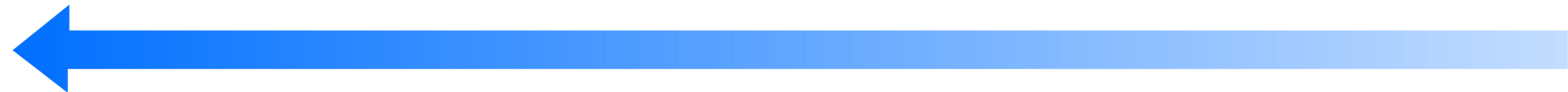


Ion-Ion Interactions

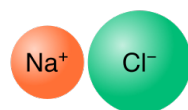
DR. MIOY T. HUYNH
YALE UNIVERSITY
CHEMISTRY 161
FALL 2019

www.mioy.org/chem161

INTERMOLECULAR FORCES (IMFS): TYPES AND STRENGTHS

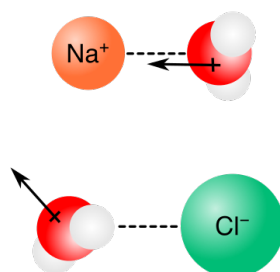


ION-ION



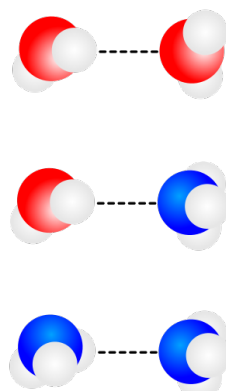
- Only for ionic compounds
- No other IMFs

ION-DIPOLE



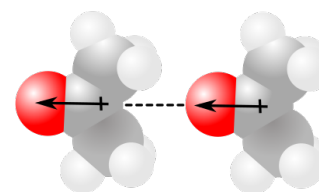
- IMF between an ionic compound and a polar molecule

HYDROGEN BONDING



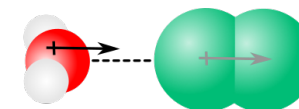
- IMF between two polar molecules
- **H** bonded to **N**, **O**, or **F** atom
- **H** near another **N**, **O**, or **F** atom

DIPOLE-DIPOLE



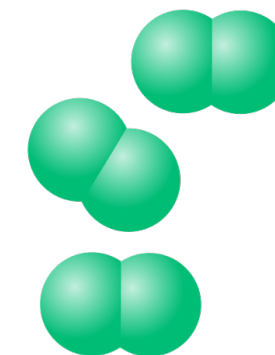
- IMF between two polar molecules
- Dipoles need to be oriented

DIPOLE-INDUCED DIPOLE



- IMF between a polar molecule and a nonpolar molecule

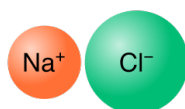
LONDON DISPERSION



- IMF between two nonpolar molecules
- Strength of dispersion forces proportional to mass and surface area
- More massive and more spread out molecules have stronger dispersion forces

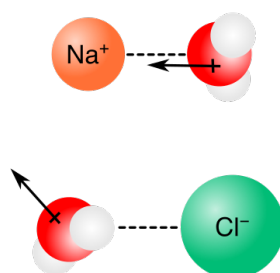
INTERMOLECULAR FORCES (IMFS): TYPES AND STRENGTHS

ION-ION



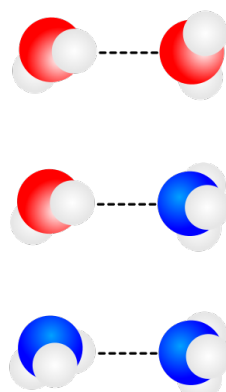
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ION-DIPOLE



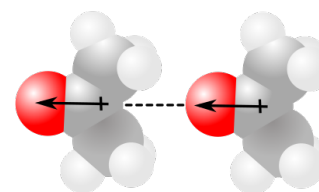
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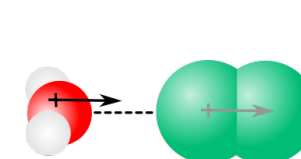
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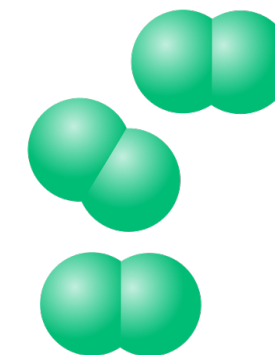
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Strength of Ion-Ion Interactions

The strength of ion-ion interactions is dependent on two things:

1. Charges of the ions: q_1 & q_2

$$E \propto \frac{q_1 \times q_2}{r^2}$$

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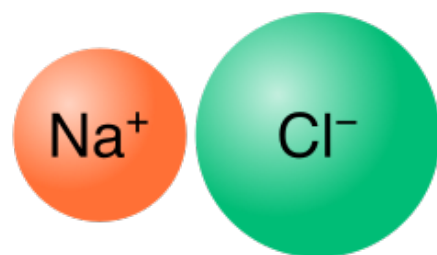
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For **NaCl**:

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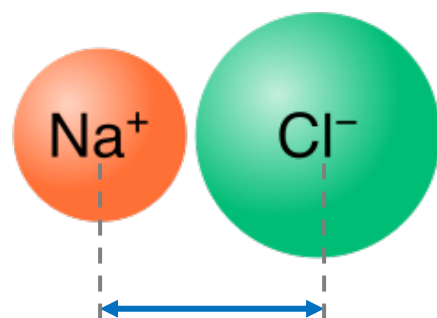
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- $d = r(\text{Na}^+) + r(\text{Cl}^-)$

** Often, the charges have a greater effect than the radii.*

INFLUENCE OF ION-ION INTERACTION STRENGTH

Phases of matter: the stronger the ion-ion interactions between the ions, the greater stability of the solid state.

STRONG	→	high melting point	high boiling point
WEAK	→	low melting point	low boiling point

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Solubility of an ionic compound is determined, to a degree, by the strength of the ion-ion interactions.

STRONG ION-ION	→	INSOLUBLE
WEAK ION-ION	→	SOLUBLE