

Learning Guide 2D – Chemistry of Smell  
Chem 1010

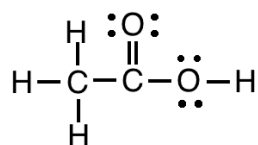
Review

Draw the Lewis structures for all of the atoms in CO<sub>2</sub>.

Draw the Lewis structure for the CO<sub>2</sub> molecule.

How many electrons does each O share with the C?

Draw an isomer for acetic acid.



What is different about these two groups of molecules?

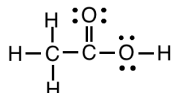
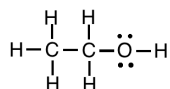
Which do you think there are more of?

What is different about these two groups of molecules?

Which of these do you think there are more of?

What is different about these two groups of molecules?

What two functional groups have we talked about so far?



## Introduction

Today we will be talking about the chemistry of smell.

What are some of your favorite smells?

Of course, there are some bad smells too. Examples?

Besides things that naturally have a smell, there are lots of products that have smells added to make us want to buy them.

What are some you can think of?

How many smells do you think that there are?

Are there any other animals that can smell better than we can?

## Name that smell

See if you can identify the smell in each of these bottles.

A

B

C

D

E

Where do these come from?

Vanilla:



Cinnamon:



Bananas:



Wintergreen:



Lemon:



## How smells work

Before looking at how smells work, let's review what you know about the other senses.

Sight: light bounces off things around us and reaches our eyes, where special cells detect the light and send a message to our brain

Hearing: pressure waves in the air (sound) make our eardrums vibrate, which is detected by special cells in our ears, which send a message to our brain

Touch: cells in our skin detect pressure, heat, and cold, and send a message to our brain

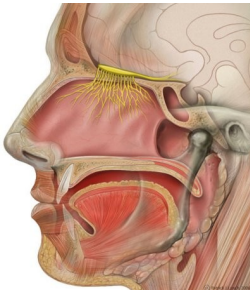
Taste: when certain molecules touch our tongues, they activate special cells that send a message to our brains

Smell: molecules from objects around us evaporate and travel to our noses, where they activate special cells that send a message to our brains

What do these all have in common?

Which of the senses involve sensing molecules?

Where are the cells that sense molecules and send messages to your brain about smells?



So, when you smell a rose, what happens?

- 1) molecules from the rose evaporate
- 2) they float through the air and get in your nose and hit the olfactory epithelium
- 3) they reach a receptor that they fit into
- 4) the cell the receptor is on gets activated and sends a message to your brain
- 5) you recognize the smell of a rose

Why do some things not have a smell?

What does that mean about everything that does have a smell?

Is it possible for molecules to be evaporating and reaching your nose but not causing a smell?

Why does strawberry shampoo smell good but taste bad?

Why can other animals smell things much better than we can?

- 1)
- 2)
- 3)

## Taste and Smell

How are taste and smell connected?

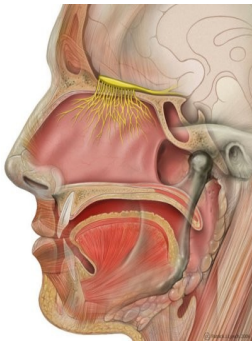
your tongue can detect:

everything else:

examples:

How could you test this yourself?

How do the gaseous molecules from food reach your nose?

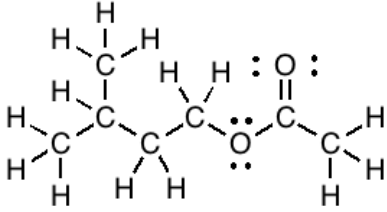
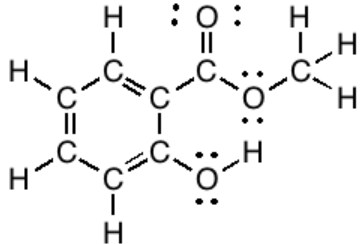
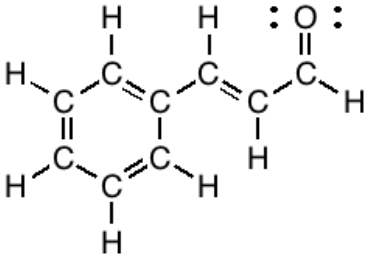
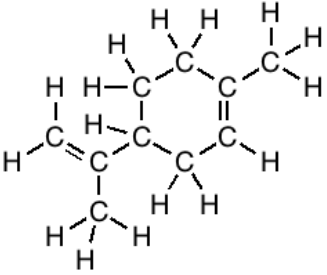
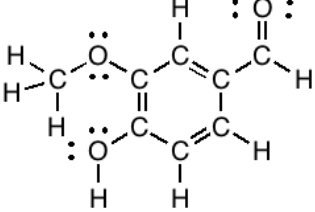


1)

2)

## Molecules of Smell

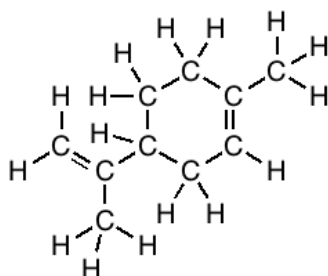
Let's go back to the 5 smells that you identified. What do the molecules look like, and what are their names?

	Lewis structure	name and formula	line structure
bananas			
wintergreen			
cinnamon			
lemon			
vanilla			

How do these molecules compare to the ones from the previous lecture?

Which of these molecules is a hydrocarbon?

Molecules are called terpenes when they are made of groups of 4 carbon atoms in a row with one branch off of them. Terpenes are also commonly found in fruits, flowers, and perfumes. Limonene is a terpene – circle its groups.



Aldehydes are another functional group. They have a C=O with a H directly attached. Which of these molecules is an aldehyde?



When a carbon is double bonded to an oxygen, then another oxygen with a carbon, this is called an ester. Esters are commonly found in fruits, flowers, and perfumes. Which molecules are esters?



When a molecule has a ring of 6 carbons with double bonds between every other carbon, the molecule is called an aromatic molecule. This name comes from the fact that the first compounds that were discovered with this ring all had a strong smell. Which molecules are aromatic?



Are all compounds which have a smell aromatic?

Do all compounds which are aromatic have a smell?

When molecules get this large, we need a shorter method to write their structures. We call these line structures.

propane	$  \begin{array}{c}  \text{H} & \text{H} & \text{H} \\    &   &   \\  \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\    &   &   \\  \text{H} & \text{H} & \text{H}  \end{array}  $	
butane	$  \begin{array}{c}  \text{H} & \text{H} & \text{H} & \text{H} \\    &   &   &   \\  \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\    &   &   &   \\  \text{H} & \text{H} & \text{H} & \text{H}  \end{array}  $	
isobutane	$  \begin{array}{c}  \text{H} & \text{H} & \text{H} \\    &   &   \\  \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\    &   &   \\  \text{H} & \text{H}-\text{C}-\text{H} \\  &   \\  & \text{H}  \end{array}  $	
ethanol	$  \begin{array}{c}  \text{H} & \text{H} & & \\    &   & & \\  \text{H}-\text{C}-\text{C}-\text{O}-\text{H} \\    &   & \cdot\cdot & \\  \text{H} & \text{H} & \cdot\cdot &  \end{array}  $	
isopropyl alcohol	$  \begin{array}{c}  & \text{H} & & \\  &   & & \\  & \text{O} & & \\  & \cdot\cdot & & \\  \text{H} &   & \text{H} & \\    &   &   & \\  \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\    &   &   \\  \text{H} & \text{H} & \text{H}  \end{array}  $	
ethylene glycol	$  \begin{array}{c}  & \text{H} & \text{H} & & \\  &   &   & & \\  \text{H}-\text{O}-\text{C}-\text{C}-\text{O}-\text{H} \\  &   &   & \cdot\cdot & \\  & \cdot\cdot & \cdot\cdot & \cdot\cdot & \\  & & & &  \end{array}  $	

Fill in the Lewis structures for the molecules we were looking at.

### Natural and Artificial Flavors

Not all of the cinnamaldehyde we use comes from nature.

Does cinnamaldehyde from a tree taste the same as from a when it is made from a chemical reaction?

wintergreen

vanilla

banana

lemon

Can you tell the difference?