Naming Alkenes
(Student textbook page 26)

23. Name the following alkene.

$H_3C—CH{=}CH—CH_2—CH_3$

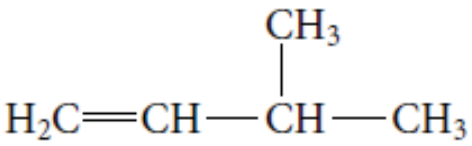
What Is Required?
You must name the alkene.

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

Plan Your Strategy	Act on Your Strategy
Find the root.	The longest carbon chain has 5 carbons. The root is pent-.
Determine the suffix.	Assign numbers to the carbon chain from left to right so that the first carbon involved in the double bond has the lowest possible number. $\underset{1}{H_3C}—\underset{2}{CH}{=}\underset{3}{CH}—\underset{4}{CH_2}—\underset{5}{CH_3}$ Because the molecule has one double bond between carbon 2 and 3, the suffix is -2-ene.
Write the name.	pent-2-ene

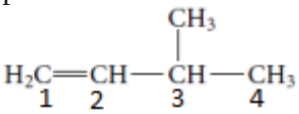
Check Your Solution
The length of the main chain and the position of the double bond agree with the given structure.

24. Name the following alkene.



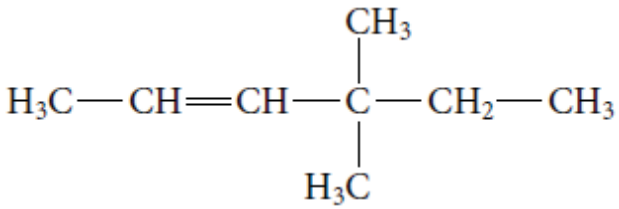
What Is Required?
You must name the alkene.

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

Plan Your Strategy	Act on Your Strategy
Find the root.	The longest chain that contains the double bond has 4 atoms. The root is but-.
Determine the suffix.	Assign numbers to the carbon chain from left to right so that the first carbon involved in the double bond has the lowest possible number.  Because the molecule has one double bond between carbon 1 and 2, the suffix is -1-ene.
Determine the prefix.	A methyl group is bonded to carbon atom 3. The prefix is 3-methyl.
Write the name.	3-methylbut-1-ene

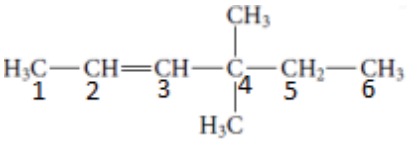
Check Your Solution
The length of the main chain and the position and name of the side group agrees with the given structure.

25. Name the following alkene.



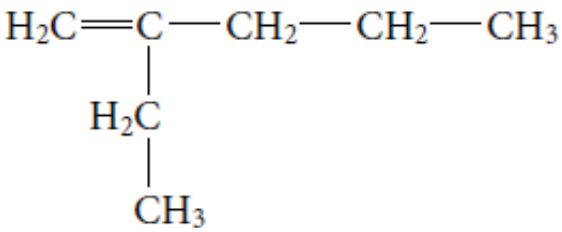
What Is Required?
You must name the alkene.

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

Plan Your Strategy	Act on Your Strategy
Find the root.	The longest chain containing the double bond has 6 atoms. The root is hex-.
Determine the suffix.	Assign numbers to the carbon chain from left to right so that the first carbon involved in the double bond has the lowest possible number.  Because the molecule has one double bond between carbon 2 and 3, the suffix is -2-ene.
Determine the prefix.	Two methyl groups are bonded to carbon atom 4. The prefix is 4-dimethyl.
Write the name.	4-dimethylhex-2-ene

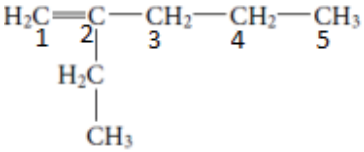
Check Your Solution
The length of the main chain and the position and name of the side groups agree with the given structure.

26. Name the following alkene.



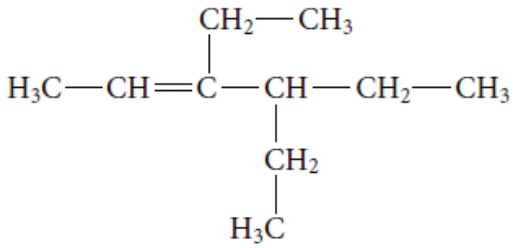
What Is Required?
You must name the alkene.

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

Plan Your Strategy	Act on Your Strategy
Find the root.	The longest chain that includes the double bond has 5 carbons. The root is pent-.
Determine the suffix.	Assign numbers to the carbon starting at the end nearest the double bond.  Because the molecule has one double bond between carbon 1 and 2, the suffix is -1-ene.
Determine the prefix.	An ethyl group is bonded to carbon atom 2. The prefix is 2-ethyl.
Write the name.	2-ethylpent-1-ene

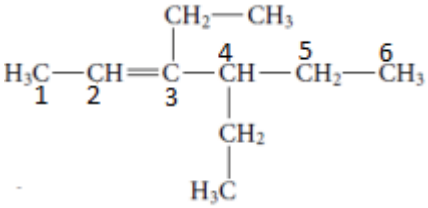
Check Your Solution
The length of the main chain and the position and name of the side group agree with the given structure.

27. Name the alkene



What Is Required?
You must name the alkene.

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

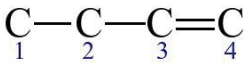
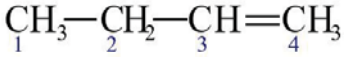
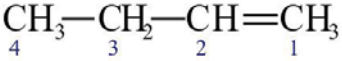
Plan Your Strategy	Act on Your Strategy
Find the root.	The longest chain that includes the double bond has 6 carbons. The root is hex-.
Determine the suffix.	Assign numbers to the carbon chain starting at the end nearest the double bond.  Because the molecule has one double bond between carbon 2 and 3, the suffix is -2-ene.
Determine the prefix.	An ethyl group is bonded to carbon 3 and another is bonded to carbon 4. The prefix is 3,4-diethyl.
Write the name.	3,4-diethylhex-2-ene

Check Your Solution
The length of the main chain and the position and name of the side group agree with the given structure.

28. Identify any errors in the structure below by drawing it. Rename the structure correctly.
but-3-ene

What Is Required?
You must identify any errors in the structure and rename it.

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

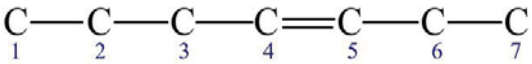
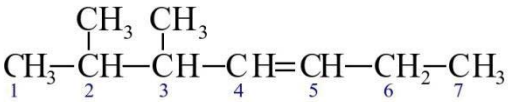
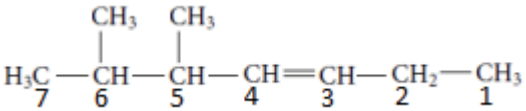
Plan Your Strategy	Act on Your Strategy
Identify the root.	The root is but- so the main chain has 4 carbons.
Identify the suffix.	The suffix is -3-ene so there is a double bond after the third carbon atom. 
Identify the prefix and draw the side groups.	There is no prefix so there are no side groups. The complete structure is: 
Identify any errors in the name.	The numbering of the carbon atoms does not start at the end nearest the double bond.
Correct the naming.	The correct numbering is:  Therefore, the correct name is but-1-ene.

Check Your Solution
The length of the carbon chain agrees with the given structure, and the suffix is correct giving the lowest number to the first carbon involved in the double bond.

29. Identify any errors in the structure below by drawing it. Rename the structure correctly.
2,3-dimethylhept-4-ene

What Is Required?
You must identify any errors in the structure and rename it.

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

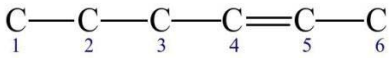
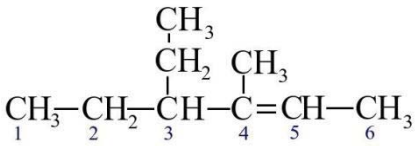
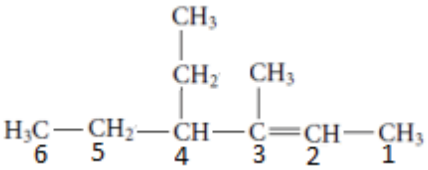
Plan Your Strategy	Act on Your Strategy
Identify the root.	The root is hept-. Therefore, the longest carbon chain has 7 carbon atoms.
Identify the suffix.	The suffix is -4-ene. Therefore, there is a double bond after carbon atom 4. 
Identify the prefix, draw the side groups and complete the structure.	The prefix is 2,3-dimethyl so there are methyl groups on carbon atoms 2 and 3. 
Identify any errors in the name.	The numbering of the carbon atoms does not start at the end nearest the double bond.
Make corrections and write the correct the name.	Renumber the carbon atoms starting at the right end of the chain.  The correct name is 5,6-dimethylhept-3-ene.

Check Your Solution
The length of the carbon chain agrees with the given structure, and the suffix is correct.

30. Identify any errors in the structure below by drawing it. Rename the structure correctly.
3-ethyl-4-methylhex-4-ene

What Is Required?
You must identify any errors in the structure and rename it.

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

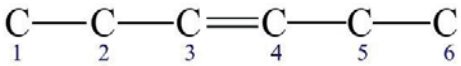
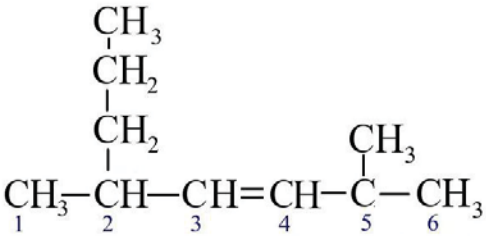
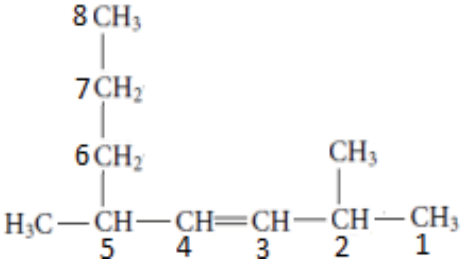
Plan Your Strategy	Act on Your Strategy
Identify the root.	The root is hex- so the main chain has six carbon atoms.
Identify the suffix.	The suffix is -4-ene so there is a double bond after carbon atom 4. 
Identify the prefix, draw the side groups and complete the structure.	The prefix is 3-ethyl-4-methyl so there is a two-carbon group on carbon atom3 and a one-carbon group on carbon atom 4. 
Identify any errors in the name.	The numbering of the carbon atoms does not start at the end nearest the double bond.
Make corrections and write the correct the name.	Number the carbon atoms at the end nearest the double bond.  The methyl group is not on carbon atom 3 and the ethyl group is on carbon atom 4. The correct name is 4-ethyl-3-methylhex-2-ene.

Check Your Solution
The length of the carbon chain and the position of the side groups agree with the given structure, and the suffix is correct.

31. Identify any errors in the structure below by drawing it. Rename the structure correctly.
5-methyl-2-propyl-hex-3-ene

What Is Required?
You must identify any errors in the structure and rename it.

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

Plan Your Strategy	Act on Your Strategy
Identify the root.	The root is hex- so there are six carbon atoms in the main chain.
Identify the suffix.	The suffix is -3-ene so there is a double bond after carbon atom 3. 
Identify the prefix, draw the side groups and complete the structure.	The prefix is 5-methyl-2-propyl- so there is a one-carbon group on carbon atom 5 and a three-carbon group of carbon atom 2. 
Identify any errors in the name.	The main chain was incorrectly chosen. There is an eight carbon chain that is the correct main chain. With the correct main chain, the numbering must begin at the right end which is now nearest the double bond.
Make corrections and write the correct the name.	Renumber and then rename the correct main chain.  The correct root now is oct-. There are one-carbon side groups on carbon atoms 2 and 5. The correct name is thus 2,5-dimethyloct-3-ene.

Check Your Solution
The length of the carbon chain and the position of the side groups agree with the given structure, and the suffix is correct, giving the lowest number to the first carbon involved in the double bond.

32. Name the following compound.

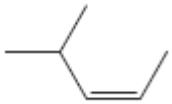
What Is Required?
You must name a compound.

What Is Given?
You are given the structural formula for the compound.

Plan Your Strategy	Act on Your Strategy
Find the root.	The longest carbon chain has 3 carbons. The root is prop-.
Determine the suffix.	Assign numbers to the carbon chain starting at the end nearest the double bond.  Because the molecule has one double bond between carbon 1 and 2, the suffix is -1-ene. When the double bond is between carbon 1 and 2 and there are no side groups, the 1 does not need to be written and the suffix is just -ene.
Write the name.	propene

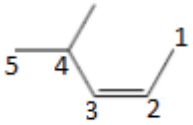
Check Your Solution
The length of the main chain and the position of the double bond agree with the given structure.

33. Name the following compound.



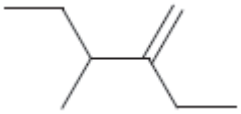
What Is Required?
You must name a compound.

What Is Given?
You are given the structural formula for the compound.

Plan Your Strategy	Act on Your Strategy
Find the root.	The longest chain contains 5 atoms. The root is pent-.
Determine the suffix.	Assign numbers to the carbon chain starting at the end nearest the double bond.  Because the molecule has one double bond between carbon 2 and 3, the suffix is -2-ene.
Determine the prefix.	A methyl group is bonded to carbon atom 4. The prefix is 4-methyl.
Write the name.	4-methylpent-2-ene

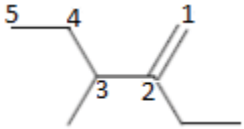
Check Your Solution
The length of the main chain and the position and name of the side group agree with the given structure.

34. Name the following compound:



What Is Required?
You must name a compound.

What Is Given?
You are given the structural formula for the compound.

Plan Your Strategy	Act on Your Strategy
Find the root.	The longest chain containing the double bond has 6 atoms. The root is hex-.
Determine the suffix.	Assign numbers to the carbon chain beginning at the end nearest the double bond.  Because the molecule has one double bond between carbon 1 and 2, the suffix is -1-ene.
Determine the prefix.	An ethyl group is bonded to carbon atom 2, and a methyl group is bonded to carbon atom 3. The groups in the prefix must be in alphabetical order, and “e” comes before “m.” Therefore the prefix is 2-ethyl-3-methyl.
Write the name.	2-ethyl-3-methylpent-1-ene

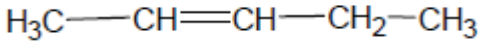
Check Your Solution
The length of the main chain and the position and name of the side groups agree with the given structure.

Drawing Alkenes
(Student textbook page 27)

35. Draw the condensed structural formula for the following alkene.
pent-2-ene

What Is Required?
You must draw a condensed structural formula.

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

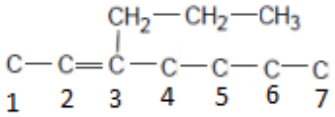
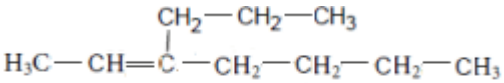
Plan Your Strategy	Act on Your Strategy
Identify the root.	The root is pent-, so there are 5 carbon atoms in the main chain.
Identify the suffix.	The suffix is -2-ene, so there is a double bond between carbon atom 2 and 3 in the main chain.
Draw and number the carbon chain.	C – C = C – C – C 1 2 3 4 5
Identify the prefix.	There is no prefix so the structure has no side groups.
Complete the structural formula. Add enough hydrogen atoms so that each carbon atom has a total of four bonds.	

Check Your Solution
The number of carbon atoms in the main chain and the position of the double bond in the condensed structural formula agree with the name.

36. Draw the condensed structural formula for the following alkene.
3-propylhept-2-ene

What Is Required?
You must draw a condensed structural formula.

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

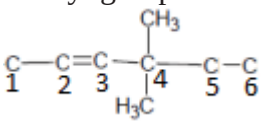
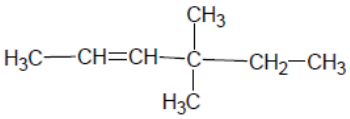
Plan Your Strategy	Act on Your Strategy
Identify the root.	The root is hept-, so there are 7 carbon atoms in the main chain.
Identify the suffix.	The suffix is -2-ene, so there is a double bond between carbon atom 2 and 3 in the main chain.
Draw and number the carbon chain.	C – C = C – C – C – C – C 1 2 3 4 5 6 7
Identify the prefix and draw the side groups.	The prefix is 3-propyl, so there is a propyl group on carbon atom 3. 
Complete the structural formula. Add enough hydrogen atoms so that each carbon atom has a total of four bonds.	

Check Your Solution
The number of carbon atoms in the main chain, the position of the double bond, and the type and position of the side group in the condensed structural formula agree with the name.

37. Draw the condensed structural formula for the following alkene.
4,4-dimethylhex-2-ene

What Is Required?
You must draw a condensed structural formula.

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

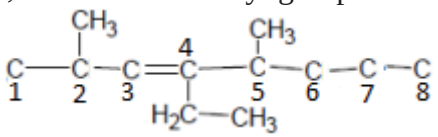
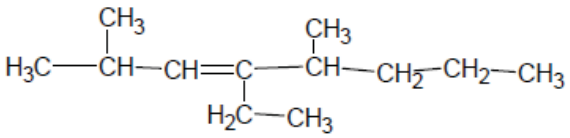
Plan Your Strategy	Act on Your Strategy
Identify the root.	The root is hex-, so there are 6 carbon atoms in the main chain.
Identify the suffix.	The suffix is -2-ene, so there is a double bond between carbon atoms 2 and 3 in the main chain.
Draw and number the carbon chain.	C – C = C – C – C – C 1 2 3 4 5 6
Identify the prefix and draw the side groups.	The prefix is 4,4-dimethyl, so there are two methyl groups on carbon atom 4. 
Complete the structural formula. Add enough hydrogen atoms so that each carbon atom has a total of four bonds.	

Check Your Solution
The number of carbon atoms in the main chain, the position of the double bond, and the type and position of the side group in the condensed structural formula agree with the name.

38. Draw the condensed structural formula for the following alkene.
4-ethyl-2,5-dimethyloct-3-ene

What Is Required?
You must draw a condensed structural formula.

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

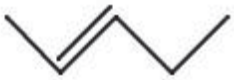
Plan Your Strategy	Act on Your Strategy
Identify the root.	The root is oct-, so there are 8 carbon atoms in the main chain.
Identify the suffix.	The suffix is -3-ene, so there is a double bond between carbon atom 3 and 4 in the main chain.
Draw and number the carbon chain.	C – C – C = C – C – C – C – C 1 2 3 4 5 6 7 8
Identify the prefix and draw the side groups.	The prefix is 4 ethyl-2,5-dimethyl, so there is an ethyl group on carbon atom 4, a methyl group on carbon atom 2, and another methyl group on carbon atom 5. 
Complete the structural formula. Add enough hydrogen atoms so that each carbon atom has a total of four bonds.	

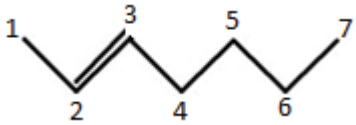
Check Your Solution
The number of carbon atoms in the main chain, the position of the double bond, and the type and position of the side group in the condensed structural formula agree with the name.

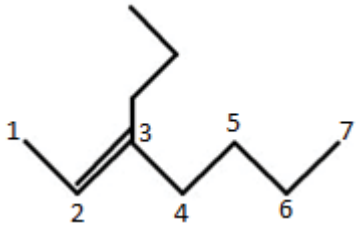
39. For each of the molecules listed in questions 35–38, draw a line structural formula.

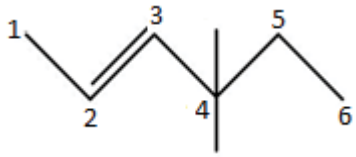
What Is Required?
You need to draw a line structural formula.

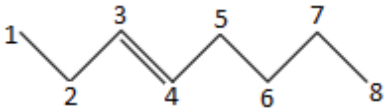
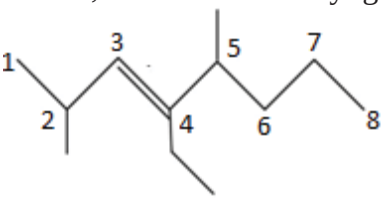
What Is Given?
You are given the name of the compound and the condensed structural formula.

Plan Your Strategy	Act on Your Strategy
Use the condensed structural formulas from question 35 to draw the line structural formulas.	Use the condensed structural formula as a guide. $H_3C—CH{=}CH—CH_2—CH_3$ Each bend, intersection, and end of a straight line represents a carbon atom, unless otherwise specified. Hydrogen atoms are not included as it is assumed each carbon atom is bonded to the number hydrogen atoms necessary to give it four bonds. 

Plan Your Strategy	Act on Your Strategy
Identify the root.	The root is hept-, so there are 7 carbon atoms in the main chain.
Identify the suffix.	The suffix is -2-ene, so there is a double bond between carbon atom 2 and 3 in the main chain.
Draw and number the carbon chain.	Each bend, intersection, and end of a straight line represents a carbon atom, unless otherwise specified. Hydrogen atoms are not included as it is assumed each carbon atom is bonded to the number hydrogen atoms necessary to give it four bonds. Draw 6 lines to represent 7 carbons. Between carbon 2 and 3 draw a double bond. 

Identify the prefix and draw the side groups.	The prefix is 3-propyl, so there is a propyl group on carbon atom 3. 

Plan Your Strategy	Act on Your Strategy
Identify the root.	The root is hex-, so there is a double bond between carbon atom 2 and 3 in the main chain.
Identify the suffix.	The suffix is -2-ene, so there is a double bond between carbon atom 2 and 3 in the main chain.
Draw and number the carbon chain.	Each bend, intersection, and end of a straight line represents a carbon atom, unless otherwise specified. Hydrogen atoms are not included as it is assumed each carbon atom is bonded to the number hydrogen atoms necessary to give it four bonds. Draw 5 lines representing 6 carbons. 
Identify the prefix and draw the side groups.	The prefix is 4,4-dimethyl, so there is 2 methyl groups on carbon atom 4. 

Plan Your Strategy	Act on Your Strategy
Identify the root.	The root is oct-, so there are 8 carbon atoms in the main chain.
Identify the suffix.	The suffix is -3-ene, so there is a double bond between carbon atom 3 and 4 in the main chain.
Draw and number the carbon chain.	Each bend, intersection, and end of a straight line represents a carbon atom, unless otherwise specified. Hydrogen atoms are not included as it is assumed each carbon atom is bonded to the number hydrogen atoms necessary to give it four bonds. Draw 7 lines representing 8 carbon atoms. Draw a double bond between carbon 3 and 4. 
Identify the prefix and draw the side groups.	The prefix is 4 ethyl-2,5-dimethyl so there is an ethyl group on carbon atom 4, a methyl group on carbon atom 2, and another methyl group on carbon atom 5. 

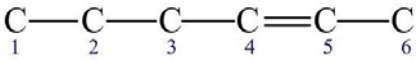
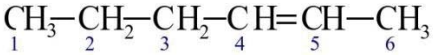
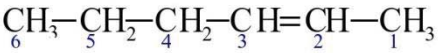
Check Your Solution

The number of carbon atoms in the main chain, the position of the double bond, and the type and position of the side group in the line structural formula agree with the names and condensed structural formulae.

40. The name of this structure is incorrect. Draw the structure, and rename it correctly.
hex-4-ene

What Is Required?
You draw the structure and rename it correctly.

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

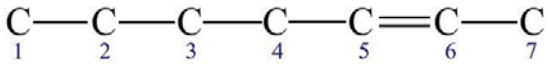
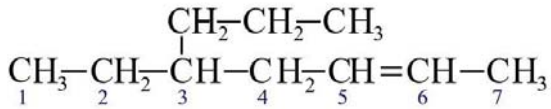
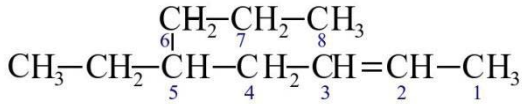
Plan Your Strategy	Act on Your Strategy
Indentify the root.	The root is hex- so there are six carbon atoms in the main chain.
Indentify the suffix.	The suffix is -4-ene so there is a double bond between carbon atoms 4 and 5. 
Identify the prefix and draw the side groups. Complete the structure.	There is no prefix so there are no side groups. 
Identify any errors in the name.	The numbering does not start at the end nearest the double bond.
Correct the naming.	Renumber the main chain and name the compound accordingly.  The correct name is hex-2-ene.

Check Your Solution
The length of the carbon chain and the position of the side groups agree with the given structure and the suffix is correct.

41. The name of this structure is incorrect. Draw the structure, and rename it correctly.
3-propylhept-5-ene

What Is Required?
You must draw the structure and rename it.

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

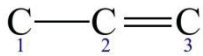
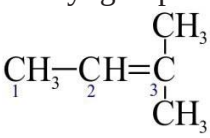
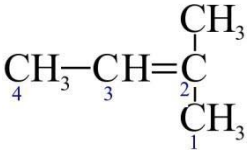
Plan Your Strategy	Act on Your Strategy
Identify the root.	The root is hept- so the main chain is seven carbon atoms long.
Identify the suffix.	The suffix is -5-ene so there is a double bond between carbon atoms 5 and 6. 
Identify the prefix and draw the side groups. Complete the structure.	The prefix is 3-propyl- so there is a three-carbon side group on carbon atom 3. 
Identify any errors in the name.	The numbering does not start at the end nearest the double bond. The longest carbon chain containing the double bond is not seven carbon atoms long but is eight carbon atoms long. These changes make the prefix and suffix wrong.
Correct the naming.	 The double bond is now between carbon atoms 2 and 3. The root is now oct-, and the side group is two carbon atoms long and is on carbon atoms 5. The correct name is 5-ethyloct-2-ene.

Check Your Solution
The length of the carbon chain and the position of the side groups agree with the given structure, and the suffix is correct.

42. The name of this structure is incorrect. Draw the structure, and rename it correctly.
3,3-dimethylprop-2-ene

What Is Required?
You must draw the structure and rename it.

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

Plan Your Strategy	Act on Your Strategy
Identify the root.	The root is prop- so the main chain is three carbon atoms long.
Identify the suffix.	The suffix is -2-ene so there is a double bond between carbon atoms 2 and 3. 
Identify the prefix and draw the side groups. Complete the structure.	The prefix is 3,3-dimethyl so there are two methyl groups on carbon atom 3. 
Identify any errors in the name.	The longest chain is not three carbon atoms long but is, instead, four carbon atoms long.
Correct the naming.	Because the main chain is four carbon atoms long, the root is but-. Numbering could start at either end of the chain because they are an equal number of carbon atoms from the double bond. However, the current numbering makes the side groups on carbon atom number 3. Because the numbering should keep the numbers of the side groups as low as possible while following the rules involving double bonds, the numbering must be changed. The only methyl group is now on carbon atom 2.  The correct name is 2-methylbut-2-ene.

Check Your Solution
The length of the carbon chain and the position of the side groups agree with the given structure and the suffix is correct.

43. Draw the complete structural formula for the following.

a. 2-methylbut-1-ene

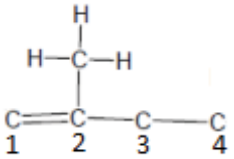
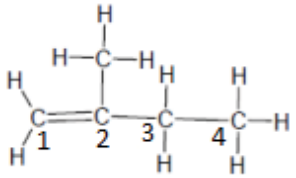
b. 4-ethyl-4,5-dimethylhex-1-ene

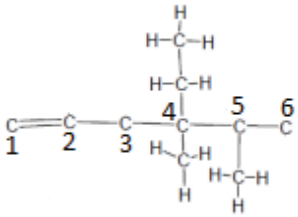
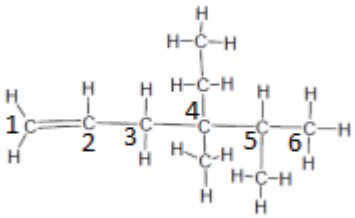
What Is Required?

You must draw the complete structural formula.

What Is Given?

You are given the name of the compound.

Plan Your Strategy	Act on Your Strategy
a. Identify the root.	The root is but-, so there are 4 carbon atoms in the main chain.
Identify the suffix.	The suffix is -1-ene, so there is a double bond between carbon atoms 1 and 2 in the main chain.
Draw and number the carbon chain.	C = C – C – C 1 2 3 4
Identify the prefix and draw the side groups.	The prefix 2-methyl, so there is a methyl group on carbon atom 2. 
Complete the structural formula. Add enough hydrogen atoms so that each carbon atom has a total of four bonds.	

b. Identify the root.	The root is hex-, so there are 6 carbon atoms in the main chain.
Identify the suffix.	The suffix is -1-ene, so there is a double bond between carbon atoms 1 and 2 in the main chain.
Draw and number the carbon chain.	C = C – C – C – C – C 1 2 3 4 5 6
Identify the prefix and draw the side groups.	The prefix is 4-ethyl-4,5-dimethyl, so there is an ethyl group on carbon atom 4, a methyl group on carbon atom 4, and another methyl group on carbon atom 5. 
Complete the structural formula. Add enough hydrogen atoms so that each carbon atom has a total of four bonds.	

Check Your Solution

The number of carbon atoms in the main chain, the position of the double bond, and the type and position of the side group in the condensed structural formula agree with the name.