

Coulomb's Law

$$F = \frac{k Q_1 Q_2}{r^2}$$

charge magnitude
distance

Shielding effect

the inner (core) e⁻'s shield the outer e⁻'s from feeling the entire (+) nuclear charge

trend: increases $\rightarrow R$

EFFECTIVE NUCLEAR CHARGE

Z_{eff} the charge experienced by the e⁻

trend: increasing $L \rightarrow R$ (but not as fast as Z)

$Z_{eff} = Z - \#e^-$ in lower E orbitals

Al: $13 - 12 = +1$ $3p^1$

Cl: $17 - 12 = +5$ $3p^5$

Na	Mg	Al	S	P	S	Cl	Ar
+1	+2	+1	+2	+3	+4	+5	+6
metals				nonmetals			

PERIODIC TRENDS

① ATOMIC RADIUS

bond length / 2 identical atoms

top atoms grow larger
↓
bottom "increasing n"

left \rightarrow right atoms get smaller

increasing Z , Z_{eff}

NO SHIELDING WITHIN AN ORBITAL SET

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PERIODIC TRENDS

① ATOMIC RADIUS

$\frac{\text{bond length}}{2}$ identical atoms

top atoms grow larger
↓
bottom "increasing n"

left → right atoms get smaller

increasing Z, Z_{eff}

NO SHIELDING WITHIN AN ORBITAL SET

② IONIC RADIUS

ANIONS (-) → Larger than the atom they were formed from

Same p^+ , more e^-
ratio $p^+ : e^- \downarrow$ Increased e^-/e^- repulsion

CATIONS (+) → Smaller than the atom they were formed from

ratio $p^+ : e^- \uparrow$
 $Na^+ \quad Mg^{2+} \quad Al^{3+}$ isoelectronic w/ Ne