Chem 1013 Exam 3 version A pg 1/3

Your name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1 pt

**3.1. Composition Calculations (23 pts)**

1. Which compounds listed below are empiric formulas (circle all that apply) 4 pts
2. C2H4 b) H2C4F5 c)N2O d) BH3 e) H2S2O4 f) P3F6O2
3. A compound contains 1 gram of H, 16 grams of S and 24 grams of O. What is the compound’s **empiric** formula? (5 pts)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Element | Mass(g) | Atomic weight (g/mol) |  |  |
| H | 1.0 | 1  |  |  |
| S | 16.0 | 32 |  |  |
| O | 24.0 | 16 |  |  |

Empiric formula H S O

1. A sample of a compound with a molecular mass of 186 g/mol contains the masses of C, H and O listed in the table below. What is the compound’s **molecular** formula ? (6 pts)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Element | Mass(g) | Atomic weight(g/mol) |  |  |  |
| C | 1.0000 | 12 |  |  |  |
| H | 0.2083 |  1 |  |  |  |
| O | 2.6666 | 16 |  |  |  |

Molecular formula C H O

4a. A student measures the masses of Fe nd O in a compound and finds the values listed in the table

 below. What is the implied empiric formula? (5 pts)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Element | Mass (g) | Atomic weight(g/mol) |  |  |
| Fe | 2.000 | 55.9 |  |  |
| O | 0.572 | 16.0 |  |  |

Empiric formula Fe O

4b. The student claims the molecular mass of the compound he examined in 4a has a mass of

159.6 g/mol. Is this consistent with the data in 4a ? YES NO

 Circle answer (3 pts)

\_\_\_/24 includes name point

* 1. **Lewis Octet Rules and Formal Charge (24 points)**

Assuming the Lewis Octet rule is strictly obeyed, supply the Lewis structures for the molecules below.

Make sure to show all lone pairs and if present, any formal charges. (4 points each/24 points total)

 CO SO2 O3

 SO4-2 COCl2 (C in middle; NO3-1

 O and Cl attached to it)

* 1. **Resonance Part 1 (4 pts)**

Which, if any of the structures you drew above exhibit resonance? (circle choices below)

 CO SO2 O3 SO42- COCl2 NO3-

* 1. **Beyond the Octet Rule (4 pts each/12 points total)**

Assuming you can break the Octet rule to satisfy the minimize formal charge rule, provide the best Lewis structures for the molecules below. Make sure to include all lone pairs and if relevant, formal charges.

 SO2 ClO4- SO42-

* 1. **Bond Order and Resonance Part 2: 8 pts**
1. Compute the Bond Order to the three molecules in 3.4: (6 pts total/2 pts each)

SO2 \_\_\_\_\_\_\_\_\_\_\_\_ ClO4-\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ SO42- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Circle any of the molecules your drew in 3.4. that exhibit resonance (2 pts)

 SO2 ClO4- SO42-

\_\_\_\_/48

**3.6. Molecular Structure Using VSEPR Theory (2 pts each/10 pts total)**

Provide the likely structures of the molecules below:

N2\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ PCl5\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

NO3-\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ H2O\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

NH3\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**3.7. Liquids and Solids (18 points)**

1. Name the five main kinds of intermolecular interactions holding liquids and solids together

1)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 2)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 3)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 5)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Order the compounds below from highest to lowest melting point (1 pt each/ 3 pts total)

H2O, H2Se, H2Te \_\_\_\_\_\_\_\_\_\_\_>\_\_\_\_\_\_\_\_\_\_\_\_\_>\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

CCl4 , CF4, CBr4 `\_\_\_\_\_\_\_\_\_\_\_>\_\_\_\_\_\_\_\_\_\_\_\_\_>\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

CO, CH4, SiO2 \_\_\_\_\_\_\_\_\_\_\_>\_\_\_\_\_\_\_\_\_\_\_\_\_>\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 P(atm)

 c) Indicate where Liquid(L), Solid(S) and Gas(G) 100

 phases exist on the diagram to the right (3 pts) 75 A

d) Name of phase change going from A🡪B

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ B

 T= 55oC 110oC 145oC

 e) What is the ~temperature and pressure of the critical point? Tcrit= \_\_\_\_\_\_\_\_\_\_\_\_\_ Pcrit=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (2 pts)

f) On diagram to the right, what is the melting point? 80oC

 \_\_\_\_\_\_\_\_\_\_\_\_\_oC

 10oC

g) Where is the boiling point ? \_\_\_\_\_\_\_\_\_\_\_\_oC

h) How many calories are needed to melt 2 grams of the 0 10 12 16 calories/g

 of the material ? \_\_\_\_\_\_\_\_\_\_\_\_calories (2 pts)

\_\_\_/28