

**Revised August 2012**

## HONORS LAB 9a: Molecular Models

**Aim** To build models of some simple molecules

**Apparatus** Multi-colored toothpicks, modeling clay, protractor, paper, ruler, pencils

**Method**

### **PART A Methane (CH<sub>4</sub>)**

1. Roll some modeling clay into a small ball (about the size of a marble).
2. Select four toothpicks (one red, one blue, one green and one yellow).
3. Stick one end of each toothpick into the ball. You should attempt to get the toothpicks to touch one another at the center of the ball and outside the ball they should be as far apart as possible.
4. Measure the distance between the ends of each pair of toothpicks and record these distances in the results table.
5. On a sheet of paper, draw a straight line the same length as the distance between the red and the blue toothpick. Then, taking two additional toothpicks create a triangle using the line you have drawn as the third side. Using the protractor measure the bond angle between the two toothpicks. This is the same as the bond angle in your model. Record it in the results table.
6. Repeat step #5 for all the pairs of toothpicks.
7. To complete the model, make four smaller balls of modeling clay (using a different color) and stick these on the ends of the toothpicks. Preserve the model.

### **PART B Other Molecules**

1. Using the modeling clay and toothpicks in a similar manner to part A, construct models of the following molecules.

NH<sub>3</sub>, BCl<sub>3</sub>, H<sub>2</sub>O, CO<sub>2</sub>, O<sub>2</sub>, PCl<sub>5</sub>, SF<sub>6</sub>

2. Using the dotted lines as a guide, cut out the arrows on the attached sheet of paper and using tape, attach an arrow to any toothpick (bond) that is polar. (The arrows should point toward the negative end of the bond). Use the arrows to determine if the **molecule** is polar or non-polar.

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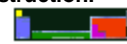
**Results**

**PART A**

<b>Toothpicks</b>	<b>Yellow/Green</b>	<b>Yellow/Blue</b>	<b>Blue/Green</b>	<b>Red/Yellow</b>	<b>Red/Blue</b>	<b>Red/Green</b>
<b>Distance (mm)</b>						
<b>Bond Angle (°)</b>						



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6. Fill in the table below.

	Polar Molecule?	Around central atom			Bond Angle(s)	3D Sketch	Atom geometry
		# of bonding pairs	# of lone pairs	Total electron pairs			
CH <sub>4</sub>							
BCl <sub>3</sub>							
PCl <sub>5</sub>							
SF <sub>6</sub>							
NH <sub>3</sub>							
H <sub>2</sub> O							

