N20 – Energy of Bonding
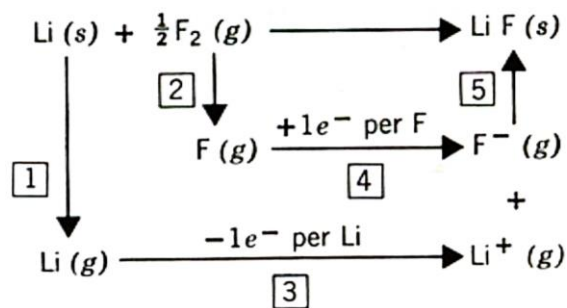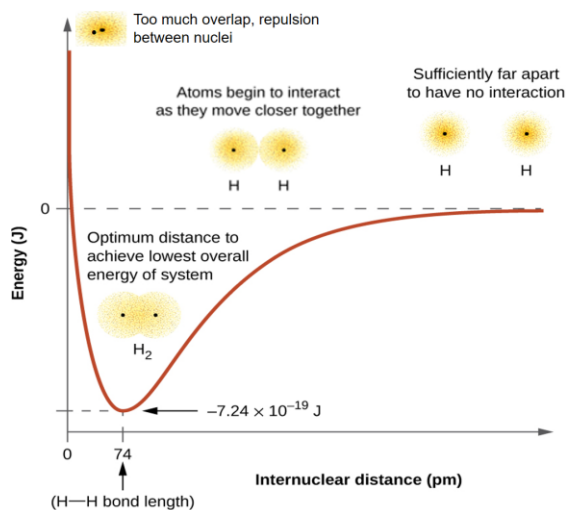
Example: Steps for Forming LiF

1) **Turn solid Li into a gas**
   - Sublimation
2) **Break the $F_{2\,(g)}$ bond to get $F_{(g)}$**
   - Bond energy
3) **Ionize Li → Li⁺**
   - Ionization energy
4) **Add an electron to F → F⁻**
   - Electron affinity
5) **Form the ionic bond**
   - Lattice energy
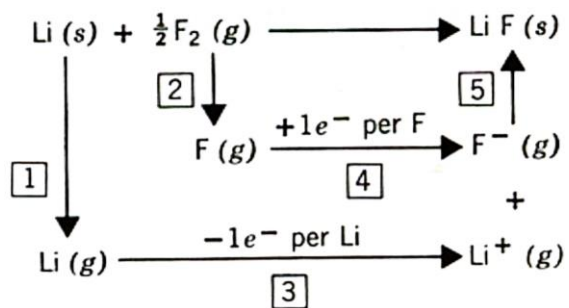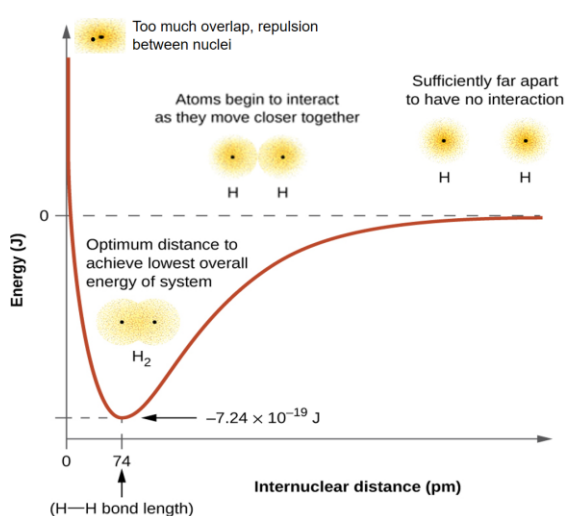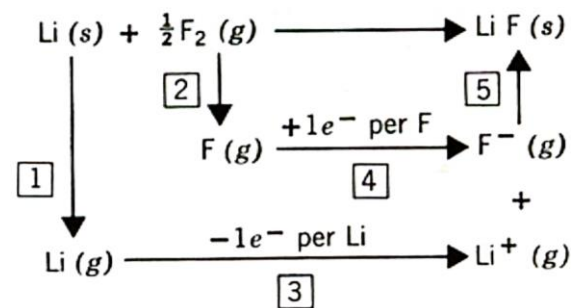
Pretend there are a mole of each element here ☺

$$Li\,(s) + \tfrac{1}{2} F_2\,(g) \longrightarrow LiF\,(s)$$

[2] ↓ [5] ↑

$$F\,(g) \xrightarrow{+1e^- \text{ per } F} F^-\,(g)$$

[4] +

[1] ↓

$$Li\,(g) \xrightarrow{-1e^- \text{ per } Li} Li^+\,(g)$$

[3]

$Na(s) + ½\ Cl_2(g) \rightarrow NaCl(s)$

Lattice Energy	-786 kJ/mol
Ionization Energy for Na	495 kJ/mol
Electron Affinity for Cl	-349 kJ/mol
Bond energy of Cl_2	239 kJ/mol
Enthalpy of sublimation for Na	109 kJ/mol

Too much overlap, repulsion between nuclei

Atoms begin to interact as they move closer together

Sufficiently far apart to have no interaction

H   H   H   H

0

Optimum distance to achieve lowest overall energy of system

H_2

-7.24×10^{-19} J

Energy (J)

0   74

(H—H bond length)

Internuclear distance (pm)