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AP LAB 02EG: 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_4)

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_3, BCl_3, H_2O, CO_2, O_2, PCl_5, SF_6

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

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

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Conclusion/Calculation

1. The bond angles actually present in a molecule of methane are all approximately 109.5°. How do the bond angles you have calculated compare?

2. Compare the bond angles in your models of methane, ammonia and water. Are all the bond angles the same? Should they be equal?

3. In Part B which of the molecules have polar **bonds**?

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4. In Part B which of the molecules are polar **molecules**?

5. Is it possible for a molecule with polar bonds to be non-polar overall? Explain your answer.

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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	Hybridization			
CH_4								
BCl_3								
PCl_5								
SF_6								
NH_3								
H_2O								

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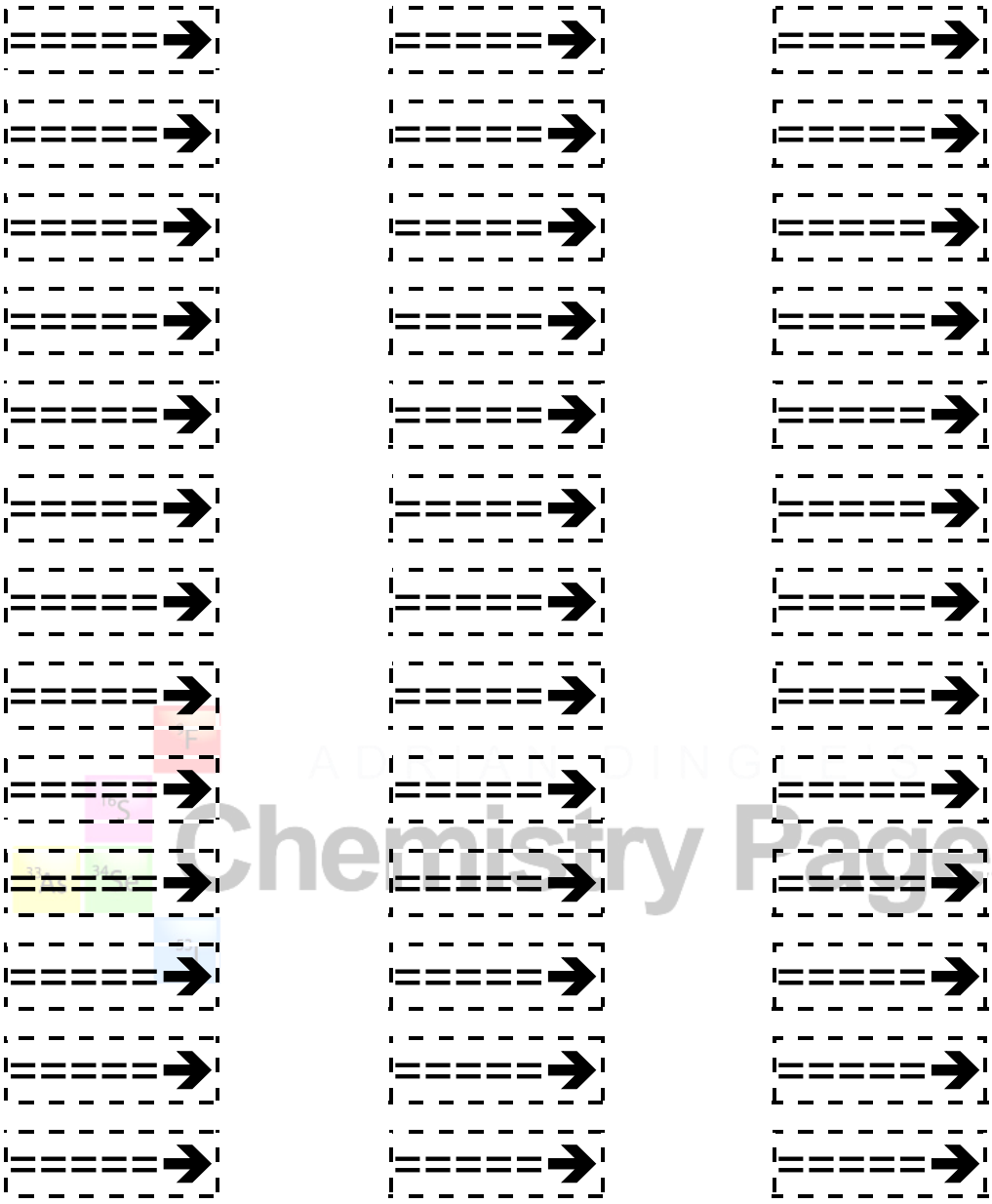

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