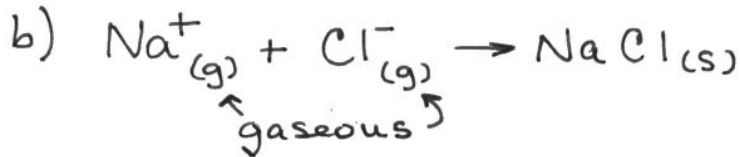


21. a) Lattice Energy is usually exothermic.
When particles naturally attract it usually results in a release of energy and greater stability.



c) Use Coulombs law to explain/justify!
Singly-charged ions would have smaller lattice energy compared to doubly-charged ions.

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

$$\frac{(+1)(-1)}{r} \quad \frac{(+2)(-2)}{r}$$

$$\left(\frac{-1}{r}\right) \text{ compare to } \left(\frac{-4}{r}\right)$$

Force of attraction is 4x greater than in singly-charged ions.

The main factor is the charges because the radii of ions do not vary over a wide range.

The more attracted the ions are to each other, the more energy is released.

Force of attraction between the 2 ions.
Also a measure of Lattice Energy.

* This depends on how you define lattice energy!!

22. a) NaCl LE = 788 KJ/mole
KF LE = 808 KJ/mole

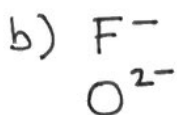
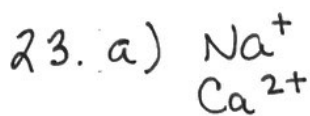
I would expect the NaCl bond to be longer than the KF bond length. LE is the energy released when an ionic bond forms. It would also be the amount of Energy needed to break the bond.

- b) Na^+ 1.16 Å
 Cl^- 1.67 Å
 K^+ 1.52 Å
 F^- 1.19 Å

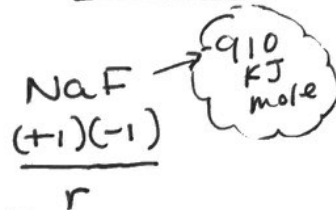
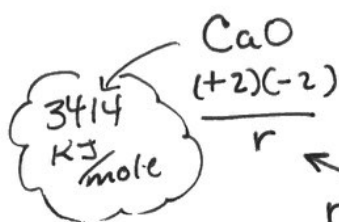
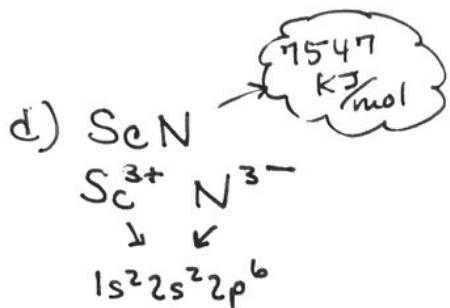
Na - Cl ~ 2.83 Å
 K - F ~ 2.71 Å

* Long bonds are usually weaker than short bonds.

← agrees



c) CaO has largest LE according to Coulomb's Law:



r is \sim same for both because all 4 ions have same electron configuration $1s^2 2s^2 2p^6$

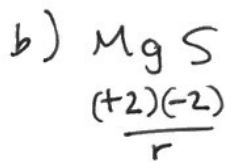
$\frac{(+3)(-3)}{r} = \frac{-9}{r} \rightarrow$ Predict $\sim 6\times$ greater than NaF

$910 \times 9 = 8190 \text{ KJ/mol} \rightarrow$ slightly larger than actual LE of 7547. Our estimate does not take r into account.

24. a) i) As charges of ions increases, LE increases

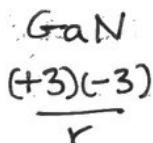
ii) As sizes of ions increases, LE decreases

$E = \frac{(Q_1)(Q_2)}{r}$ coulombs law



$\frac{-4}{r}$
 \downarrow

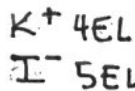
2nd highest L.E.



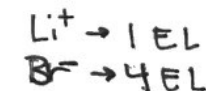
$\frac{-9}{r}$
 \downarrow

highest LE

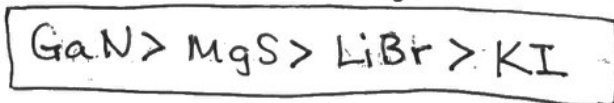
Both $\frac{-1}{r} \leftarrow$ LE now depends on ionic radius



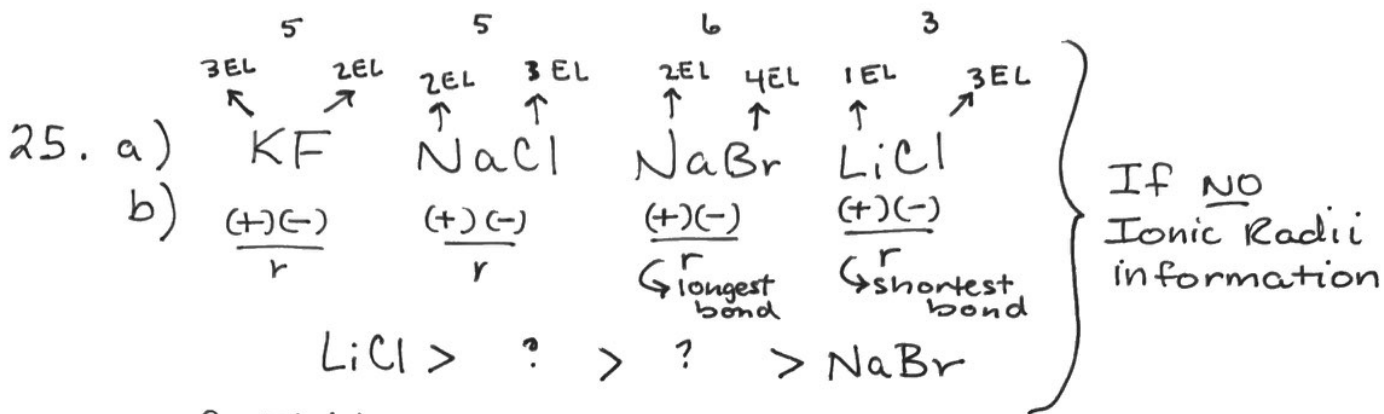
\downarrow
longest r



\downarrow
shortest r



Coulomb's Law



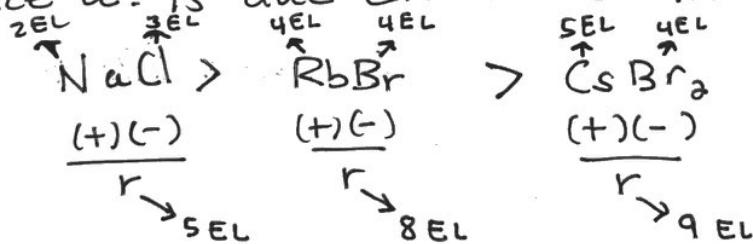
Using the Table:

a) K-F $1.52\text{\AA} + 1.19\text{\AA} = 2.71\text{\AA}$
 Na-Cl $1.16\text{\AA} + 1.67\text{\AA} = 2.83\text{\AA}$
 Na-Br $1.16\text{\AA} + 1.82\text{\AA} = 2.98\text{\AA}$
 Li-Cl $0.90\text{\AA} + 1.67\text{\AA} = 2.57\text{\AA}$

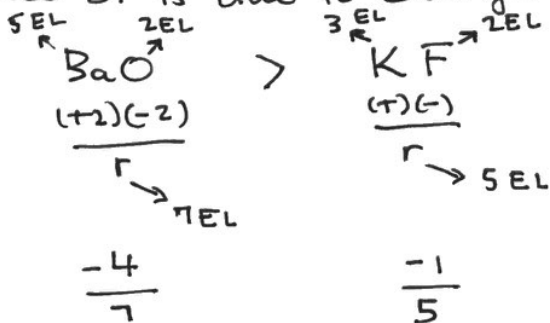
b) LiCl > KF > NaCl > NaBr

Coulomb's Law

26. choice a. is due differences in ionic radii

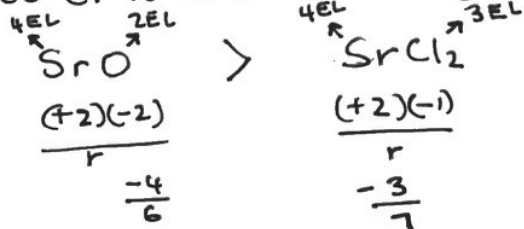


choice b. is due to charge



Coulomb's Law

choice c. is due to charge



27. a. ^(exothermic) The lattice energy of CaO is large enough to overcome the 2 endothermic processes.

- 28.
1. Sublimation of the $\text{Ba}_{(s)} \rightarrow \text{Ba}_{(g)}$ endothermic (ΔH_{sub})
 2. Ionization of the $\text{Ba}_{(g)}$ to $\text{Ba}^{2+}_{(g)}$
 $(1^{\text{st}} \text{ IE}) \rightarrow \text{endothermic } \text{Ba}_{(g)} \rightarrow \text{Ba}^{+}_{(g)} + e^{-}$
 $(2^{\text{nd}} \text{ IE}) \rightarrow \text{endothermic } \text{Ba}^{+}_{(g)} \rightarrow \text{Ba}^{2+}_{(g)} + e^{-}$
 3. Separation of I_2 molecules into I atoms \rightarrow endothermic
?
 $\text{I}_{2(s)} \rightarrow 2\text{I}_{(g)}$ $\text{I}_{2(s)} \rightarrow \text{I}_{2(g)} \text{ (endo)} \rightarrow (\Delta H_{\text{sub}})$
 $\text{I}_{2(g)} \rightarrow 2\text{I}_{(g)} \text{ (endo)} \rightarrow (\text{Bond energy})$
 4. Ionization
 $2\text{I}_{(g)} + 2e^{-} \rightarrow 2\text{I}^{-}_{(g)}$ (1^{st} electron affinity $\times 2$)
exothermic
 5. $\text{Ba}^{2+}_{(g)} + 2\text{I}^{-}_{(g)} \rightarrow \text{BaI}_{2(s)}$ exothermic
(lattice energy)