Section A

CHEM 1101

MID-TERM TEST #2 Fall, 2012 – 75 minutes – Calculators allowed

TURN OFF YOUR CELL PHONES!!!!

Profs. Pam Wolff

- PRINT YOUR NAME AND STUDENT NUMBER ON YOUR BOOKLET. **Underline your last name.**
- SPACE OUT YOUR ANSWERS – we will mark answers on the lined side of the page only – you can use the other side for rough work if you wish
- you do not need to answer the questions in order; do what you know first
- KEEP YOUR TEST PAPER - HAND IN ONLY THE BOOKLET

1. For the following: (30%)
   * Draw and name the VSEPR geometry
   * Indicate the bond dipoles
   * Indicate the net dipole

   a) NH_3 (ammonia)
   b) XeO_4 (xenon tetroxide)
   c) ICl_3 (iodine trichloride)

2. For carbon ~~dioxide~~ monoxide, CO: (25%)

   a) Draw and label the molecular orbital diagram (*use at least half a page – don't crowd it*)
   b) Determine the bond order
   c) Give the magnetism
   d) If the molecule were ionized (i.e. CO^+ formed), predict whether the bond would be longer or shorter. Explain your reasoning briefly (do not draw another MO diagram).

3. Draw a band diagram and label the bands (s and p if appropriate, valence and conduction) for: (25%)

   a) calcium
   b) Silicon
   c) Silicon doped with gallium – indicate whether it is n-type or p-type and explain your choice very briefly

4. You have 1.00 kg of helium gas in a 40.0 L container at 24°C. The Van der Waals constants for helium are: $a = 0.039\ L^2atm/mol^2$, $b = 0.0237\ L/mol$ (20%)

   a) Calculate the pressure assuming ideal behaviour
   b) Calculate the pressure under real conditions
   c) Explain (briefly – a line or two will do) what factor is contributing most to the difference between real and ideal pressure.

Data/Equations

$PV = nRT$

$[P+an^2/V^2]\,[V-nb] = nRT$

$R = 0.08206\ L\cdot atm/K\cdot mol$

$= 8.314\ J/K\cdot mol$

$T(K) = T(°C) + 273$