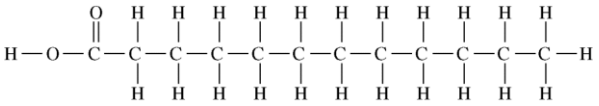
Name _____ **AP Chemistry** **October 22, 2020**

AP Chemistry Unit 2 Practice Exam

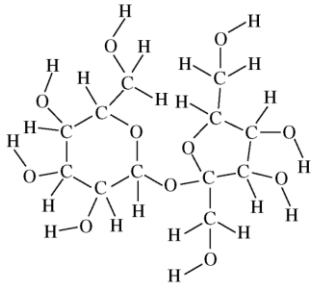
Part II: Free-Response Answer each of the following free response questions. Show ALL work below. Work should be done in a clear and orderly fashion and IN INK!!!!!

#1. Answer each part of the following multi-part question.



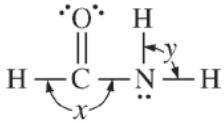
Lauric Acid

(a) The structures of two compounds commonly found in food, lauric acid, $C_{12}H_{24}O_2$, and sucrose, $C_{12}H_{22}O_{11}$, are shown to the right. Which compound, lauric acid or sucrose, is more soluble in water? Justify your answer in terms of the intermolecular forces present between water and each of the compounds.



Sucrose

(b) Methanamide, CH_3NO, is a liquid at 25°C. The complete Lewis electron-dot diagram for methanamide is shown to the immediate right.

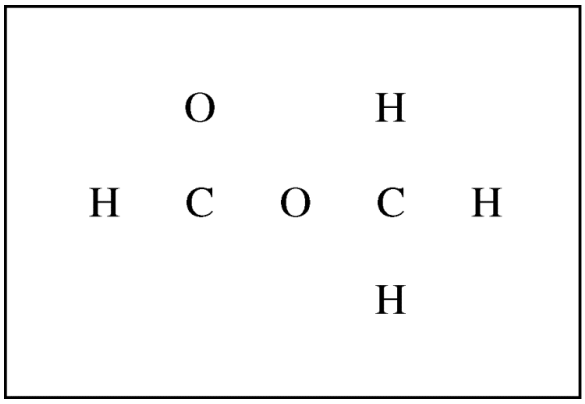


(i) In the molecule, angle *x* is not 180°. Estimate the observed angle. Justify your answer.

(ii) In the molecule, angle *y* is not 90°. Explain why in terms of electron domains (VSEPR model).

(c) Consider a molecule with the formula CH_2O_2. The structure of this molecule has a molecular geometry around the carbon atom similar to the geometry around carbon in methanamide. Draw the complete Lewis electron-dot diagram for the molecule.

(d) Complete the Lewis electron-dot diagram of methyl methanoate in the box to the bottom right. Show all valence electrons.



#2. Some binary compounds that form between fluorine and various nonmetals are listed in the table to the right. A student examines the data in the table and poses the following hypothesis: the number of F atoms that will bond to a nonmetal is always equal to 8 minus the number of valence electrons in the nonmetal atom.

Nonmetal	C	N	O	Ne	Si	P	S	Ar
Formula of Compound	CF_4	NF_3	OF_2	No compound	SiF_4	PF_3	SF_2	No compound

(a) Based on the student's hypothesis, what should be the formula of the compound that forms between chlorine and fluorine?

(b) In an attempt to verify the hypothesis, the student researches the fluoride compounds of the other halogens and finds the formula ClF_3. Draw a complete Lewis electron-dot diagram for a molecule of ClF_3.

(c) Two possible geometric shapes for the ClF_3 molecule are trigonal planar and T-shaped. The student does some research and learns that the molecule has a dipole moment. Which of the two shapes is consistent with the fact that the ClF_3 molecule has a dipole moment? Justify your answer in terms of bond polarity and molecular structure.

Halogen	Formula(s)
F	F_2
Cl	
Br	BrF, BrF_3, BrF_5
I	IF, IF_3, IF_5, IF_7

(d) In an attempt to resolve the existence of the ClF_3 molecule with the hypothesis stated above, the student researches the compounds that form between halogens and fluorine, and assembles the following list.

Based on concepts of atomic structure and periodicity, propose a modification to the student's previous hypothesis to account for the compounds that form between halogens and fluorine.