

# شرح الدرس الأول Halides Aryl and Halides Alkyl من وحدة Substituted Hydrocarbons and Their Reactions انسباير منهج



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موقع المناهج ← المناهج الإماراتية ← الصف الحادي عشر المتقدم ← كيمياء ← الفصل الثالث ← ملفات متنوعة ← الملف

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المزيد من مادة  
كيمياء:

إعداد: Mouad

## التواصل الاجتماعي بحسب الصف الحادي عشر المتقدم



صفحة المناهج  
الإماراتية على  
فيسبوك

الرياضيات

اللغة الانجليزية

اللغة العربية

التربية الاسلامية

المواد على تلغرام

## المزيد من الملفات بحسب الصف الحادي عشر المتقدم والمادة كيمياء في الفصل الثالث

قوانين الفصل الدراسي الثاني والثالث للوحدات (4+5+6+7)

1

شرح الدرس الخامس Hydrocarbons Aromatic من وحدة Hydrocarbons منهج انسباير

2

شرح الدرس الرابع Isomers Hydrocarbon من وحدة Hydrocarbons منهج انسباير

3

شرح الدرس الثالث Alkynes and Alkenes من وحدة Hydrocarbons منهج انسباير

4

شرح الدرس الثاني Alkanes من وحدة Hydrocarbons منهج انسباير

5

The background features a dark grey gradient with several chemistry-related illustrations. On the left, there is a round-bottom flask with a stopper and a test tube, both containing yellow liquid with bubbles. In the center, a single yellow sphere is shown. On the right, a Bohr-style atomic model is depicted with a yellow nucleus and three black elliptical orbits, each with a small white electron. The word 'CHEMISTRY' is written in a large, white, sans-serif font across the top center.

CHEMISTRY

# “Substituted Hydrocarbons & Their Reactions”

## \*Alkyl Halides & Aryl Halides\*

Mr. Mouad

مناهج دولة الإمارات

عام، متقدم ونخبة 9،10،11،12

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Inspire Chemistry


Module 21

# “Substituted Hydrocarbons & Their Reactions”

**\*Alkyl Halides & Aryl Halides\***

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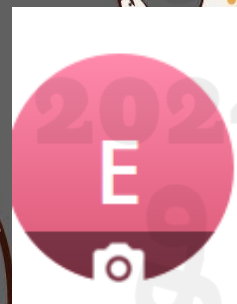
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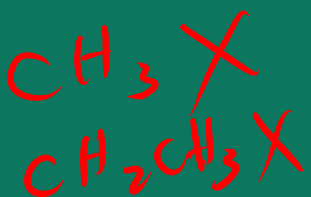
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Inspire Chemistry

Module 20

# "Substituted Hydrocarbons & Their Reactions"

\*Alkyl Halides & Aryl Halides\*

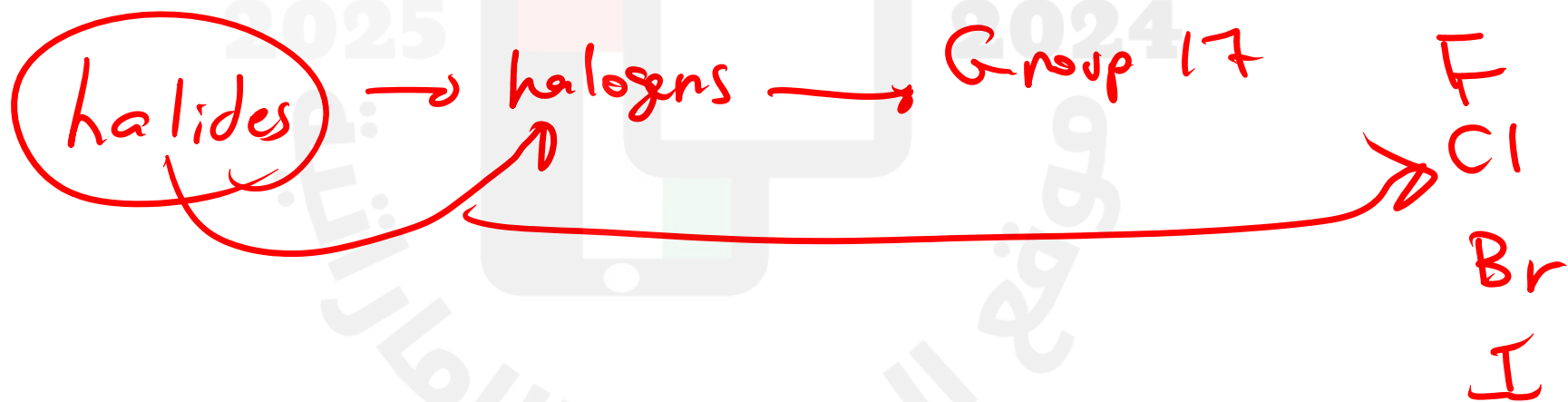


Lesson 1

O  
N  
Br  
F

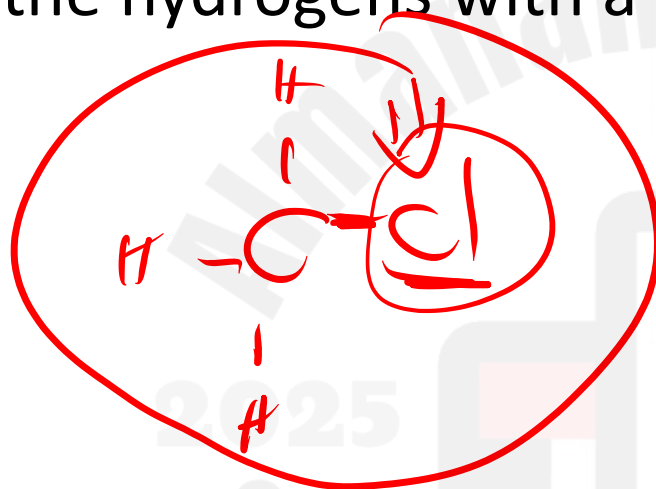
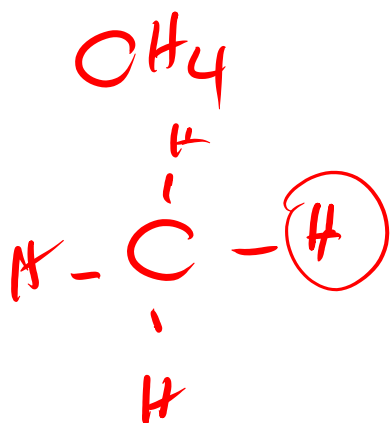
# Learning Outcomes:

- Define functional group, and give examples.
- Compare and contrast alkyl and aryl halide structures.
- Evaluate the boiling points of organic halides.



## Focus Question

How does a hydrocarbon's properties change if you replace one of the hydrogens with a chlorine or fluorine atom?





# New Vocabulary

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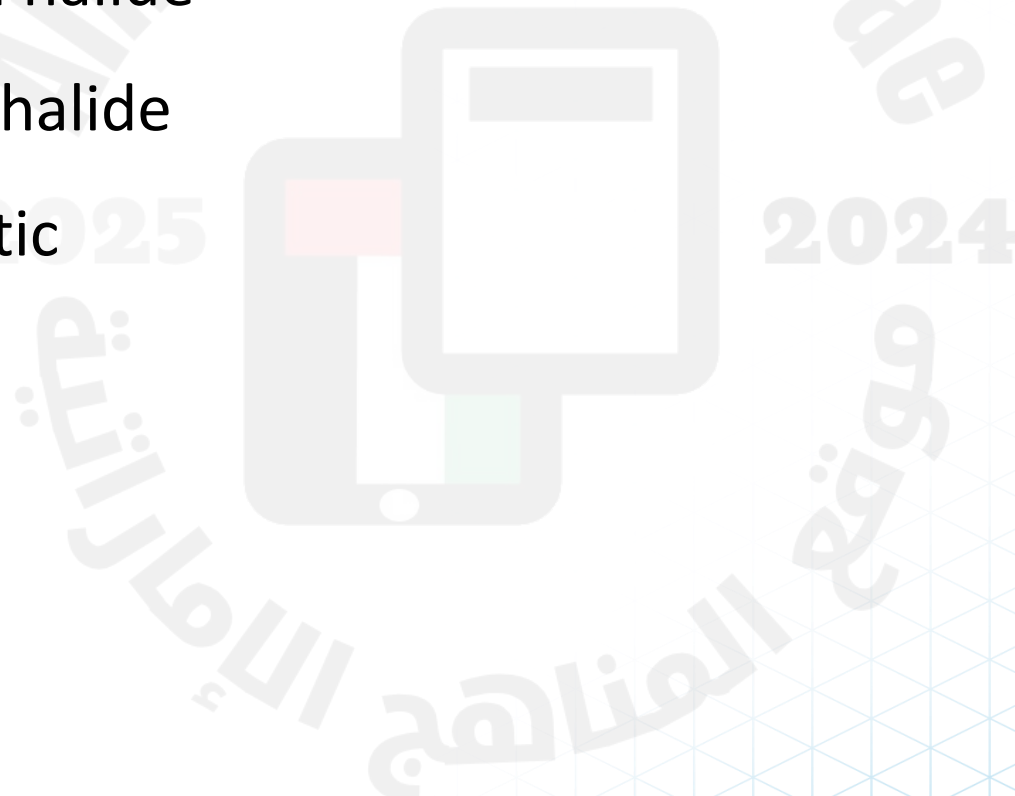
functional group

halocarbon

alkyl halide

aryl halide

plastic



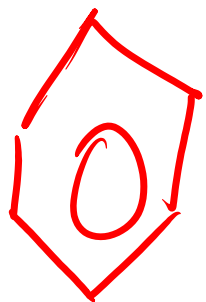


# Review Vocabulary

aliphatic compound: a nonaromatic hydrocarbon,  
such as an alkane, an alkene, or an alkyne

aromatic


✓ Benzene



No benzene



# Functional Groups

- In an organic molecule, a **functional group** is an atom or group of atoms that always reacts in a certain way. *fingerprint* 
- Addition of a functional group to a hydrocarbon always produces a substance with different chemical and physical properties.



- Double and triple bonds between carbon atoms are considered functional groups.

Table 1 Organic Compounds and Their Functional Groups

Compound Type	General Formula	Functional Group
Halocarbon	$R-X$ (X = F, Cl, Br, I)	Halogen
Alcohol	$R-OH$	Hydroxyl
Ether	$R-O-R'$	Ether
Amine	$R-NH_2$	Amino
Aldehyde	$\begin{array}{c} O \\    \\ * - C - H \end{array}$	Carbonyl
Ketone	$\begin{array}{c} O \\    \\ R - C - R' \end{array}$	Carbonyl
Carboxylic acid	$\begin{array}{c} O \\    \\ * - C - OH \end{array}$	Carboxyl
Ester	$\begin{array}{c} O \\    \\ * - C - O - R \end{array}$	Ester
Amide	$\begin{array}{c} O \\    \\ * - C - N - * \end{array}$	Amide

- The symbols **R** and **R'** in the general formulas represent carbon chains or rings bonded to the functional group.



- An asterisk (\*) represents a hydrogen atom, carbon chain, or carbon ring.

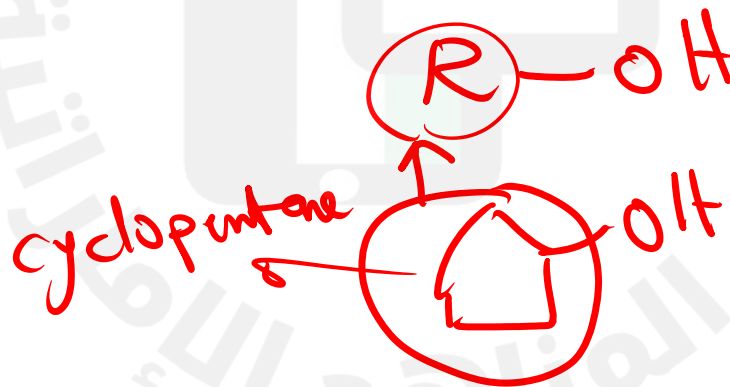
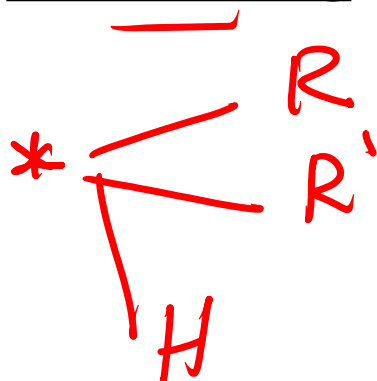
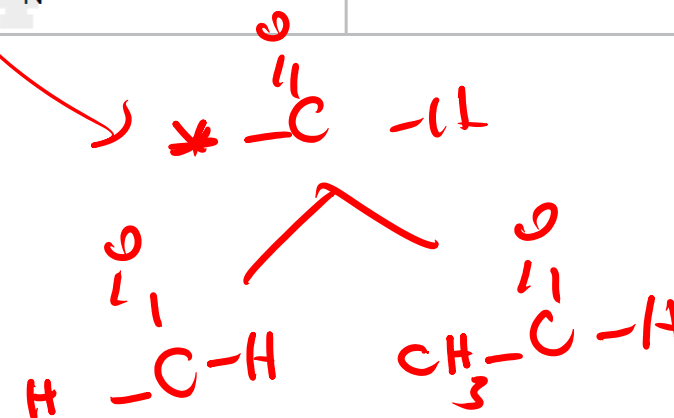


Table 1 Organic Compounds and Their Functional Groups

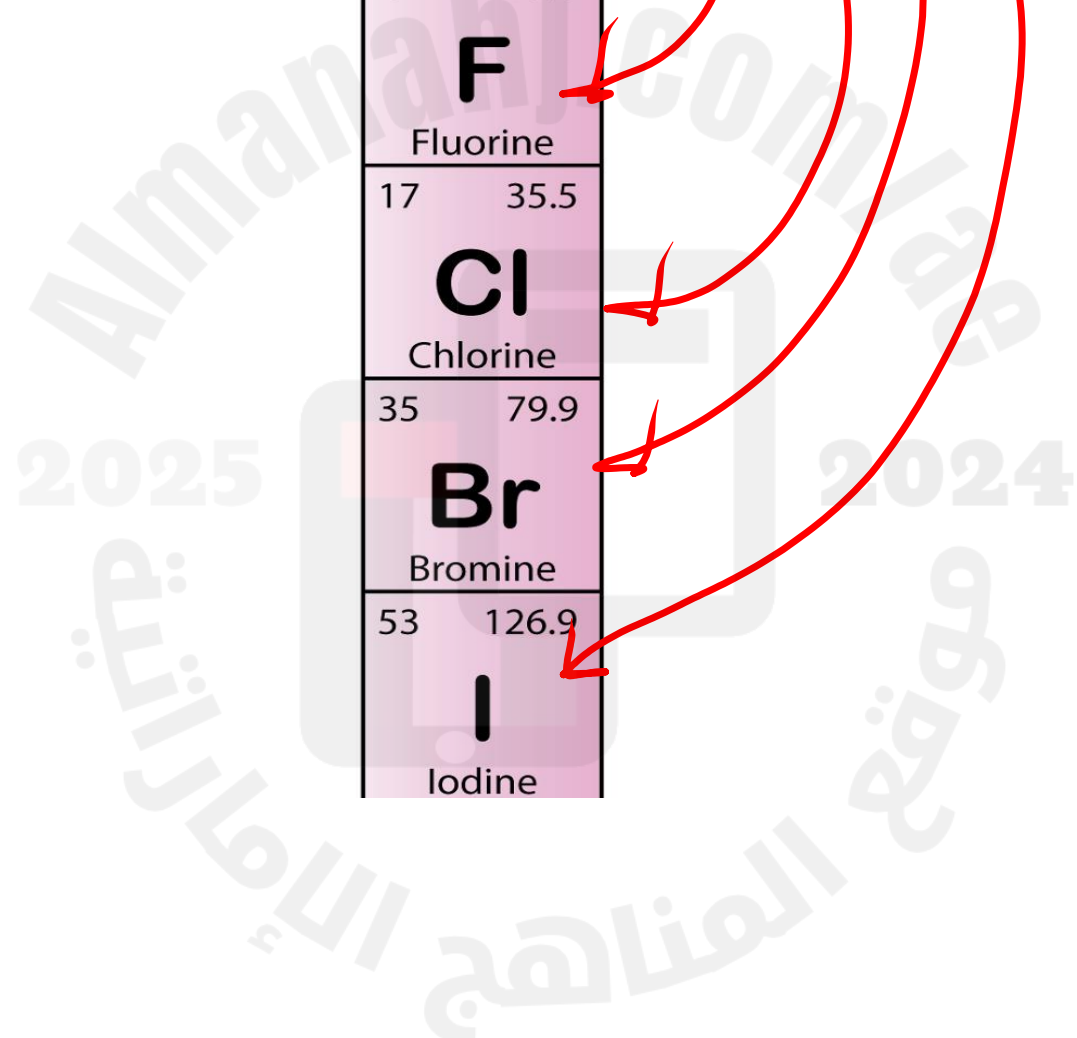
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Amide	$\begin{array}{c} O \\    \\ * - C - N - * \end{array}$	Amide



# Halogens (X)

17

9	19.0
<b>F</b>	
Fluorine	
17	35.5
<b>Cl</b>	
Chlorine	
35	79.9
<b>Br</b>	
Bromine	
53	126.9
<b>I</b>	
Iodine	



# Halocarbons

Halogen(X)

branch

Any organic compound that contains a **halogen substituent (X)** is called a **halocarbon**.

The first four halogens

17

9	19.0
<b>F</b>	
Fluorine	
17	35.5
<b>Cl</b>	
Chlorine	
35	79.9
<b>Br</b>	
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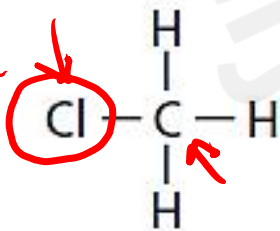
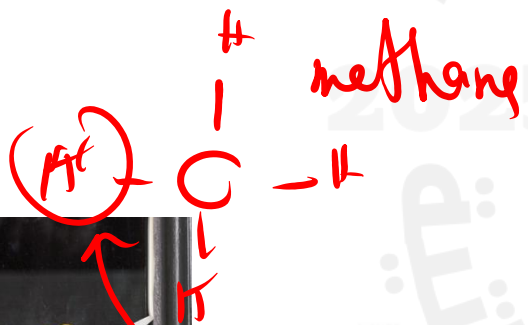
Halocarbons

NO benzene  
Alkyl Halides

benzene  
Aryl Halides

# Alkyl Halides and Aryl Halides

- An **alkyl halide** is an organic compound containing a halogen atom covalently bonded to an aliphatic carbon atom.
- For example, chloromethane is the alkyl halide formed when a chlorine atom replaces one of methane's four carbon atoms.



Chloromethane



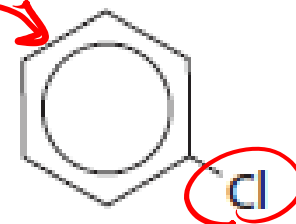
Chloromethane is an alkyl halide that is used in the manufacturing process for silicone products, such as window and door sealants.



# Alkyl Halides and Aryl Halides

- An aryl halide is an organic compound containing a halogen atom bonded to a benzene ring or other aromatic group.

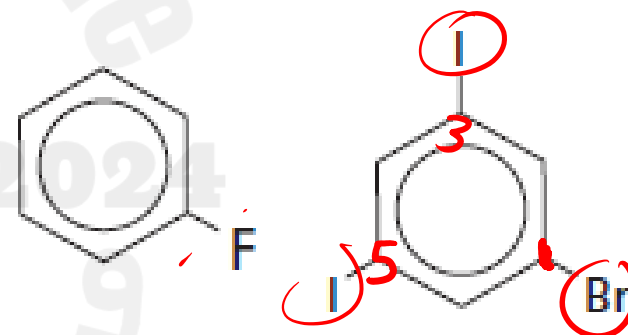
a



Chlorobenzene

- The structural formula for an aryl halide is created by first drawing the aromatic structure and then replacing its hydrogen atoms with the halogen atoms specified.

d



Fluorobenzene and 1-Bromo-3,5-diiodobenzene

# Quiz

---

An alkyl halide has a halogen bonded to a(n) \_\_\_\_\_.

**A** aliphatic carbon atom

**B** aromatic group

**C** halogen

**D** salt

# Quiz

2. What term refers to an organic compound with a halogen bonded to an aromatic group?

*benzene*

A halocarbon

B alkyl halide

C aryl halide

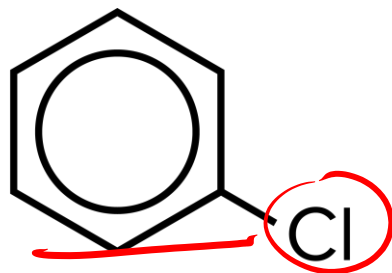
D plastic

# Naming halocarbons



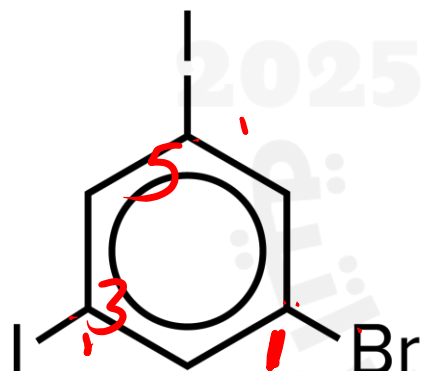
- a **prefix** indicates which halogen is present. The prefixes are formed by changing the -ine at the end of each halogen name to -o. Thus, the prefix for fluorine is fluoro-, chlorine is chloro-, bromine is bromo-, and iodine is iodo-.
- If more than one kind of halogen atom is present in the same molecule, the atoms are listed alphabetically in the name.
- The chain also must be numbered in a way that gives the lowest position number to the substituent that comes first in the alphabet.
- Similarly, the **benzene ring** in an aryl halide is numbered to give each substituent the lowest position number possible.

# Organic Compounds Containing Halogens

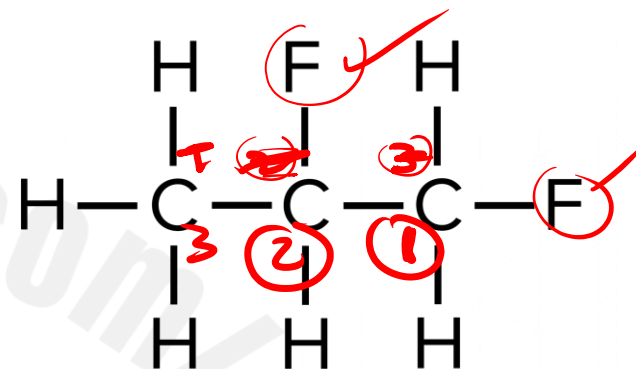


Chlorobenzene

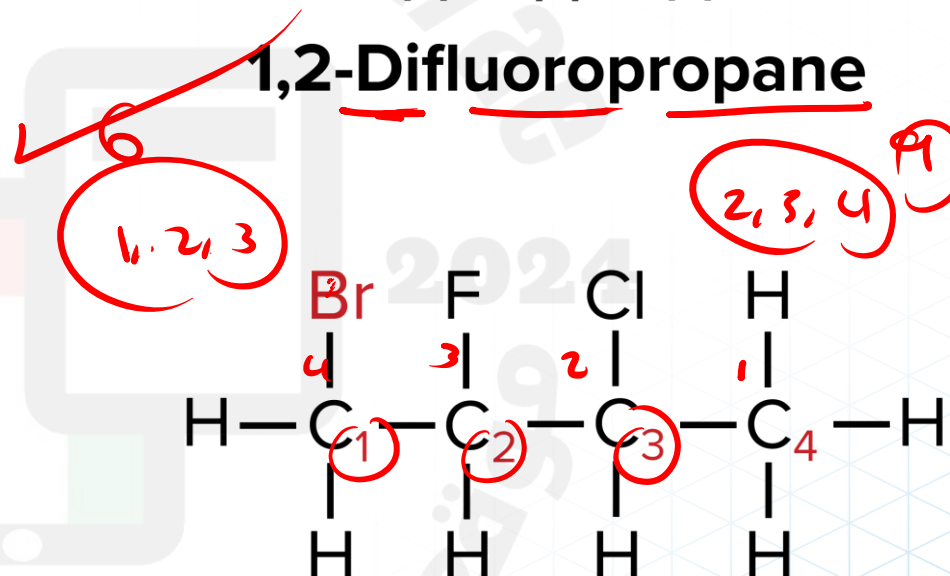
1, 3, 5



1-Bromo-3,5-diiodobenzene



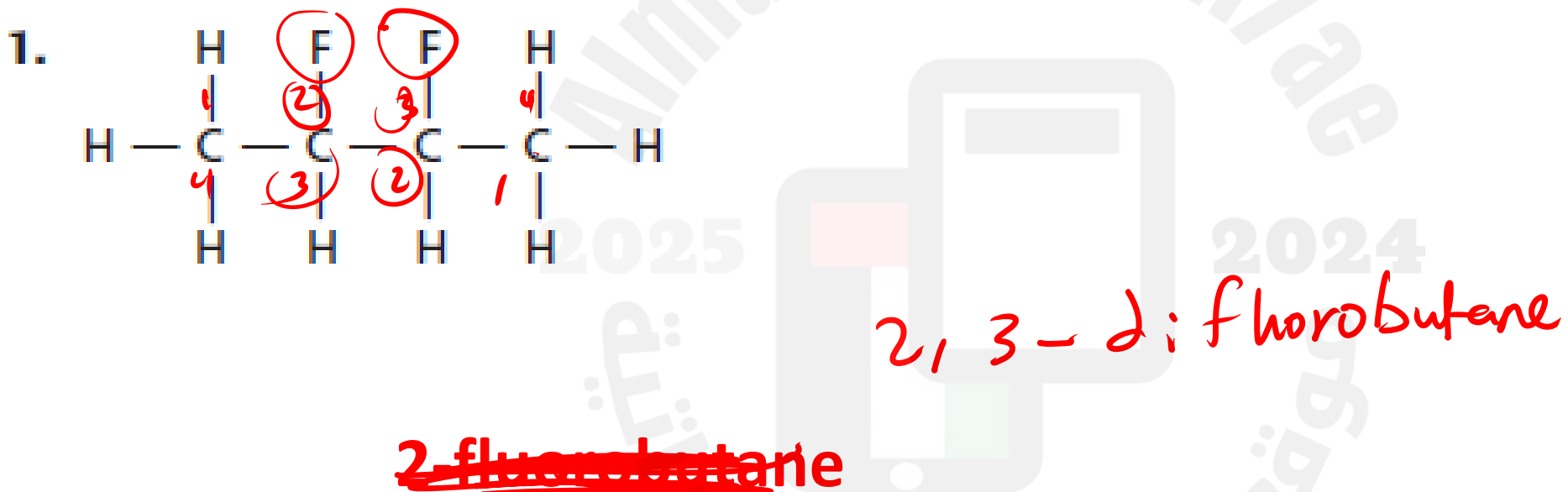
1,2-Difluoropropane



1-Bromo-3-chloro-2-fluorobutane

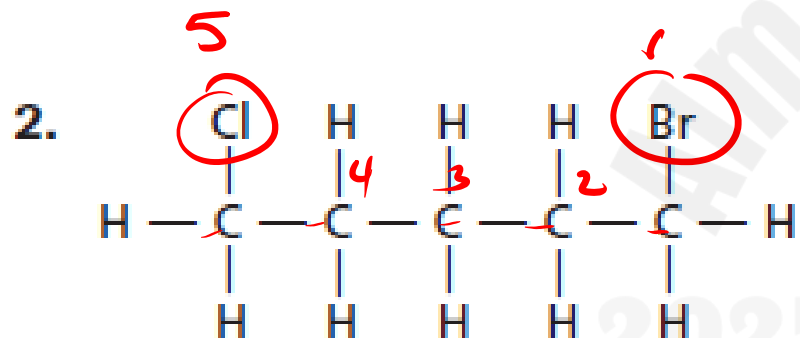
# Activity

Name the alkyl or aryl halide whose structure is shown.



# Activity

Name the alkyl or aryl halide whose structure is shown.

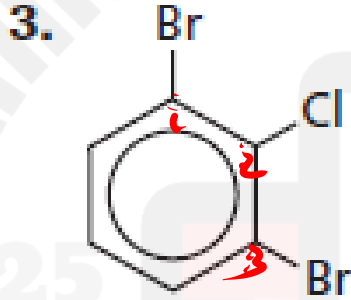


**1-bromo-5-chloropentane**



# Activity

Name the alkyl or aryl halide whose structure is shown.



1,3-dibromo-2-chlorobenzene

# Organic Compounds Containing Halogens

Table 2 A Comparison of Alkyl Halides and Their Parent Alkanes

Structure	Name	Boiling Point (°C)	Density (g/mL) in Liquid State
<u>CH<sub>4</sub></u>	methane	-162	0.423 at -162°C (boiling point)
<u>CH<sub>3</sub>Cl</u>	chloromethane	-24	0.911 at 25°C (under pressure)
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>3</sub>	<u>pentane</u>	36	0.626
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> F	1-fluoropentane	62.8	0.791
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> Cl	1-chloropentane	108	0.882
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> Br	1-bromopentane	130	1.218
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> I	1-iodopentane	155	1.516

17

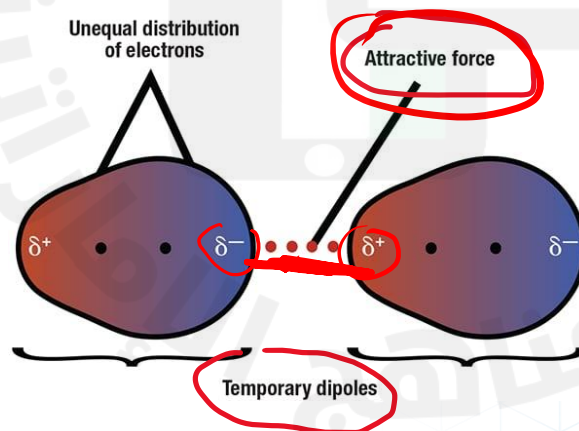
9	19.0
<b>F</b>	
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35	79.9
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53	126.9
<b>I</b>	
Iodine	

# Organic Compounds Containing Halogens: Halocarbons

- The trend of increasing the boiling points and densities as the halogen changes from fluorine to chlorine, bromine, and iodine was observed in the table. **WHY??**

❑ **because** the halogens from **fluorine to iodine** have increasing numbers of **electrons** that lie farther from the halogen nucleus.

- These electrons shift position easily and, as a result, the halogen-substituted hydrocarbons have an increasing tendency to form **temporary dipoles**.



17

9	19.0
<b>F</b>	
Fluorine	
17	35.5
<b>Cl</b>	
Chlorine	
35	79.9
<b>Br</b>	
Bromine	
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# Organic Compounds Containing Halogens: Halocarbons

17

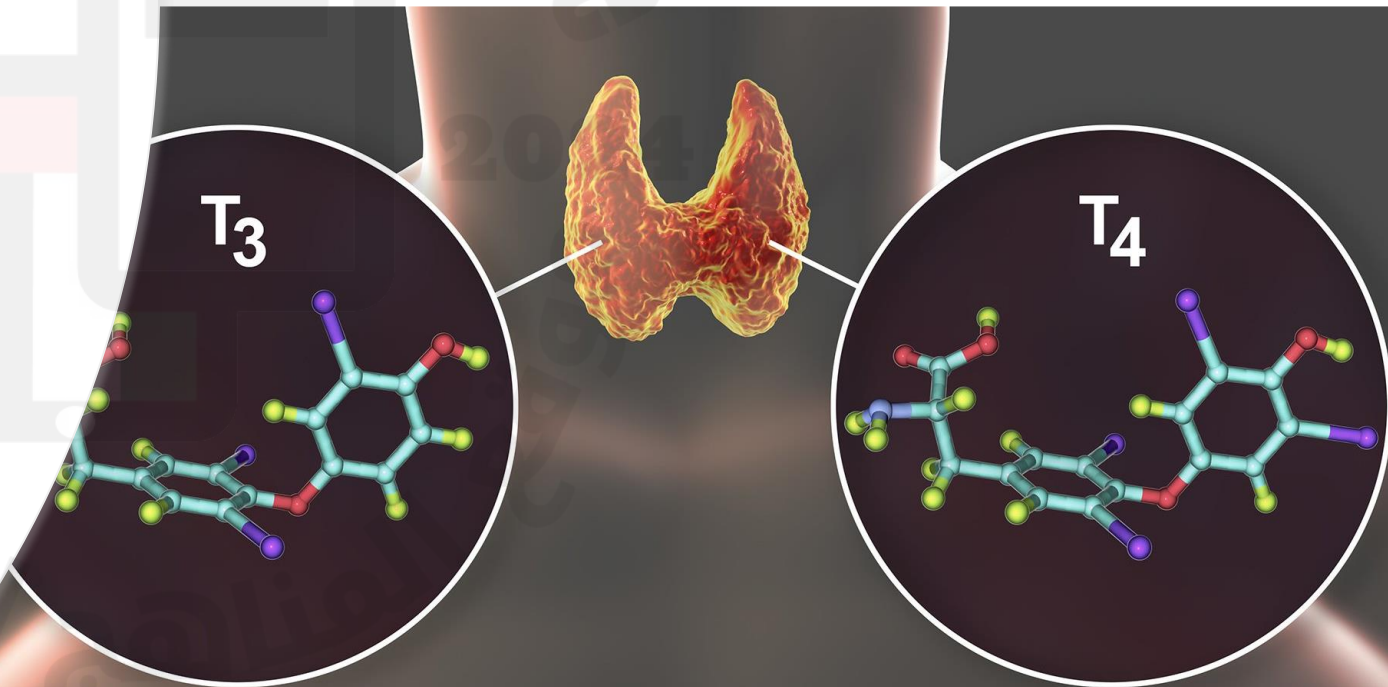
9	19.0
<b>F</b>	
Fluorine	
17	35.5
<b>Cl</b>	
Chlorine	
35	79.9
<b>Br</b>	
Bromine	
53	126.9
<b>I</b>	
Iodine	

- Because the **dipoles attract each other**, the energy needed to separate the molecules also increases.
- Thus, the boiling points of halogen-substituted alkanes increase as the size of the halogen atom increases.



# uses of halocarbons

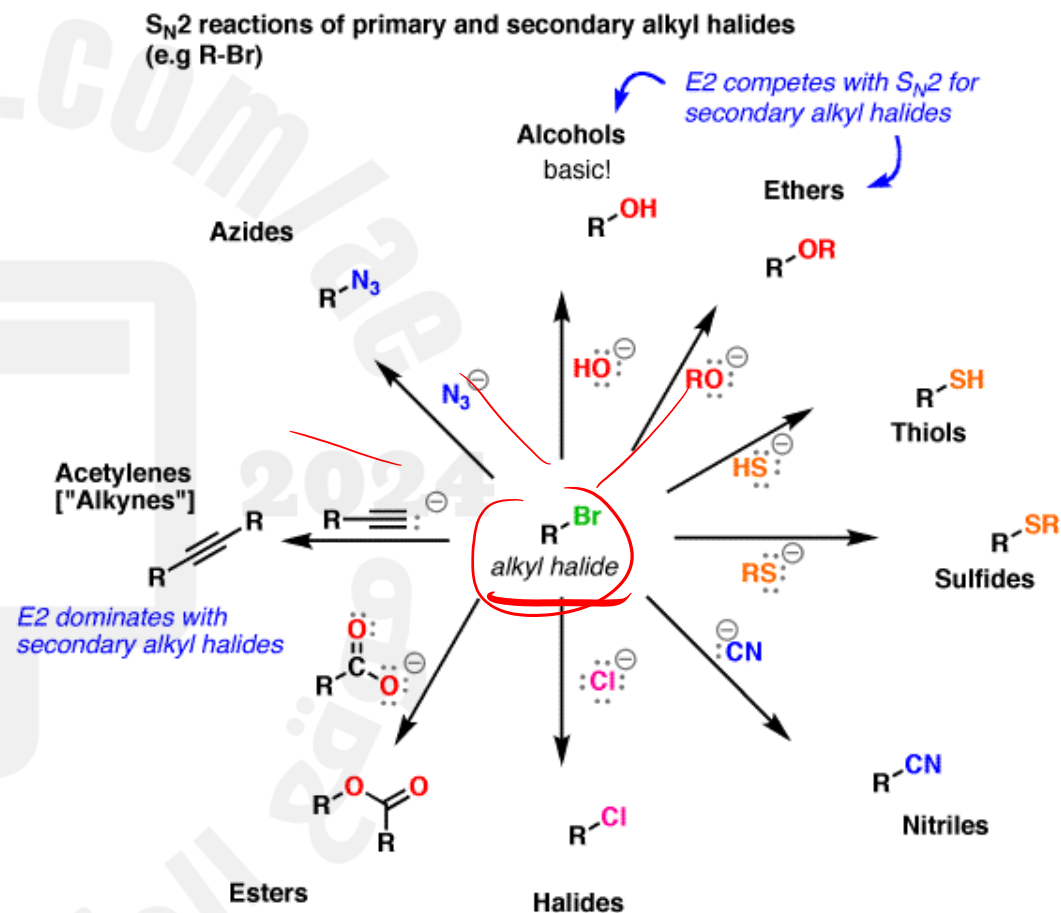
- Organic halides are seldom found in nature, although human **thyroid hormones are organic iodides**.
- Alkyl halides are also used as **solvents** and **cleaning agents** because they readily dissolve nonpolar molecules, such as greases.



# uses of halocarbons

Halogen atoms bonded to carbon atoms are **more reactive** than the hydrogen atoms they replace.

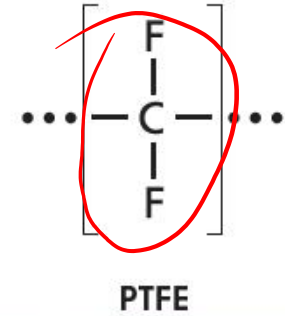
For this reason, alkyl halides are often used as **starting materials** in the chemical industry.



# Uses of halocarbons

- **polytetrafluoroethene (PTFE)**, a plastic made from gaseous **tetrafluoroethylene**. It is used for non-stick surfaces.
- A plastic is a polymer that can be heated and molded while relatively soft.
- Another plastic commonly called **vinyl** is **polyvinyl chloride (PVC)**. It can be manufactured soft or hard, as thin sheets, or molded into objects.

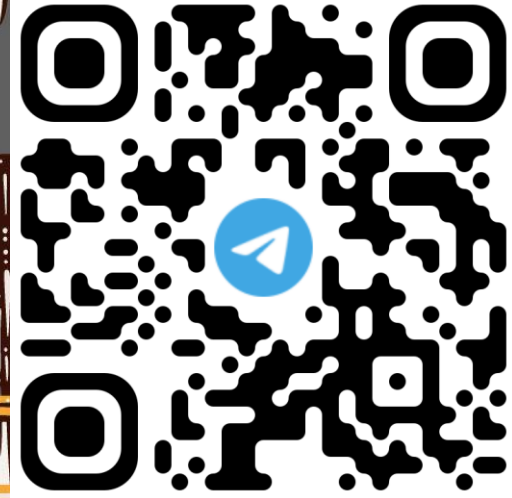
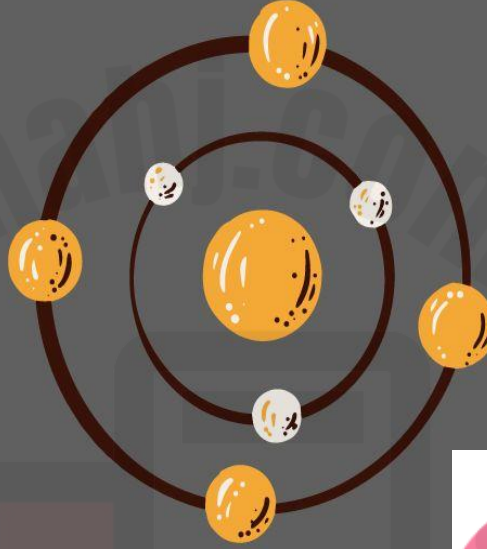
■ **Figure 4** Polytetrafluoroethene (PTFE) is made up of hundreds of units. PTFE provides a nonstick surface for many kitchen items, including bakeware.





PTFE Application



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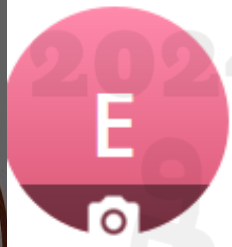
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