Chem 111 **Summer 2015** **Exam II** **Whelan**

Question 1 (10 Points)

Solution of the **Schrödinger wave equation** results in a set of functions (orbitals) that describe the behavior of the electron.
Each function is characterized by **3 quantum numbers**: **n, l, and ml**.

If the value of n= 3:

a) Then the **l quantum number** can have **values from** 0 **to** 2.

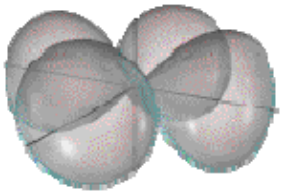
b) The **total number of orbitals possible** with **n=3** is: 9

c) If **n=3** and **l = 2**, then the **obital is desiginated** as a 3d orbital.

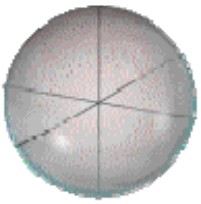
d) With **l =2**, the **ml quantum number** can have a **total of** 5 values.

Question 2 (6 Points)

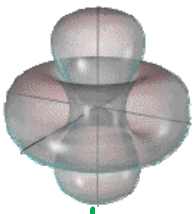
Label the following orbital's as either: **s, p, d, f, g?**



d

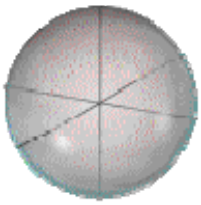


s



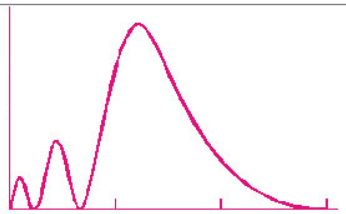
d

Question 3 (4 Points)



a) The orbital depicted on the left is what type of orbital? s

b) Based on its Radial Distribution depicted on the right you can label this orbital as? 3s



Question 4 (16 Points)

a) Write the **complete electron configuration** for **Na**: $1s^2 2s^2 2p^6 3s^1$

b) Write the **noble gas configuration** for **Zn**: $[Ar]4s^2 3d^{10}$

c) The **element** with an **electron configuration** $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^7$ Co

d) The **element** with the **noble gas configuration** $[Ar]4s^1 3d^{10}$ Cu

e) Write the **noble gas configuration** for **Cr**: $[Ar]4s^1 3d^5$

f) Write the **noble gas configuration** for Fe^{2+}: $[Ar]3d^6$

g) The **element** with the configuration $[Ar]4s^2 3d^{10} 4p^3$ has 5 **valence electrons**.

h) **Period 6** has 4 **diamagnetic** elements.

Question 5 (6 Points)

a) Using only the periodic table **arrange** the following elements in order of **increasing atomic size**: **Ga, Ca, S, Si**

S (*smallest*) Si Ga Ca (*largest*)

b) Which one has the **greatest Electron Affinity**: S

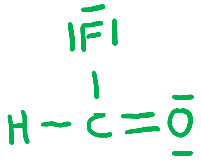
c) Which one has the **smallest first ionization energy**: Ca

Question 6
12 Points

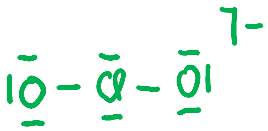
Draw the **best** Lewis Dot structure for the following

N_2:

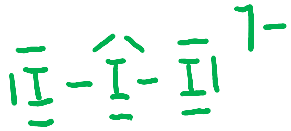
HFCO:



ClO_2^-: (Cl = Chlorine)



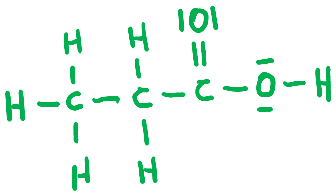
I_3^-



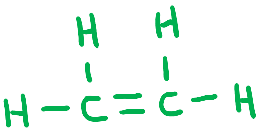
Question 7
6 Points

Draw the **best** Lewis Dot structure for the following organic molecules

CH_3CH_2COOH:



C_2H_4:



Question 8
4 Points

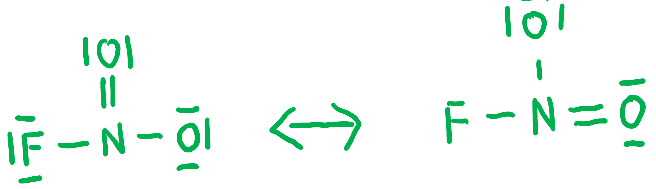
Draw the **best** Lewis Dot structure for **the following molecules** on the rough work paper provided and then **classify each as either a free radical (yes) or not (no)**

a) **O_2^-:** YES

b) **OCl_2:** (Cl = Chlorine) NO

Question 9
8 Points
(6 Points)

Draw all **reasonable** resonance structure for **NO_2F:**



(2 Points)

Circle the best answer:

Average bond length table is on the front page of this exam.

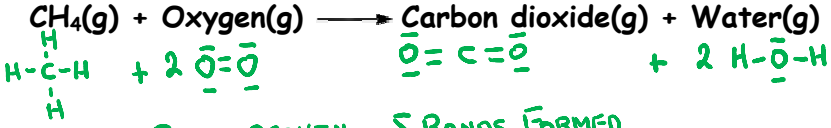
The **N** to **O** bond **length** in **pm** is expected to be:

a) = 136 **b)** > 136 **c)** = 115 **(d)** > 115

Question 10 (6 Points)

Using the ***Average bond energy table on the front page of this exam***, **estimate** the **enthalpy change** associated with the following reaction.

$CH_4(g)$ + Oxygen(g) ⟶ Carbon dioxide(g) + Water(g)



Σ BONDS BROKEN − Σ BONDS FORMED

$4(C\text{-}H) + 2(O{=}O) - \{2(C{=}O) + 4(O\text{-}H)\}$

$4(414) + 2(498) - \{2(803) + 4(464)\}$

$1656 + 996 - 1606 - 1856$

−810 kJ

Question 11 (6 Points)

The **questions asked on the right** refer to the partial **Lewis Structure** depicted on the left.

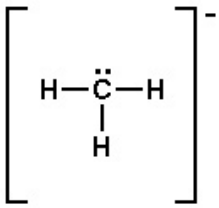
a) What is the **Formal Charge** on **N**: 0

b) What is the **Formal Charge** on **O**: +1

c) What is the **overall charge on the molecule**: +1

Question 12 (6 Points)

The **questions asked on the right** refer to the partial **Lewis Structure** depicted on the left.



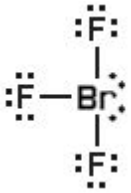
a) Give the **electron pair geometry** about **C**: TETRAHEDRON

b) Give the **molecular geometry** about **C**: TRIGONAL PYRAMID

c) Give the **bond angle** about **C**: ~109°

Question 13 (4 Points)

The **questions asked on the right** refer to the partial **Lewis Structure** depicted on the left.

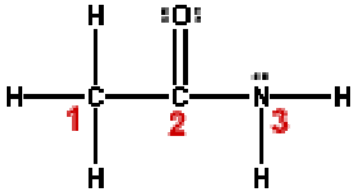


a) Give the **electron pair geometry** about **Br**: TRIGONAL BIPYRAMID

b) Give the **molecular geometry** about **Br**: T-SHAPED

Question 14 (6 Points)

The **questions asked on the right** refer to the Lewis diagram for **acetamide** depicted on the left



a) The **molecular geometry** about **1** is: TETRAHEDRON

b) The **molecular geometry** about **3** is: TRIGONAL PYRAMID

c) The **bond angle** about **2** is: 120°

Do Not Write Below This

Exam II Score