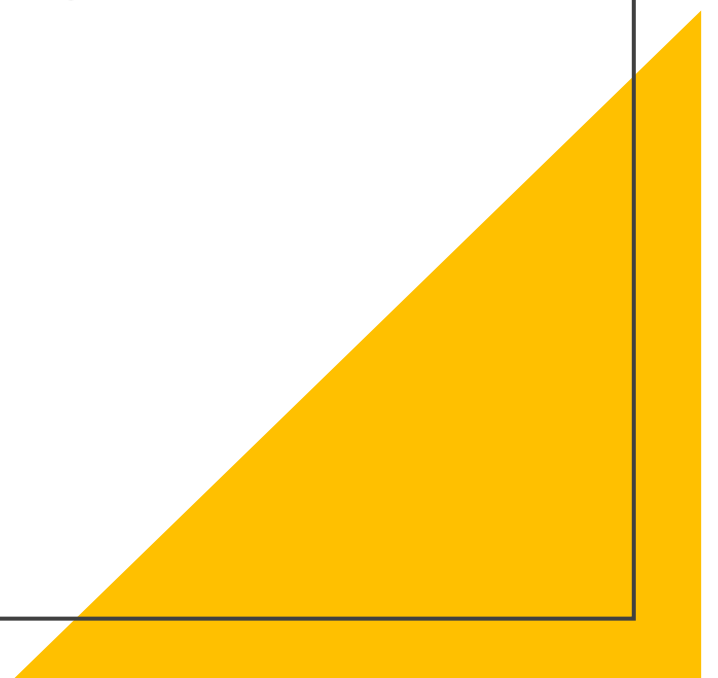


Periodic Properties of Atoms

Chapter 9



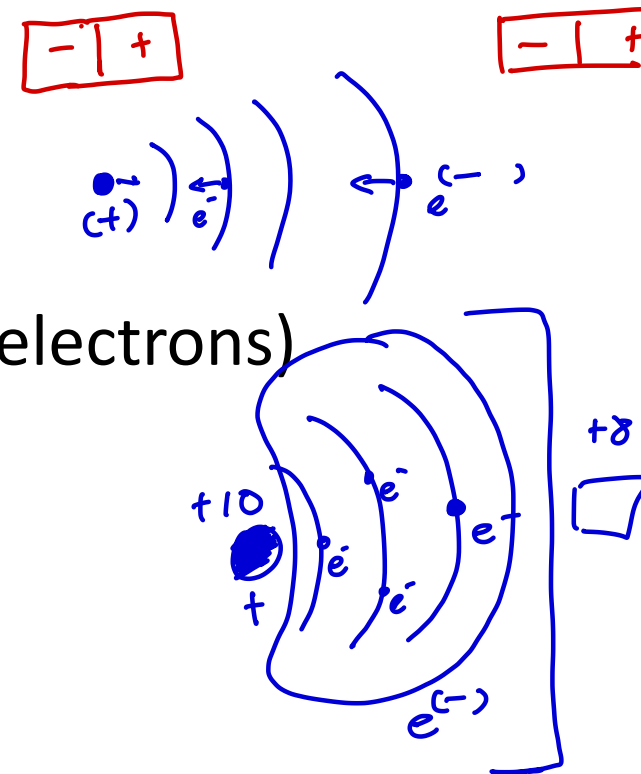
Effective Nuclear Charge (Z_{eff})

- Effective nuclear charge is the “positive charge” felt by valence electrons

$$Z_{\text{eff}} = Z - \sigma$$

Z is the actual nuclear charge

σ is the shielding constant (repulsive effect of other electrons)



Ionic Size

- Cation is always smaller than atom from which it formed.
- Anion is always larger than atom from which it is formed

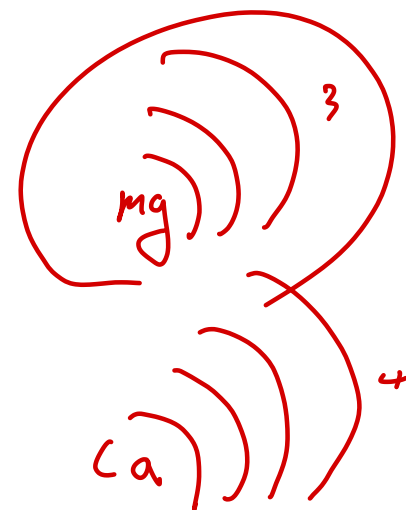
For each of the following pairs, indicate which one of the two species is larger

- N^{3-} or F^-
- Mg^{2+} or Ca^{2+}
- Fe^{2+} or Fe^{3+}

	P	e
Fe^{2+}	26	(24)
Fe^{3+}	26	(23)

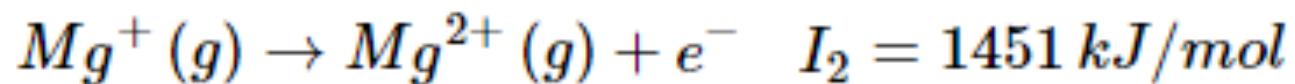
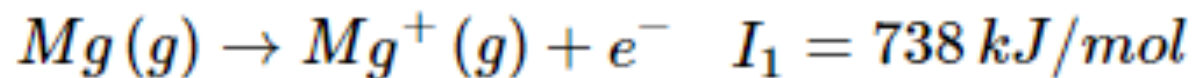
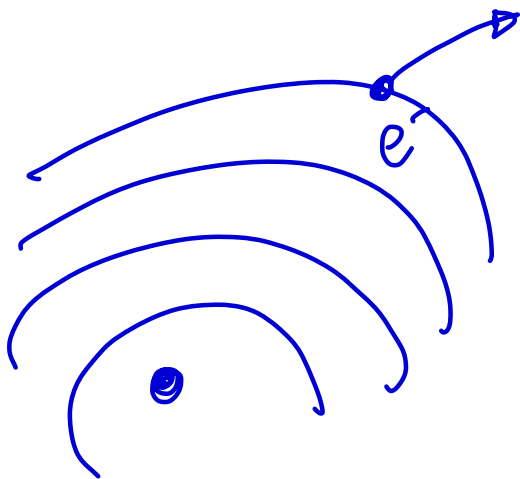
Bigger.

	P ⁺	e ⁻
N^{3-}	7	10
F^-	9	10



Ionization energy

- Maximum energy (KJ/mol) required to remove an electron from a gaseous atom in its ground state. *+ from the most outer energy level.*
- You can remove one electron at a time
- Each succeeding ionization energy is larger than the preceding energy

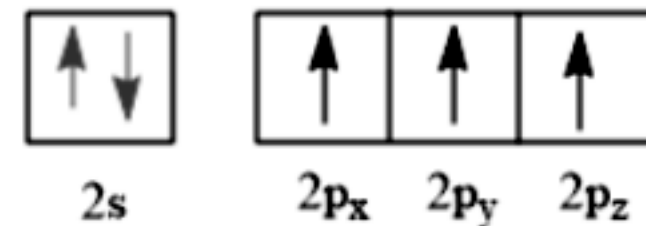


Exception in Ionization Energy Trend

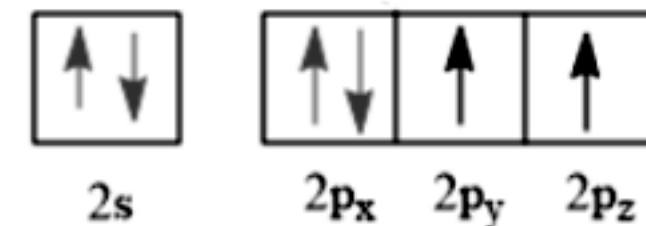
P orbital is stable when it is half-filled or fully filled. P orbital in Nitrogen is already at the stable state. So removing an electron from there is difficult (takes more energy).

However, P orbital in Oxygen has one extra from the stable state. So removing an electron actually helps it to go back to the stable state. So it is easier (takes less energy)

Nitrogen
 $2s^2 2p^3$

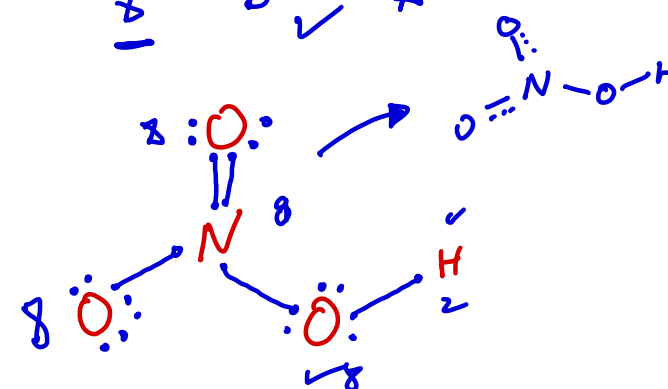
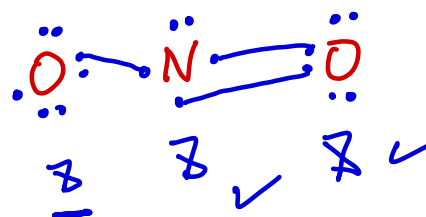
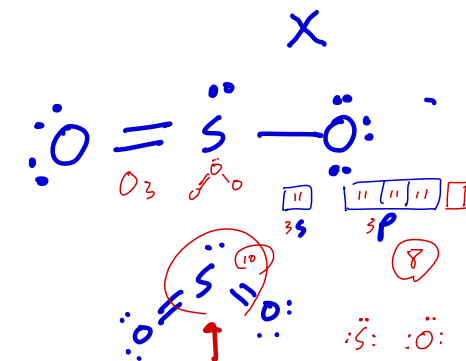
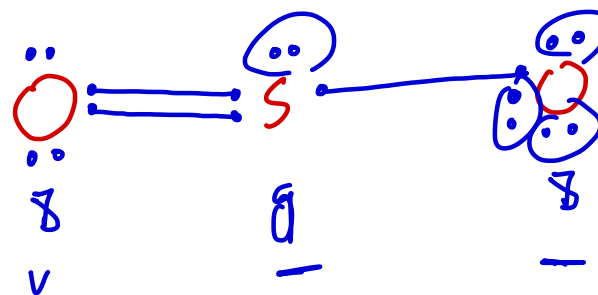
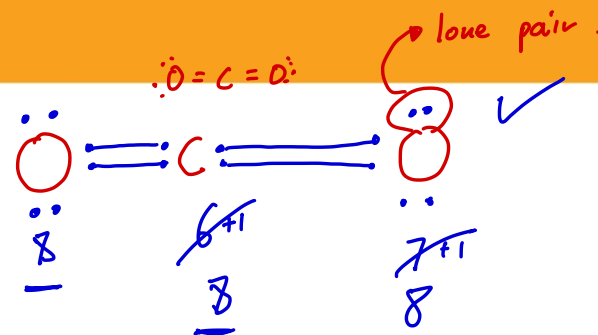
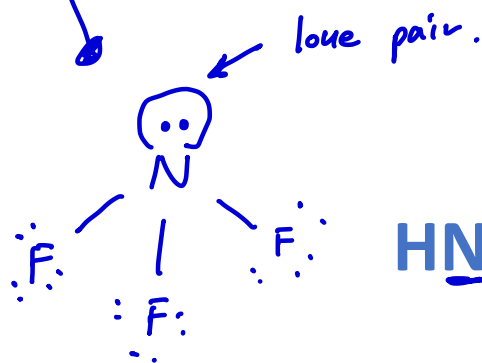
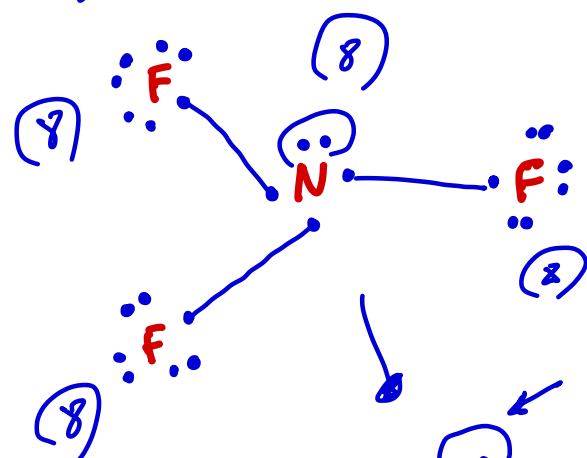
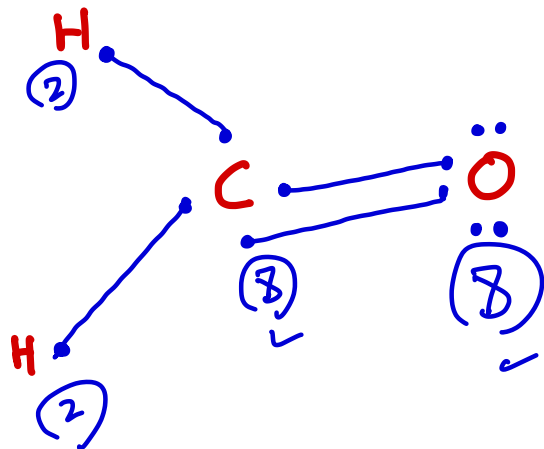


Oxygen
 $2s^2 2p^4$



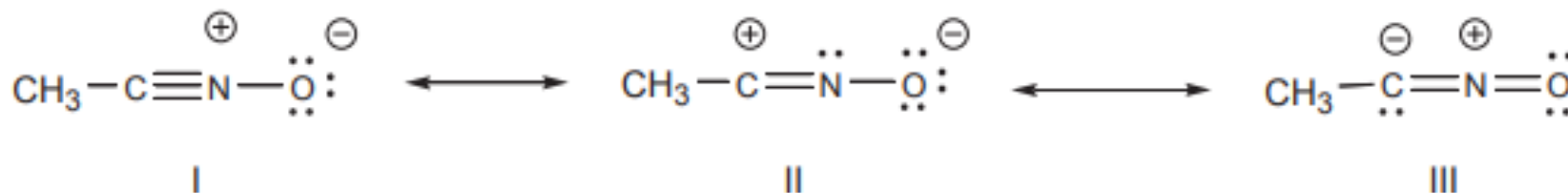
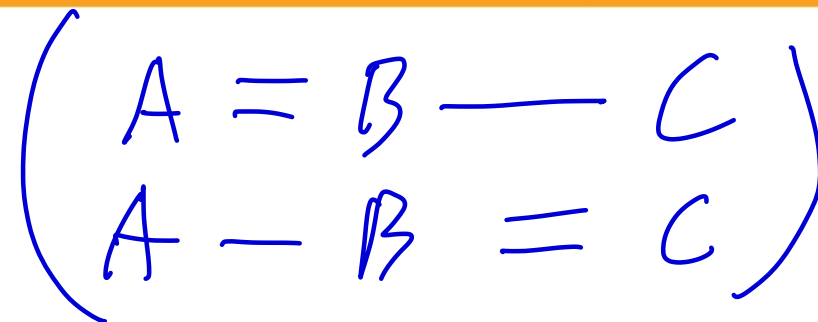
Steps for Writing Lewis Structures

1. Write an atomic skeleton.
2. Place all the valence electrons
3. Connect two electrons to make a single bond
4. Check by the octet rule—if it doesn't satisfy it, try double bond or transfer e-
 - Octet Rule – having 8 electrons per element



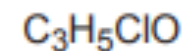
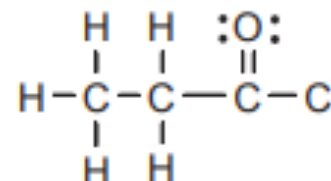
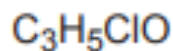
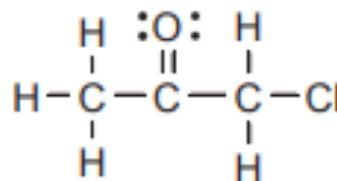
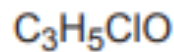
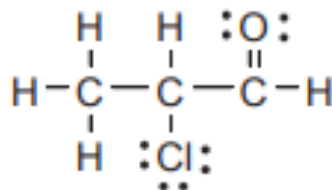
Resonance

- Same formula, different e- location



Isomers

- Same formula, different atom location



Which of the following has resonance? For those that do, how many resonance structures do they have?

