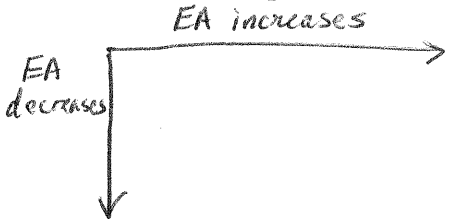
1) (4 points) Elements have a property known as *electron affinity* (EA). EA measures a neutral element's ability to grab one electron to become an anion, $X_{(g)} + e^- \text{ ------> } X^-_{(g)}$.

While we have not studied this property, you should be able to predict the periodic trend for EA going <u>left to right across a period</u> and <u>top to bottom in a group</u>.

Make your trend predictions in both directions and briefly explain them.



As with any periodic trend, moving left to right across a period results in an ever greater pull on an atom's electrons by the protons in the nucleus. Since the effective nuclear charge increases L to R it makes sense that an atom's ability to hold on to 1 extra e⁻ also increases L to R.

Top to bottom movement in a group has the outermost e⁻s farther from the nucleus of an atom in higher energy levels. Increasing energy, greater distance from nucleus, leads to atoms T to B being less likely to attract 1 more e⁻.

2) (2 points) Circle the appropriate atom or ion that

a) has the greatest electronegativity (EN)	Li	Rb	(O)	Bi
b) has the highest ionization energy (IE)	(Mg)	Ba	Ca	Fr
c) is the most metallic	Sn	C	Si	(Pb)
d) has the smallest atomic radius	P^{3-}	P	(P^+)	P^-

3) (3 points) A monoatomic ion with a 2- charge has a ground state electron configuration

$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6$ 36 e⁻, 34 e⁻ + 2 e⁻

a) Write the symbol of the <u>neutral noble gas atom</u> having the same configuration? Kr

b) Write the symbol of the <u>monoatomic ion with a 2- charge</u> that has this configuration? Se^{2-}

c) Write the symbol of <u>an ion with a 1+ charge</u> that is *isoelectronic* with the species in (a) and (b). Rb^+

4) (4 points) Complete the electron configuration table.

Atom or Ion	Ground-state Electron Configuration (long form)	# of valence electrons
Ca^{2+}	$1s^2 2s^2 2p^6 3s^2 3p^6$	8
Cl	$1s^2 2s^2 2p^6 3s^2 3p^5$	7

5) (4 points) Element 118 (ununoctium) can be produced by colliding californium-249 and calcium-48. The actual isotope of element 118 is ununoctium-294. This isotope decays in 1.29 msec.

a) How many neutrons are in an atom of ununoctium-294. $294 - 118 = 176$

b) Write the short form ground state electron configuration for element 118

$[Rn]\ 7s^2\ 5f^{14}\ 6d^{10}\ 7p^6$

c) In what chemical family would element 118 belong? Noble Gases, Group VIII A, Group 18

d) State one possible physical property and one possible chemical property for element 118.

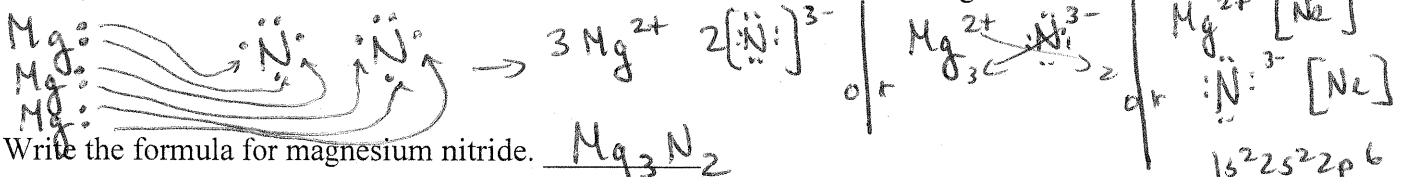
Gas Unreactive

6) (5 points) Magnesium reacts with nitrogen to produce magnesium nitride.

a) What type of compound is magnesium nitride? Ionic

b) Write the Lewis Dot symbols for a magnesium atom and a nitrogen atom. Mg: :N:

c) Clearly indicate that each element achieves an octet in the formation of magnesium nitride.



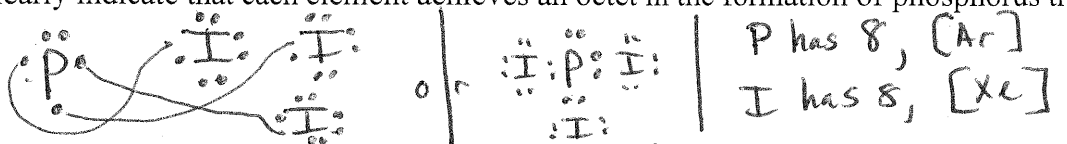
d) Write the formula for magnesium nitride. Mg_3N_2

7) (5 points) Phosphorus and iodine react to produce phosphorus triiodide. The electronegativities of P and I are 2.1 and 2.5, respectively.

a) What type of compound is phosphorus triiodide? Covalent

b) Write the Lewis Dot symbols for a phosphorus atom and an iodine atom. :P: :I:

c) Clearly indicate that each element achieves an octet in the formation of phosphorus triiodide.



d) Write the formula for phosphorus triiodide. PI_3

e) Is the bond between phosphorus and iodine ionic, polar covalent, or non-polar covalent? polar covalent

Use the given electronegativities to support your answer.

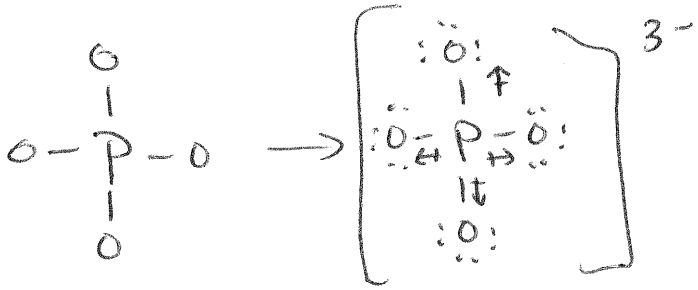
P — I
2.1 2.5

P → I

8) (3 points) Draw the Lewis Dot structure for PO_4^{3-}. Show all lone pairs and bond pairs. Show bond dipole moments on each bond.

PO_4^{3-}

$5 + 4(6) + 3 = 32$



9) (2 points) TRUE or FALSE

a) A covalent bond likely forms when Se and Sr react. F

b) C^{2-} is *isoelectronic* with O. T

c) The ionization energy of Mg^{+} is less than that of Mg. F

d) A bond can be defined as a net attractive force between particles. T

e) OF_2 and $SeBr_2$ have similar Lewis Dot structures T

f) Non-metals conduct electricity. F

g) The quantum mechanical model of the atom includes <u>all</u> of the Bohr model. F

h) The bond between As and N is polar covalent. T

Extra Credit (4 points)

Why can't a metallic bond be described as purely ionic or purely covalent?

Your answer must include a discussion of the octet rule and the physical properties of metallic, ionic, and covalent compounds.

Both ionic + covalent bonds are localized bonds in the Lewis Dot formalism. Localized models cannot explain the movement of e⁻s as current or heat flow in metals.

Attempts to describe the bonding between two metal atoms as ionic or covalent fail:

ionic: Li· + Li· $\xrightarrow{e^- \text{ transfer}}$ $Li^{\oplus}$ + $Li:^{\ominus}$

[He] [He] $2s^2$

violates duet rule

2nd energy level still unfilled

covalent: Li:Li → both Li have [He] $2s^2$