

Names _____

Molecular Models of Functional Groups

Working in a group of 2-3 students, use 1 molecular model kit to construct the models below and answer all questions (in *italics*) neatly on a separate sheet of paper(s). Submit 1 copy of your answers per group together with this sheet.

- 1 Construct a water molecule
 - a) *Is water a polar molecule?*
 - b) *Why or why not?*
 - c) *What specific type of bond occurs between an O and H in water?*
 - d) *What specific type of bond occurs between separate water molecules?*

- 2 Construct a carbon dioxide molecule
 - a) *How many bonds link each oxygen atom to the carbon atom?*
 - b) *What specific type of bonds are present in the molecule?*
 - c) *What is the overall shape of the molecule?*
 - d) *Is this a polar or a non-polar molecule overall?*

- 3 Construct a methane molecule (CH₄)

- 4 Now remove one H atom and replace it with a methyl group (CH₃) You have formed ethane
 - a) *Draw the structural formula for ethane*
 - b) *Why is ethane called a hydrocarbon?*
 - c) *What family does this molecule belong to?*

- 5 Construct an ethene molecule (C₂H₄)
 - a) *What family does this molecule belong to?*
 - b) *Is ethene saturated or unsaturated?*
 - c) *Why?*

- 6 Construct a methanol molecule (CH₃OH)

- 7 Now remove one H atom from the C atom of methanol Replace it with a methyl group You have formed ethanol
 - a) *Draw the structural formula for ethanol*
 - b) *What family does this molecule belong to?*

- 8 Split your ethanol and construct two separate methanol molecules Remove the OH from one methanol and the H (from the OH group) of the other methanol Simulate a chemical reaction by joining the two fragments through the oxygen atom
 - a) *What family does this new molecule belong to?*
 - b) *Draw the structural formula for this molecule*
 - c) *In the chemical reaction you just simulated, the H and OH which were removed unite What do they form?*

- 9 Remake a methane molecule Now remove two H atoms from C atom and attach one O atom (remember to make a double bond from the C to the O) You have made formaldehyde, a preservative for dissection specimens
 - a) *Draw the structural formula for this molecule*
 - b) *What family does this molecule belong to?*
 - c) *Is formaldehyde a polar or a non-polar molecule overall?*

- 10 Remove one H atom from formaldehyde and replace it with a methyl group
 - a) *Draw the structural formula for the molecule created*

b) What family does this molecule belong to?

- 11 Remove the H atom from the central C atom (ie not from the methyl group) and add on another methyl group. You should now have a molecule with 2 methyl groups called acetone
 - a) Draw the structural formula for this molecule*
 - b) What family does this molecule belong to?*

- 12 Remake a methanol molecule. Remove two H atoms from the C atom (ie not from the OH group) and replace them with one O atom (you will need a double bond)
 - a) Draw the structural formula for this molecule*
 - b) What family does this molecule belong to?*

- 13 Now remove the last H atom from the C atom (ie not from the OH group) and add on a methyl group. You have produced vinegar or acetic acid
 - a) Draw the structural formula for this molecule*

- 14 Construct the molecule CH_3NH_2
 - a) Draw the structural formula for this molecule*
 - b) What family does this molecule belong to?*

- 15 *Name any TWO functional groups or families that were not constructed in this lab*