Structure and Scent
Grade level: Kindergarten – 1st grade

This is a set of activities that is designed to teach young children about molecules and molecular structure. The first activity ("Scent-Matching") is a simple activity with the goal of understanding that scents are molecules, and different molecules have different scents. The goal of the second activity ("Bonding") is for the children to understand that molecules are made up of atoms joined together by bonds. The third activity ("Molecular Size") is designed to get children to understand the relative size of a single molecule. The number of sugar molecules is demonstrative. The final activity ("Make Your Own Molecular Models") allows the children to make molecules (we found that water is a good molecule to start with, then 2,3-dibutanone). They will use gumdrops for atoms and toothpicks as bonds.

Materials:

- Scent bottles (squeeze bottles containing a cotton ball charged with ~3 drops of compound – see below for compound list and corresponding product)
- Actual products
- Molecular model kits
- Gumdrops and toothpicks
- Element signs and number signs (see attached)
- Tape

Scents:

	Molecule	**Product**
1	R-(–)-carvone	spearmint gum
2	S-(+)-carvone	caraway (rye bread or caraway seeds)
3	2,3-dibutanone	buttered popcorn (microwave popcorn)
4	vanillin	vanilla extract
5	citronellal	citronella candle
6	menthol	cough drop
7	naphthalene	moth balls
8	α-Pinene	pine-scented candle
9	cinnamaldehyde	cinnamon
10	benzaldehyde	almond extract
11	isoamyl acetate	banana runts (crushed)

Activity 1: Scent Matching
Each child will be given either a scent bottle or a product. They will have to find their partner that has the same scent.

Discussion question: What exactly do we smell and taste? Really really small particles, or ***molecules***.

Molecules are made up of even smaller particles called ***atoms***. Atoms bond with other atoms to form molecules.

Activity 2: Bonding

Tape an "H" to 2/3 of the children and tape an "O" to the other 1/3. They have now been transformed from children into atoms! Explain that atoms *have* to make a certain number of bonds when they form molecules. H can *only* make 1 bond, while O *has* to make 2 bonds.

Water molecules contain 2 H's and 1 O. Have the children (atoms) make bonds with each other to form groups of three (2 H's and 1 O) – each group is now a water molecule!

Activity 3: Size of Molecules

Show the children a gumdrop, and have them guess how many molecules of sugar are in the gumdrop. Take the number 6 and tape it to a child's shirt. Do they think there are more or less than 6 molecules? Now tape a 0 to another child's shirt (to make 60) – ask again – more or less than 60 molecules? Continue on until there are 21 0's taped to children (and volunteer)'s shirts – that's how many sugar molecules are in each gumdrop!

Sucrose = 342.3 g/mol, 1 gumdrop ~ 3.6 g; ~0.0105 mol ~ 6×10^{21} molecules
6,000,000,000,000,000,000,000, or 6 sextillion molecules (the figure below was copied from Wikipedia for reference)

Prefix	Symbol	1000^m	10^n	Decimal	English word[n 1]	Since[n 2]
yotta	Y	1000^8	10^{24}	1 000 000 000 000 000 000 000 000	septillion	1991
zetta	Z	1000^7	10^{21}	1 000 000 000 000 000 000 000	sextillion	1991
exa	E	1000^6	10^{18}	1 000 000 000 000 000 000	quintillion	1975
peta	P	1000^5	10^{15}	1 000 000 000 000 000	quadrillion	1975
tera	T	1000^4	10^{12}	1 000 000 000 000	trillion	1960
giga	G	1000^3	10^9	1 000 000 000	billion	1960
mega	M	1000^2	10^6	1 000 000	million	1960
kilo	k	1000^1	10^3	1 000	thousand	1795
hecto	h	$1000^{2/3}$	10^2	100	hundred	1795
deca	da	$1000^{1/3}$	10^1	10	ten	1795

Activity 4: Make Your Own Molecular Models

Break up into smaller groups. Show how gumdrops can be used to make molecular models. Have each child assign a color to O and a different color to H. Have them make water.

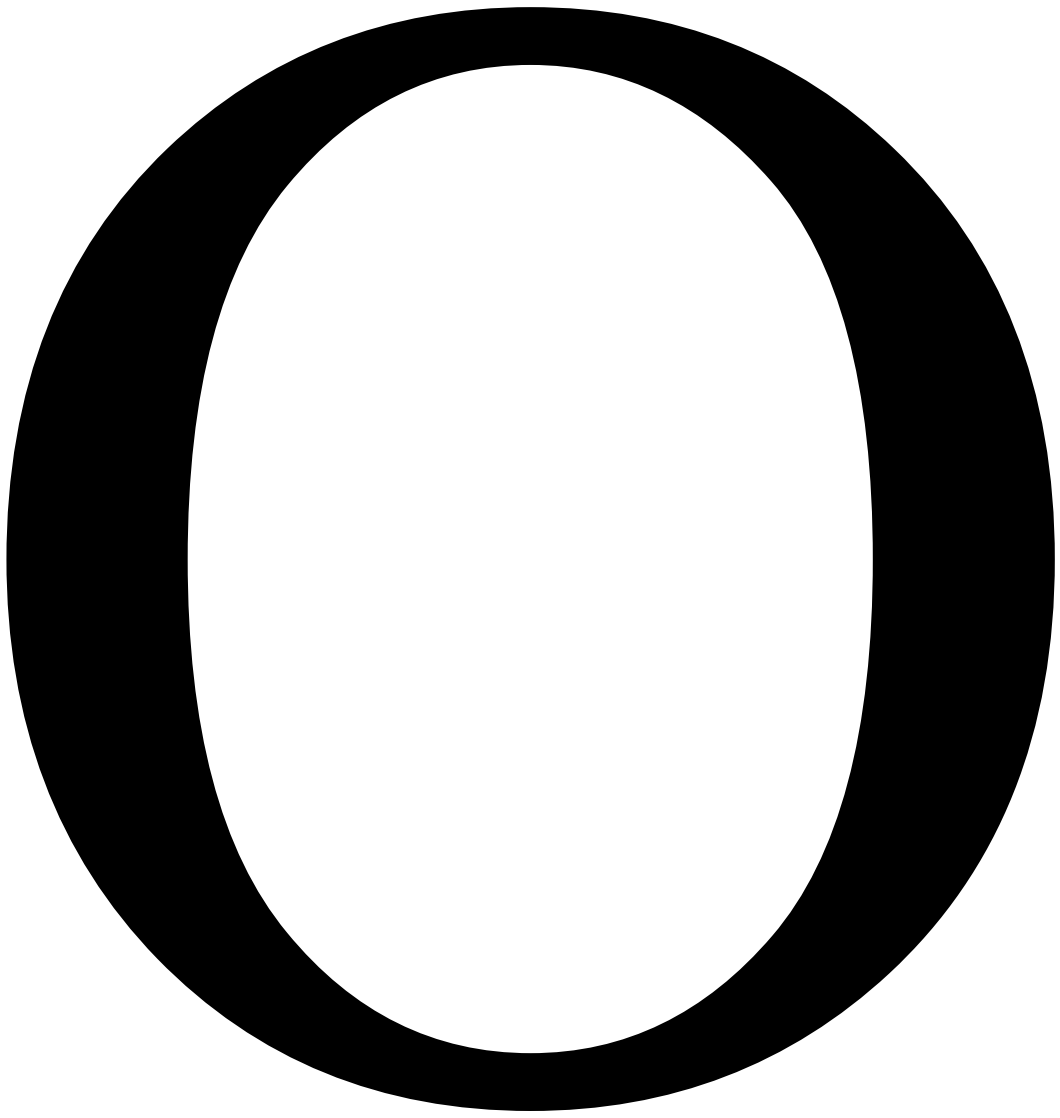
Now give each table a molecular model of one of the molecules from the scent matching activity, and have each child at the table make it out of gumdrops. They will need to assign a third color to carbon, and possibly a fourth to nitrogen.

Hydrogen

1 bond

Hydrogen

1 bond



Oxygen

2 bonds

6

0

0

0

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