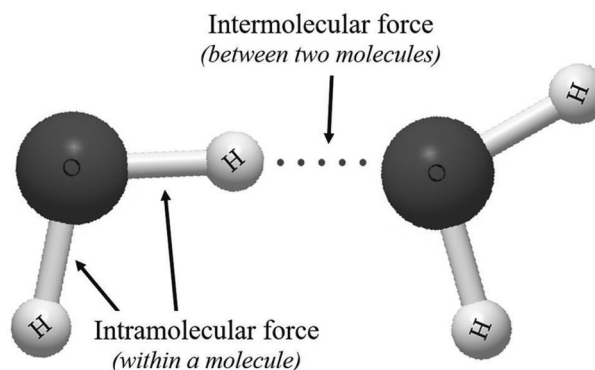


Intramolecular and Intermolecular Forces

The attraction between atoms produces connections called forces. A force is a push or pull between objects due to a direct connection between the two objects.

Intramolecular forces and forces that hold together the atoms in an ionic, covalent, or metallic bond. These bonds are very strong.



Intermolecular forces are forces between molecules. These bonds range from very weak to very strong.

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Strength of Intramolecular Forces

Force	Model	Basis of Attraction	Energy (kJ/mol)	Example
Bonding				
Ionic		Cation–anion	400–4000	NaCl
Covalent		Nuclei–shared e^- pair	150–1100	H–H
Metallic		Cations–delocalized electrons	75–1000	Fe

Each intermolecular force has a specific strength. Ionic Bonds are the overall strongest, with Metallic Bonds being about 2 – 3 times weaker. Covalent Bonds are the weakest due to the sharing of electrons

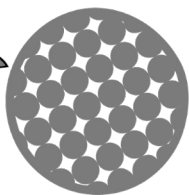
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Three States of Matter



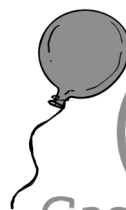
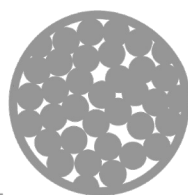
Solid

- Particles in a solid are tightly packaged usually in a regular pattern.
- Particles in a solid will vibrate but cannot move past each other.
- Solids retain their shapes.



Liquid

- Particles in a liquid are close together with no regular pattern.
- Particles in a liquid flow and can easily move or slide past one another.
- Liquids assume the shape of their containers.



Gas

- Particles in a gas are well separated with no regular pattern.
- Particles in a gas vibrate freely at high speeds.
- Gases assume the shapes of their containers.



A **state of matter** is the way that groups of atoms, compounds, and molecules connect together in space.

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Intermolecular Forces & States of Matter



Solid

A **solid** is a state of matter (*the way matter exists in nature*) that has a fixed shape and volume.

In *solids* particles are held tightly together with strong intermolecular forces, normally between + and – ions from ionic compounds.

Fixed is a property that *can't change* over time. **Variable** is a property that *will change* over time in a system

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Intermolecular Forces & States of Matter



Liquid

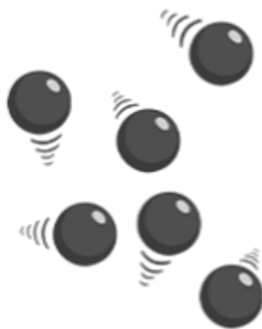
A **liquid** is a state of matter (*the way matter exists in nature*) that has a **fixed** volume but a **variable** shape.

In *liquids* particles are held together enough intermolecular force to keep the particles together with each other but are weak enough to allow movement.

Volume is a measurement of the space a groups of particles occupy.

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Intermolecular Forces & States of Matter



Gaseous

A **gas** is a state of matter (*the way matter exists in nature*) that has a **variable** shape and volume.

In *gases* particles are held together with very weak intermolecular forces, only connecting together when they are close, or in contact with each other in space

Shape is the physical arrangement of particles in space.

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