(5) **Today**

2.2.4 Shielding

2.3 Periodic Properties

Next Class (6)

2.3 Periodic Properties

3.1.1 Resonance and 3.1.3 Formal Charge

3.1.2 Expanded Octets

3.1.4 Failure of Lewis Structures to Predict Unusual Cases

(7) **Second Class from Today**

3.2 VSEPR

Third Class from Today (8)

3.2 VSEPR

Slater's Rules for Approximating Effective Nuclear Charge

$$Z_{eff} = Z - S$$

Where Z_{eff} = effective nuclear charge, Z = nuclear charge, and S = shielding constant

1. group orbitals by n and l
   (1s) (2s,2p) (3s,3p) (3d) (4s, 4p) (4d) (4f) (5s, 5p) (5d) (etc)
2. electrons in groups to the right do not shield electrons to their left
3. S can be determined for *ns* and *np* electrons
   a. each electron in the same group contributes 0.35 to the value of S for other electrons in the same group
      exception, 1s electron contributes 0.30
   b. each electron in n - 1 groups contribute 0.85 to S
   c. each electron in n - 2 groups contribute 1.00 to S
4. for *nd* and *nf*
   a. each electron in the same group contributes 0.35 to the value of S (same as 3a)
   b. each electron in a group to the left contributes 1.00 to S

s+p

d+f

e⁻ in the same shell

e⁻'s 1 shell closer to nucleus

e⁻'s 2 or more shells closer the nucleus

H	He	F
$1s^1$ the 1s e⁻ experiences a $Z_{eff} = 1$ e⁻'s don't shield themselves	$1s^2$ $S = 1 \cdot 0.3 = 0.3$ $Z_{eff} = 2 - 0.3 = 1.7$ 1e⁻ shields the other e⁻	$1s^2\ 2s^2 2p^5$ 1s e⁻'s experience... $S = 1 \cdot 0.3 = 0.3$ $Z_{eff} = 9 - 0.3 = 8.7$ 2s+2p $S = 6 \cdot 0.35 + 2 \cdot 0.85$ 2.1 1.7 = 3.8 $Z_{eff} = 9 - 3.8 = 5.2$

$1s^2\ 2s^2 2p^6\ 3s^2 3p^6\ 3d^6\ 4s^2$

Slater's Rules for Determining Effective Nuclear Charge

$$Z_{eff} = Z - S$$

Where Z_{eff} = effective nuclear charge, Z = nuclear charge, and S = shielding constant

1. group orbitals by n and l
   (1s) (2s,2p) (3s,3p) (3d) (4s, 4p) (4d) (4f) (5s, 5p) (5d) (etc)
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4. for *nd* and *nf*
   a. each electron in the same group contributes 0.35 to the value of S (same as 3a)
   b. each electron in a group to the left contributes 1.00 to S

Z_{eff} for Fe's 4s e^-'s .... contribution 4s e^-'s, 3d, 3s3p, 2s2p, 1s

$S = 1 \cdot 0.35 + 6 \cdot 0.85 + 8 \cdot 0.85 + 8 \cdot 1 + 2 \cdot 1 = 22.25$

$Z_{eff} = 26 - 22.25 = 3.75$

Z_{eff} for Fe's 3d e^-'s contribute 3d, 3s3p, 2s2p, 1s

$S = 5 \cdot 0.35 + 8 \cdot 1 + 8 \cdot 1 + 2 \cdot 1 = 18 + 1.75 = 6.25$

3d 3s3p 2s2p 1s

$H \longrightarrow H^+ + e^-$

From left to right ionization E increases Z_{eff} increases ... more E needed to remove e^-

From top to bottom as distance from the nucleus increases it becomes easier to remove e^-'s