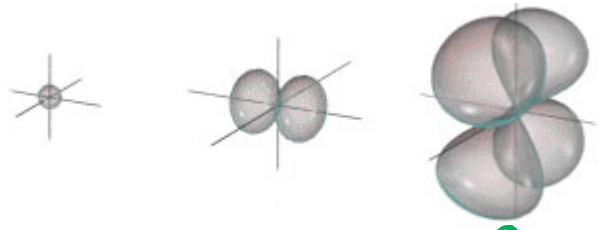
Chem 111 **Summer 2014** **Exam II** **Whelan**

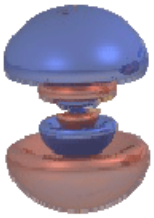
Question 1 (3 Points)

Each of the orbitals depicted has the **lowest** value of **n** possible **for its type**. Which one has the **highest n** value?



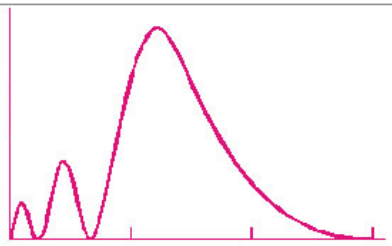
a b c

Question 2 (4 Points)



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

b) Based on its Radial Distribution depicted on the right you can label this orbital as? 4p



Question 3 (4 Points)

I am an **orbital** belong to a family whose m_l values are **-2, -1, 0, +1,+2** therefore I am a(n) d type orbital. I have a grand total of **5 nodes**, therefore my principal quantum number (**n**) is 6. Apart from me there are a **total** of 35 **other** orbital's that have this same principal quantum number. **Combined** we can accommodate a **total** of 72 **electrons**.

Question 4 (6 Points)

Give the **complete** electronic configuration for the following:

a. **P** $1s^2 2s^2 2p^6 3s^2 3p^3$ b. **Al^{3+}** $1s^2 2s^2 2p^6$

Question 5 (4 Points)

How many **unpaired electrons** are in the **Fe** atom? 4

Therefore **Fe** is **parmagnetic** or **diamagnetic**? PARAMAGNETIC

Question 6 (6 Points)

Give the **noble gas** configuration for the following

a. **Kr** $[Ar]\,4s^2 3d^{10} 4p^6$ c. **Cu** $[Ar]\,4s^1 3d^{10}$

b. **Ni^{2+}** $[Ar]\,3d^8$

Question 7 (4 Points)

Using only the periodic table **arrange** the following elements in order of **increasing atomic radius**: **Na^+, F^-, O^{2-}, Mg^{2+}**

Mg^{2+} (*smallest*) Na^+ F^- O^{2-} (*largest*)

Question 8 (6 Points)

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

F (*smallest*) — S — Mg — Ca (*largest*)

b) Which one has the greatest Electron Affinity: F

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

Question 9 (3 Points)

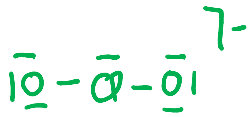
Using only the periodic table **arrange** the following elements in order of **decreasing ionization energy**: **bromine, potassium, gallium**

Br (*largest*) — Ga — K (*smallest*)

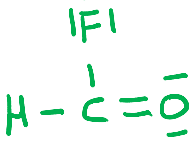
Question 10 (12 Points)

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

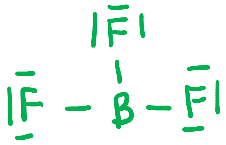
ClO_2^- (Cl=Chlorine)



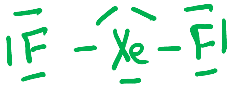
HFCO



BF_3



XeF_2



Question 11 (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) **NO_2** YES

b) **ClO_2^-** No (Cl = chlorine)

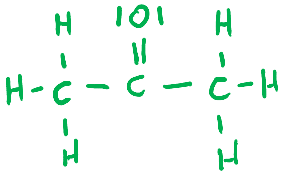
c) **BrO_2** YES

d) **ClO_2** YES

Question 12 (6 Points)

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

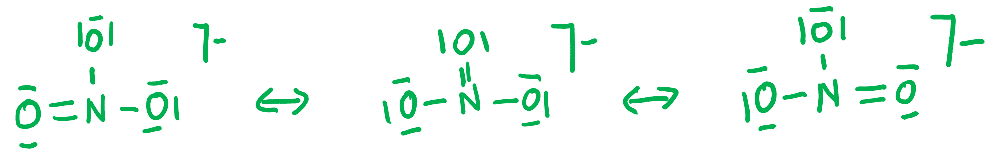
CH_3COCH_3



C_2H_2

Question 13
8 Points
(6 Points)

Draw all **reasonable** resonance structure for NO_3^-.



(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:

1. = 136 **(2)** > 115 **3.** = 115 **4.** > 136

Question 14
4 Points

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

$$N_2(g) + 3\,H_2(g) \longrightarrow 2\,NH_3(g)$$

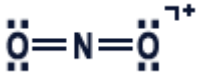
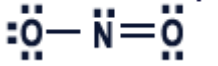
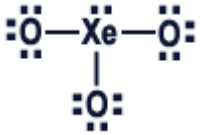
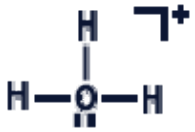
$$N\equiv N + 3\,(H-H) = 2\,(H-\underset{\displaystyle H}{\overset{\displaystyle |}{N}}-H)$$

$$\Sigma \text{ Bonds Broken} - \Sigma \text{ Bonds Formed}$$

$$946 + 3(436) - 6(389) = -80$$

-80 kJ

Question 15
18 Points

A	B	C	D
			
E	**F**	**G**	**H**
			

1. List the **structure(s)** whose **only** bond angle is **180°** **A, B**

2. Give the **electron pair geometry** (**epg**) for:

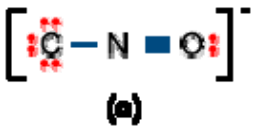
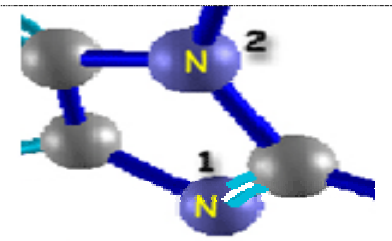
   A: LINEAR C: OCTAHEDRON

   B: TRIGONAL BIPYRAMID E: TRIGONAL PLANAR

3. Give the **molecular geometry** for:

   D: SQUARE PLANAR F: ANGULAR / BENT ~109°

   G: TRIGONAL PYRAMID B: LINEAR

Question 16 6 Points	A resonance structure of **CNO^-** is given below: Give the formal charge on:  (a) C <u>-3</u> N <u>+1</u> O <u>+1</u>
Question 17 6 Points	 What is the **predicted bond angle** about the following atoms? a) **Nitrogen 1** <u>120°</u> b) **Nitrogen 2** <u>~109°</u>

Do Not Write Below This

Exam II Score