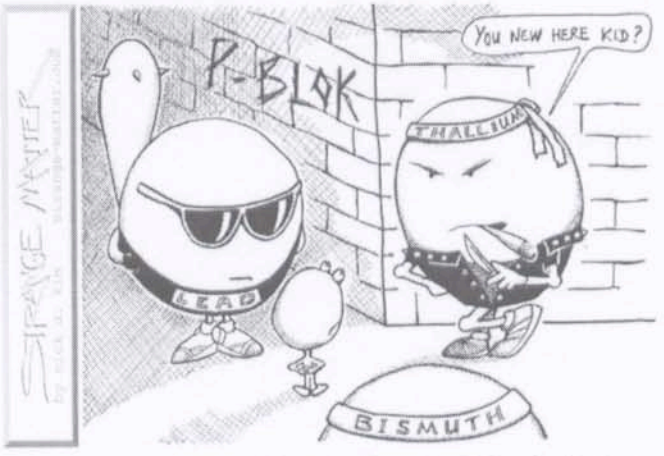
Chemistry 121
Spring 2007
Exam 2

Name: KEY

Take a deep breath, and relax! First, answer the questions you know how to do and then work on the more difficult problems. Don't forget to show all your work, so I can give you as much credit as possible.

Good Luck!

Andy



Unwittingly, and against his mother's advice, Vince the first-row Transition Metal had been lured far away from home, and now found himself surrounded by heavier elements of the P-block.

Q1. Fill in the blanks: (15 pts.)

Name	Formula
Nitrate ion	NO_3^-
Sulfate ion	SO_4^{2-}
Carbonate ion	CO_3^{2-}
Bicarbonate ion	HCO_3^-
Ammonium ion	NH_4^+
nitrite	NO_2^-
sulfite	SO_3^{2-}
dihydrogen phosphate	$H_2PO_4^-$
phosphate	PO_4^{3-}
hydroxide	OH^-

Q2. Write the formula for the following compounds: (15 pts.)

a) sodium iodide NaI

b) potassium nitride K_3N

c) iron(II) chloride $FeCl_2$

d) dinitrogen heptoxide N_2O_7

e) sodium sulfate Na_2SO_4

f) ammonium sulfide $(NH_4)_2S$

g) pentachlorine octoxide Cl_5O_8

h) copper(I) acetate $CuC_2H_3O_2$

i) tetraboron decafluoride B_4F_{10}

j) lithium oxide Li_2O

Q3. What is meant by the term, *valence electrons?* How many valence electrons does an atom of carbon have? (5 pts.)

valence e⁻s: outer shell e⁻s in an atom.

Carbon's e⁻ config is 2-4 ⇒ 4 valence e⁻s.

(2: core, 4: valence)

Q4. Name the following compounds: (15 pts.)

a) $MgCl_2$ magnesium chloride

b) $NaNO_3$ sodium nitrate

c) N_2Cl_6 dinitrogen hexachloride

d) $CaSO_4$ calcium sulfate

e) P_2O_5 diphosphorus pentoxide

f) $CuBr_2$ copper(II) bromide

g) Cl_2O dichlorine monoxide

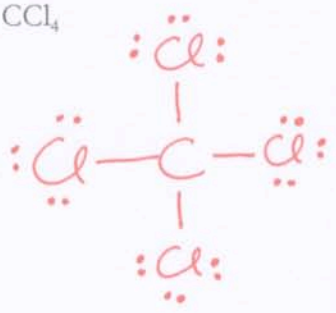
h) NH_4F ammonium fluoride

i) Li_2SO_3 lithium sulfite

j) Fe_2O_3 iron(III) oxide

Q5. Write a valid Lewis structure for the following compounds: (15 pts.)

a) CCl_4



b) NF_3

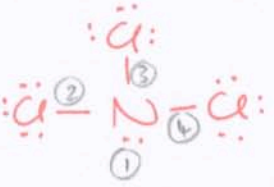
c) SO_2

Q6. Using VSEPR theory, predict the shape of NCl_3. Your answer should include: (16 pts.)

☐ A valid Lewis structure ☐ a sketch of the geometry

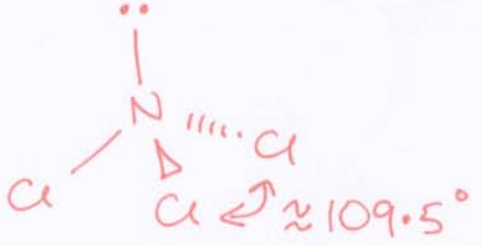
☐ the name of the molecular geometry, and ☐ approximate bond angles

Lewis:



VSEPR: 4 repulsions around central N (e^- geom = tetrahedral)

⇒



Molecular Geometry: Atoms are in a trigonal pyramidal arrangem

Q7. Which bond is more polar, C—F or N—F? Explain why. (4 pts.)

C-F. There is a greater difference in electronegativity between C-F than N-F. (e/neg increases across periods)

Q8. Predict whether F_2O will be polar or non-polar. Be sure to show all working, including a valid Lewis structure, a sketch of the approximate geometry, and any other necessary information. (15 pts.)

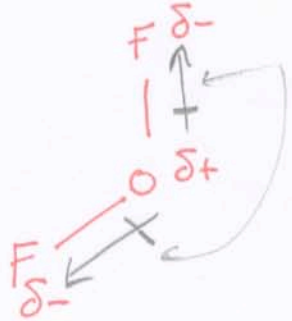
Lewis:

VSEPR:

4 e⁻ pairs ⇒ e⁻ geom is tetrahedral

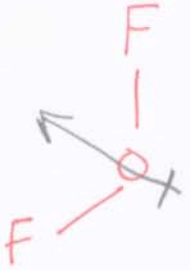
Molecular geom: Bent

Fluorine is more e/neg than Oxygen ⇒ F-O bond is polar.



Bond dipoles.

Bond dipoles don't cancel out
⇒ overall dipole moment ≠ 0
⇒ molecule is POLAR!



overall dipole