

Organic Compounds

Textbook pages 244–251

Before You Read

What do you think of when you hear the term “organic”? Outline your thoughts in the lines below.



Make Flash Cards

Create flash cards to help you remember common organic compounds. Write the name of the compound on the front of the card and the information you want to recall on the back.

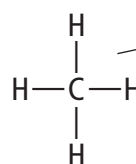
What are organic compounds?

Organic compounds are any compounds that contain carbon (with a few exceptions). All other compounds are referred to as **inorganic compounds**. In almost all organic compounds, carbon atoms are bonded to hydrogen atoms or other elements that are near carbon in the periodic table, especially nitrogen, oxygen, sulphur, phosphorus, and the halogens. Other elements, including metals and non-metals, may also be present.

The carbon in organic compounds forms four bonds, which enables it to form complex, branched-chain structures, ring structures, and even cage-like structures. Several different methods can be used to model these structures. These include the structural formula, the ball-and-stick model, and the space-filling model shown below.

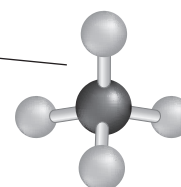


molecular formula



structural formula

Shows a single covalent bond



ball-and-stick model



space-filling model

To recognize a compound as organic, look for an indication of the presence of carbon in its name, chemical formula, or diagram. However, there are a few exceptions to this rule. Certain compounds that contain carbon are classified as inorganic carbon compounds. These include any compounds that contain carbonates, (i.e., CaCO_3); carbides, (i.e., SiC); and oxides (i.e., CO_2 , CO). ✓



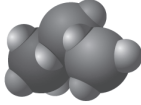
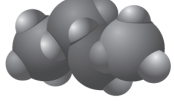
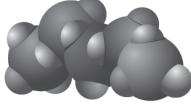
What are some common organic compounds?

Two common organic compounds are hydrocarbons and alcohols.

1. Hydrocarbons: A **hydrocarbon** is an organic compound that contains only the elements carbon and hydrogen. The simplest of all organic compounds is the hydrocarbon molecule called methane (CH_4) which consists of a carbon atom bonded to four hydrogen atoms. Other hydrocarbons are formed by linking two or more carbons together to make a chain. The first five hydrocarbons are given in the table below.

✓ Reading Check


How does an organic compound differ from an inorganic compound?

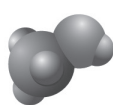
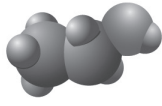
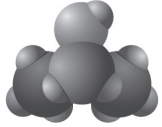
| Name | Molecular Formula | Structural Formula | Shortened Structural Formula | Space-Filling Model | Common Uses |
|---------|---------------------------|--|---|---|---|
| methane | CH_4 | <pre> H H — C — H H </pre> | CH_4 |  | <ul style="list-style-type: none"> • Natural gas heaters |
| ethane | C_2H_6 | <pre> H H H — C — C — H H H </pre> | CH_3CH_3 |  | <ul style="list-style-type: none"> • Manufacturing plastic |
| propane | C_3H_8 | <pre> H H H H — C — C — C — H H H H </pre> | $\text{CH}_3\text{CH}_2\text{CH}_3$ |  | <ul style="list-style-type: none"> • Camp fuel |
| butane | C_4H_{10} | <pre> H H H H H — C — C — C — C — H H H H H </pre> | $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$ |  | <ul style="list-style-type: none"> • Hand-held lighters |
| pentane | C_5H_{12} | <pre> H H H H H H — C — C — C — C — C — H H H H H H </pre> | $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$ |  | <ul style="list-style-type: none"> • Component of gasoline |

 **Reading Check**

Provide the molecular formula for ethanol.

⋮
⋮
⋮
⋮
⋮

2. Alcohols: An **alcohol** is one kind of organic compound that contains C, H, and O in a specific structure. The table below shows some common alcohols. 

| Name | Molecular Formula | Structural Formula | Shortened Structural Formula | Space-Filling Model | Common Use |
|-------------------|---------------------------------|--|--------------------------------------|---|---------------------------|
| methanol | CH ₄ O | $ \begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{O}-\text{H} \\ \\ \text{H} \end{array} $ | CH ₃ OH |  | • Solvent |
| ethanol | C ₂ H ₆ O | $ \begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{O}-\text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array} $ | CH ₃ CH ₂ OH |  | • Fuel |
| isopropyl alcohol | C ₃ H ₈ O | $ \begin{array}{c} \text{H} \\ \\ \text{H} \quad \text{O} \quad \text{H} \\ \quad \quad \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\ \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \end{array} $ | (CH ₃)CH ₂ OH |  | • Sterilizer • Cleaner |

Name _____

Date _____

Use with textbook pages 244–248.

Organic chemistry

Vocabulary

alcohol
butane
carbon
ethaneethanol
hydrocarbons
inorganic compounds
methaneorganic chemistry
organic compounds
oxygen
propane
solvent

Use the terms in the vocabulary box to fill in the blanks. You may use each term only once.

1. Almost all compounds that contain carbon, with the exception of carbon dioxide, carbon monoxide, and ionic carbonates, are _____. The study of carbon-containing compounds is known as _____.
2. _____ are compounds that do not contain carbon.
3. _____ is an element with an atomic number of 6. It has four electrons in its valence shell and can form four covalent bonds.
4. Compounds that contain only hydrogen atoms and carbon atoms are called _____.
5. _____, CH_4 , is the simplest hydrocarbon, with four hydrogens covalently bonded to one carbon. It is a gas at room temperature.
6. _____, C_2H_6 , is a gas at room temperature and is used in manufacturing plastic.
7. _____, C_3H_8 , is a gas that is easily turned into a liquid under pressure. That is why it is often used as fuel for camp stoves and gas-fired barbeques.
8. _____, C_4H_{10} , is a gas that is used in hand-held lighters.
9. An _____, such as isopropyl alcohol, is a compound that contains carbon, hydrogen, and _____.
10. Methanol is an example of a _____, which is a liquid that can dissolve other substances.
11. _____, an alcohol with the formula of $\text{C}_2\text{H}_6\text{O}$ or $\text{C}_2\text{H}_5\text{OH}$, can be seen to be related to the hydrocarbon ethane, C_2H_6 , if one H is removed and replaced with OH.

Use with textbook pages 244–248.

Recognizing organic and inorganic compounds

Classify each of the following compounds as organic or inorganic by examining their formulas.

- | | |
|---|--|
| 1. CO _____ | 16. CH ₃ OH _____ |
| 2. CH ₄ _____ | 17. NaHCO ₃ _____ |
| 3. HCl _____ | 18. C ₆ H ₁₂ O ₆ _____ |
| 4. NH ₃ _____ | 19. Na ₂ CO ₃ _____ |
| 5. CO ₂ _____ | 20. K ₂ Cr ₂ O ₇ _____ |
| 6. CrS _____ | 21. Ca(OH) ₂ _____ |
| 7. C ₂ H ₄ _____ | 22. Co(NO ₃) ₂ _____ |
| 8. C ₄ H ₁₀ _____ | 23. C ₁₉ H ₂₈ O ₂ _____ |
| 9. C ₆ H ₁₄ _____ | 24. NH ₄ OH _____ |
| 10. C ₈ H ₁₈ _____ | 25. CH ₃ OCH ₃ _____ |
| 11. Cu ₂ O _____ | 26. C ₁₈ H ₂₁ NO ₃ _____ |
| 12. Cr ₂ O ₃ _____ | 27. CH ₃ COOH _____ |
| 13. CHCl ₃ _____ | 28. CH ₃ NHCH ₃ _____ |
| 14. CaCO ₃ _____ | 29. CH ₃ CH ₂ OH _____ |
| 15. C ₂ H ₆ O _____ | 30. CH ₃ CH ₂ OCH ₂ CH ₃ _____ |

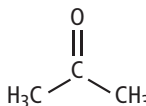
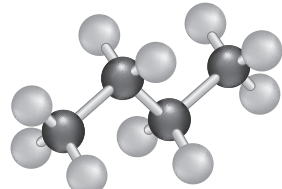
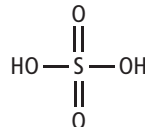
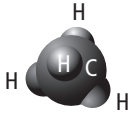
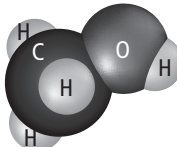
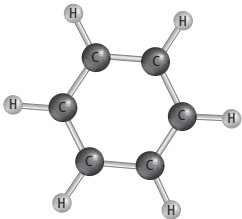
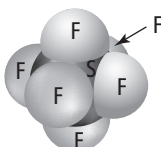
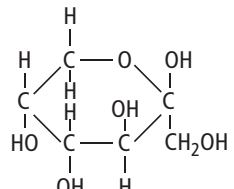
Name _____

Date _____

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Organic compounds versus inorganic compounds

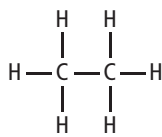
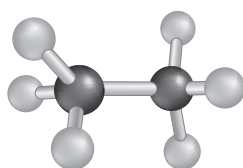
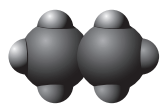
Classify each of the following compounds as organic or inorganic by examining the structural formula, ball-and-stick model, or space-filling model.

| | Structural formula, ball-and-stick model, or space-filling model | Type of compound (Organic or Inorganic) |
|----|---|---|
| 1. |  | |
| 2. |  | |
| 3. |  | |
| 4. |  | |
| 5. |  | |
| 6. |  | |
| 7. |  | |
| 8. |  | |

Use with textbook pages 244–248.

Organic compounds

Using the compound ethane, match the Descriptor on the left with the best Formula / Model that represents ethane on the right. Each Formula / Model may be used only once.

| Descriptor | Formula / Model |
|-------------------------------|--|
| 1. _____ structural formula | A. C_2H_6 |
| 2. _____ molecular formula | B.  |
| 3. _____ space-filling model | C.  |
| 4. _____ ball-and-stick model | D.  |

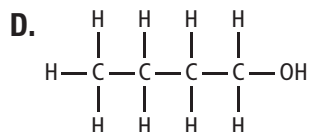
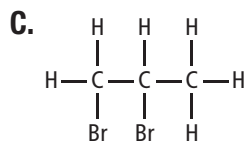
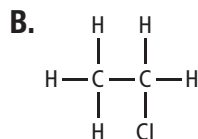
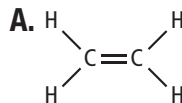
5. What element must always be present in an organic compound?

- A. carbon
- B. oxygen
- C. chlorine
- D. hydrogen


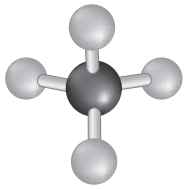
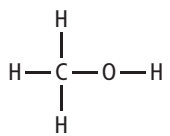
6. Which formula represents a hydrocarbon?

- A. $HClO_3$
- B. CH_3COOH
- C. $CH_3CH_2CH_2COOH$
- D. $CH_3CH_2CH_2CH_2CH_3$

7. Which of the following represents an alcohol?



8. Which of the following represents methane, CH_4 ?

| | |
|------|---|
| I. |  |
| II. |  |
| III. |  |

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II, and III