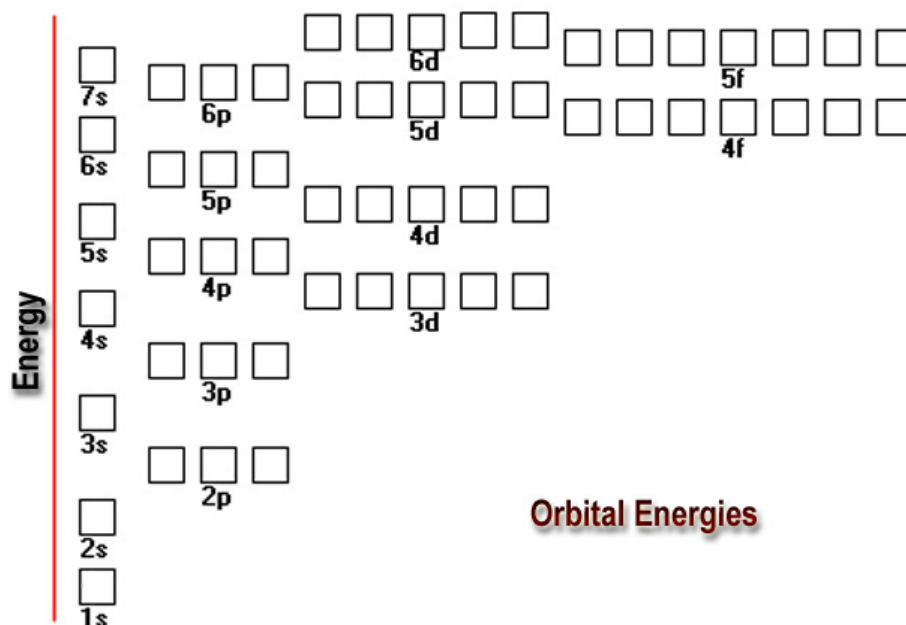


The Periodic Table

<i>IA</i> H 1 1.01																	<i>VIIIA</i> He 2 4.00
<i>IIA</i> Li 3 6.94	Be 4 9.01											<i>IIIA</i> B 5 10.81	<i>IVA</i> C 6 12.01	<i>VA</i> N 7 14.01	<i>VIA</i> O 8 16.00	<i>VIIA</i> F 9 19.00	Ne 10 20.18
Na 11 22.99	Mg 12 24.31	<i>IIIB</i>	<i>IVB</i>	<i>VB</i>	<i>VIB</i>	<i>VII B</i>	<i>VIII B</i>	<i>VIII B</i>	<i>VIII B</i>	<i>IB</i>	<i>IIB</i>	Al 13 26.98	Si 14 28.09	P 15 30.97	S 16 32.07	Cl 17 35.45	Ar 18 39.95
K 19 39.10	Ca 20 40.08	Sc 21 44.96	Ti 22 47.88	V 23 50.94	Cr 24 52.00	Mn 25 54.94	Fe 26 55.85	Co 27 58.93	Ni 28 58.69	Cu 29 63.55	Zn 30 65.39	Ga 31 69.72	Ge 32 72.61	As 33 74.92	Se 34 78.96	Br 35 79.90	Kr 36 83.80
Rb 37 85.47	Sr 38 87.62	Y 39 88.91	Zr 40 91.22	Nb 41 92.91	Mo 42 95.94	Tc 43 (97.9)	Ru 44 101.07	Rh 45 102.91	Pd 46 106.42	Ag 47 107.87	Cd 48 112.41	In 49 114.82	Sn 50 118.71	Sb 51 121.76	Te 52 127.60	I 53 126.90	Xe 54 131.29
Cs 55 132.91	Ba 56 137.33	La 57 138.91	Hf 72 178.49	Ta 73 180.95	W 74 183.85	Re 75 186.21	Os 76 190.2	Ir 77 192.22	Pt 78 195.08	Au 79 197.97	Hg 80 200.59	Tl 81 204.38	Pb 82 207.2	Bi 83 208.98	Po 84 (209)	At 85 (210)	Rn 86 (222)
Fr 87 223.02	Ra 88 226.03	Ac 89 227.03	Rf 104 (261)	Db 105 (262)	Sg 106 263	Bh 107 (262)	Hs 108 (265)	Mt 109 (266)	Ds 110 (271)	Rg 111 (272)	Uub 112 (285)	Uut 113 (284)	Uuq 114 (289)	Uup 115 (288)			

Ce 58 140.12	Pr 59 140.91	Nd 60 144.24	Pm 61 (145)	Sm 62 150.36	Eu 63 152.97	Gd 64 157.25	Tb 65 158.93	Dy 66 162.50	Ho 67 164.93	Er 68 167.26	Tm 69 168.93	Yb 70 173.04	Lu 71 174.97
Th 90 232.04	Pa 91 231.04	U 92 238.03	Np 93 237.05	Pu 94 (240)	Am 95 243.06	Cm 96 (247)	Bk 97 (248)	Cf 98 (251)	Es 99 252.08	Fm 100 257.10	Md 101 (257)	No 102 259.10	Lr 103 262.11



Some Approximate Single and Multiple Bond Lengths*

Single Bond Lengths											
	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

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

*In picometers (pm); 1 pm = 10⁻¹² m.

Some Average Single- and Multiple-Bond Energies*

Single Bonds											
	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

Multiple Bonds			
N=N	418	C=C	611
N≡N	946	C≡C	837
N=O	590	C=O (in O=C=O)	803
C≡N	891	C=O (as in H ₂ C=O)	745
O=O (in O ₂)	498	C≡O	1075

*In kilojoules per mole.

Question 1 Using noble gas notation, write the electron configuration for the following:
10 Points

1. Ni _____
2. Cr _____
3. Fe²⁺ _____

The rare earth elements, or lanthanides exist as +3 ions. Using the noble gas notation, show the electron configuration of:

1. Eu _____
2. Eu³⁺ _____

Question 2 Arrange the following elements in order of increasing size, by ranking them from 1 (smallest) to 5 (largest)
5 Points

Al	<input type="text"/>	K	<input type="text"/>
B	<input type="text"/>	Na	<input type="text"/>
C	<input type="text"/>		

Question 3 Arrange the following elements in order of increasing ionization energy, by ranking them from 1 (least) to 4 (greatest)
4 Points

S	<input type="text"/>	O	<input type="text"/>
F	<input type="text"/>	He	<input type="text"/>

Question 4 Consider the elements Na, O, F and Cl:
4 Points

1. Which element has the **greatest electronegativity**? _____
2. Which element has the **greatest metallic character**? _____

Question 5 Draw the **best** Lewis Dot structure for the following
16 Points

CO	F ₂ CO
BCl ₃	IBr ₂ ⁻

Question 6
6 Points



1 2 3

What is the **formal charge** on the oxygen atoms on the Lewis Dot Structure depicted on the left.

O1: _____

O2: _____

O3: _____

Question 7
12 Points

Draw all **reasonable** resonance structure for FNO_2 .

Circle the correct answer:

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

The F to N bond length is expected to be:

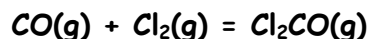
1. > 134 pm
2. < 134 pm
3. = 134 pm

The N to O bond length is expected to be:

1. = 136 pm
2. > 136 pm
3. = 115 pm
4. > 115 pm

Question 8
6 Points

Phosgene, Cl_2CO is a highly toxic gas. Using the *bond energies given on the front page* of this exam, estimate the enthalpy change for the reaction of carbon monoxide and chlorine to produce phosgene.



Question 9
10 Points

Give the **electron pair geometry** and the **molecular geometry** for the following.

1. CH_2Cl_2

Electron Pair Geometry

Molecular Geometry

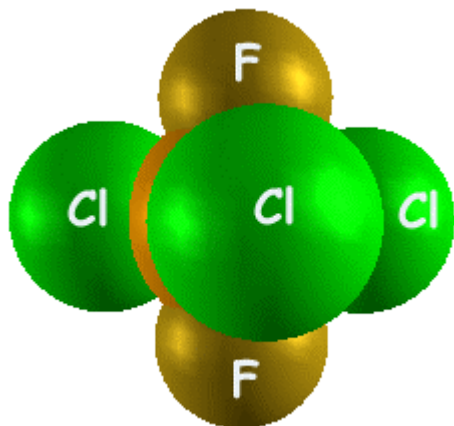
2. NO_2^-

3. NO_2^+

4. SF_4

5. BrF_5

Question 10
6 Points

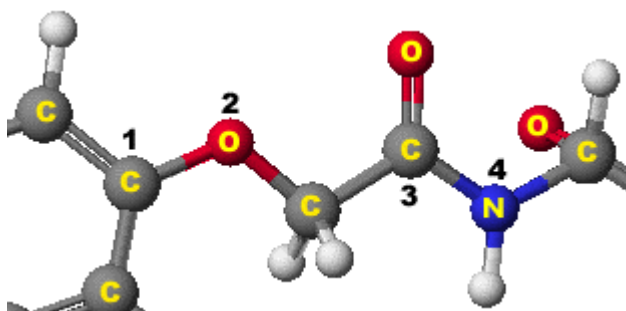


The geometry of PF_2Cl_3 is depicted on the left. Note that the Chlorine atoms occupy the trigonal planar portion of this geometry.

1. Why do you think this is?

2. What molecular property of this molecule would further verify the structure depicted?

Question 11
8 Points



What is the bond angle about the **numbered** atoms

1. _____
2. _____
3. _____
4. _____

Question 12
8 Points

Classify each of the following molecules as either **polar** or **non-polar**.

- | | | | |
|-----------------------------|-------|-------------------|-------|
| 1. CH_2Cl_2 | _____ | 3. I_3^- | _____ |
| 2. NH_3 | _____ | 4. N_2 | _____ |

Question 13
5 Points

Which of the following would you anticipate as being the **least soluble** in water.
[Circle your choice]

- | | |
|---------------------|----------------------|
| 1. Sodium nitrate | 3. Hydrochloric acid |
| 2. carbon disulfide | 4. Ammonia |

Briefly justify your choice.

Exam I ... Extra Credit Question

You must get all five absolutely correct to obtain the bonus 5 points

Fill in the name or the formula for the following ionic salts

- | | |
|------------------------------|-----------------------------|
| 1. Sodium hydrogen carbonate | _____ |
| 2. _____ | $\text{Fe}(\text{ClO}_2)_3$ |
| 3. Potassium dichromate | _____ |
| 4. _____ | $\text{Al}(\text{NO}_2)_3$ |
| 5. Sodium nitride | _____ |

Do Not Write Below This Line

Exam II Score