Name KEY1

Chemistry 11 - Atomic Theory, Periodic Table, and Bonding Theory Review

1. Give the number of protons, neutrons and electrons in the following:

Isotope	*Protons*	*Neutrons*	*Electrons*
$^{177}Hf^{3+}$	72	105	69
$^{209}Po^{2+}$	84	125	82
$^{212}At^{-}$	85	127	86

2. Give the nuclear notation of the following:

Isotope	*Protons*	*Neutrons*	*Electrons*
$^{96}_{42}Mo^{5+}$	42	54	39
$^{74}_{32}Ge$	32	42	32
$^{265}_{108}Hs^{3+}$	108	157	105

3. What is the name of the element, X, which has the following mixture of isotopes:
$^{192}X = 35.5\%$, $^{194}X = 34.9\%$, $^{198}X = 20.3\%$, $^{209}X = 9.3\%$

At. Mass = $(0.355)(192) + (0.349)(194) + (0.203)(198) + (0.093)(209)$
$= 195.50\ g/mol$ – Pt

4. Each single orbital can hold a maximum of 2 electrons.

5. An "s" subshell (1 orbital) can hold a maximum of 2 electrons
A "p" subshell (3 orbitals) can hold a maximum of 6 electrons
A "d" subshell (5 orbitals) can hold a maximum of 10 electrons
An "f" subshell (7 orbitals) can hold a maximum of 14 electrons

When electrons in an atom are filling energy levels, they fill the lowest possible energy levels first.

6. Give the electron configuration for each of the following atoms and ions: (You may use core notation)

Si	$[Ne]3s^2 3p^2$	Cr	$[Ar]4s^1 3d^5$
Br	$[Ar]4s^2 3d^{10} 4p^5$	Sr	$[Kr]5s^2$
K	$[Ar]4s^1$	Fe	$[Ar]4s^2 3d^6$
Ge	$[Ar]4s^2 3d^{10} 4p^2$	P	$[Ne]3s^2 3p^3$
Na^+	$[He]2s^2 2p^6$	Mg^{+2}	$[He]2s^2 2p^6$
Br^-	$[Ar]4s^2 3d^{10} 4p^6$	As^{-2}	$[Ar]4s^2 3d^{10} p^6$
O^{-2}	$[He]2s^2 2p^6$	Te^{-2}	$[Kr]5s^2 4d^{10} 5p^6$

7. Write the configuration and then find the number of valence electrons for the following atoms:

N (configuration) $[He]2s^2 2p^3$ (# of valence e⁻'s) 5

Si (configuration) $[Ne]3s^2 3p^2$ (# of valence e⁻'s) 4

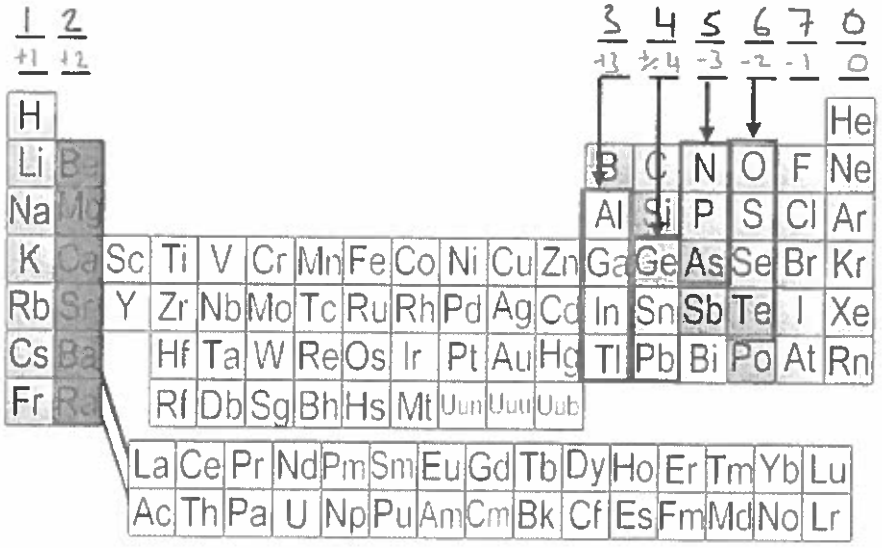
Ca (configuration) $[Ar]4s^2$ (# of valence e⁻'s) 2

P (configuration) $[Ne]3s^2 3p^3$ (# of valence e⁻'s) 5

Al (configuration) $[Ne]3s^2 3p^1$ (# of valence e⁻'s) 3

On the following diagram of the Periodic Table, list the number of valence electrons and the most common ion charge in Groups 1,2 & 13-18

# of Valence e⁻s
Ion Charge



8. In order to become stable,

an atom of Ca will donate 2 electrons and become the ion Ca^{2+}

an atom of Se will gain 2 electrons and become the ion Se^{2-}

an atom of K will donate 1 electrons and become the ion K^{+}

an atom of Br will gain 1 electrons and become the ion Br^{-}

an atom of N will gain 3 electrons and become the ion N^{3-}

an atom of As will gain 3 electrons and become the ion As^{3-}

an atom of Al will donate 3 electrons and become the ion Al^{3+}

an atom of Te will gain 2 electrons and become the ion Te^{2+}

9. What is the general trend in atomic radius (size of atoms) as you move from left to right across any Period? (*increase/decrease*) decrease

10. As you move from Li to Ne, electrons are filling (*the same/different*) Same energy levels(s). This may help explain why atoms *don't* get bigger as you move to the right within a period.
↑ protons while NO increase in shielding (no more core electrons)

11. As you move across from Li to Ne, what is happening to the number of *protons* in the nucleus? increases. What do the protons do to the electrons? attracted. Suggest a reason why the atoms in a period actually get *smaller* as you move from left to right.

12. What is the general trend in atomic radius (size of atoms) as you move *down* a vertical column (group)? (*increase/decrease*) Increase

13. Suggest a reason for this trend. (*Hint: are electrons filling up the same energy level (orbitals) as you move down a column?*) No! Every new row means +1 energy level!

14. What is meant by **ionization energy?**
The amount of E required to remove an e⁻ from the outter most shell

15. What is the general trend in first ionization energy as you move from left to right across any Period? (eg. from Li→Ne or from Na→Ar) (*increase/decrease*) increase

16. Keeping in mind the trend in atomic radius as you move from left to right across a period, suggest a reason for this trend in ionization energies. (Hint: *What happens to the distance and the force of attraction between the nucleus and the outer electron as atoms get smaller?*)
↑ protons increase attraktive force ∴ harder to remove e⁻

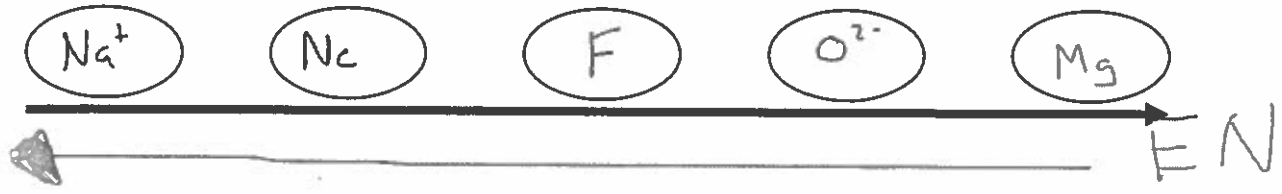
17. What is the trend in ionization energy as you move down a vertical column, like from Li→Na→K or from He→Ne→Ar→Kr? (*increase/decrease*) decrease

Suggest a reason for this trend based on atomic radius (size) and the distance and force of attraction between the nucleus and the outer electron.
while attrack increases so does shielding + distance
overall attraktive force goes ↓

18. Compare the following particles:

sodium ion	oxide	neon	Magnesium atom	Fluorine atom

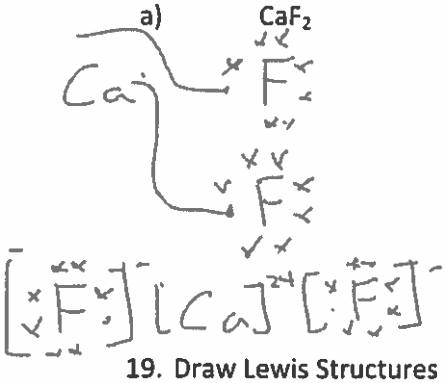
a. Arrange the particles using **chemical formulas** from **smallest atomic radii** to **largest atomic radii:**



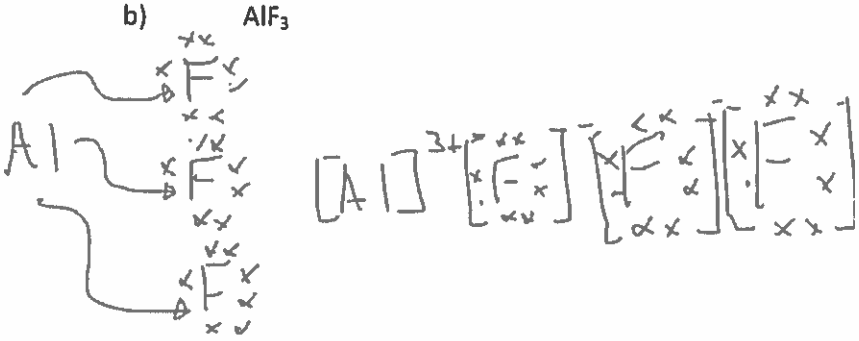
b. On your answer above, using **arrows** show the trend of **electronegativity, ionization energy** and **electron affinity.**

Draw Lewis Structures (Electron-dot diagrams) for the following ionic compounds:

a) CaF_2



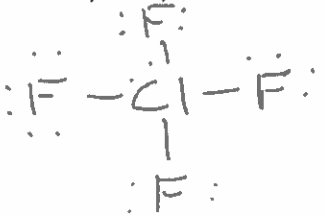
b) AlF_3



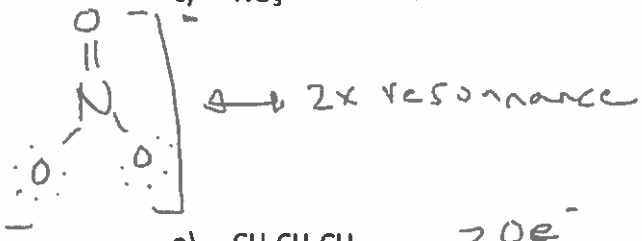
19. Draw Lewis Structures (Electron-dot diagrams) for the following covalent compounds.

a) NH_3 8e⁻

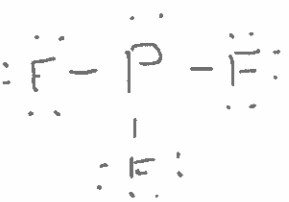
b) ClF_4^+ 34e⁻



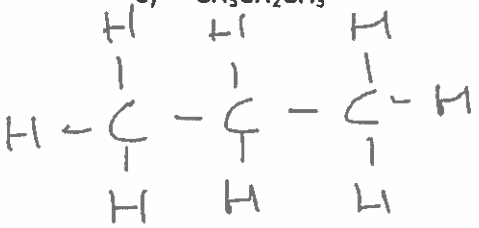
c) NO_3^- 24e⁻



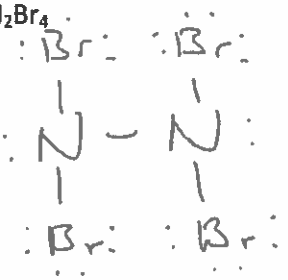
d) PF_3 26e⁻



e) $CH_3CH_2CH_3$ 20e⁻

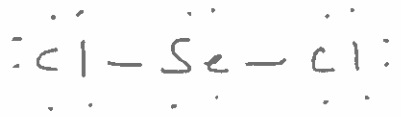


f) N_2Br_4 38e⁻

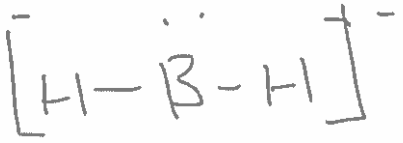


g) H_2S 8e⁻

h) $SeCl_2$ 20e⁻



i) BH_2^- 8e⁻



j) SF_5^- 42e⁻