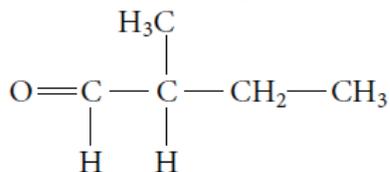


97. Name the following aldehyde.



What Is Required?

You must name the aldehyde.

What Is Given?

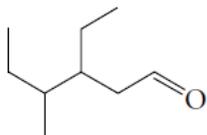
You are given the structure.

| Plan Your Strategy | Act on Your Strategy |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Identify the root. | There are four carbon atoms in the longest chain, including the formyl group, so the root is butan-. $ \begin{array}{c} \text{H}_3\text{C} \\ \\ \overset{1}{\text{O}=\text{C}}-\overset{2}{\text{C}}-\overset{3}{\text{CH}_2}-\overset{4}{\text{CH}_3} \\ \quad \\ \text{H} \quad \text{H} \end{array} $ |
| Identify the suffix. | The compound is an aldehyde so the suffix is -al. There are no numbers on the suffix because the formyl group is always on carbon 1. |
| Identify the prefix. | There is a methyl group on carbon 2, so the prefix is 2-methyl-. |
| Write the name. | 2-methylbutanal |

Check Your Solution

The compound has a formyl group at the beginning of the main chain, so it is an aldehyde. The length of the chain and the name and position of the side group agree with the name.

98. Name the following aldehyde.



What Is Required?

You must name the aldehyde.

What Is Given?

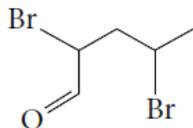
You are given the structure.

| Plan Your Strategy | Act on Your Strategy |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Identify the root. | There are six carbon atoms in the longest chain, including the formyl group, so the root is hex-. |
| Identify the suffix. | The first part of the suffix is an- because there are no double bonds within the main chain. The compound is an aldehyde, so the final part of the suffix is -al. There are no numbers on the suffix because the formyl group is always on carbon 1. |
| Identify the prefix. | There is an ethyl group on carbon 3 and a methyl group on carbon 4, so the prefix is 3-ethyl-4-methyl-. |
| Write the name. | 3-ethyl-4-methylhexanal |

Check Your Solution

The compound has a formyl group at the beginning of the main chain, so it is an aldehyde. The length of the chain and the name and position of the side groups agree with the name.

99. Name the following aldehyde.

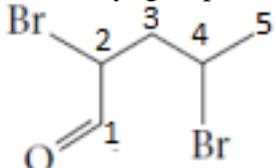


What Is Required?

You must name the aldehyde.

What Is Given?

You are given the structure.

| Plan Your Strategy | Act on Your Strategy |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Identify the root. | There are five carbon atoms in the longest chain including the formyl group, so the root is pent-.  |
| Identify the suffix. | There are no double bonds so an- is included in the suffix. The compound is an aldehyde so the end of the suffix is -al. There are no numbers on the suffix because the formyl group is always on carbon 1. |
| Identify the prefix. | There is a bromine atom on carbon 2 and 4, so the prefix is 2,4-dibromo-. |
| Write the name. | 2,4-dibromopentanal |

Check Your Solution

The compound has a formyl group at the beginning of the main chain, so it is an aldehyde. The length of the chain and the name and position of the side groups agree with the name.

100. Draw the condensed structural formula for the following aldehyde.
3-methylbutanal

What Is Required?

You must draw the condensed structural formula for an aldehyde.

What Is Given?

You are given the name.

| Plan Your Strategy | Act on Your Strategy |
|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Identify the root and draw the main chain. | <p>The root is but-, so there are four carbons in the main chain. The beginning of the suffix is an- so there are only single bonds in the main chain.</p> $\begin{array}{cccc} \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ 1 & & 2 & & 3 & & 4 \end{array}$ |
| Identify the suffix. | <p>The suffix is -al, so it is an aldehyde. The carbon atom in the formyl group is always carbon atom 1. So, add a hydrogen atom and oxygen atom to carbon atom 1.</p> $\begin{array}{cccc} & \text{O} & & & & & & \\ & // & & & & & & \\ \text{H} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & 1 & & 2 & & 3 & & 4 \end{array}$ |
| Identify the prefix and add any side groups and necessary hydrogen atoms to complete the structure | <p>The prefix is 3-methyl-, so there is a methyl group on carbon 3.</p> $\begin{array}{ccccccc} & & & & \text{CH}_3 & & & \\ & & & & & & & \\ \text{O} & & & & & & & \\ // & & & & & & & \\ \text{H} & - & \text{C} & - & \text{CH}_2 & - & \text{CH} & - & \text{CH}_3 \\ & & 1 & & 2 & & 3 & & 4 \end{array}$ |

Check Your Solution

The compound has the suffix -al, so it is an aldehyde. The length of the chain and the name and position of the side group agree with the name.

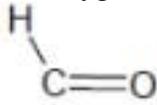
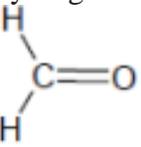
101. Draw the condensed structural formula for the following aldehyde.
methanal (commonly known as formaldehyde)

What Is Required?

You must draw the condensed structural formula for an aldehyde.

What Is Given?

You are given the name.

| Plan Your Strategy | Act on Your Strategy |
|-----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Identify the root and draw the main chain. | The root is meth-, so there is one carbon in the main chain. With only one carbon atom, there can be no bonds at all so an- is included in the name. C 1 |
| Identify the suffix. | The suffix is -al, so it is an aldehyde. Add a hydrogen atom and oxygen atom to carbon atom 1.  |
| Identify the prefix and add any side groups and necessary hydrogen atoms to complete the structure. | There is no prefix. Finish the structure by adding another hydrogen atom to carbon atom so that it has 4 bonds.  |

Check Your Solution

The compound has the suffix -al, so it is an aldehyde. The length of the chain agrees with the name.

102. Draw the condensed structural formula for the following aldehyde.
2-methylpropanal

What Is Required?

You must draw the condensed structural formula for an aldehyde.

What Is Given?

You are given the name.

| Plan Your Strategy | Act on Your Strategy |
|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Identify the root and draw the main chain. | <p>The root is prop-, so there are three carbon atoms in the main chain. The suffix starts with an- so there are only single bonds within the main chain.</p> $\begin{array}{c} \text{C} - \text{C} - \text{C} \\ 1 \quad 2 \quad 3 \end{array}$ |
| Identify the suffix. | <p>The suffix is -al, so it is an aldehyde. The carbon atom in the formyl group is always carbon atom 1. So, add a hydrogen atom and oxygen atom to carbon atom 1.</p> $\begin{array}{c} \text{O} \\ \parallel \\ \text{H} - \text{C} - \text{C} - \text{C} \\ 1 \quad 2 \quad 3 \end{array}$ |
| Identify the prefix and add any side groups and necessary hydrogen atoms to complete the structure. | <p>The prefix is 2-methyl-, so there is a methyl group on carbon atom 2.</p> $\begin{array}{c} \text{O} \quad \text{CH}_3 \\ \parallel \quad \\ \text{H} - \text{C} - \text{CH} - \text{CH}_3 \\ 1 \quad 2 \quad 3 \end{array}$ |

Check Your Solution

The compound has the suffix -al, so it is an aldehyde. The length of the chain and the name and position of the side group agree with the name.

103. Draw the condensed structural formula for the following aldehyde.
2-chloroethanal

What Is Required?

You must draw the condensed structural formula for an aldehyde.

What Is Given?

You are given the name.

| Plan Your Strategy | Act on Your Strategy |
|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Identify the root and draw the main chain. | The root is ethan-, so there are two carbons with only single bonds in the main chain. $\begin{array}{c} \text{C} - \text{C} \\ 1 \quad 2 \end{array}$ |
| Identify the suffix. | The suffix is -al, so it is an aldehyde. The carbon atom in the formyl group is always carbon atom 1. So, add a hydrogen atom and oxygen atom to carbon atom 1. $\begin{array}{c} \text{O} \\ \parallel \\ \text{H} - \text{C} - \text{C} \\ 1 \quad 2 \end{array}$ |
| Identify the prefix and add any side groups and necessary hydrogen atoms to complete the structure. | The prefix is 2-chloro-, so there is a chlorine atom on carbon atom 2. $\begin{array}{c} \text{O} \quad \text{Cl} \\ \parallel \quad \\ \text{H} - \text{C} - \text{CH}_2 \\ 1 \quad 2 \quad 2 \end{array}$ |

Check Your Solution

The compound has the suffix -al, so it is an aldehyde. The length of the chain and the name and position of the side group agree with the name.

105. Explain why the following aldehydes are named incorrectly or cannot exist.

a. 2-ethanal

b. 5-ethylhexanal

c. cyclobutanal

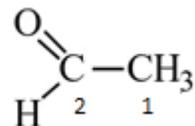
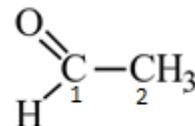
d. 1-fluoropentanal

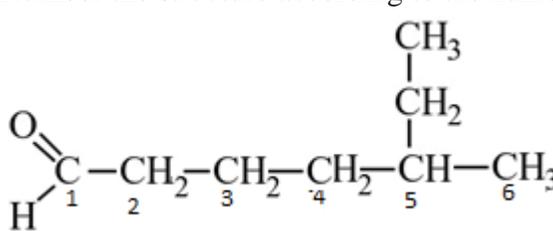
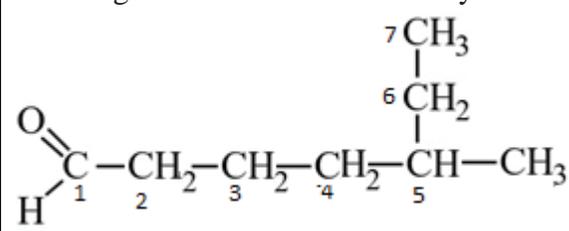
What Is Required?

You must explain why the aldehydes are named incorrectly or why they cannot exist.

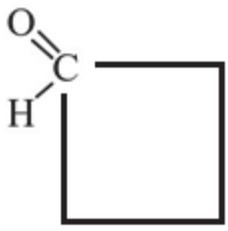
What Is Given?

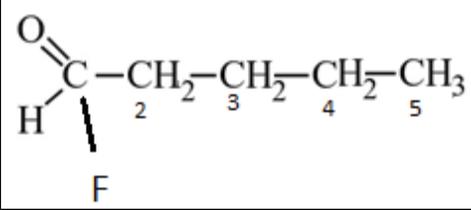
You are given the names of the aldehydes.

| Plan Your Strategy | Act on Your Strategy |
|-----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| a. 2-ethanal Draw the structure according to the name. | Number the structure according to the name.  |
| Renumber the structure correctly. | Numbering priority goes to the carbon in the formyl group, so that carbon must be number 1.  |
| Name the structure correctly. | The root is ethan-, and the suffix is -al, so the name is ethanal. |

| Plan Your Strategy | Act on Your Strategy |
|----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| b. 5-ethylhexanal Draw the structure according to the name. | Number the structure according to the name.  |
| Renumber the structure correctly. | The longest carbon chain is actually seven carbons long.  |
| Name the structure | The root is heptan-, and the suffix is -al. The prefix is 5- |

| | |
|------------|---------------------------------------|
| correctly. | methyl. The name is 5-methylheptanal. |
|------------|---------------------------------------|

| Plan Your Strategy | Act on Your Strategy |
|--------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| c. cyclobutanal Draw the structure according to the name. | Draw the structure according to the name.  |
| Identify the problem. | An aldehyde must be able to contain a formyl group, but that is impossible because then the carbon in the formyl group would have 5 bonds and carbon can only form 4 bonds. Therefore, this compound cannot exist. |

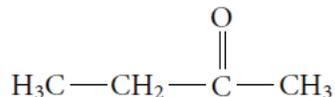
| Plan Your Strategy | Act on Your Strategy |
|------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| d. 1-fluoropentanal Draw the structure according to the name. | Draw the structure according to the name.  |
| Identify the problem. | If the fluorine atom and the rest of the chain is bonded to the formyl carbon, then carbon 1 will have 5 bonds. This is impossible because carbon can only have 4 bonds. Therefore, this compound cannot exist. |

Check Your Solution

Any structure that gives a carbon atom more than four bonds cannot exist thus two of the names describe structures that cannot exist. In one of the compounds, the name did not begin with the carbon atom in the formyl group and in another the main chain had not been correctly described. These errors were corrected and proper names were given.

Naming and Drawing Ketones
(Student textbook page 56)

106. Name the following ketone.



What Is Required?

You must name a ketone.

What Is Given?

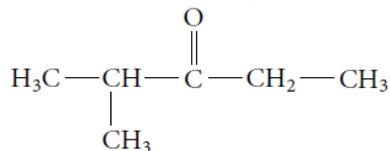
You are given the structure.

| Plan Your Strategy | Act on Your Strategy |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Identify the root. | The longest chain containing the carbonyl carbon is four carbon atoms long and has only single bonds. The root is butan-. |
| Identify the suffix. | Numbering of the main chain begins at the end nearest the carbonyl carbon so it is carbon atom 2. The compound is a ketone, so the suffix is -2-one. $\begin{array}{cccc} & & \text{O} & \\ & & \parallel & \\ \text{H}_3\text{C} & - & \text{CH}_2 & - & \text{C} & - & \text{CH}_3 \\ 4 & & 3 & & 2 & & 1 \end{array}$ |
| Identify the prefix. | There are no side groups. |
| Write the name. | butan-2-one |

Check Your Solution

There is a carbonyl group in the structure and not at the end, so it is a ketone. The length of the chain in the name correctly reflects the structure.

107. Name the following ketone.



What Is Required?

You must name a ketone.

What Is Given?

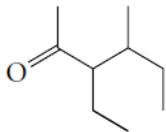
You are given the structure.

| Plan Your Strategy | Act on Your Strategy |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Identify the root. | The longest chain containing the carbonyl carbon is five carbon atoms long and has only single bonds. The root is pentan-. |
| Identify the suffix. | Numbering of the main chain begins at the end nearest the carbonyl carbon so it is carbon atom 3. In this compound, the carbonyl carbon is in the centre of the chain so numbering could start at either end. However, because there is a side group, numbering should be chosen to make the sum of the numbers of side chains and functional groups as small as possible. The compound is a ketone, so the suffix is -3-one. $\begin{array}{c} \text{O} \\ \parallel \\ \text{H}_3\text{C}-\underset{\text{1}}{\text{CH}}-\underset{\text{3}}{\text{C}}-\underset{\text{4}}{\text{CH}_2}-\underset{\text{5}}{\text{CH}_3} \\ \\ \text{CH}_3 \end{array}$ |
| Identify the prefix. | There is a methyl group on carbon atom 2, so the prefix is 2-methyl. |
| Write the name. | 2-methylpentan-3-one |

Check Your Solution

There is a carbonyl group in the structure, and not at the beginning, so it is a ketone. The length of the chain in the name and the name and position of the side group correctly reflects the structure.

108. Name the following ketone.

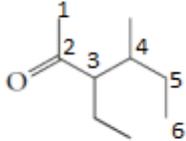


What Is Required?

You must name a ketone.

What Is Given?

You are given the structure.

| Plan Your Strategy | Act on Your Strategy |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Identify the root. | The longest chain containing the carbonyl carbon is six carbon atoms long and has only single bonds. The root is hexan-. |
| Identify the suffix. | The carbonyl carbon is carbon atom 2, and the compound is a ketone, so the suffix is -2-one.  |
| Identify the prefix. | There is an ethyl group on carbon atom 3 and a methyl group on carbon atom 4, so the prefix is 3-ethyl-4-methyl. |
| Write the name. | 3-ethyl-4-methyl-hexan-2-one |

Check Your Solution

There is a carbonyl group internal to the main chain, so it is a ketone. The name of the length of the chain and the name and position of the side groups correctly reflects the structure.

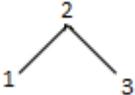
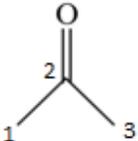
109. Draw the line structural formula for the following ketone.
propanone (commonly known acetone)

What Is Required?

You must draw a line structural formula for a ketone.

What Is Given?

You are given the name of the compound.

| Plan Your Strategy | Act on Your Strategy |
|---------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Identify the root and draw and number the carbon atoms in the main chain. | The root is propan-, so the main chain is 3 carbons long and has only single bonds.  |
| Identify the suffix and add any necessary structures to the main chain. | The suffix is -one, which means the compound is a ketone. The oxygen must be bonded to carbon 2 in order for it to be a ketone. If the oxygen atom was on either end, it would be an aldehyde.  |

Check Your Solution

The compound is a ketone, the length of the chain and the position of the carbonyl carbon agree with the name.

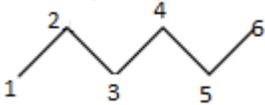
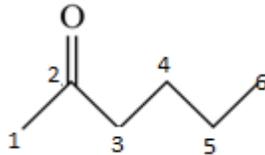
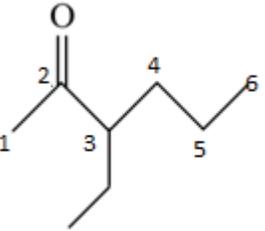
110. Draw the line structural formula for the following ketone.
3-ethylhexan-2-one

What Is Required?

You must draw a line structural formula for a ketone.

What Is Given?

You are given the name of the compound.

| Plan Your Strategy | Act on Your Strategy |
|---------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Identify the root and draw and number the carbon atoms in the main chain. | The root is hexan-, so the main chain is 6 carbons long and has only single bonds.  |
| Identify the suffix and add any necessary structures to the main chain. | The suffix is -2-one, which means the compound is a ketone. Add the oxygen atom to carbon atom 2 to make it a carbonyl carbon.  |
| Identify the prefix and add any necessary structures to the main chain. | The prefix is 3-ethyl, so there is an ethyl group on carbon atom 3.  |

Check Your Solution

The compound is a ketone, the length of the chain, the position of the carbonyl carbon, and the position of the side group agree with the name.

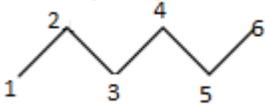
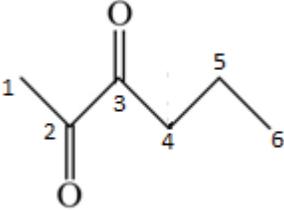
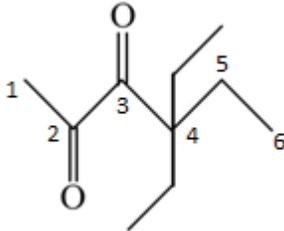
111. Draw the line structural formula for the following ketone.
4,4-diethylhexane-2,3-dione

What Is Required?

You must draw a line structural formula for a ketone.

What Is Given?

You are given the name of the compound.

| Plan Your Strategy | Act on Your Strategy |
|---------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Identify the root and draw and number the carbon atoms in the main chain. | <p>The root is hexan-, so the main chain is 6 carbons long and has only single bonds.</p>  |
| Identify the suffix and add any necessary structures to the main chain. | <p>The suffix is -2,3-dione, which means the compound is a ketone having two carbonyl carbon atoms. Add the oxygen atom to carbon atom 2 and carbon 3 to make them each carbonyl carbon.</p>  |
| Identify the prefix and add any necessary structures to the main chain. | <p>The prefix is 4,4-diethyl so there are two ethyl groups on carbon atom 4</p>  |

Check Your Solution

The compound is a ketone, the length of the chain, the position of the carbonyl carbon, and the position of the side group agree with the name.

112. Explain why the following ketone is named incorrectly or cannot exist. If it can exist, give the proper name.
propan-1-one

What Is Required?

You must explain how the ketone is named incorrectly and name it correctly or explain why it cannot exist.

What Is Given?

You are given the name of the ketone.

| Plan Your Strategy | Act on Your Strategy |
|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Draw the structure according to the name. | An oxygen atom is placed on carbon atom 1 of a three carbon (prop-) main chain. $\begin{array}{c} \text{O} \\ \\ \text{HC} - \text{CH}_2 - \text{CH}_3 \\ \underset{1}{\quad} \quad \underset{2}{\quad} \quad \underset{3}{\quad} \end{array}$ |
| Identify the reason it cannot exist. | When you analyze the structure that has been drawn from the name propan-1-one, you can see that you have drawn an aldehyde. The carbonyl carbon of a ketone must be bonded to two other carbon atoms. That is, it must be within the main chain and not at the end of a chain. Therefore, this name is incorrect because it describes the aldehyde, propanal. |

Check Your Solution

The ketone cannot exist because a ketone can never have a numerical assignment of 1. A compound with a carbonyl carbon at the end of a chain and bonded to a hydrogen atom, is an aldehyde.

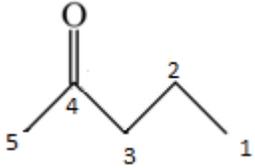
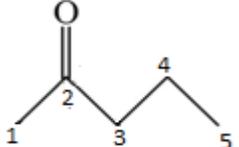
113. Explain why the following ketone is named incorrectly or cannot exist. If it can exist, give the proper name.
 pentan-4-one

What Is Required?

You must explain how the ketone is named incorrectly and name it correctly or explain why it cannot exist.

What Is Given?

You are given the name of the ketone.

| Plan Your Strategy | Act on Your Strategy |
|---------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Draw the structure and number it according to the name. |  |
| Number the structure correctly. | <p>The structure should be numbered in order to give the carbonyl carbon the lowest possible number (2).</p>  <p>The original name describes a structure that was incorrectly numbered.</p> |
| Write the correct name. | The root is pentan- and the suffix is -2-one. The name is pentan-2-one. |

Check Your Solution

The structure is a ketone, and the lowest numbering has now been given to the carbonyl carbon. The name now correctly represents the structure.

114. Explain why the following ketone is named incorrectly or cannot exist. If it can exist, give the proper name.

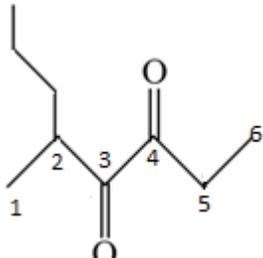
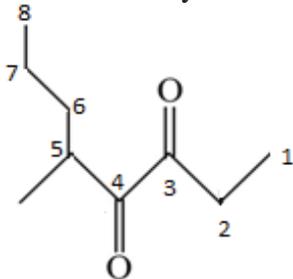
2-propylhexan-3,4-dione

What Is Required?

You must explain how the ketone is named incorrectly and name it correctly or explain why it cannot exist.

What Is Given?

You are given the name of the ketone.

| Plan Your Strategy | Act on Your Strategy |
|---------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Draw the structure and number it according to the name. |  |
| Number the structure correctly. |  <p>The original name did not use the longest chain as the main chain, leading to an incorrect side group and incorrect numbering.</p> |
| Name the structure. | <p>The longest chain is 8 carbon atoms long and has only single bonds, so the root is octane-. There is a carbonyl group on carbon atoms 3 and 4, so the structure is a ketone and the suffix is -3,4-dione. There is a methyl group on carbon atom 5, so the prefix is 5-methyl-. The correct name is 5-methyloctane-3,4-dione.</p> |

Check Your Solution

The name correctly reflects the longest carbon chain present in the structure. The name and position of the side group and the name of the carbonyl are now correct.