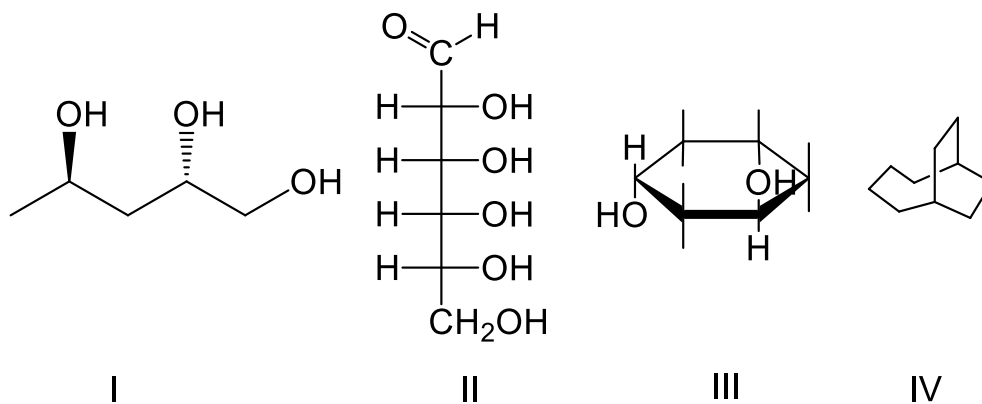
- A. in the plane
- B. out of the plane
- C. behind the plane
- D. None of these

Answer: C

Learning Objective: 2.6 Describe how wedges and dashes are used to indicate three-dimensional molecular structure

Difficulty: Easy

105. Which of the following is a Fischer projection?



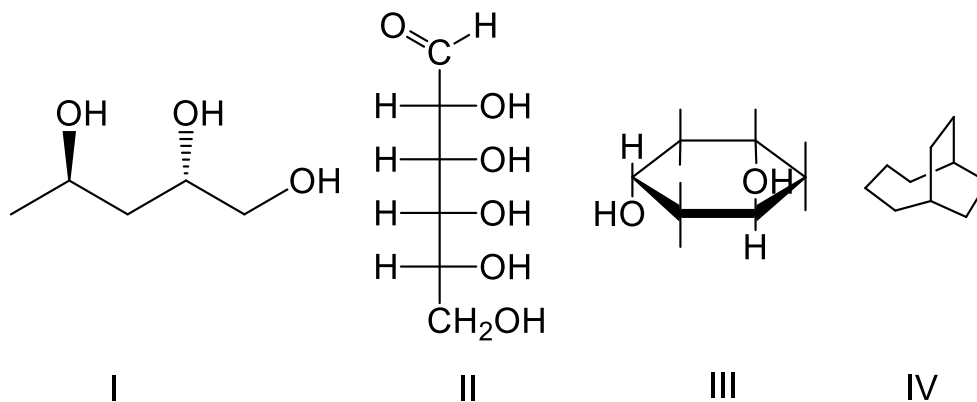
- A. I
- B. II
- C. III
- D. IV
- E. Both III and IV

Answer: B

Learning Objective: 2.6 Describe how wedges and dashes are used to indicate three-dimensional molecular structure

Difficulty: Easy

106. Which of the following is a Haworth projection?



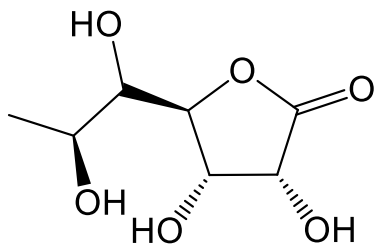
- A. I
- B. II
- C. III
- D. IV
- E. Both III and IV

Answer: C

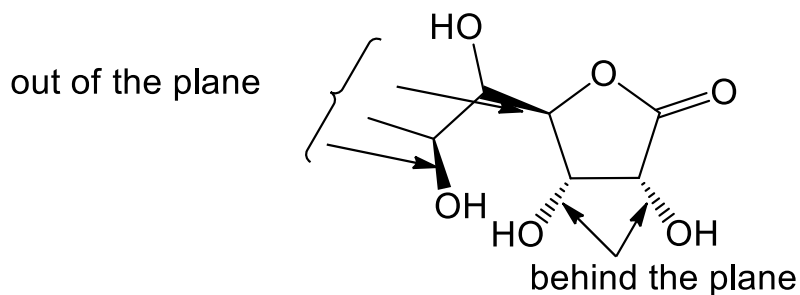
Learning Objective: 2.6 Describe how wedges and dashes are used to indicate three-dimensional molecular structure

Difficulty: Easy

107. Label the bonds that are out of the plane and behind the plane of the paper.



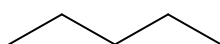
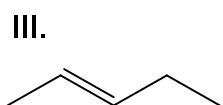
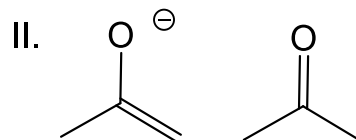
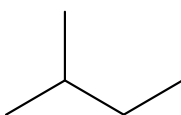
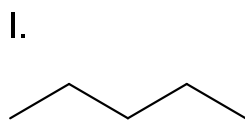
Answer:



Learning Objective: 2.6 Describe how wedges and dashes are used to indicate three-dimensional molecular structure

Difficulty: Medium

108. Which of the following pairs are resonance structures of each other?



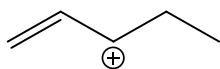
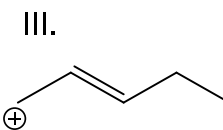
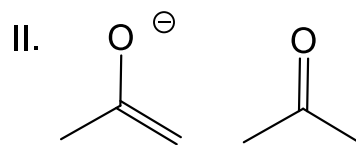
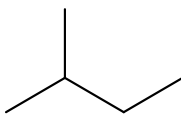
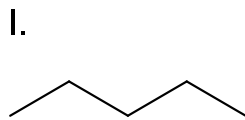
- A. I
- B. II
- C. III
- D. IV
- E. None of these

Answer: D

Learning Objective: 2.7 Define "resonance," describing the relationship between resonance and molecular orbital theory

Difficulty: Easy

109. Which of the following pairs are resonance structures of each other?



- A. I
- B. II
- C. III
- D. IV
- E. None of these

Answer: C

Learning Objective: 2.7 Define "resonance," describing the relationship between resonance and molecular orbital theory

Difficulty: Easy

110. The spreading of positive or negative charge over two or more atoms in a compound is called\_\_\_\_\_.

- A. isomerism
- B. delocalization
- C. stereoisomerism
- D. localization
- E. None of these

Answer: B

Learning Objective: 2.7 Define "resonance," describing the relationship between resonance and molecular orbital theory

Difficulty: Easy

111. Delocalization of charge over two or more atoms \_\_\_\_\_ a molecule.

- A. destabilizes
- B. delocalizes
- C. localizes
- D. stabilizes
- E. None of these

Answer: D

Learning Objective: 2.7 Define "resonance," describing the relationship between resonance and molecular orbital theory

Difficulty: Easy

112. Resonance structures have \_\_\_\_\_ connectivity of atoms and \_\_\_\_\_ distribution of electrons.

- A. different, same
- B. same, same
- C. different, different
- D. same, different
- E. None of these

Answer: D

Learning Objective: 2.7 Define "resonance," describing the relationship between resonance and molecular orbital theory

Difficulty: Medium

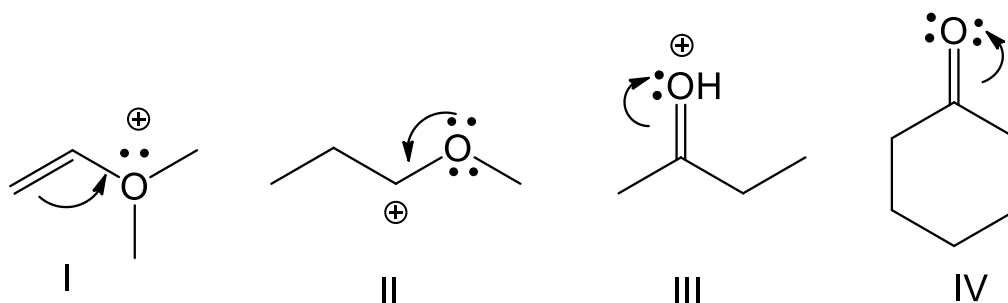
113. What is a resonance hybrid?

Answer: A molecule that can be represented by drawing two or more resonance structures is viewed as a resonance hybrid.

Learning Objective: 2.7 Define "resonance," describing the relationship between resonance and molecular orbital theory

Difficulty: Medium

114. Which of the following violates the rules for curved arrows?



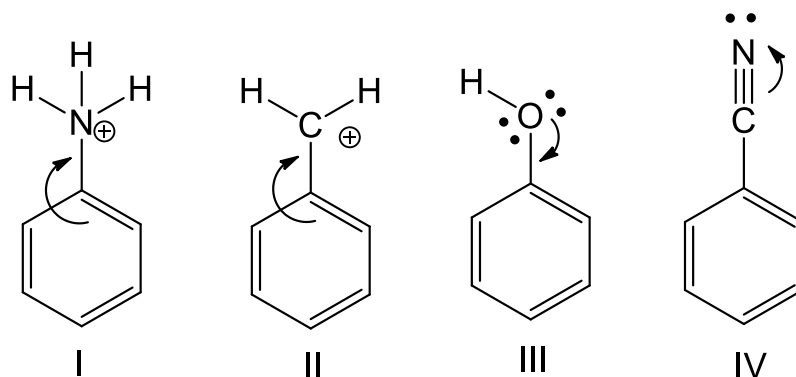
- A. I
- B. II
- C. III
- D. IV
- E. none of these

Answer: A

Learning Objective: 2.8 Demonstrate the use of curved arrows in drawing resonance structures, stating the two rules to be applied when drawing curved arrows

Difficulty: Easy

115. Which of the following violates the rules for curved arrows?



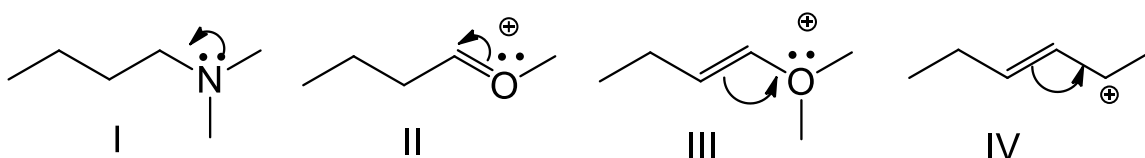
- A. I
- B. II and IV
- C. I and III
- D. III and IV
- E. None of these

Answer: C

Learning Objective: 2.8 Demonstrate the used of curved arrows in drawing resonance structures, stating the two rules to be applied when drawing curved arrows

Difficulty: Easy

116. Which of the following violates the rules for curved arrows?



- A. I and II
- B. III and IV
- C. I, and III
- D. II, III and IV
- E. all of these

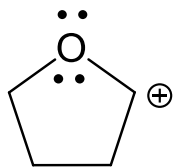
Answer: C

Learning Objective: 2.8 Demonstrate the used of curved arrows in drawing resonance structures, stating the two rules to be applied when drawing curved arrows

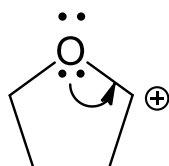
Difficulty: Easy

117. Provide the curved arrow(s) to draw a resonance structure for the following compound.





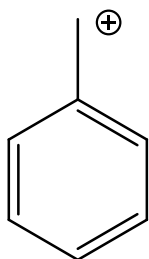
Answer:



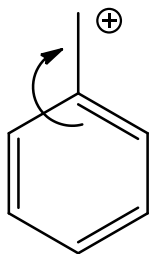
Learning Objective: 2.8 Demonstrate the use of curved arrows in drawing resonance structures, stating the two rules to be applied when drawing curved arrows

Difficulty: Medium

118. Provide the curved arrow(s) to draw a resonance structure for the following compound.



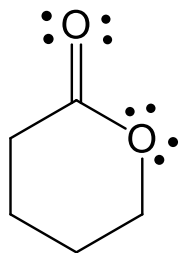
Answer:



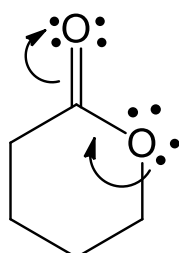
Learning Objective: 2.8 Demonstrate the use of curved arrows in drawing resonance structures, stating the two rules to be applied when drawing curved arrows

Difficulty: Medium

119. Provide the curved arrow(s) to draw a resonance structure for the following compound.



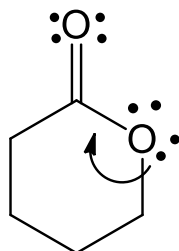
Answer:



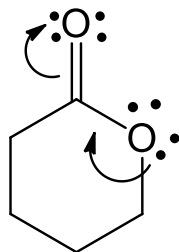
Learning Objective: 2.8 Demonstrate the used of curved arrows in drawing resonance structures, stating the two rules to be applied when drawing curved arrows

Difficulty: Hard

120. Explain using words as well as structural drawings, if the single curved arrow shown is sufficient to draw the resonance structure.

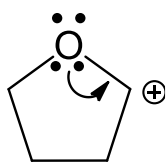


Answer: The single arrow shown will violate the octet rule. Drawing another curved arrow will remove the violation.

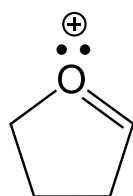


Learning Objective: 2.8 Demonstrate the used of curved arrows in drawing resonance structures, stating the two rules to be applied when drawing curved arrows  
 Difficulty: Hard

121. Draw the resonance structure indicated by the curved arrows.

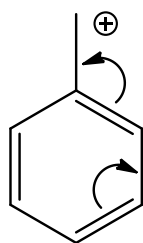


Answer:

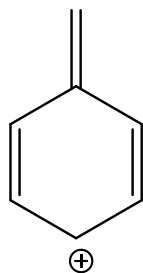


Learning Objective: 2.9 Describe the use of arrow pushing and formal charges in resonance structures  
 Difficulty: Medium

122. Draw the resonance structure indicated by the curved arrows.



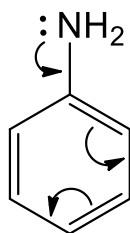
Answer:



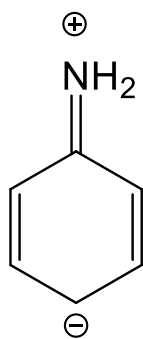
Learning Objective: 2.9 Describe the use of arrow pushing and formal charges in resonance structures

Difficulty: Medium

123. Draw the resonance structure indicated by the curved arrows.



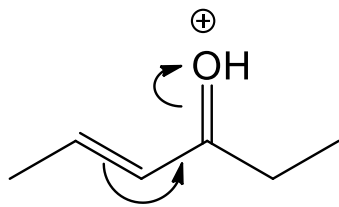
Answer:



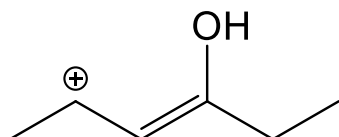
Learning Objective: 2.9 Describe the use of arrow pushing and formal charges in resonance structures

Difficulty: Medium

124. Draw the resonance structure indicated by the curved arrows.



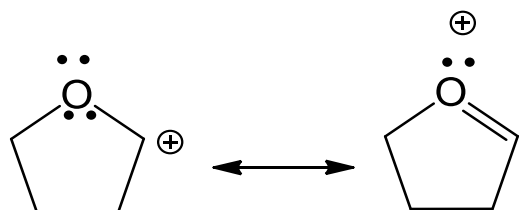
Answer:



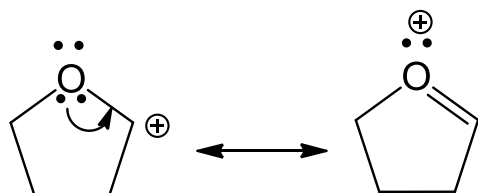
Learning Objective: 2.9 Describe the use of arrow pushing and formal charges in resonance structures

Difficulty: Medium

125. Draw the curved arrow(s) for converting the first resonance structure into the second resonance structure.



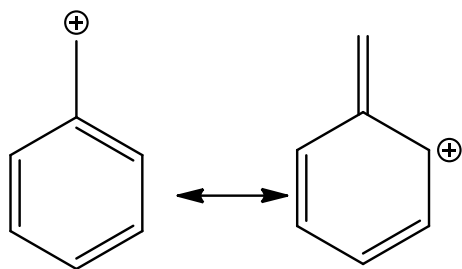
Answer:



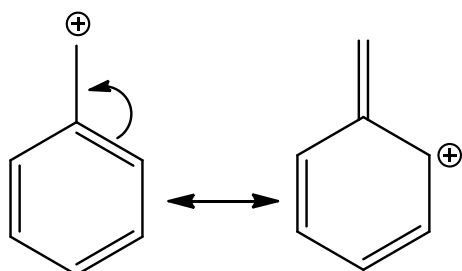
Learning Objective: 2.9 Describe the use of arrow pushing and formal charges in resonance structures

Difficulty: Medium

126. Draw the curved arrow(s) for converting the first resonance structure into the second resonance structure.



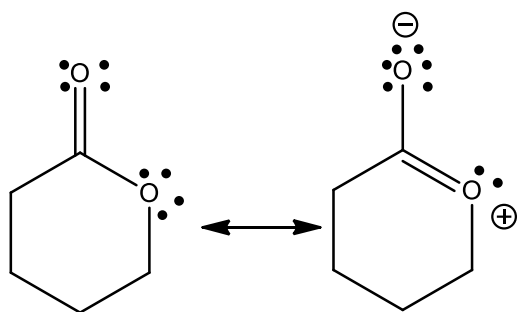
Answer:



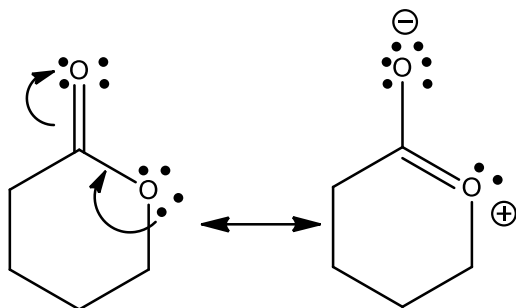
Learning Objective: 2.9 Describe the use of arrow pushing and formal charges in resonance structures

Difficulty: Hard

127. Draw the curved arrow(s) for converting the first resonance structure into the second resonance structure.



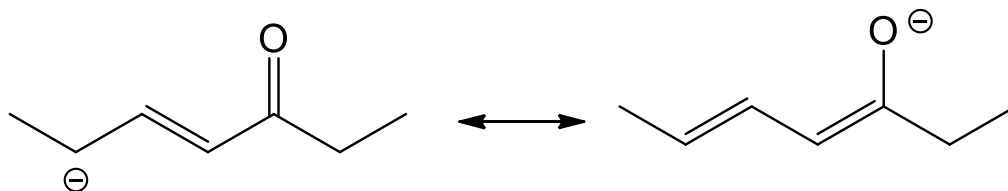
Answer:



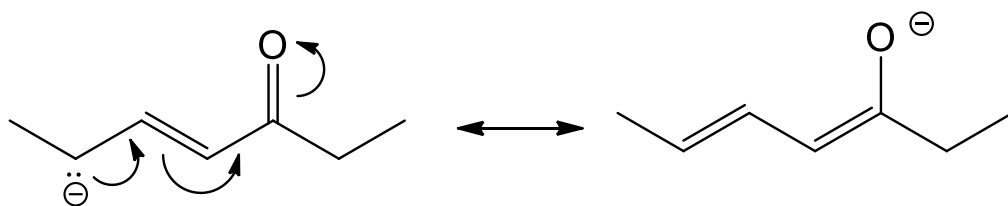
Learning Objective: 2.9 Describe the use of arrow pushing and formal charges in resonance structures

Difficulty: Hard

128. Draw the curved arrow(s) for converting the first resonance structure into the second resonance structure.



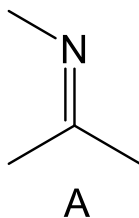
Answer:

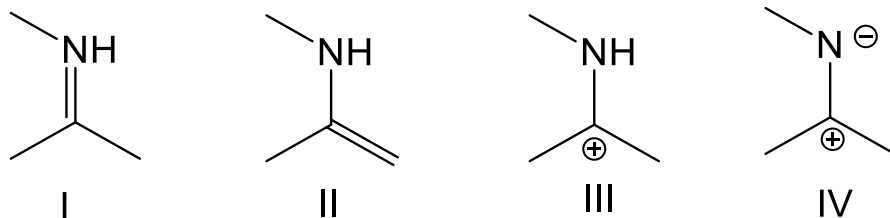


Learning Objective: 2.9 Describe the use of arrow pushing and formal charges in resonance structures

Difficulty: Hard

129. Which of the following is a correct resonance structure for compound A?





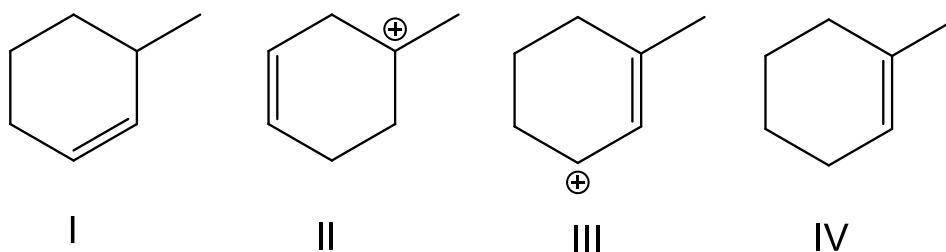
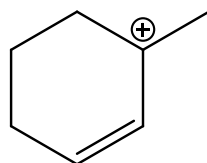
- A. I  
 B. II  
 C. III  
 D. IV  
 E. none of these

Answer: D

Learning Objective: 2.10 Identify resonance structures by naming the five different structural patterns in molecules

Difficulty: Easy

130. Which of the following is a correct resonance structure for compound A?



- A. I  
 B. II  
 C. III  
 D. IV  
 E. None of these

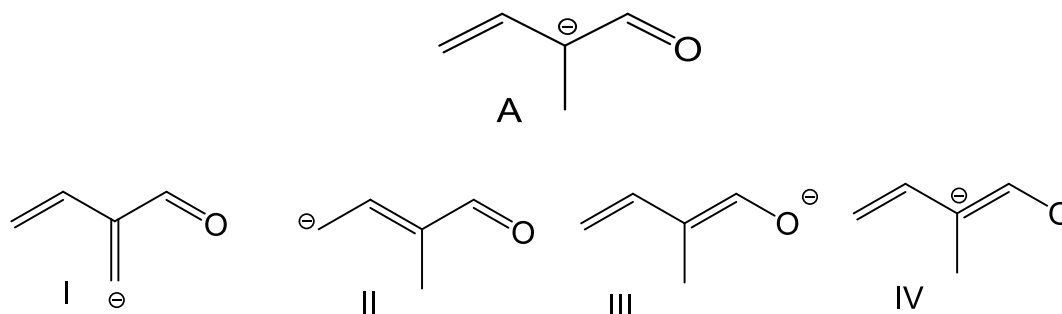
Answer: C

Learning Objective: 2.10 Identify resonance structures by naming the five different structural patterns in molecules

Difficulty: Medium



131. Which of the following is/are correct resonance structure(s) for compound A?



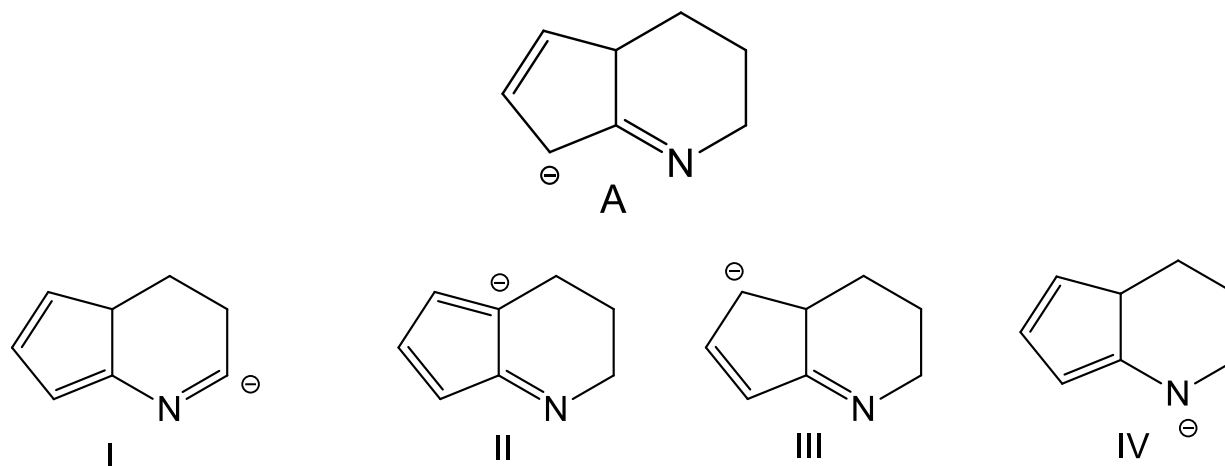
- A. I
- B. II and III
- C. III and IV
- D. I and III
- E. I and IV

Answer: B

Learning Objective: 2.10 Identify resonance structures by naming the five different structural patterns in molecules

Difficulty: Easy

132. Which of the following is/are correct resonance structure(s) for compound A?



- A. I and II
- B. II and III
- C. III and IV
- D. I and III

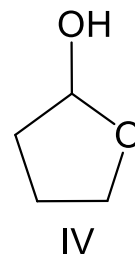
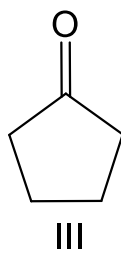
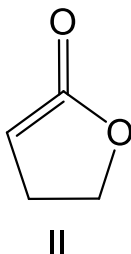
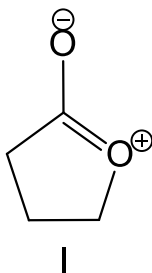
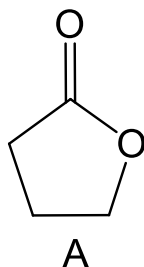
E. I and IV

Answer: C

Learning Objective: 2.10 Identify resonance structures by naming the five different structural patterns in molecules

Difficulty: Medium

133. Which of the following is a correct resonance structure for compound A?



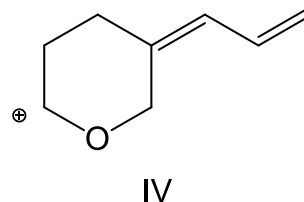
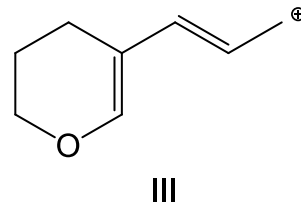
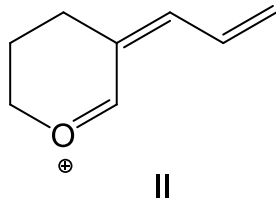
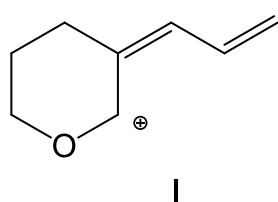
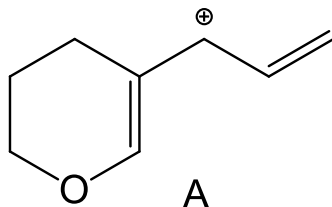
- A. I
- B. II
- C. III
- D. IV
- E. none of these

Answer: A

Learning Objective: 2.10 Identify resonance structures by naming the five different structural patterns in molecules

Difficulty: Easy

134. Which of the following is/are correct resonance structure(s) for compound A?



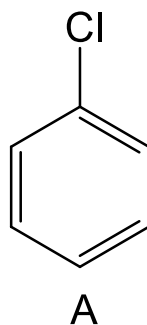
- A. I and II
- B. II and III
- C. III and IV
- D. I, II and III
- E. I and IV

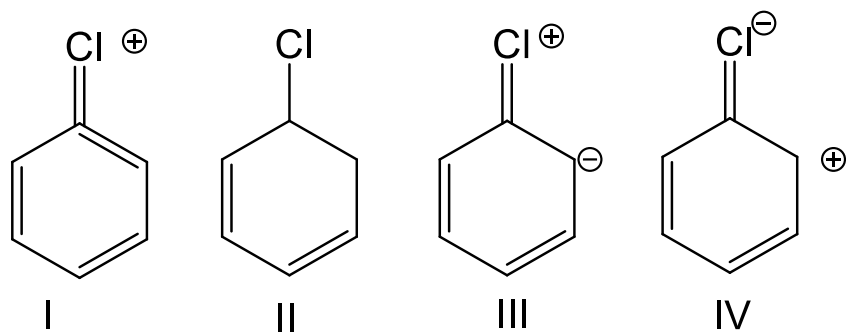
Answer: D

Learning Objective: 2.10 Identify resonance structures by naming the five different structural patterns in molecules

Difficulty: Medium

135. Which of the following is a correct resonance structure for compound A?





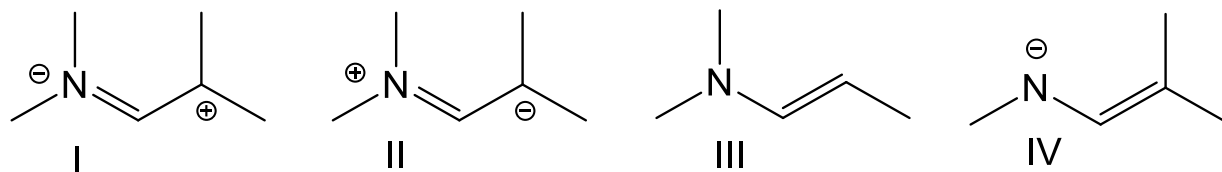
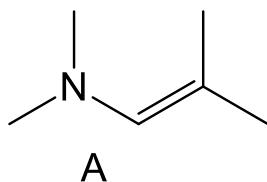
- A. I  
 B. II  
 C. III  
 D. IV  
 E. None of these

Answer: C

Learning Objective: 2.10 Identify resonance structures by naming the five different structural patterns in molecules

Difficulty: Easy

136. Which of the following is a correct resonance structure for compound A?



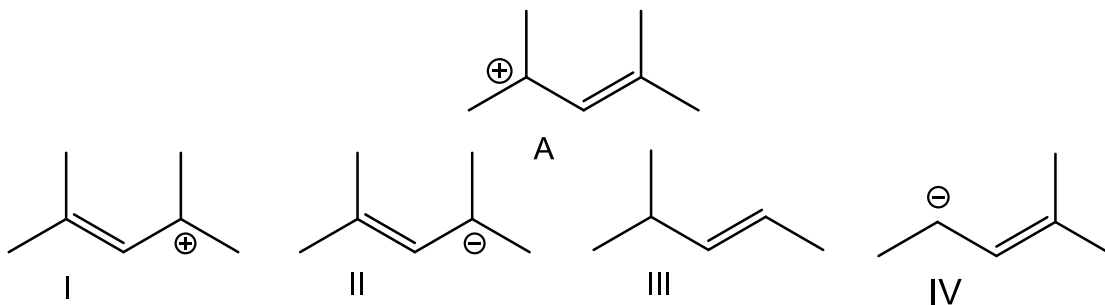
- A. I  
 B. II  
 C. III  
 D. IV  
 E. None of these

Answer: B

Learning Objective: 2.10 Identify resonance structures by naming the five different structural patterns in molecules

Difficulty: Easy

137. Which of the following is a correct resonance structure for compound A?



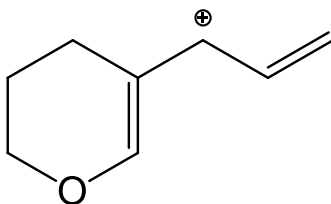
- A. I
- B. II
- C. III
- D. IV
- E. none of these

Answer: A

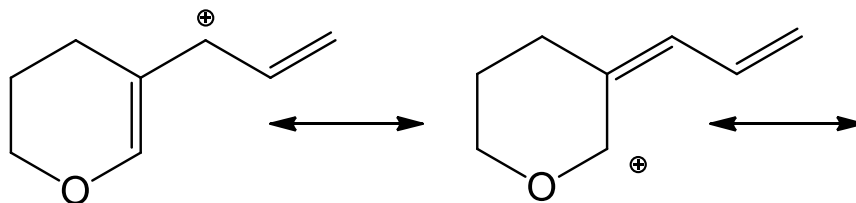
Learning Objective: 2.10 Identify resonance structures by naming the five different structural patterns in molecules

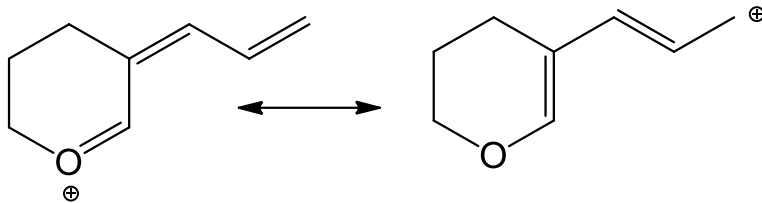
Difficulty: Medium

138. Draw resonance structures for the following compound.



Answer:



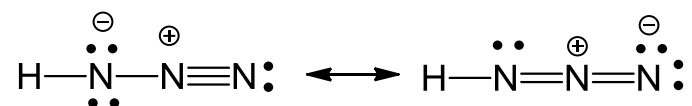


Learning Objective: 2.10 Identify resonance structures by naming the five different structural patterns in molecules

Difficulty: Medium

139. Draw two resonance structures for  $\text{HN}_3$ .

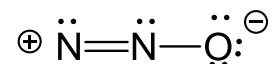
Answer:



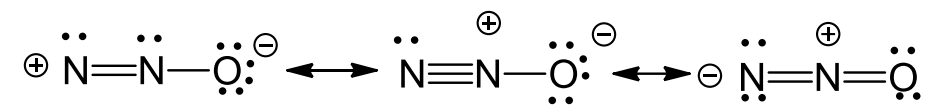
Learning Objective: 2.10 Identify resonance structures by naming the five different structural patterns in molecules

Difficulty: Hard

140. Draw two additional resonance structures for the following compound.



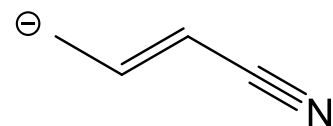
Answer:



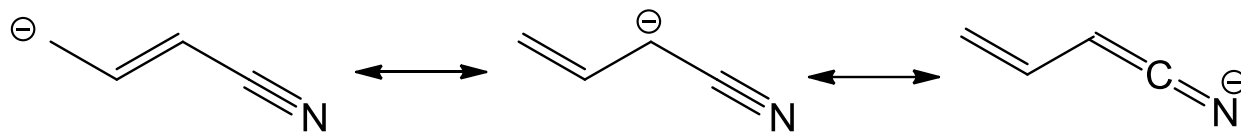
Learning Objective: 2.10 Identify resonance structures by naming the five different structural patterns in molecules

Difficulty: Hard

141. Draw two additional resonance structures for the following compound.



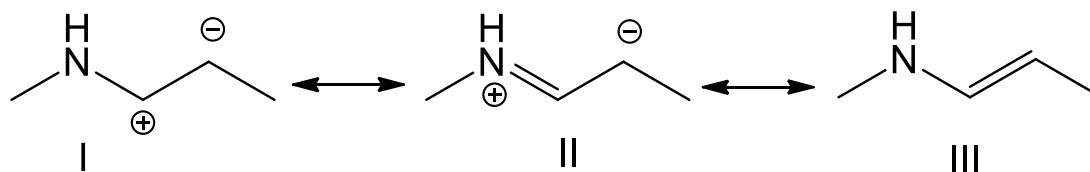
Answer:



Learning Objective: 2.10 Identify resonance structures by naming the five different structural patterns in molecules

Difficulty: Hard

142. Which of the following is/are the most significant resonance structure(s)?



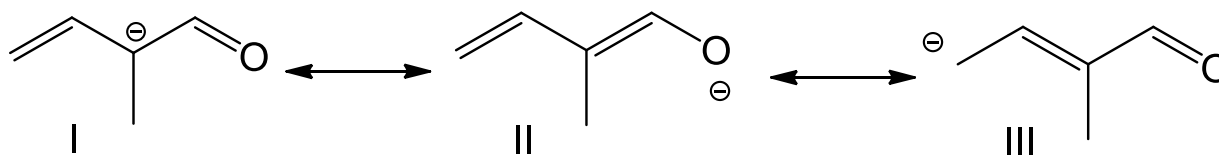
- A. I
- B. II
- C. III
- D. II and III
- E. all of these

Answer: C

Learning Objective: 2.11 Distinguish between significant and insignificant resonance structures, describing how the significance of resonance is determined

Difficulty: Easy

143. Which of the following is/are the most significant resonance structure(s)?



- A. I
- B. II
- C. III
- D. I and II
- E. all of these





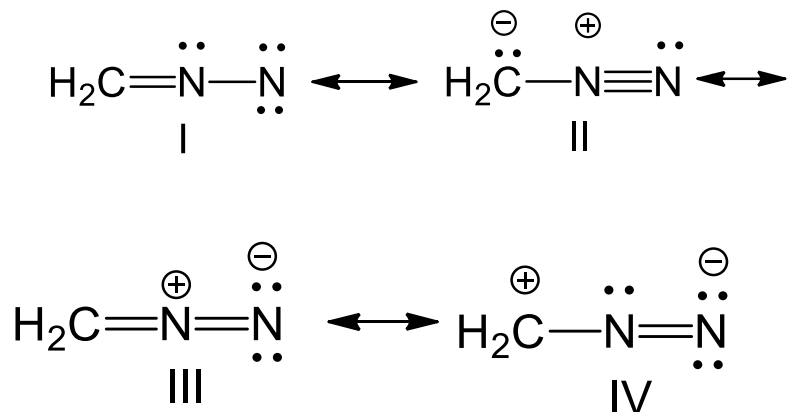
E. I and IV

Answer: C

Learning Objective: 2.11 Distinguish between significant and insignificant resonance structures, describing how the significance of resonance is determined

Difficulty: Medium

146. Which of the following is the most significant resonance structure?



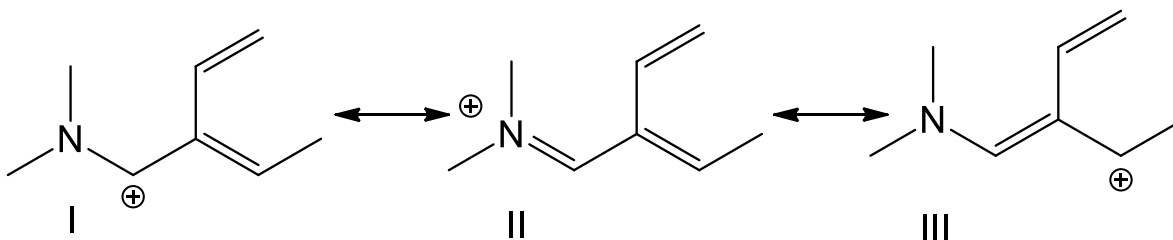
- A. I
- B. II
- C. III
- D. IV
- E. None of these

Answer: C

Learning Objective: 2.11 Distinguish between significant and insignificant resonance structures, describing how the significance of resonance is determined

Difficulty: Medium

147. Which of the following is/are the most significant resonance structure(s)?



- A. I
- B. II

- C. III
- D. I and III
- E. all of these

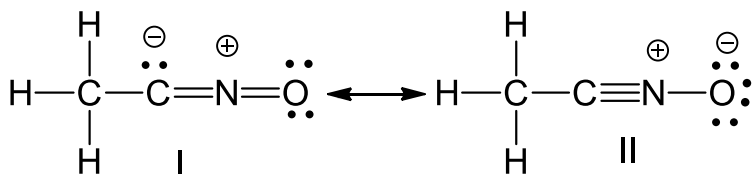
Answer: B

Learning Objective: 2.11 Distinguish between significant and insignificant resonance structures, describing how the significance of resonance is determined

Difficulty: Medium

148. Draw significant resonance structures for the following compound,  $\text{CH}_3\text{CNO}$ . Which of these is/are the most significant resonance structure(s)? Explain why.

Answer:

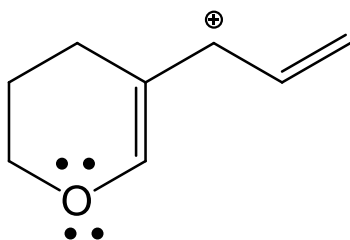


Resonance structure II is most significant, because the more electronegative oxygen atom carries a negative formal charge.

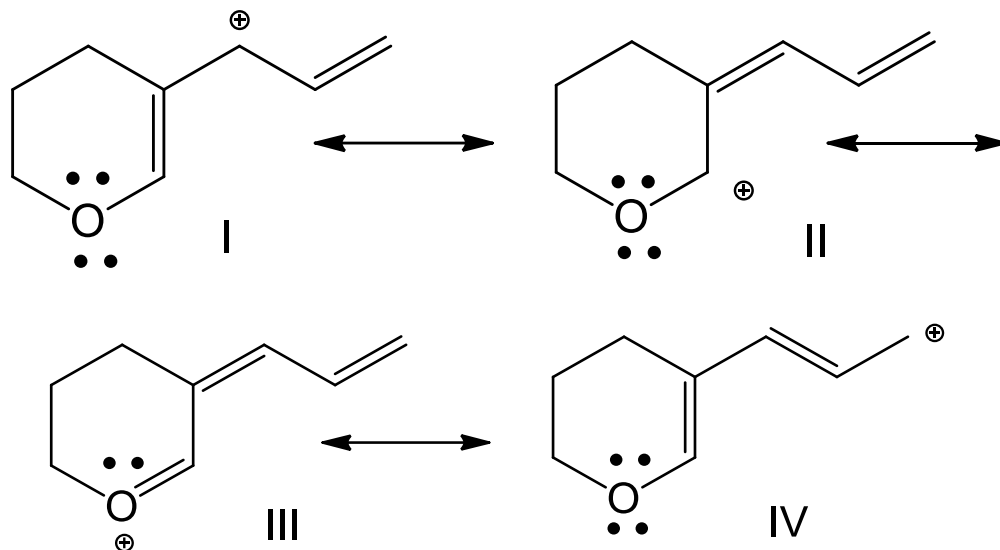
Learning Objective: 2.11 Distinguish between significant and insignificant resonance structures, describing how the significance of resonance is determined

Difficulty: Hard

149. Draw significant resonance structures for the following compound. Which of these is/are the most significant resonance structure(s)? Explain why.



Answer:



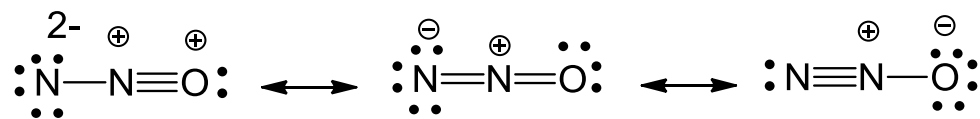
Resonance structure III is most significant, because all atoms have octet of electrons.

Learning Objective: 2.11 Distinguish between significant and insignificant resonance structures, describing how the significance of resonance is determined

Difficulty: Hard

150. Draw significant resonance structures for  $\text{N}_2\text{O}$ . Which of these is/are the most significant resonance structure(s)? Explain why.

Answer:



Resonance structure III is most significant, because the more electronegative oxygen atom carries a negative formal charge.

Learning Objective: 2.11 Distinguish between significant and insignificant resonance structures, describing how the significance of resonance is determined

Difficulty: Hard

151. What is the relationship between the following compounds?



- A. constitutional isomers
- B. resonance structures
- C. conformers
- D. identical compounds

Answer: B

Learning Objective: 2.11 Distinguish between significant and insignificant resonance structures, describing how the significance of resonance is determined

Difficulty: Easy

152. What is the relationship between the following compounds?



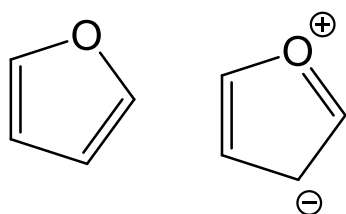
- A. constitutional isomers
- B. resonance structures
- C. conformers
- D. identical compounds

Answer: A

Learning Objective: 2.11 Distinguish between significant and insignificant resonance structures, describing how the significance of resonance is determined

Difficulty: Easy

153. What is the relationship between the following compounds?



- A. constitutional isomers
- B. resonance structures
- C. conformers
- D. identical compounds
- E. different compounds

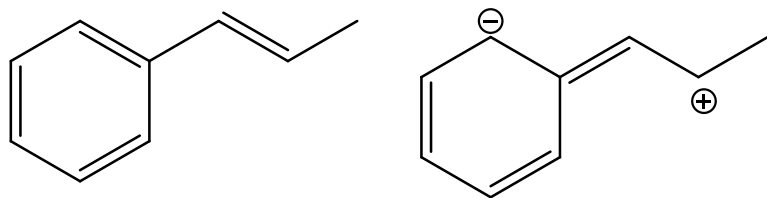
Answer: B

Learning Objective: Assessing Importance

Section: 2.11

Difficulty: Easy

154. What is the relationship between the following compounds?



- A. constitutional isomers
- B. resonance structures
- C. conformers
- D. identical compounds
- E. different compounds

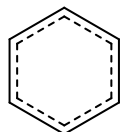
Answer: B

Learning Objective: 2.11 Distinguish between significant and insignificant resonance structures, describing how the significance of resonance is determined

Difficulty: Easy

155. Draw the resonance hybrid of  $C_6H_6$ .

Answer:

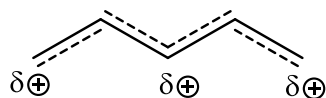


Learning Objective: 2.12 Draw a resonance hybrid using partial bonds and partial charges, reflecting the combination of individual resonance structures

Difficulty: Medium

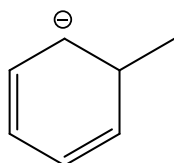
156. Draw the resonance hybrid of  $CH_2CHCHCH_2^+$ .

Answer:

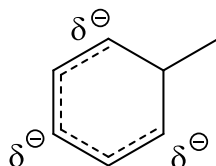


Learning Objective: 2.12 Draw a resonance hybrid using partial bonds and partial charges, reflecting the combination of individual resonance structures  
Difficulty: Medium

157. Draw the resonance hybrid for the following structure.

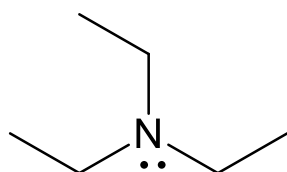


Answer:



Learning Objective: 2.12 Draw a resonance hybrid using partial bonds and partial charges, reflecting the combination of individual resonance structures  
Difficulty: Medium

158. The lone pair on nitrogen in the following compound is \_\_\_\_\_.

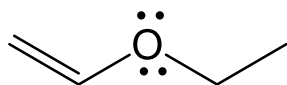


- A. localized
- B. delocalized

Answer: A

Learning Objective: 2.13 Distinguish between delocalized and localized lone pairs and describe how delocalized lone pairs participate in resonance and why localized lone pairs do not participate in resonance  
Difficulty: Easy

159. The lone pair on oxygen in the following compound is \_\_\_\_\_.



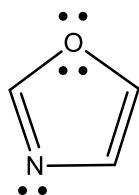
- A. both localized
- B. both delocalized
- C. one localized and one delocalized

Answer: C

Learning Objective: 2.13 Distinguish between delocalized and localized lone pairs and describe how delocalized lone pairs participate in resonance and why localized lone pairs do not participate in resonance

Difficulty: Easy

160. The lone pair on nitrogen in the following compound is \_\_\_\_\_.



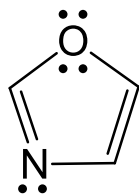
- A. localized
- B. delocalized

Answer: A

Learning Objective: 2.12 Distinguish between delocalized and localized lone pairs and describe how delocalized lone pairs participate in resonance and why localized lone pairs do not participate in resonance

Difficulty: Easy

161. The lone pairs on oxygen in the following compound are \_\_\_\_\_.



- A. both localized
- B. both delocalized

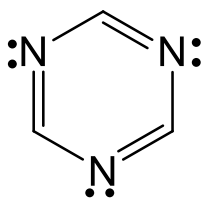
C. one localized and one delocalized

Answer: C

Learning Objective: 2.13 Distinguish between delocalized and localized lone pairs and describe how delocalized lone pairs participate in resonance and why localized lone pairs do not participate in resonance

Difficulty: Easy

162. The lone pairs on nitrogen in the following compound are \_\_\_\_\_.



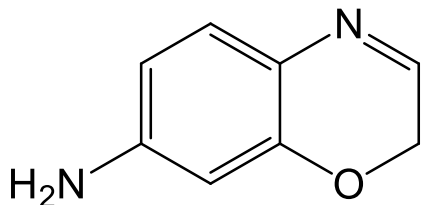
- A. three localized
- B. three delocalized
- C. two localized and one delocalized
- D. one localized and two delocalized

Answer: A

Learning Objective: 2.13 Distinguish between delocalized and localized lone pairs and describe how delocalized lone pairs participate in resonance and why localized lone pairs do not participate in resonance

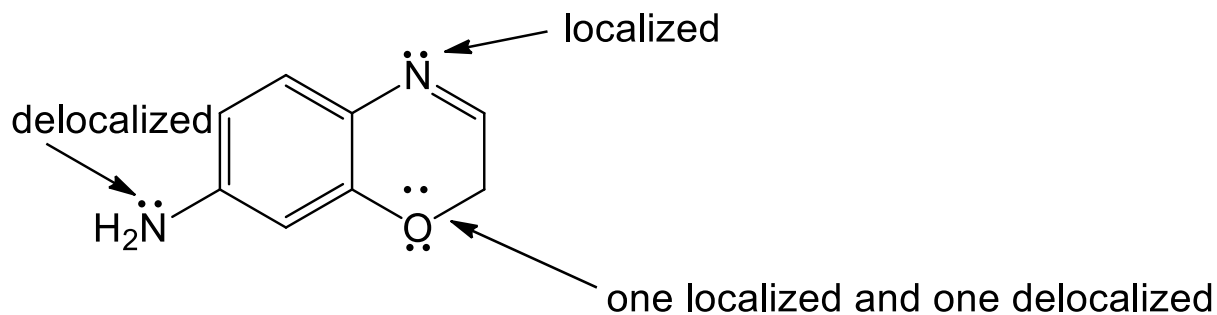
Difficulty: Easy

163. For the following compound identify the lone pairs and indicate if each lone pair is localized or delocalized.



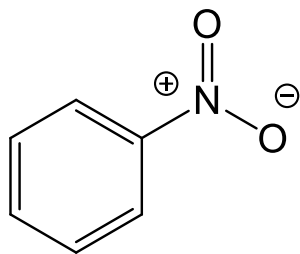
Answer:



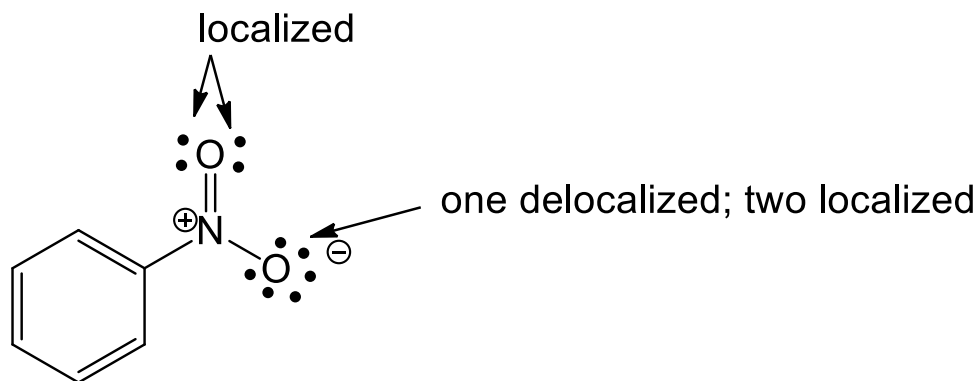


Learning Objective: 2.13 Distinguish between delocalized and localized lone pairs and describe how delocalized lone pairs participate in resonance and why localized lone pairs do not participate in resonance  
 Difficulty: Medium

164. For the following compound identify the lone pairs and indicate if each lone pair is localized or delocalized.

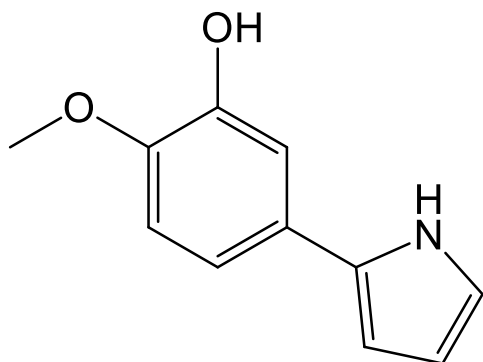


Answer:

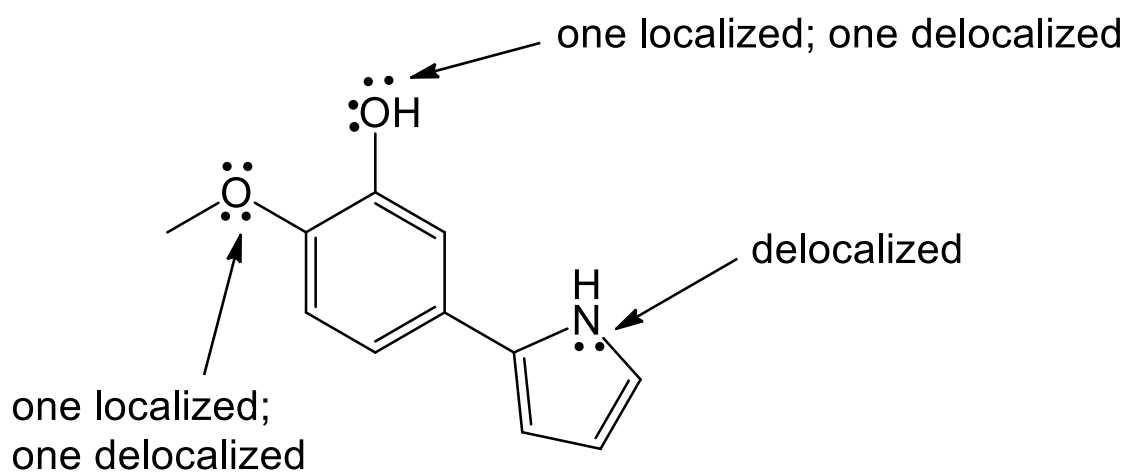


Learning Objective: 2.13 Distinguish between delocalized and localized lone pairs and describe how delocalized lone pairs participate in resonance and why localized lone pairs do not participate in resonance  
 Difficulty: Medium

165. For the following compound identify the lone pairs and indicate if each lone pair is localized or delocalized.



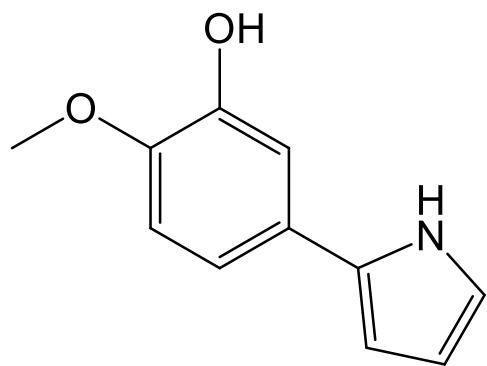
Answer:



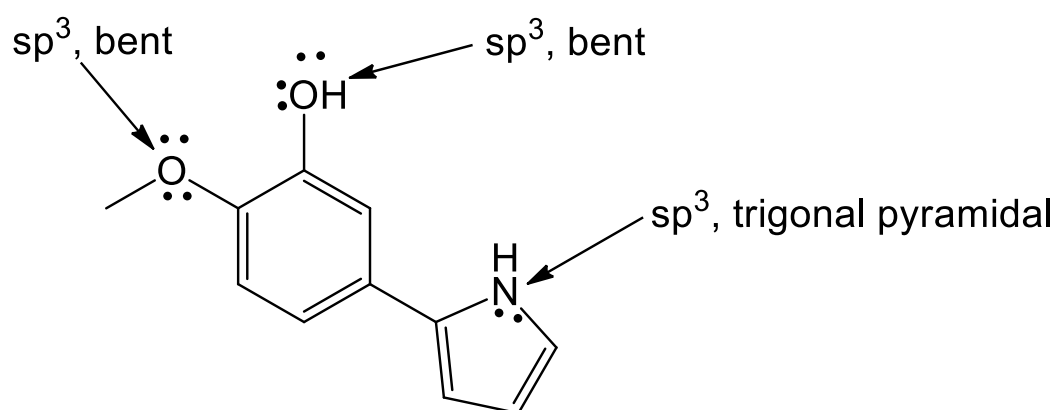
Learning Objective: 2.13 Distinguish between delocalized and localized lone pairs and describe how delocalized lone pairs participate in resonance and why localized lone pairs do not participate in resonance

Difficulty: Medium

166. For the following compound what is the hybridization state and molecular geometry at each oxygen and nitrogen atom.



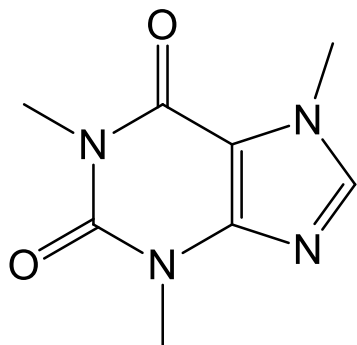
Answer:



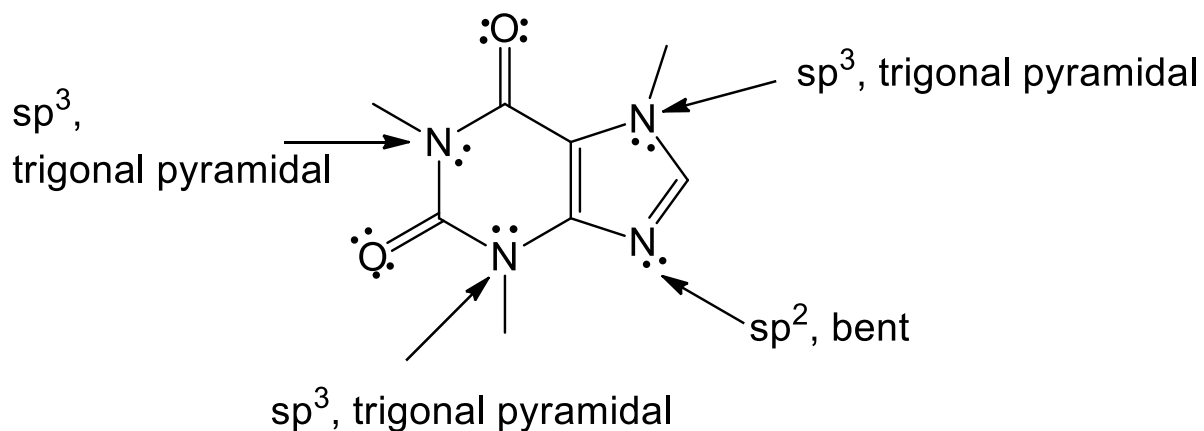
Learning Objective: 2.13 Distinguish between delocalized and localized lone pairs and describe how delocalized lone pairs participate in resonance and why localized lone pairs do not participate in resonance

Difficulty: Hard

167. Caffeine has the following structure. What is the hybridization state and molecular geometry at each nitrogen atom in caffeine?

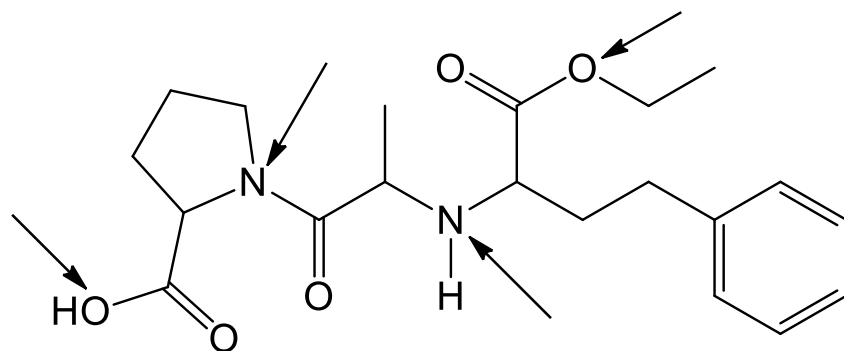


Answer:

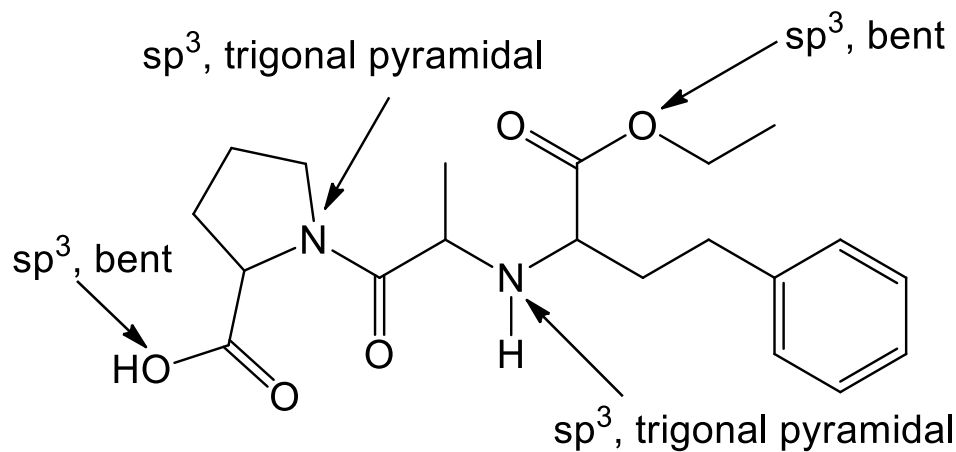


Learning Objective: 2.13 Distinguish between delocalized and localized lone pairs and describe how delocalized lone pairs participate in resonance and why localized lone pairs do not participate in resonance  
 Difficulty: Hard

168. Enalapril, is a drug used in the treatment of heart disease. What is the hybridization state and molecular geometry at the indicated atoms in Enalapril?



Answer:



Learning Objective: 2.13 Distinguish between delocalized and localized lone pairs and describe how delocalized lone pairs participate in resonance and why localized lone pairs do not participate in resonance  
Difficulty: Hard