



### Average Single Bond Lengths (Picometers)

	H	C	N	O	F	Si	P	S	Cl	Br	I
H	74	110	98	94	92	145	138	132	127	142	161
C		154	147	143	141	194	187	181	176	191	210
N			140	136	134	187	180	174	169	184	203
O				132	130	183	176	170	165	180	199
F					128	181	174	168	163	178	197
Si						234	227	221	216	231	250
P							220	214	209	224	243
S								208	203	218	237
Cl									200	213	232
Br										228	247
I											266

### Average Multiple Bond Lengths (Picometers)

C = C	134	C ≡ C	121
C = N	127	C ≡ N	115
C = O	122	C ≡ O	113
N = O	115	N ≡ O	108

$$1 \text{ pm} = 1 \times 10^{-12} \text{ m}$$

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### Average Single Bond Energies (kJ per mole)

	H	C	N	O	F	Si	P	S	Cl	Br	I
H	436	414	389	464	569	293	318	339	431	368	297
C		347	293	351	439	289	264	259	330	276	238
N			159	201	272		209		201	243	
O				138	184	368	351		205		201
F					159	540	490	285	255	197	
Si						176	213	226	360	289	
P							213	230	331	272	213
S								213	251	213	
Cl									243	218	209
Br										192	180
I											151

### Average Multiple Bond Energies (kJ per mole)

N = N	418	C = C	611	
N ≡ N	946	C ≡ C	837	
N = O	590	C = O	803	<i>In CO<sub>2</sub> Only</i>
C ≡ N	891	C = O	745	
O = O	498	C ≡ O	1075	

SID

Last \_\_\_\_\_

First \_\_\_\_\_

Question 1  
6 Points

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



\_\_\_\_\_



\_\_\_\_\_



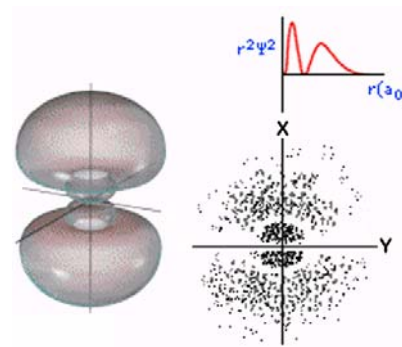
\_\_\_\_\_

Question 2  
6 Points

The orbital depicted on the left is:

- a. What **type** of orbital? \_\_\_\_\_
- b. Its **n** value is? \_\_\_\_\_
- c. Its **specific** designation is? \_\_\_\_\_

(x, y, z, xy, xz, yz, x<sup>2</sup>-y<sup>2</sup>, z<sup>2</sup>)



Question 3  
4 Points

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

- a. **Cl** \_\_\_\_\_
- b. **Ga<sup>3+</sup>** \_\_\_\_\_

Question 4  
8 Points

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

- a. **Ar** \_\_\_\_\_
- b. **Ni<sup>2+</sup>** \_\_\_\_\_
- c. **Cr** \_\_\_\_\_
- d. **Br** \_\_\_\_\_

Question 5  
4 Points

How many **Valence electrons** are associated with the **Noble Gases**? \_\_\_\_\_

Question 6  
3 Points

How many **paramagnetic** elements are there in **period 4**? \_\_\_\_\_

Question 7  
4 Points

Using only the periodic table given with this exam rank the following elements **from 1 to 4** in order of **increasing electron affinity** (1 being the **smallest** electron affinity and **4** the **largest** electron affinity):

\_\_\_\_\_ Na      \_\_\_\_\_ N      \_\_\_\_\_ P      \_\_\_\_\_ K

Question 8  
6 Points

Using only the periodic table given with this exam **arrange** the following elements in order of **increasing size**: **chlorine, aluminum, gallium (Ga)**

\_\_\_\_\_ Smallest      \_\_\_\_\_      \_\_\_\_\_ Largest

Question 9  
12 Points

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

CO

HCN

XeF<sub>4</sub>

ClO<sub>2</sub><sup>-</sup>

Question 10  
4 Points

Draw the **best** Lewis Dot structure for F<sub>2</sub>CO on the rough work paper provided and answer the following questions based on your drawing.

With regards to the **central atom**:

- a. The number of **lone pairs** \_\_\_\_\_
- b. The number of **single bonds** \_\_\_\_\_
- c. The number of **double bonds** \_\_\_\_\_

The central atom:

- 1) **Obeys** the Octet Rule
- 2) Has an **incomplete** Octet
- 3) Has an **expanded** Octet

Question 11  
8 Points

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

CH<sub>3</sub>CH<sub>2</sub>OCH<sub>3</sub>

CH<sub>3</sub>COOCH<sub>3</sub>

Question 12  
9 Points  
(6 Points)

Draw all **reasonable** resonance structure for NO<sub>2</sub>F.

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

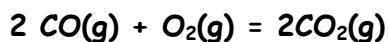
3. = 115

4. > 115

(3 Points)

Question 13  
6 Points

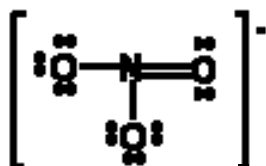
Using **average bond energies** (given on the front of this exam), **estimate the enthalpy change** for the following reaction:



Show Work

$\text{kJ}\cdot\text{mol}^{-1}$

Question 14  
4 Points



Based on the Lewis structure given, the formal charge on the central nitrogen atom is: \_\_\_\_\_

Question 15  
4 Points



A



B



C

Assign **formal charges** to **each** of the **resonance structures depicted** for  $\text{SCO}$ . Based on these numbers is there a structure that you prefer? If so circle the letter of that structure.

Question 16  
6 Points

What is the **electron-pair geometry** for **Cl** in  $\text{ClO}_2^-$ ? \_\_\_\_\_ ...

There are \_\_\_\_ **lone pair(s)** around the central atom, so the **molecular geometry** of  $\text{ClO}_2^-$  is \_\_\_\_\_.

Question 17  
6 Points

What is the **electron-pair geometry** for **S** in  $\text{SF}_4$  \_\_\_\_\_ ...

There are \_\_\_\_ **lone pair(s)** around the central atom, so the **molecular geometry** of  $\text{SF}_4$  is \_\_\_\_\_.

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*Do Not Write Below This*

Exam II Score