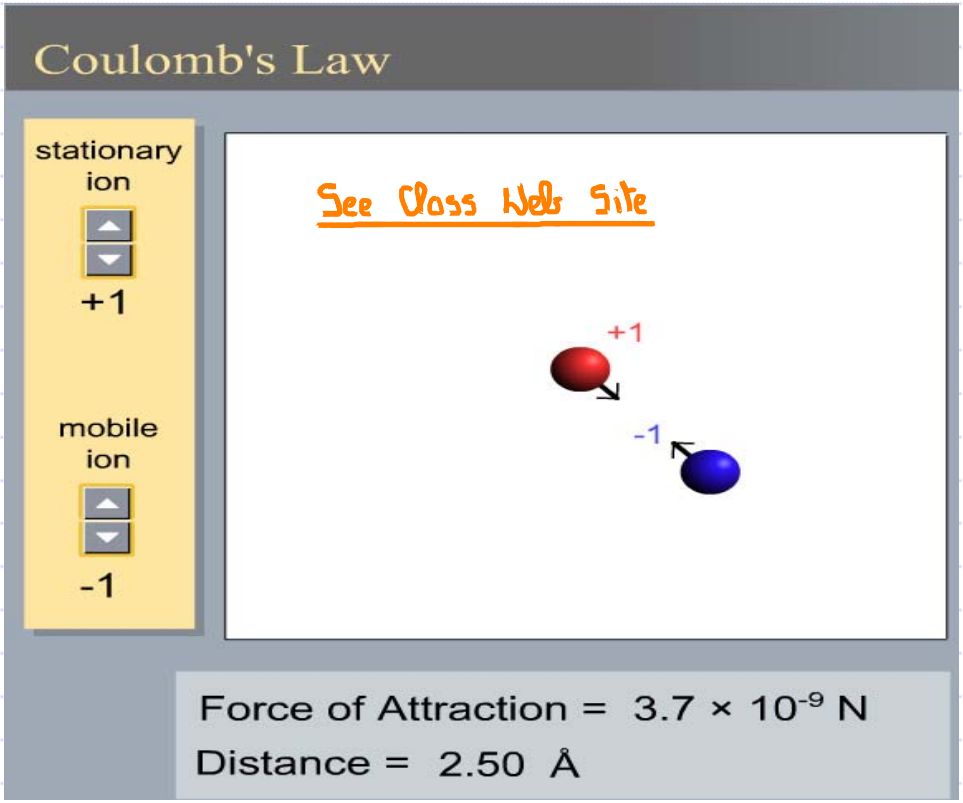
11.4 The Nature of Intermolecular Forces

The Glue that Holds Molecules Together – Coulomb's Law – Ion – Ion



FA :- Force of Attraction.

$$FA \propto \frac{Z_1 Z_2}{d^2}$$

Qualitative :

a) Magnitude of the charges.
b) Distance between them.

Which of the following salts would have the greatest force of attraction assuming the distance is the same?

NaI
$Na^+ . I^-$

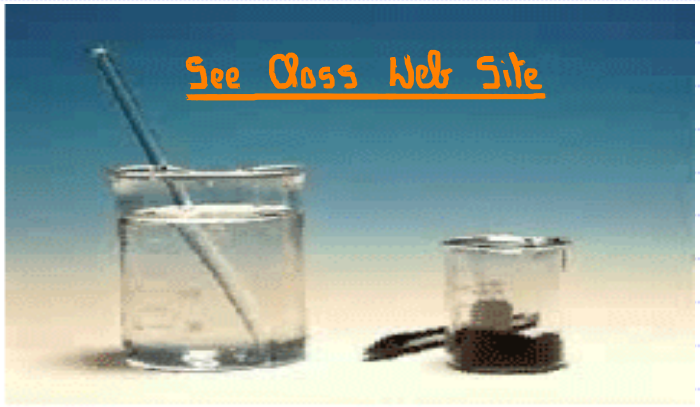
$CaSO_4$
$Ca^{2+} . SO_4^{2-}$

$AlPO_4$ ✓
$Al^{3+} . PO_4^{3-}$

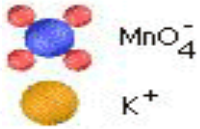
11.4 The Nature of Intermolecular Forces

Ion – Dipole – The Dissolution Process

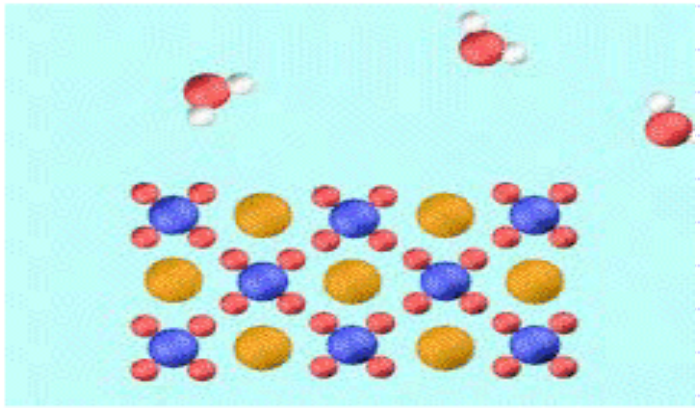
Macroscopic Scale



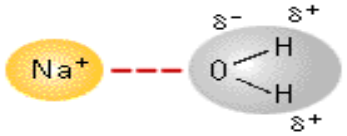
$H_2O(\ell)$ $KMnO_4(s)$



Nano Scale



Enthalpy of Hydration : A measure of the Ion / Dipole glue – the amount of energy given off when an ion is surrounded (usually by 6) by water molecules



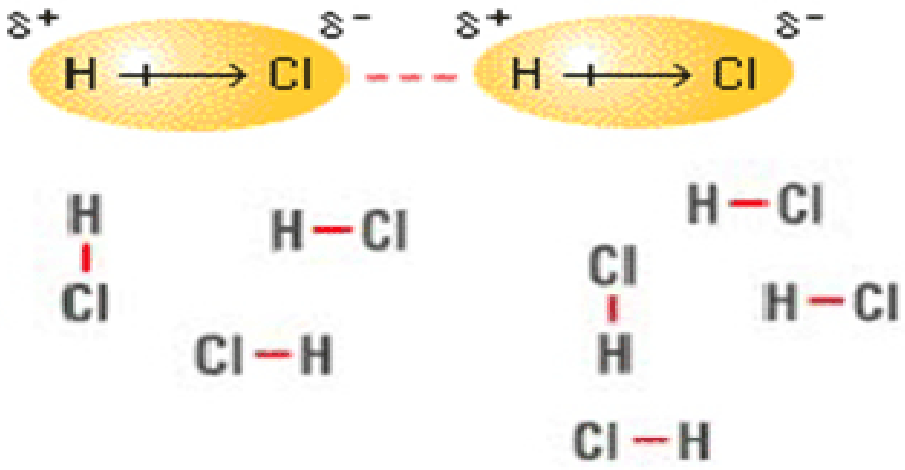
	Cation	Ion Radius pm	Enthalpy of Hydration kJ
a ✓	Li^+	90	-515
b	Na^+	116	-405
c	K^+	152	-312
d	Rb^+	166	-296
e	Cs^+	181	-263

Which of the above cations has the greatest Ion/Dipole interaction – strongest binding glue!

11.4 The Nature of Intermolecular Forces

Dipole – Dipole

Molar Masses Vs Boiling Points		
	M	B.P.
	g/mol	°C
CO	28	-192
PH_3	34	-88
AsH_3	78	-62
ICl	162	97



The higher the Boiling Point the stronger the Intermolecular Force ... Translate ... the stronger the glue holding it together.

Note: See anything with respect to Molar Mass and Boiling Point?

See the obvious Trend