Review for Test 2: Chemical Bonding

1. Compare the following terms:

a) Similarity: both diagrams illustrate the bonding between atoms in a compound

Differences:

Lewis diagram	Structural diagram
• valence electrons, represented by dots or x's, are written around each atom's symbol • can be drawn for atoms, ions, ionic compounds and covalent compounds	• no valence electrons are shown in the diagram. Instead shared pairs of electrons are represented by a dash, one dash /pair • can only be drawn for covalent compounds

b) Similarity: both are forces that hold atoms together in compounds

Differences:

Ionic bond	Covalent bond
• formed between a metal and a non-metal • valence electrons are transferred from one atom (the metal) to the other atom (the non-metal)	• formed between two non-metals • valence electrons are shared between the two atoms

c) Similarity: both are covalent bonds

Differences:

Single bond	Double bond
• one pair of electrons is shared between the two atoms	• two pairs of electrons are shared between the two atoms

d) Similarity: both are covalent bonds

Differences:

Polar bond	Non-polar bond
• the shared pair of electrons are not shared evenly between the two atoms in the bond • formed between two atoms with different electronegativity values	• the shared pair of electrons are shared evenly between the two atoms in the bond

• partial charges are formed on the atoms in the bond, δ- for the atom with the higher electronegativity value and δ+ for the other atom	• formed between two atoms with the same (or almost the same) electronegativity values • no partial charges on the atoms in the bond

e) Similarity: in both the atoms do not have partial charges; valence electrons are evenly shared between the atoms

Differences:

Non-polar molecule	Non-polar bond
• electronegativity values of the atoms involved may or may not have the same values; the even sharing of valence electrons may be due to the shape and direction of pull on the electrons	• Electronegativity values of the atoms involved are the same or close to the same

f) Similarity: both are shapes of molecules that consist of a central atom surrounded by 3 bonding atoms

Differences:

Trigonal planar shape	Trigonal pyramid shape
• Shape is 2-D • No lone pairs around the central atom • Symmetrical shape	• Shape is 3-D • One lone pair around the central atom • Non-symmetrical shape

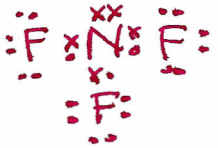
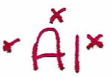
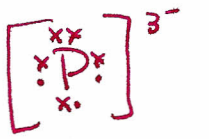
g) Similarity: both are shapes of molecules that can be made from a central atom surrounded by two bonding atoms

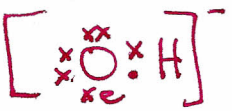
Differences:

Linear shape	v-shape
• No lone pairs around the central atom • Can be made with only 2 atoms	• lone pair(s) around the central atom • must have 3 atoms

2. Draw the Lewis diagrams for the following:

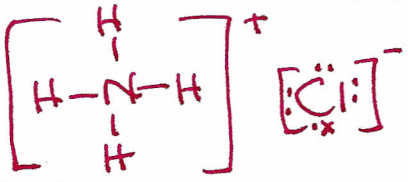
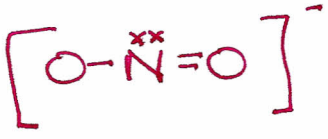
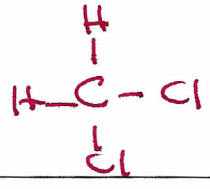
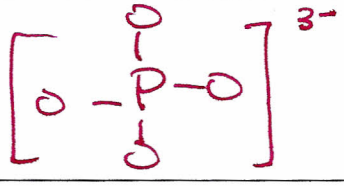
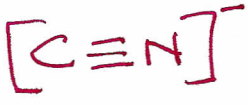
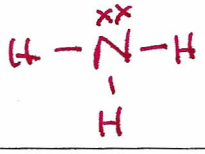
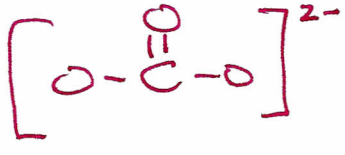
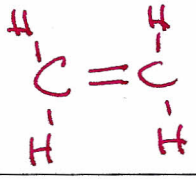
a) lithium sulfide
b) calcium phosphide
c) silver nitrate
d) carbon monoxide
e) nitrogen trifluoride
f) aluminum
g) phosphide ion
h) calcium ion
i) hydroxide



3. Draw structural diagrams for the following:

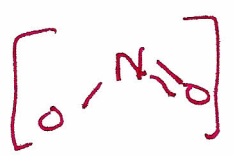
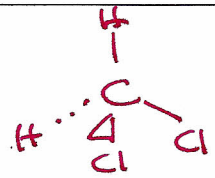
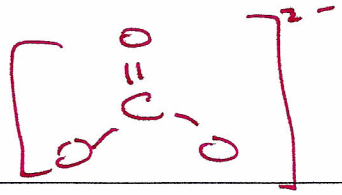
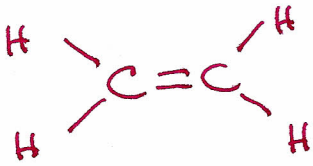
a) Sulfur monoxide	b) Cl_2	c) Ammonium chloride	d) N_2
e) NO_2^-	f) SiO_2	g) CH_2Cl_2	h) PO_4^{3-}
i) CN^-	j) O_3	k) NH_3	l) CO_3^{2-}
m) C_2H_4	n) C_2H_2		

4. Draw and name the shape of:

a) NO_2^- b) SiO_2 c) CH_2Cl_2 d) O_3

e) NH_3 f) CO_3^{2-} g) CH_2CH_2

 V-shaped	O=Si=O linear
 tetrahedron	 V-shaped
 trigonal pyramid	 trigonal planar
	

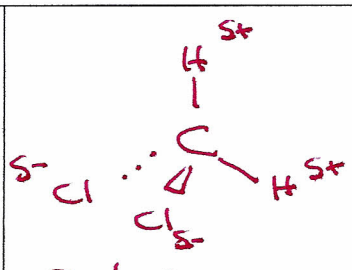
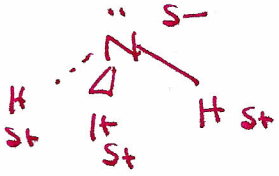
5. Rank the following bonds from highest to lowest polarity and then assign partial charges where appropriate.

O-O O-H O-Cl C-H P-H

O-H O-Cl C-H O-O P-H

6. Which compounds below will be polar molecules? Assign partial charges to the polar molecules.

a) SiO_2 b) CH_2Cl_2 c) NH_3

O=Si=O non-polar no partial charges	 polar	

* Could also be considered to be non-polar i.e Δen C-H = 0.4 Δen C-Cl = 0.4

7. i) Predict which of the following compounds are ionic, purely covalent or polar covalent.
   ii) Name each of the compounds.
   iii) Which substance has the greatest ionic character?

a) I_2 b) SO_2 c) OCl_2
d) Fe_2O_3 e) KBr f) SrO
g) BCl_3 h) HF i) CsF

I_2 purely covalent iodine	SO_2 sulfur dioxide polar covalent	oxygen dichloride polar covalent
Fe_2O_3 ionic iron (III) oxide	KBr ionic potassium bromide	SrO ionic strontium oxide
BCl_3 purely covalent ie non-polar	HF polar hydrogen fluoride	CsF ionic cesium fluoride * greatest ionic character Δen = 3.2

8. Create all the possible formulas of substances formed between oxygen and chlorine and name each.

Cl O
+1 -2
+3
+5
+7

Cl_2O dichlorine monoxide
Cl_2O_3 dichlorine trioxide
Cl_2O_5 dichlorine pentaoxide
Cl_2O_7 dichlorine heptaoxide

9. Complete the following chart.

	Name	Formula
a)	Lithium chlorate	$LiClO_3$
b)	Sodium hydroxide	NaOH
c)	Silver nitrate	$AgNO_3$
d)	Zinc bromide	$ZnBr_2$
e)	Magnesium sulfide	MgS
f)	Carbonic acid	$H_2CO_{3(aq)}$
g)	Copper (I) phosphide	Cu_3P

h)	Silicon dioxide	SiO_2
i)	Sulfurous acid	$H_2SO_{3(aq)}$
j)	Lead (II) sulfate	$PbSO_4$
k)	Dinitrogen tetraoxide	N_2O_4
l)	Tin(IV) oxide	SnO_2
m)	Phosphorus pentachloride	PCl_5
n)	Potassium nitrate	KNO_2
o)	Sulfur monoxide	SO
p)	Calcium cynanide	$Ca(CN)_2$
q)	Nitrous acid	$HNO_{2(aq)}$
r)	Iron (II) nitrate	$Fe(NO_3)_2$
s)	Calcium hydrogen carbonate	$Ca(HCO_3)_2$
t)	Beryllium fluorate	$Be(FO_3)_2$
u)	Hydroiodic acid	$HI_{(aq)}$
v)	Phosphoric acid	$H_3PO_{4(aq)}$
w)	Sodium dihydrogen phosphate	NaH_2PO_4
x)	Bromic acid	$HBrO_{3(aq)}$
y)	Aluminum phosphate	$AlPO_4$
z)	Sulfuric acid	$H_2SO_{4(aq)}$