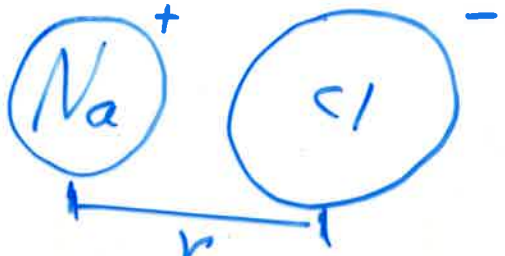
Ionic Binding

e.g. 

$r_0 = 2.81\,\text{Å} = 2.81\times10^{-8}\,\text{cm} = 2.81\times10^{-10}\,\text{m}$

MKS Potential energy

k_e = Coulomb constant

$$U = \boxed{\frac{1}{4\pi\epsilon_0}}\frac{q_1 q_2}{r_0} = \frac{-1}{4\pi\epsilon_0}\frac{e^2}{r_0}$$

$$= -\left(8.99\times10^9\ \frac{N m^2}{C^2}\right)\frac{(1.602\times10^{-19}\,C)^2}{2.81\times10^{-10}\,m} = -8.21\times10^{-19}\,J$$

$$= -8.21\times10^{-19}\,J\left(\frac{1\ eV}{1.602\times10^{-19}\,J}\right) = \boxed{-5.12\,eV}$$

negative potential energy $\leftrightarrow$ bound.

cgs $k_e = 1$ $\quad U = 1\dfrac{(-e^2)}{r_0}$ ← cm

$e = 4.80325\times10^{-10}$ esu ← electrostatic unit

It takes 5.12eV of energy to separate the Na^+ and Cl^- ions to infinity.

But need 7.9eV per molecule to separate a crystal into ions at infinity. Lattice energy.

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Structure	α	Z	
NaCl		6	fcc (0,0,0) + $(\frac{1}{2},\frac{1}{2},\frac{1}{2})$
CsCl		8	sc (0,0,0) $(\frac{1}{2},\frac{1}{2},\frac{1}{2})$
ZnS		4	diamond fcc (0,0,0) $(\frac{1}{4},\frac{1}{4},\frac{1}{4})$