

aroma chemistry

Functional Groups

Questions:

1. What is the difference between Aldehyde and Ketone functional groups? between Hydroxyl and Carboxyl functional groups?

2. Identify the elements and the bonds that distinguish one functional group from the other.

Alcohol	<input type="text"/>	Aldehyde	<input type="text"/>	Ketone	<input type="text"/>
Carboxyl	<input type="text"/>	Ester	<input type="text"/>	Ether	<input type="text"/>
Amine	<input type="text"/>	Amide	<input type="text"/>	Thiol	<input type="text"/>
Phenyl	<input type="text"/>	Phosphate	<input type="text"/>		

Properties and importance of functional groups

Functional Group attached to organic compounds give the compounds their biological properties and figure importantly in the molecular interactions that takes place in the living cells. Take note that organic chemistry is a kind of chemistry that includes us, our food and others. Study the table below.

FUNCTIONAL GROUP	MOLECULAR FORMULA	PROPERTIES / IMPORTANCE
Hydroxyl Group	R-OH	Polar in nature; Has high boiling point ; It is protonated when leaving a molecule and deprotonated in the presence of a strong base. Found in beverages, antifreeze, antiseptics and fuels . Used as preservatives for specimens. Can dissolve both polar and non-polar substances. Can be obtained from rice, corn, wheat, barley. Used to flavour biscuits.
Ether	R-O-R	Nonpolar due to the presence of an alkyl group. Has lower boiling point . Has relatively low chemical reactivity .
Aldehyde	R-CHO	Found in essential oil, sugar . Can be obtained in coffee and butter . Fresh pumpkin has the smell of acetaldehyde.
Ketone	R-CO-R	Soluble in water. More volatile . Can show up in blood and urine . Used to check for diabetic ketoacidosis in people with diabetes. Found in perfume and other solvents .
Carboxyl Group	R-CO-OH	Polar . Used as precursors to form other compounds such as esters, aldehydes and ketones. Can exhibit hydrogen bonding with themselves. Used in the production of polymers, pharmaceuticals, solvents and food additives . Found within fatty acids, amino acids (proteins) and many organic acids.
Ester	R-COO-R	More polar than ethers, but less so than alcohols. More volatile than carboxylic acids. Soluble in water .
Amine	R-NH ₂	Many important molecules are amine-based such as neurotransmitters and amino acids . Starting materials for dyes and models for drug design. Used for gas treatment , such as removing CO ₂ from combustion gases.
Phosphate Group	R-PO ₄ ²⁻	Polar . Found within phospholipids (building blocks of cell membranes), nucleotides (building block of nucleic acids) and many proteins .



Activity 3: Functional Group, where the action is?

Objective:

- explore and investigate common properties of these functional groups.
- appreciate the importance of functional groups in our daily life.

Direction: Create an awesome **INFOGRAPHICS** of substances or products with functional groups and state the importance of these organic functional groups in our daily lives.

Things to consider in creating infographics:

- Collect and compile data that your infographic will illustrate.
- The visual structure of your information should be clear & logical.
- Your design must be catchy (creative design) and
- Your infographic must lead the viewer to a conclusion.

Key points:

In our everyday life we benefit from the importance of functional groups in so many substances we encountered. Some of them are mentioned below.

- The odor of **vinegar** is caused by the presence of acetic acid, a **carboxylic acid**, in the vinegar.
- The odor of **ripe bananas and many other fruits** is due to the presence of **esters**, compounds that can be prepared by the reaction of a carboxylic acid with an alcohol.
- The biggest commercial use of **formaldehyde** is manufacture of **Bakelite, melamine, and other plastics**.

It's your turn now to gather substances with functional groups and present them in INFOGRAPHICS

Materials: recyclable materials, old magazines or cut out pictures from printed materials, etc. (You may use any other materials of your choice but not computerize.)

RUBRIC SCORE FOR CREATING INFOGRAPHIC

	Advanced (5 pts)	Proficient (4 pts)	Progressing (3 pts)	Basic (2 pts)
Infographic Content	The infographic includes all of the required information	The infographic includes the required information	The infographic is missing some of the required information	The infographic is missing several pieces of the required information
Visual Appeal	Outstanding use of color, design, and space. Original and creative	Adequate use of color, design, and space. Design is adequate.	Inappropriate use of color, design, and space. Design lacks creativity. Lack of	Little attempt to use color, design and space appropriately.

	design Overall design is pleasing and harmonious	Overall design is mostly pleasing and harmonious	harmonious design in presentation.	Design is dull. Project has sloppy appearance
Quality of Work	Quality of infographic exceeds expectations	The work was done with satisfactory effort	Final product shows little effort	Final product does not show effort, quality is not acceptable.



REMEMBER

- ✓ Functional groups are collections of atoms that attach the carbon skeleton of an organic molecule and confer specific properties.
- ✓ Each type of organic molecule has its own specific type of functional group.
- ✓ Functional groups in biological molecules play an important role in the formation of molecules like DNA, proteins, carbohydrates, and lipids.
- ✓ Functional groups include: hydroxyl, carbonyl, carboxyl, amino, phosphate, and sulfhydryl.
- ✓ The organic molecule is sometimes denoted as "R." Molecules with other elements in their carbon backbone are substituted hydrocarbons.

Structural Formula of Functional Groups

Hydroxyl	R-OH	Carbonyl Group	R-CO-R (ketone) R-CHO (Aldehyde)
Carboxyl	R-COOH	Amino (Amine)	R-NH ₂
Phosphate	R-PO ₄ ³⁻	Amide	R-NH ₃ ⁺
Thiol (Sulfhydryl)	R-SH	Esther	R-COO-R
Ether	R-O-R		



CHECKING YOUR UNDERSTANDING

Identify the functional groups from the structure of organic compounds.

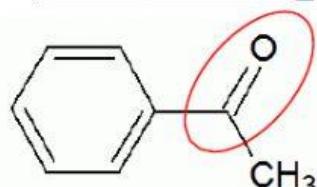
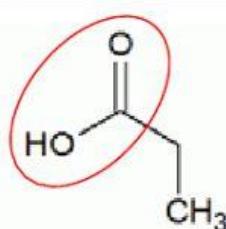
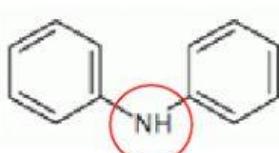
Refer to the choices in the box.

<input type="checkbox"/> KETONE	<input type="checkbox"/> ESTER	<input type="checkbox"/> HYDROXYL	<input type="checkbox"/> ETHER
<input type="checkbox"/> ALDEHYDE	<input type="checkbox"/> AMINE	<input type="checkbox"/> CARBOXYL	<input type="checkbox"/> THIOL

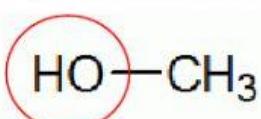
1. _____

2. _____

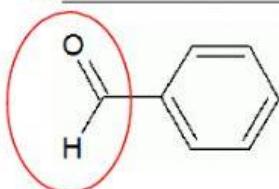
3. _____



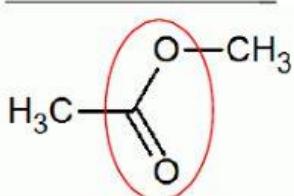
4. _____



5. _____



6. _____



POST TEST

Direction: Write the letter of the correct answer on your answer sheet.

1. A functional group that accepts H⁺ to form NH₃⁺ _____
 a. Amine b. Aldehyde c. Ketone d. Hydroxyl
2. A functional group that is used to check diabetic ketoacidosis of people with diabetes.
 a. Carboxylic acid b. Ketone c. Ester d. Ether
3. What is functional group?
 a. Group molecules that gives specific characteristics to an atom
 b. Group of molecules that make up a group of atoms
 c. Group of atoms that give specific characteristics to a molecule
 d. Group of atoms that give specific characteristics to an element.
4. What two elements are in Hydroxyl?
 a. Sulfur and oxygen b. Argon and Hydrogen
 c. Helium and Neon d. Oxygen and Hydrogen
5. What functional group is in this organic compound R—O—H ?
 a. Hydroxyl b. Carbonyl c. Ketone d. Carboxyl
6. A functional group that act as organic acids _____
 a. phenyl b. Carboxyl c. Sulfhydryl d. Ester
7. Functional group found in carbohydrates aldoses and ketoses is _____
 a. Thiol b. Amine c. Carbonyl d. Amide
8. Which functional group can store or transfer energy?
 a. Amine b. Amide c. Ether d. Phosphate
9. A thiol groups that stabilize the structure of protein _____
 a. Sulfhydryl b. Phosphate c. Phenyl d. Amino
10. What is the suffix of the alcohol functional group?
 a. -al b. -ol c. -oic acid d. -ate



REFERENCES:

Retrieved from:

<https://courses.lumenlearning.com/introchem/chapter/functional-groups/>

Retrieved from:

<https://www.masterorganicchemistry.com/2010/10/06/functional-groups-organic-chemistry/#:~:text=Functional%20groups%20are%20specific%20groupings,acids%20ketones%20and%20eth>