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Intermolecular Forces Vs Thermal Energy

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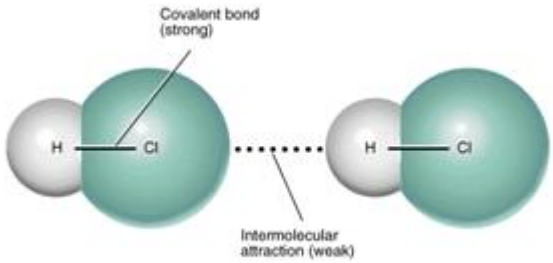
Intermolecular Forces

The different phases of matter are dependent on the forces that exist between the molecules and the type of molecular movement present at different temperatures. The forces that exist between the molecules or atoms are termed as intermolecular forces.

These forces stick or bind the atoms or molecules together in different state of matter.



On the basis of type of compound, the intermolecular forces are divided into two categories:

1. Intermolecular forces inionic compounds.
2. Intermolecular forces in covalent compounds.

Intermolecular Forces in Ionic Compounds

Ionic compounds are made of charged ions. The force that develops due to the presence of opposite charges on ions is referred as electrostatic force. The electrostatic or ionic force is the strongest force among the intermolecular forces.

Intermolecular Forces in Covalent Compounds

Covalent compounds are formed by sharing of electrons among the participating elements. Three types of intermolecular forces are present between the molecules of covalent compounds. They are

- **London force:** London forces are present between all types of covalent compound. These forces are formed due to the motion of electrons in the molecule which develops a partial negative and positive region in the covalent molecule. London forces are the weakest forces.

- **Dipole force:** Dipole dipole interactions are found only in polar covalent molecules. These molecules have one positive and one negative end. As like magnets, the opposite dipole attracts each other to develop dipole forces among them.
- **Hydrogen bond:**Hydrogen bond is formed in polar covalent molecules that contains hydrogen atom linked to other electronegative atom such as nitrogen, oxygen and fluorine.

Thermal Energy

The internal energy produced due to irregular motion of atoms or molecules is termed as thermal energy. Thermal energy is dependent on the temperature of matter. When the temperature is high, the molecules moves with greater kinetic energy whereas when the temperature is low, the molecules moves with low kinetic energy, and the molecules remain adhere to each other.

Intermolecular and Thermal Energy

Strength of intermolecular forces present between the molecules determines the state of matter and is related to the various physical properties like its melting point, boiling point, and solubility. The phases of matter formed are a result of equilibrium between intermolecular forces and molecular motion at different temperatures.

When interaction between the molecules is very weak the molecules do not bind with each other and form solids or liquids . By reducing the temperature, thermal energy is reduced which binds the molecules in a specific order to make it solid or liquid. Think about water condensing on the outside of a cold glass—this is water from the air cooling and becoming a liquid. If you further reduced the temperature, you would create ice—a solid!

Effect of Intermolecular forces and thermal energy on states of matter

The three state of matter formed are:

- **Solid**: At low temperatures, the intermolecular force present between the molecules overcomes the thermal energy of matter. As a result, the atoms or molecules are stuck together at their lattice places and form rigid structures called solids which are not compressible.
- **Liquids**: When the temperature is neither too high nor too low, the liquid phase of matter is formed. In this state the intermolecular forces also overcome the thermal energy. The molecules translate but they remain together.
- **Gases**: At high temperatures, the thermal energy of molecules overcomes the intermolecular forces due increase kinetic energy of molecules and gases form.Gases are compressible and can freely flow.

Why gases do not liquefy on compression only?

In case of gases, the interaction forces between the molecules are very weak so they are not tightly bound to each other. The molecules are free to move. On compression, the molecules of gas come close to each other but do not liquefy. However, on reducing the temperature, the kinetic energy, or random motion of molecule is reduced thus they are easily liquefied by compressing and lowering the thermal energy.

What are the effects of intermolecular forces and thermal energy on states of matter?

Try to answer. Still need help? Want to know more about it? Click here to schedule live help from a certified tutor!

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Reference Links:

- http://en.wikipedia.org/wiki/Solids
- http://en.wikipedia.org/wiki/Matter
- http://www.elmhurst.edu/~chm/vchembook/143Aioniccpds.html
- http://hyperphysics.phy-astr.gsu.edu/hbase/thermo/inteng.html
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