Naming and Drawing Cyclic Hydrocarbons
(Student textbook page 34)

55. Name the cyclic hydrocarbon.

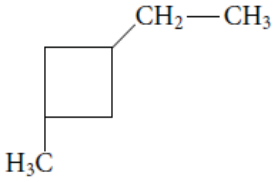
What Is Required?
You must write the name for the cyclic hydrocarbon.

What Is Given?
You are given the structural diagram.

Plan Your Strategy	Act on Your Strategy
Find the root.	The ring has 5 carbon atoms, so the root is cyclopent-.
Find the suffix.	There are no multiple bonds, so the structure is an alkane. Therefore the suffix is -ane.
Find the prefix.	There are no side groups thus there is no prefix.
Write the name.	cyclopentane.

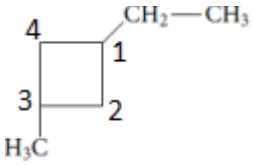
Check Your Solution
The root, prefix, and suffix correctly describe the structure.

56. Name the cyclic hydrocarbon.



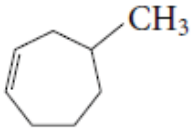
What Is Required?
You must write the name for the cyclic hydrocarbon.

What Is Given?
You are given the structural diagram.

Plan Your Strategy	Act on Your Strategy
Find the root.	The ring has 4 carbon atoms, which is the longest continuous chain, so the root is cyclobut-.
Find the suffix.	There are no multiple bonds, so the structure is an alkane. Therefore the suffix is -ane.
Find the prefix.	The side groups have the same numbers no matter the direction in which the compound is numbered. Number in the direction that gives the side group that comes first alphabetically the lowest number. There is an ethyl and methyl group so the carbon with the ethyl group would receive the number 1.  Therefore, the prefix is 1-ethyl-3-methyl.
Write the name.	1-ethyl-3-methylcyclobutane

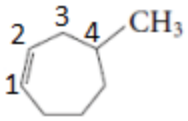
Check Your Solution
The root, prefix, and suffix correctly describe the structure.

57. Name the cyclic hydrocarbon.



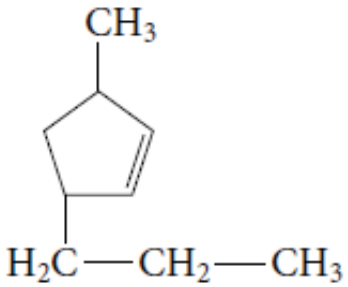
What Is Required?
You must write the name for the cyclic hydrocarbon.

What Is Given?
You are given the structural diagram.

Plan Your Strategy	Act on Your Strategy
Find the root.	The ring has 7 carbon atoms, which is the longest continuous chain, so the root is cyclohept-.
Find the suffix.	The ring has one double bond, so the structure is an alkene. The suffix is -ene.
Find the prefix.	The carbon atoms on the two sides of the double bond must be numbers 1 and 2. The numbering must proceed so that the side group has the lowest possible number.  Since the numbering of the carbon atoms on the double bond must be 1 and 2, it is not necessary to specify these in the name. There is a methyl group on carbon atom 4, so the prefix is 4-methyl.
Write the name.	4-methylcycloheptene

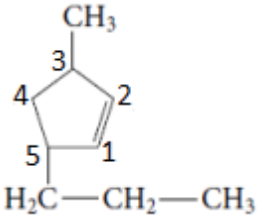
Check Your Solution
The root, prefix, and suffix correctly describe the structure.

58. Name the cyclic hydrocarbon.



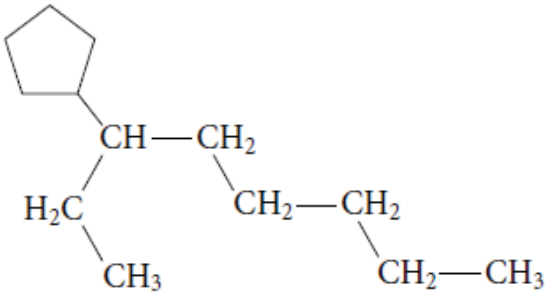
What Is Required?
You must write the name for the cyclic hydrocarbon.

What Is Given?
You are given the structural diagram.

Plan Your Strategy	Act on Your Strategy
Find the root.	The ring has 5 carbon atoms, which is the longest continuous chain, so the root is cyclopent-.
Find the suffix.	The ring has one double bond, so the structure is an alkene. The suffix is -ene.
Find the prefix.	The carbon atoms on the two sides of the double bond must be numbers 1 and 2. The numbering must proceed so that the sum of the numbers of the side groups must be as small as possible. There is a methyl group and propyl group. In this structure, the side groups will be at carbon atoms 3 and 5 regardless of the direction of numbering. Therefore, number so that the first named side group has the lowest number.  Since the numbering of the carbon atoms on the double bond must be 1 and 2, it is not necessary to specify these in the name. There is a methyl group on carbon atom 3 and a propyl group on carbon atom 5, so the prefix is 3-methyl-5-propyl.
Write the name.	3-methyl-5-propylcyclopentene

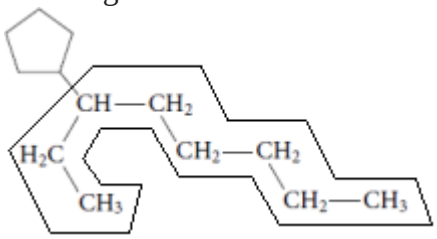
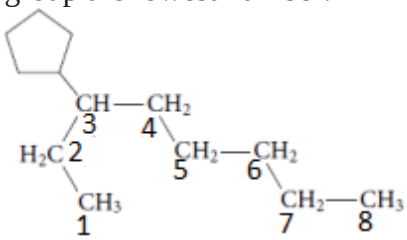
Check Your Solution
The root, prefix, and suffix correctly describe the structure.

59. Name the cyclic hydrocarbon.



What Is Required?
You must write the name for the cyclic hydrocarbon.

What Is Given?
You are given the structural diagram.

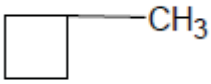
Plan Your Strategy	Act on Your Strategy
Find the root.	The longest continuous carbon chain in 8 atoms long.  The main chain is the straight chain alkane, not the cyclic alkane. Therefore the root is oct-.
Find the suffix.	The structure is an alkane, therefore the suffix is -ane.
Find the prefix.	Number the chain giving the carbon attached to the side group the lowest number.  The five carbon ring is a side group on carbon atom 3 of the main chain. It is named as if it were a straight chain alkyl group, except cyclo- is included in the prefix. Therefore, the prefix is 3-cylcopentyl.
Write the name.	3-cyclopentyloctane

Check Your Solution
The root, prefix, and suffix correctly describe the structure.

60. Draw a condensed structural formula for the following compound.
methylcyclobutane

What Is Required?
You must draw the condensed structural formula of the compound.

What Is Given?
You are given the name of the compound.

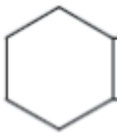
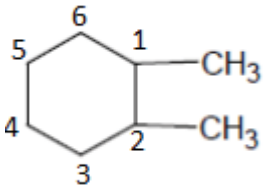
Plan Your Strategy	Act on Your Strategy
Identify the root.	The root is cyclobut-, so the structure is based on a four-carbon ring. 
Identify the suffix.	The suffix is -ane, so the ring has no double bonds.
Identify the prefix and draw the side groups.	The prefix is methyl, so there is a methyl group on carbon atom 1. The number is not found in the name because it is not necessary when there is only one side group. 

Check Your Solution
The size of the ring and the position of the side group agree with the name.

61. Draw a condensed structural formula for the following compound.
1,2-dimethylcyclohexane

What Is Required?
You must draw the condensed structural formula of the compound.

What Is Given?
You are given the name of the compound.

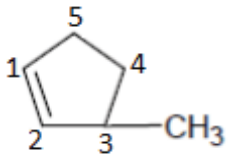
Plan Your Strategy	Act on Your Strategy
Identify the root.	The root is cyclohex-, so the structure is based on a six-carbon ring. 
Identify the suffix.	The suffix is –ane, so the ring has no double bonds.
Identify the prefix and draw the side groups.	The prefix is 1,2-dimethyl, so there is a methyl group on carbon atom 1 and carbon atom 2. 

Check Your Solution
The size of the ring and the position of the side groups agree with the name.

62. Draw a condensed structural formula for the following compound.
3-methylcyclopentene

What Is Required?
You must draw the condensed structural formula of the compound.

What Is Given?
You are given the name of the compound.

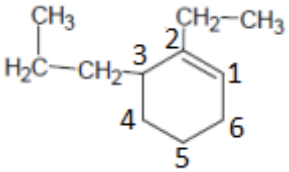
Plan Your Strategy	Act on Your Strategy
Identify the root.	The root is cyclopent-, so the structure is based on a five-carbon ring. 
Identify the suffix.	The suffix is -ene, so the ring has one double bond. 
Identify the prefix and draw the side groups.	The prefix is 3-methyl, so there is a methyl group on carbon atom 3. The carbon atoms on the ends of the double bond are always numbered 1 and 2. 

Check Your Solution
The size of the ring and the position of the side groups agree with the name.

63. Draw a condensed structural formula for the following compound.
2-ethyl-3-propylcyclohexane
Note: this name is not a possible name for a cycloalkane because, on an alkane, the numbering of side groups would be 1 and 2. The numbering of 2 and 3 implies that there is a multiple bond. The answer will be written for 2-ethyl-3-propylcyclohexane.

What Is Required?
You must draw the condensed structural formula of the compound.

What Is Given?
You are given the name of the compound.

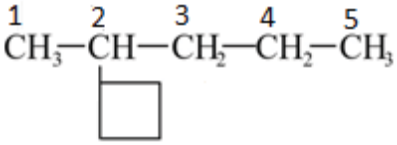
Plan Your Strategy	Act on Your Strategy
Identify the root.	The root is cyclohex-, so the structure is based on a six-carbon ring.
Identify the suffix.	The suffix is -ene, so the ring has one double bond. 
Identify the prefix and draw the side groups.	The prefix is 2-ethyl-3-propyl, so there is an ethyl group on carbon atom 2 and a propyl group on carbon atom 3. The carbon atoms at the ends of the double bond are always numbered 1 and 2. 

Check Your Solution
The size of the ring and the position of the side groups agree with the name.

64. Draw a condensed structural formula for the following compound.
2-cyclobutylpentane

What Is Required?
You must draw the condensed structural formula of the compound.

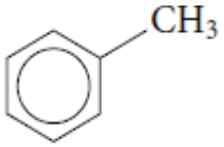
What Is Given?
You are given the name of the compound.

Plan Your Strategy	Act on Your Strategy
Identify the root.	The root is pent-, so the structure is based on a five-carbon chain. $CH_3—CH—CH_2—CH_2—CH_3$
Identify the suffix.	The suffix is -ane, so the chain is an alkane.
Identify the prefix and draw the side groups.	The prefix is 2-cyclobutyl, so the side group is a 4-carbon ring. 

Check Your Solution
The size of the ring and the position of the side groups agree with the name.

Naming and Drawing Aromatic Hydrocarbons
(Student textbook page 38)

65. Name the following aromatic hydrocarbon.



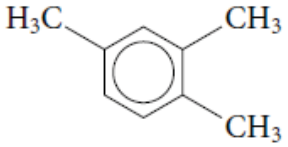
What Is Required?
You must name the aromatic hydrocarbon.

What Is Given?
You are given the structural formula of the hydrocarbon.

Plan Your Strategy	Act on Your Strategy
Identify the root.	The root for an aromatic hydrocarbon is -benzene.
Identify the prefix.	The side group has one carbon atom, so it is a methyl group. There is only one side group, so the carbon atoms in the benzene ring are not numbered.
Write the name.	The compound is methylbenzene.

Check Your Solution
The root and the prefix correctly describe the structure.

66. Name the following aromatic hydrocarbon.



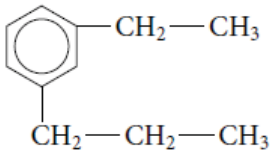
What Is Required?
You must name the aromatic hydrocarbon.

What Is Given?
You are given the structural formula of the hydrocarbon.

Plan Your Strategy	Act on Your Strategy
Identify the root.	The root for an aromatic hydrocarbon is -benzene.
Identify the prefix.	There are three methyl groups so the benzene ring must be numbered. Start at one of the methyl groups and number so that the sum of the numbers is as small as possible. The numbering places the methyl groups on carbon atoms 1, 2, and 4. The prefix is 1,2,4-trimethyl-.
Write the name.	The compound is 1,2,4-trimethylbenzene.

Check Your Solution
The carbon atoms are numbered to give the lowest numbers (1,2,4 rather than 1,3,4 or 1,2,5). The root and prefix correctly describe the structure.

67. Name the following aromatic hydrocarbon.



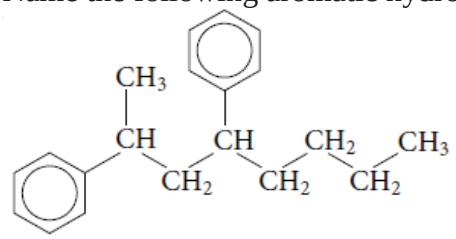
What Is Required?
You must name the aromatic hydrocarbon.

What Is Given?
You are given the structural formula of the hydrocarbon.

Plan Your Strategy	Act on Your Strategy
Identify the root.	The hydrocarbon chains have fewer than six carbon atoms, so the root is -benzene.
Identify the prefix.	There are two side groups so the benzene ring must be numbered. Number the carbon atoms in benzene so that the sum of the numbers is as small as possible. There is an ethyl side group and a propyl side group. Let the ethyl comes be carbon atom 1. The propyl group is on carbon atom 3. The prefix is 1-ethyl-3-propyl-.
Write the name.	The compound is 1-ethyl-3-propylbenzene.

Check Your Solution
The side groups are correctly identified and listed alphabetically, and the carbon atoms are numbered to give the lowest number. The prefix and root correctly describe the structure.

68. Name the following aromatic hydrocarbon.



What Is Required?
You must name the aromatic hydrocarbon.

What Is Given?
You are given the structural formula of the hydrocarbon.

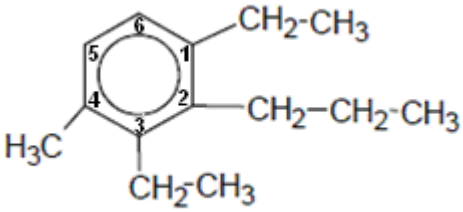
Plan Your Strategy	Act on Your Strategy
Identify the root.	There are eight carbon atoms in the hydrocarbon chain. Because there are more than six carbon atoms in the chain, it becomes the main chain, so the root is -octane.
Identify the prefix.	There is a benzene ring side group on carbon atom 2, and another on carbon atom 4. The prefix is 2,4-diphenyl-.
Write the name.	The compound is 2,4-diphenyloctane.

Check Your Solution
There are more than six carbon atoms in the hydrocarbon chain, so the benzene rings are side groups, and the carbon atoms are numbered to give the lowest numbering. The root and prefix correctly describe the structure.

69. Draw the condensed structural formula for the following aromatic hydrocarbon.
1,3-diethyl-4-methyl-2-propylbenzene

What Is Required?
You must draw the condensed structural formula for the compound.

What Is Given?
You are given the name of the aromatic hydrocarbon.

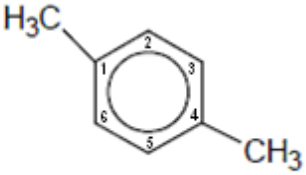
Plan Your Strategy	Act on Your Strategy
Identify the root.	The root is benzene, so the structure is based on a benzene ring. 
If there is more than one side group, number the carbon atoms in the ring.	There are four side groups, so the ring must be numbered. 
Identify the prefix, and draw the side groups to complete the structure.	The prefix is 1,3-diethyl-4-methyl-2-propyl-, so there are two ethyl groups, one methyl group, and one propyl group on the benzene ring. The ethyl groups are on carbon atoms 1 and 3, the methyl group is on carbon atom 4, and the propyl group is on carbon atom 2. 

Check Your Solution
There are ethyl groups on carbon atoms 1 and 3, a methyl group on carbon 4, and a propyl group on carbon 2. The structure is correct.

70. Draw the condensed structural formula for the following aromatic hydrocarbon.
1,4-dimethylbenzene, historically known as para-xylene or *p*-xylene

What Is Required?
You must draw the condensed structural formula for an aromatic hydrocarbon.

What Is Given?
You are given the name of the aromatic hydrocarbon.

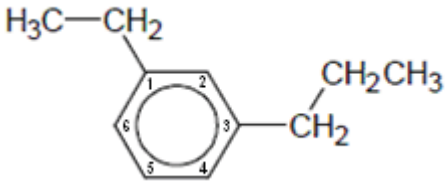
Plan Your Strategy	Act on Your Strategy
Identify the root.	The root is benzene, so the structure is based on a benzene ring. 
If there is more than one side group, number the carbon atoms in the ring.	There are two side groups, so the ring must be numbered. 
Identify the prefix and draw the side groups.	The prefix is 1,4-dimethyl-, so there are two methyl groups, located on carbon atom 1 and carbon atom 4, respectively. 

Check Your Solution
There are methyl groups on carbon atoms 1 and 4, so the structure is correct.

71. Draw the condensed structural formula for the following aromatic hydrocarbon.
1-ethyl-3-propylbenzene

What Is Required?
You must draw the condensed structural formula an aromatic hydrocarbon.

What Is Given?
You are given the name of the aromatic hydrocarbon.

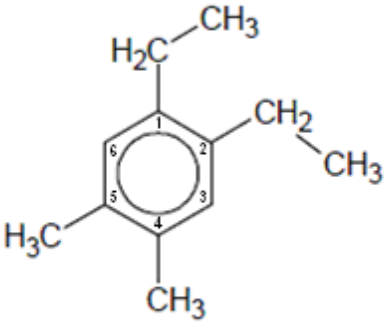
Plan Your Strategy	Act on Your Strategy
Identify the root.	The root is benzene, so the structure is based on a benzene ring. 
If there is more than one side group, number the carbon atoms in the ring.	There are two side groups, so the ring must be numbered. 
Identify the prefix, and draw the side groups.	The prefix is 1-ethyl-3-propyl, so there is an ethyl group on carbon atom 1 and a propyl group on carbon atom 3. 

Check Your Solution
The proper side groups are located on the right carbon atoms, so the structure is correct.

72. Draw the condensed structural formula for the following aromatic hydrocarbon.
1,2-diethyl-4,5-dimethylbenzene

What Is Required?
You must draw the condensed structural formula for an aromatic hydrocarbon.

What Is Given?
You are given the name of the aromatic hydrocarbon.

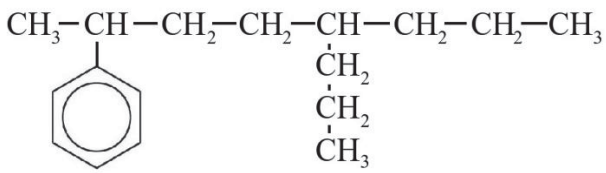
Plan Your Strategy	Act on Your Strategy
Identify the root.	The root is benzene, so the structure is based on a benzene ring. 
If there is more than one side group, number the carbon atoms in the ring.	There are four side groups, so the ring must be numbered. 
Identify the prefix, and draw the side groups.	The prefix is 1,2-diethyl-4,5-dimethyl-, so there are two ethyl groups and two methyl groups. The ethyl groups are on carbon atoms 1 and 2, and the methyl groups are on carbon atoms 4 and 5. 

Check Your Solution
The ethyl and methyl side groups are on the proper carbon atoms, so the structure is correct.

73. Draw the condensed structural formula for the following aromatic hydrocarbon.
2-phenyl-5-propyloctane

What Is Required?
You must draw the condensed structural formula for the compound.

What Is Given?
You are given the name of the aromatic hydrocarbon.

Plan Your Strategy	Act on Your Strategy
Identify the root.	The root is octane, so the structure is based on a hydrocarbon chain with eight carbon atoms. C — C — C — C — C — C — C — C
Number the carbon atoms in the main chain.	The hydrocarbon chain must be numbered. $\underset{1}{C}-\underset{2}{C}-\underset{3}{C}-\underset{4}{C}-\underset{5}{C}-\underset{6}{C}-\underset{7}{C}-\underset{8}{C}$
Identify the prefix, and draw the side groups.	The prefix is 2-phenyl-5-propyl, so there is a phenyl group on carbon atom 2 and a propyl group on carbon atom 5. 

Check Your Solution
The benzene ring appears as a side group on carbon atom 2, and the propyl group is on carbon atom 5. The structure is correct.