① Textbook Problems

DMA 1.12)

a) Nobel gases: group 18 ns^2np^6 (He $1s^2$)

b) Halogens: group 17 ns^2np^5

c) Coinage metals: group 11 $ns^1(n-1)d^{10}$ (Note exception to Aufbau)

d) Ti family: group 4 $ns^2(n-1)d^2$

e) N family: group 15 ns^2np^3

DMA 1.13)

Rb [Kr] $5s^1$
La [Xe] $6s^2 5d^1$
Cr [Ar] $4s^1 3d^5$ (exception)
Fe [Ar] $4s^2 3d^6$
Cu [Ar] $4s^1 3d^{10}$ (exception)
Tl [Xe] $6s^2 4f^{14} 5d^{10} 6p^1$
Po [Xe] $6s^2 4f^{14} 5d^{10} 6p^4$
Gd [Xe] $6s^2 5d^1 4f^7$ (exception)
Lu [Xe] $6s^2 5d^1 4f^{14}$ (exception)

DMA 1.14)

		Unpaired e^-			Unpaired e^-
K^+	[Ar]	0	Se^{2-}	$[Ar]4s^2 3d^{10}4p^6$	0
Ti^{3+}	$[Ar]3d^1$	1	Sn^{4+}	$[Kr]3d^{10}$	0
Cr^{3+}	$[Ar]3d^3$	3	Ce^{4+}	[Xe]	0
Fe^{2+}	$[Ar]3d^6$	4	Eu^{2+}	$[Xe]4f^7$	7
Cu^{2+}	$[Ar]3d^9$	1	Lu^{3+}	$[Xe]4f^{14}$	
Sb^{3+}	$[Kr]5s^2 4d^{10}$	0			

ns e⁻s always removed before (n-1)d or (n-2)f e⁻s

DMA 1.21)

		I_1/eV
Li	$z^* = 3 - 2(0.85) = 1.30$	5.392
Be	$z^* = 4 - [1(0.35) + 2(0.85)] = 1.95$	9.322
B	$z^* = 5 - [2(0.35) + 2(0.85)] = 2.60$	8.298
C	$z^* = 6 - [3(0.35) + 2(0.85)] = 3.25$	11.260
N	$z^* = 7 - [4(0.35) + 2(0.85)] = 3.90$	14.534
O	$z^* = 8 - [5(0.35) + 2(0.85)] = 4.55$	13.618
F	$z^* = 9 - [6(0.35 + 2(0.85)] = 5.20$	17.422
Ne	$z^* = 10 - [7(0.35) + 2(0.85)] = 5.85$	21.564

In general, I_1 increases w/ z^*. Exceptions occur upon going from B to Be and from N to O. The first exception is due to the 2p e^- in B being easier to remove than the 2s e^- of Be ($E_{2p} > E_{2s}$). The second occurs because we get back the coulombic repulsion energy when we oxidize O + the fact that N is very difficult to oxidize because π_c is maximized.

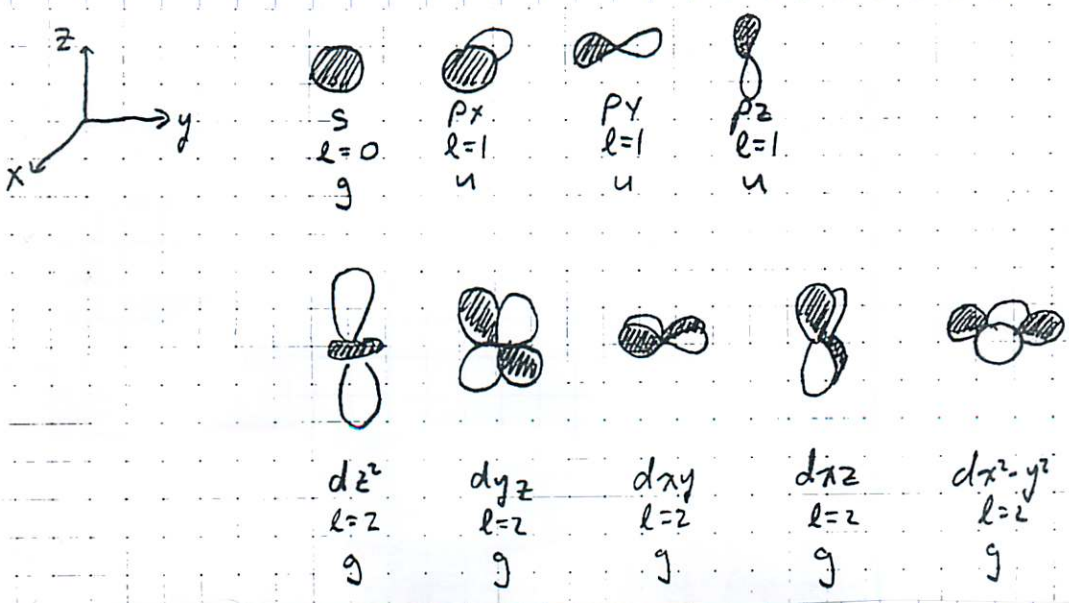
DMA 1.24)

Electron affinities of first row elements tend to be abnormally high but inspection of the following elements shows diverging trends:

	EA (ev)		EA (ev)	
P	0.746	S	2.07	All EAs are positive
As	0.81	Se	2.02	∴ all endothermic
Sb	1.07	Te	1.97	
Bi	0.946	Po	1.9	
	↓ Increasing		↓ decreasing	

In general EAs will decrease going down a group since it becomes less difficult to add an e^- as z^* increases. This case is attenuated for group 15 due to this config having maximal multiplicity.

(2)



(3)

a) $Sc = [Ar]\,4s^2\,3d^1$ $S=2$

b) $Os = [Xe]\,6s^2\,4f^{14}\,5d^6$ $S=5$

c) $Cd = [Kr]\,5s^2\,4d^{10}$ $S=0$

d) $Cl = [Ne]\,3s^2\,3p^5$ $S=2$

e) $Tc^+ = [Kr]\,5s^1\,3d^5$ $S=7$

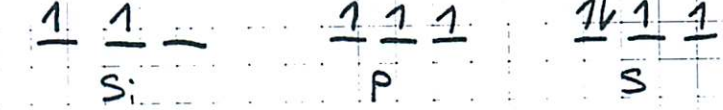
f) Fe^{2+} $[Ar]\,4s^1\,3d^5$ $S=7$

(4)

$Si = [Ne]\,3s^2\,3p^2$

$P = [Ne]\,3s^2\,3p^3$

$S = [Ne]\,3s^2\,3p^4$



- P should have a low EA since it has maximized π_e stabilization.
- Si will have a high EA since placement of an additional e^- in the d-manifold will produce a very stable p^3 config in which π_e is maximized. ∴ Si has a higher EA than P even though it has a lower Z^*
- Addition of a fifth e^- into the d-manifold of S will not significantly effect on π_e but will introduce an additional π_e term. Since it has a larger Z^* than P + addition of an e^- does not significantly lower π_e, S will have a higher EA than P.

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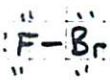
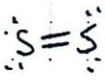
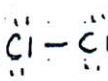
a) 

b 

c) 

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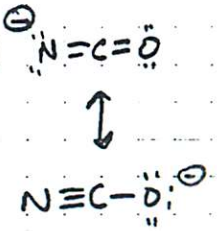
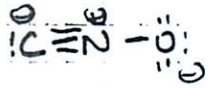
e) 

f) 

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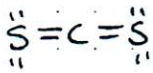
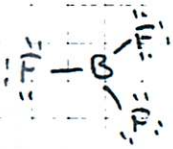
h) 

i) 

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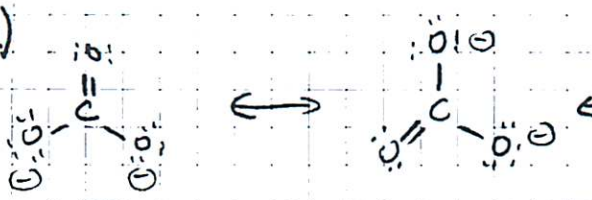
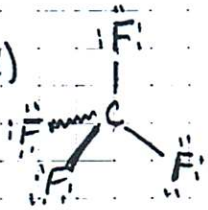
k) 

l) 

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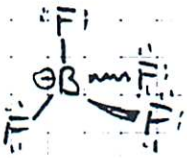
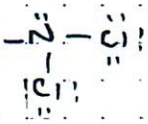
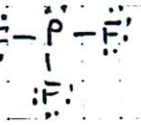
n) 

o) 

p) 

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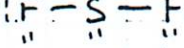
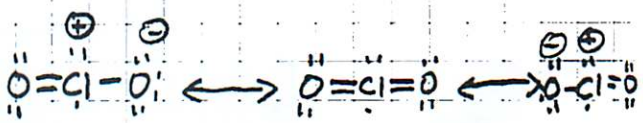
r) 

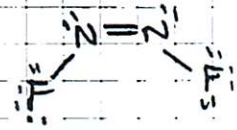
s) 

t) 

u) 

v) 

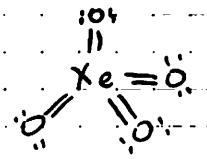
w) 

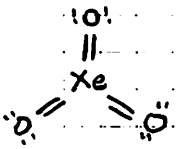
x) 

y) 

z) 

⑥

a) 

b) 

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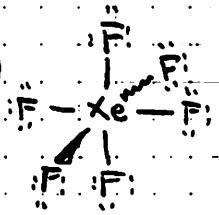
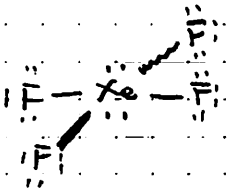
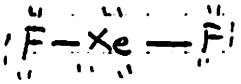
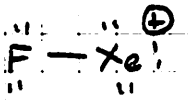
d) 

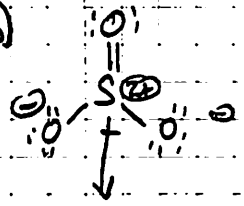
e) 

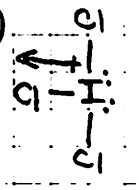
f) 

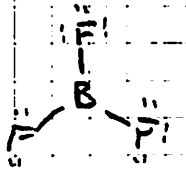
g) 

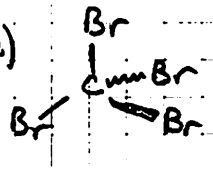
⑦

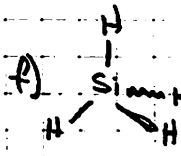
a) S=C=S linear, no net dipole

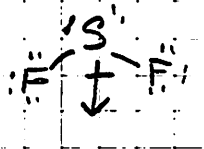
b) 
trigonal planar

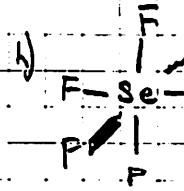
c) 
T-Shaped

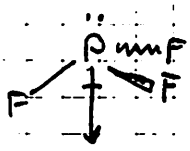
d) 
trigonal planar, no net dipole

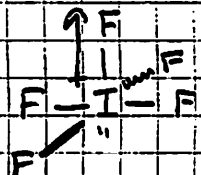
e) 
tetrahedral, no net dipole

f) 
tetrahedral
no net dipole

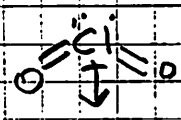
g) 
Bent

h) 
octahedral
no net dipole

i) 
trigonal

j) 

Square pyramidal

k) 

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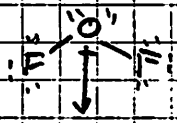
l) 

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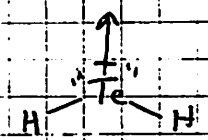
m) 

Bent