Chem 1013 Exam 3 version B **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. C2H3 b) H2C4F6 c)N2O4 d) PH3 e) H2S2O3 f) P3F6O2
3. A compound contains 1 gram of Na, 0.696grams of S and 1.391 grams of O. What is the compound’s **empiric** formula? (5 pts)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Element | Mass(g) | Atomic weight (g/mol) |  |  |
| Na | 1.0 | 23 |  |  |
| S | 0.696 | 32 |  |  |
| O | 1.391 | 16 |  |  |

Empiric formula Na S O

1. A sample of a compound with a molecular mass of 88 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 | 2.40 | 12 |  |  |
| H | 0.40 | 1 |  |  |
| O | 1.60 | 16 |  |  |

Molecular formula C H O

4a. A student measures the masses of Cu 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) |  |  |
| Cu | 3.175 | 63.5 |  |  |
| O | 0.400 | 16.0 |  |  |

Empiric formula Cu O

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

286 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) p. 2/3**

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)

SO3 O3 N2

PO4-3 COCl2 (C in middle; NO2-1

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)

SO3 O3 N2 PO43- COCl2 NO2-

* 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.

SO3 ClO3- 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)

SO3 \_\_\_\_\_\_\_\_\_\_\_\_ ClO3-\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ SO42- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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

SO3 ClO3- SO42-

\_\_\_\_/48

**3.6. Molecular Structure Using VSEPR Theory (2 pts each/10 pts total) p 3/3**

Provide the likely structures of the molecules below:

CO2\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ PCl5\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

NO2-\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ H2O\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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

**3.7. Liquids and Solids (16 points)**

1. Name the three strongest kinds of intermolecular interactions holding liquids and solids together

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

1. Order the compounds below from highest to lowest melting point (2 pt each/6 pts total)

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

CH4 , CF4, CBr4 `\_\_\_\_\_\_\_\_\_\_\_>\_\_\_\_\_\_\_\_\_\_\_\_\_>\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

CO, H2 , SiO2 \_\_\_\_\_\_\_\_\_\_\_>\_\_\_\_\_\_\_\_\_\_\_\_\_>\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

P(atm)

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

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

d) Name of phase change going from A🡪B C

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

T= 55oC 110oC 145oC

e) Name of phase change going from A🡪 C

f) 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 convert 2 grams of the 0 10 12 16 calories/g

of the material to gas? \_\_\_\_\_\_\_\_\_\_\_\_calories

\_\_\_/28