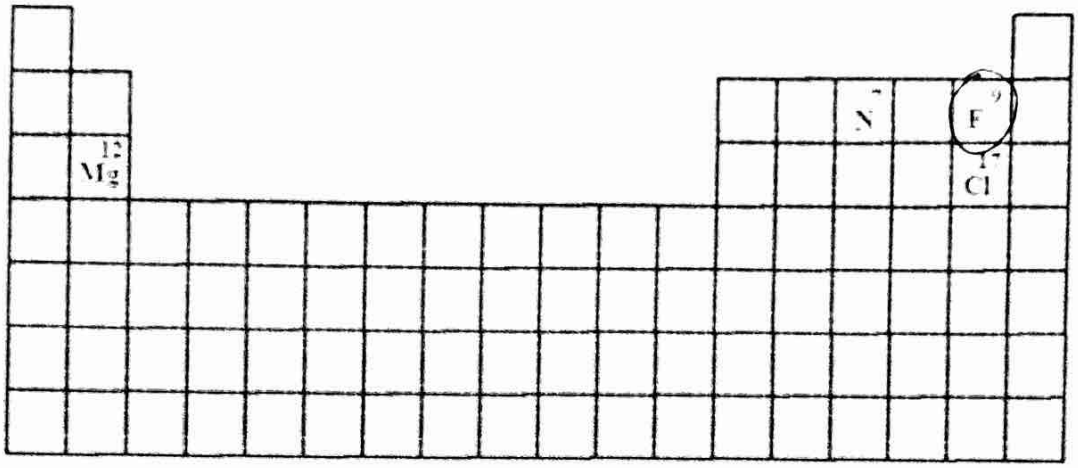
Name: KEY Per___

Chemistry HP Final Exam Review Problem

For the problems below, consider atoms of the following elements:



(1) Give the orbital notation for Nitrogen (N). $\frac{\uparrow\downarrow}{1s}$ $\frac{\uparrow\downarrow}{2s}$ $\frac{\uparrow\ \uparrow\ \uparrow}{2p}$ +1

(2) Give the electron configuration notation for Chlorine (Cl) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$ +1

(3) Give the noble gas notation for Magnesium (Mg). $[Ne]\ 3s^2$ +1

(4) Give the number of neutrons present in the isotope Fluorine-18 (F-18). 18 - 9 = 9 neutrons +1

(5) Match each element with the correct atomic radius. Explain your reasoning.

Element	Atomic Radius ($x10^{-12}$ m)
(a) Fluorine	(i) 64
(b) Magnesium	(ii) 99
(c) Chlorine	(iii) 160

+1

→ Fluorine has smallest because it has the least # of orbitals and greatest pull on electrons. +1

→ Cl and Mg are in same row, but Cl has smaller atomic radius b/c bigger pull on electrons

(6) The ionization energy for chlorine is 1255 kJ/mol. Would the ionization energy for fluorine be expected to be *greater than* or *less than* this value? Explain.

Fluorine would have a greater IE because it has a greater pull on the electrons and therefore would be more difficult to remove. +2

(7) Which of the atoms, nitrogen or fluorine, would have a higher electronegativity? Explain.

F has higher electronegativity - has greatest affinity, for electrons only needs one more +2

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(8) Which of the following correctly compares the sizes of the neutral atoms magnesium (Mg) and nitrogen (N) to their ions (Mg^{2+} and N^{3-})?

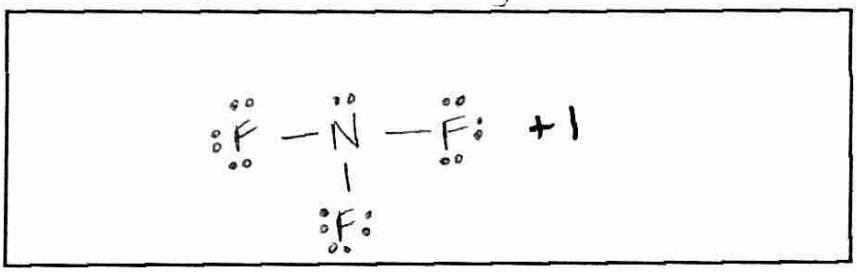
(a) N is larger than N^{3-} and Mg is larger than Mg^{2+}
(b) N^{3-} is larger than N and Mg^{2+} is larger than Mg
(c) N^{3-} is larger than N and Mg is larger than Mg^{2+}
(d) N is larger than N^{3-} and Mg^{2+} is larger than Mg

anion > neutral atom
cation < neutral atom
+1

(9) Consider the elements nitrogen and fluorine.

(i) Determine the number of atoms of each element needed to form a **covalent** bond. Draw the Lewis structures for this compound. Write the formula for the compound that forms and name the compound.

formula: NF_3 +1 name: nitrogen trifluoride +1



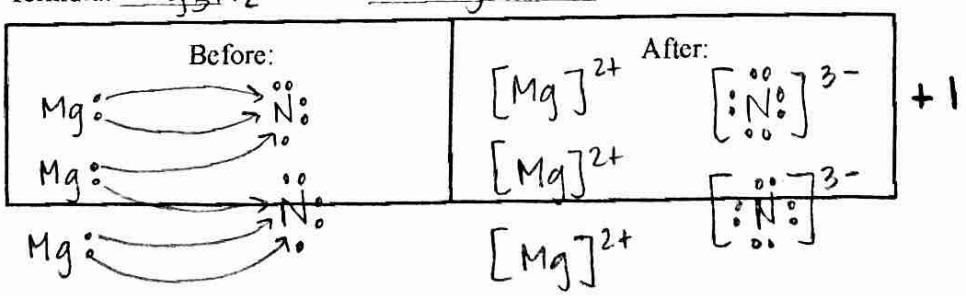
(ii) Classify the VSEPR Shape of this molecule: trigonal pyrimidal +1

(iii) Would the molecule be polar or non-polar? POLAR +1

(10) Consider the elements magnesium and nitrogen.

(i) Determine the number of atoms of each element needed to form an **ionic** bond. Draw the Lewis structures for each atom before the bond forms and after the bond forms. Use arrows to show the movement of electrons and indicate the charge of each ion. Write the formula for the compound that forms and name the compound.

formula: Mg_3N_2 +1 name: magnesium nitride +1



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(ii) The above compound is formed when magnesium metal is combined with nitrogen gas. Write a balanced chemical equation for the reaction that occurs to form the compound.

+1 $3\,Mg + \_\_\,N_2 \longrightarrow \_\_\,Mg_3N_2$ SYNTHESIS

(iii) A reaction is carried out in which 14.6 g of magnesium metal are combined with 9.50 g of nitrogen gas. The actual mass of the product obtained is 18.4 g, what is the percent yield for the reaction?

$$14.6\text{ g Mg} \times \frac{1\text{ mol Mg}}{24.31\text{ g Mg}} \times \frac{1\text{ mol } Mg_3N_2}{3\text{ mol Mg}} \times \frac{100.93\text{ g } Mg_3N_2}{1\text{ mol } Mg_3N_2} = 20.2\text{ g } Mg_3N_2$$ +1

$$9.50\text{ g } N_2 \times \frac{1\text{ mol } N_2}{28.02\text{ g } N_2} \times \frac{1\text{ mol } Mg_3N_2}{1\text{ mol } N_2} \times \frac{100.93\text{ g } Mg_3N_2}{1\text{ mol } Mg_3N_2} = 34.2\text{ g } Mg_3N_2$$

Mg = Limiting Reactant

N_2 = excess

$$\%\text{ yield} = \frac{\text{actual}}{\text{theoretical}}$$

$$= \frac{18.4\text{g}}{20.2\text{g}} \times 100$$

$$= 91\%\text{ yield}$$ +1