## Announcements – Lecture II – Thursday, Jan 25th

1. Class Web Site: https://genchem.chem.umass.edu – Under Spring, click on Chem 112 – the click on my picture!

2. iClicker for Credit: Starts, Thursday, Feb 1st
   *Register your iClicker in Owl by Friday, Jan 26th.*

3. Lab: Labs start on Monday, Jan 29th.

4. Exam Dates: Saturday, Feb 24th:
   *Session I, 1:00-3:00pm – ISB 155/160*
   *Session II, 3:00-5:00pm – ISB 155/160*
   Saturday, Mar 31st:
   *Session I, 1:00-3:00pm – ISB 155/160*
   *Session II, 3:00-5:00pm – ISB 155/160*
   Thursday, May 3rd: *1:00-3:00pm – ISB 135*

# 11.4 The Nature of Intermolecular Forces

## 8.6 – Molecular Polarity – Chem 111 Review! – Molecular Polarity

Molecule polar if $\Sigma$ polar bonds > 0 ... vector sum ... molecule has a Dipole Moment.

Q1: Does the molecule have a polar bond?

No: non-polar. YES: on to question 2.

Q2: Does the central atom have a lone pair(s)?

No: on to question 3. YES: polar*

* True if the central atom obeys the octet rule. Take care if the central atom is beyond the octet.

Q3: Is the molecule symmetrical with respect to the terminal atoms?

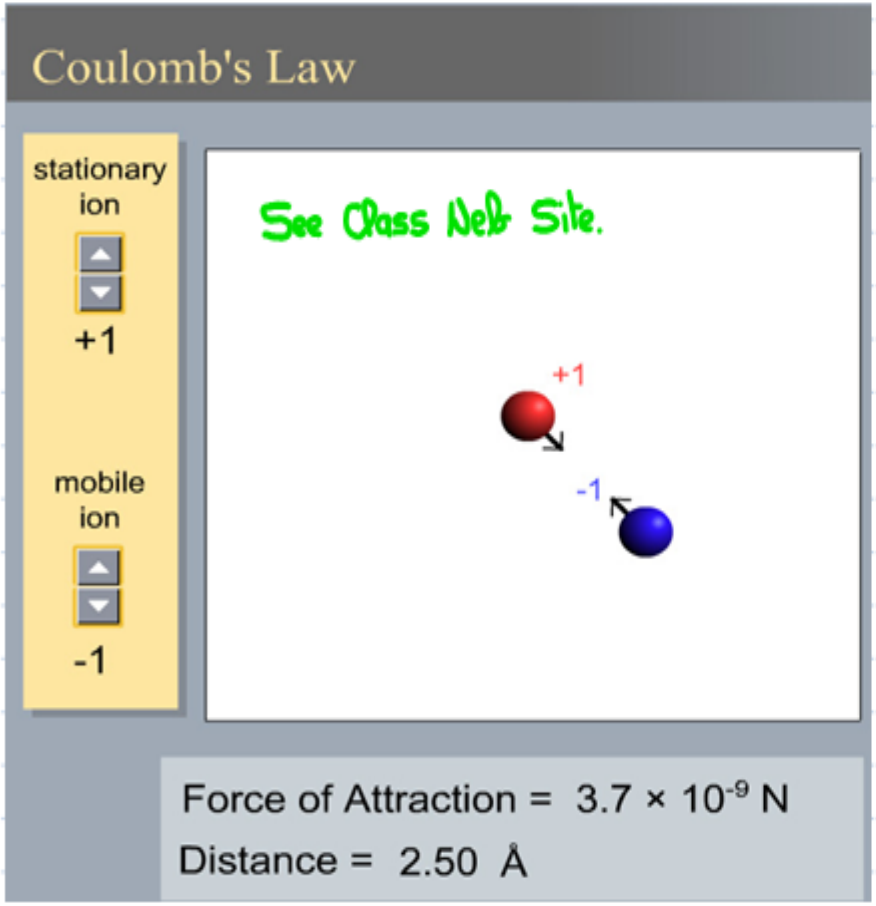
No: polar YES: non-polar

How many of the following molecules are polar?

$CCl_4$ $NH_3$✓ $NO_3^-$ $H_2$ $C_3H_8$? $H_2O$✓

# 11.4 The Nature of Intermolecular Forces

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




FA = Force of attraction

$FA \propto Z_1 Z_2 / d^2$

Qualitative:

a) Magnitude of the charge

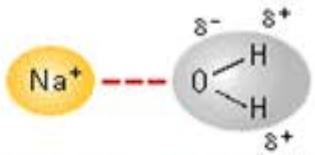
b) Distance between the charges.

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

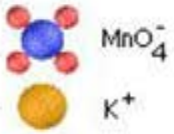


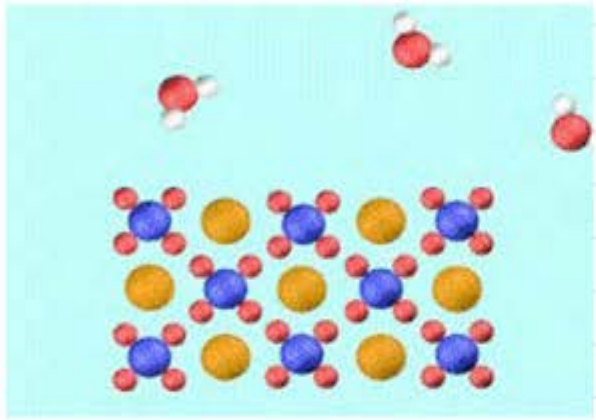

| | Cation | Ion Radius pm | Enthalpy of Hydration kJ |
|---|---|---|---|
| 1 ✓ | $Li^+$ | 90 | -515 |
| 2 | $Na^+$ | 116 | -405 |
| 3 | $K^+$ | 152 | -312 |
| 4 | $Rb^+$ | 166 | -296 |
| 5 | $Cs^+$ | 181 | -263 |

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

Macroscopic Scale


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



Nano Scale

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