Chem 1014
Review In-Class Problem Set
November 11, 1999
Fall 1999

Name_____
TA Name _____
Lab Section #_____

Here are some extra problems to practice.

1a. Define the term *valence electron(s)*.

Valence electrons are defined as those electrons furthest from the nucleus. The number of valence electrons is given by the Group number for the Group A elements, and is assumed to be equal to 2 or 3 for the transition metals (Group B). With the exception of silver (a valence of 1) and zinc (a valence of II). After determining the number of valence electrons in an element the remaining electrons are called inner-core electrons.

b) How many valence electrons do each of the following elements have?

Na **1**

Sr **2**

P **5**

I **7**

Kr **8**

2. Predict the formula of the ionic compound formed between the following pairs of elements.

a) Na and Br_2

Sodium is a metal and has a valence of 1. Metals lose electrons when combined with a nonmetal. Bromine is a nonmetal and has a valence of 7 and prefers to gain 1 electron. In each case the loss or gain of electrons is to attain 8 valence electrons. Since sodium will loss one electron to become Na^+ and bromine will gain one electron to become Br^- the correct formula for this compound in NaBr.

b) Fe and Cl_2

Iron is a transition metal and has a valence of 2 or 3. Metals lose electrons when combined with a nonmetal. Chlorine is a nonmetal and has a valence of 7 and prefers to gain 1 electron. Since iron will loss two or three electrons to become Fe^{2+} or Fe^{3+} and chlorine will gain one electron to become Cl^- the correct formula for this compound could be either $FeCl_2$ or $FeCl_3$.

c) gallium and oxygen

Ga_2O_3

d) calcium and phosphate

Calcium is a metal and has a valence of 2. Metals lose electrons when combined with a nonmetal. Phosphate (PO_4^{3-}) is a polyatomic nonmetallic anion with a charge of 3–. Since phosphate already has charge associated with is we just need to recognize that calcium will have a charge of 2+ when combined with a nonmetal. So we would need 3 calcium each with a 2+ charge to exactly balance the 3- charge on two phosphates. How did we arrive at that combination? If we use one Ca^{2+} and one PO_4^{3-} the charges do not sum to zero. The simplest ratio of the cation and an anion whose sum add to zero is 3 cations and two anions.
The formula is $Ca_3(PO_4)_2$

e) iron and nitrate

$Fe(NO_3)_2$ or $Fe(NO_3)_3$

3. Predict the formula of the covalent compound formed between the following pairs of elements.
   a) H_2 and O_2
   b) H_2 and Br_2
   c) C and O_2
   d) N_2 and Cl_2
   e) nitrogen and oxygen
4. Complete the following table;

Name of the compound	Formula of the compound
Sodium hydroxide	NaOH
silver chloride	**AgCl**
Lithium nitride	Li_3N
barium sulfate	**$BaSO_4$**
potassium phosphate	**K_3PO_4**
Carbon dioxide	CO_2
sulfur trioxide	**SO_3**
Lead nitrate	$Pb(NO_3)_2$

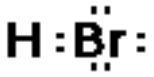
5. Predict whether the following compounds are ionic or covalent.

$SiCl_4$, $MgBr_2$, PH_3, NH_4Cl, HCl, Al_2O_3

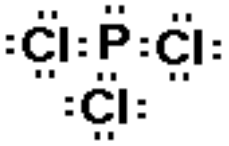
Ionic: $MgBr_2$, NH_4Cl, Al_2O_3.
Covalent: $SiCl_4$, PH_3, HCl.

6. Draw the Lewis (electron) structure for the following ions or molecules.

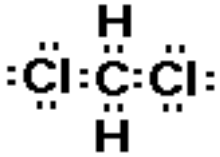
a) HBr



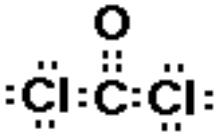
b) PCl_3



c) CH_2Cl_2



d) Cl_2CO

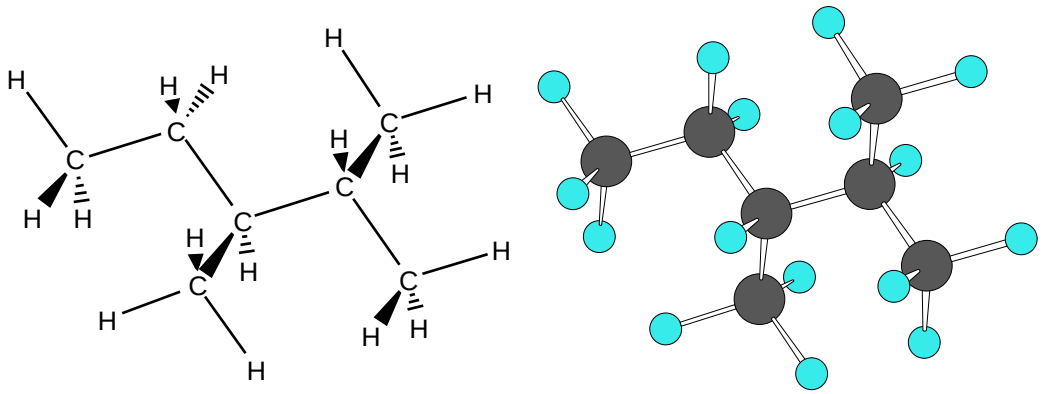


7. Name the following compounds;

a) $CH_3CH_2CH_2CH_3$

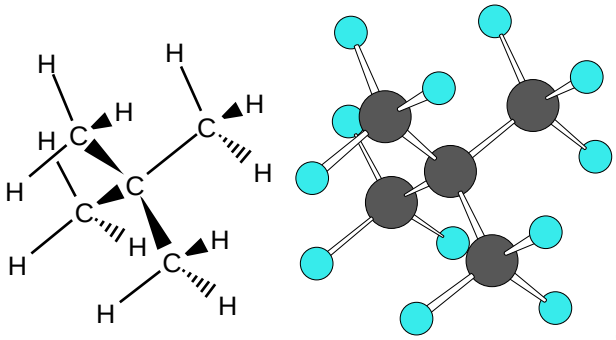
***n*-butane**

b)



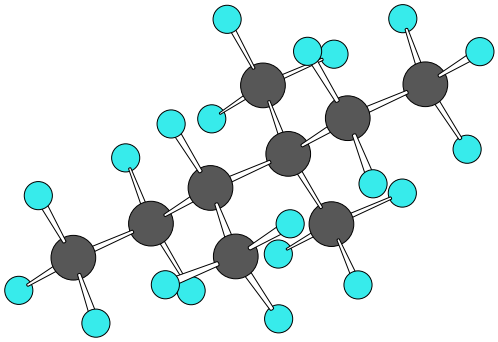
2,3-dimethylpentane 7. (CONTINUED)

c)

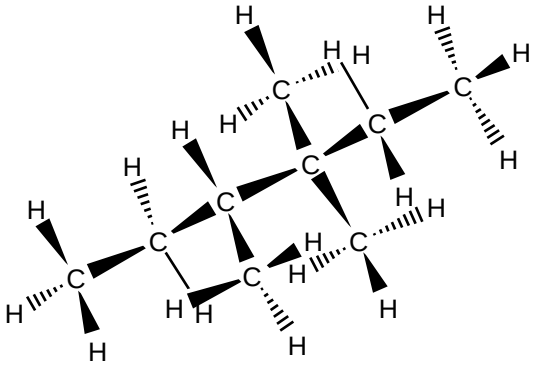


2,2-dimethylpropane

d) $CH_3CH(CH_3)C(CH_3)_2CH_2CHCH_2$

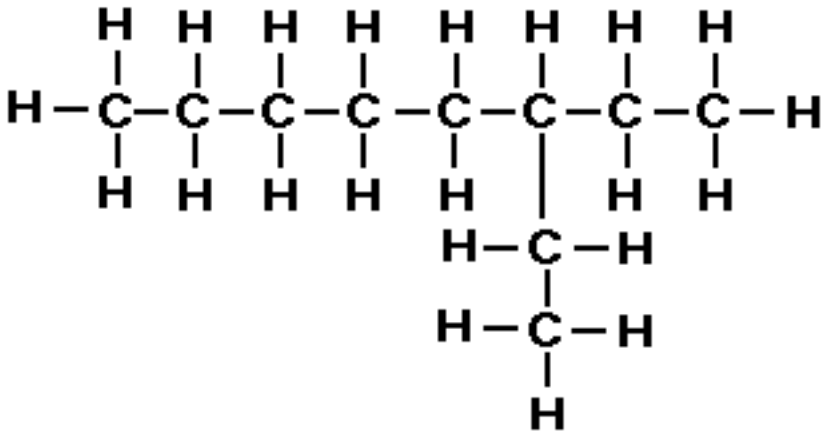


3,3,4-trimethylhexane

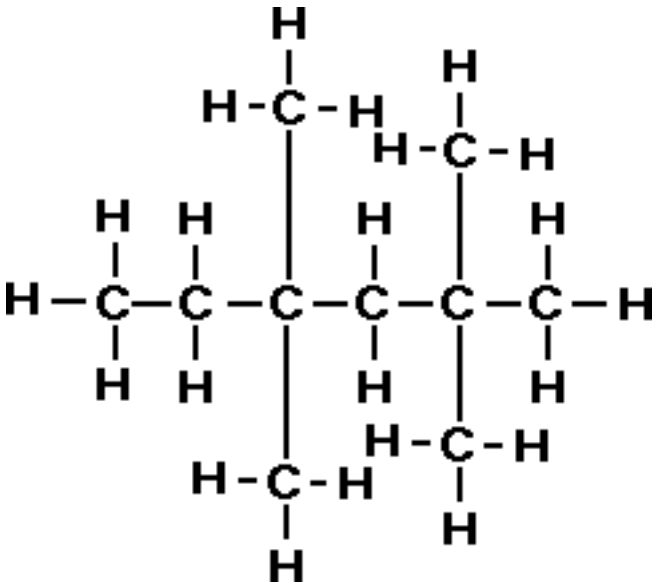


8. Draw the structure which corresponds with each of the following names.

a) 3-ethyloctane



b) 2,2,4,4-tetramethylhexane

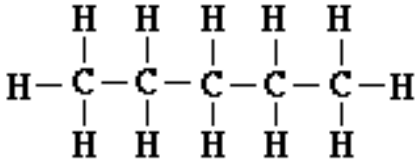
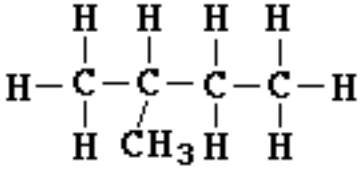
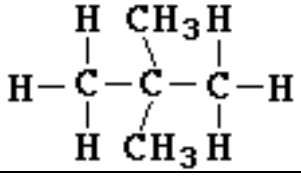


c) 2,3-dimethyl-4-ethylnonane

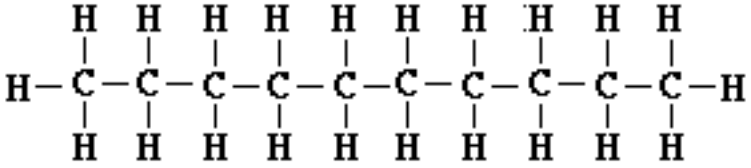
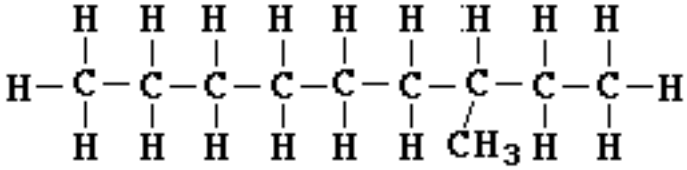
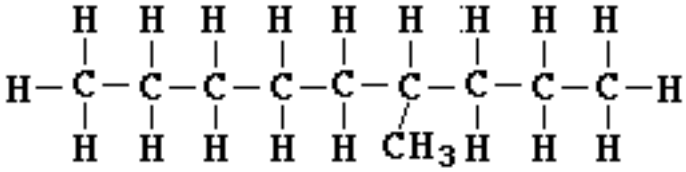
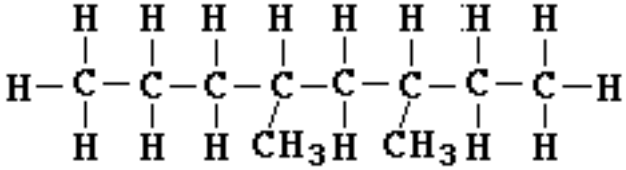
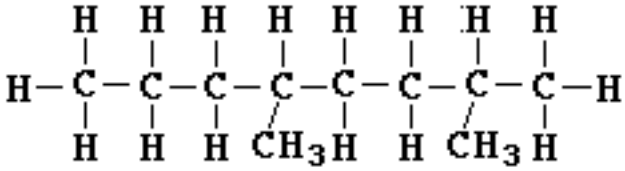
9. What are structural isomers? Draw and name all of the structural isomers for each of the following compounds;

Compounds with the same molecular formula but with a different arrangement of carbon atoms are called structural isomers.

a) C_5H_{12}

Structure	Name
	***n*-pentane**
	**2-methylbutane**
	**2,2-dimethylpropane**

b) 5 isomers of $C_{10}H_{22}$

Structure	Names
	***n*-decane**
	**3-methylnonane**
	**4-methylnonane**
	**3, 5 –dimethyloctane**
	**2, 5 –dimethyloctane**