




11.4-11.7 Microscopic Properties of the Phases of Matter

PROPERTY	11.4 SOLIDS	11.5 LIQUIDS	11.6 GASES
1. SHAPE	Definite – strong cohesive forces	Indefinite-cohesive forces not strong enough to prevent random movement	Indefinite-cohesive forces weak
2. VOLUME	Definite-strong cohesive forces	Definite-strong cohesive forces	Indefinite-cohesive forces weak
3. Density	Particles closely packed	Particles closely packed	Particles widely separated
4. Compressibility	Particles closely packed	Particles closely packed	Particles widely separated
5. Thermal expansion (thermometers)	Increased KE causes slight increase in space between particles	Increased KE causes slight increase in space between particles	Particles widely separated and have high KE and move further apart when

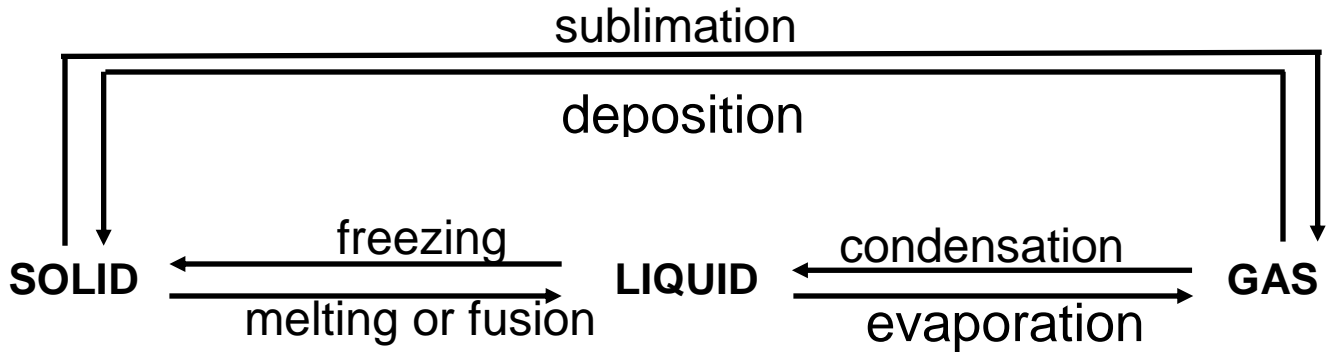
11.7 Solids and liquids have many similar properties ( ——— )

Liquids and gases have many similar properties ( - - - - - )

**Table 5.6 Some Properties of Solids, Liquids, and Gases**

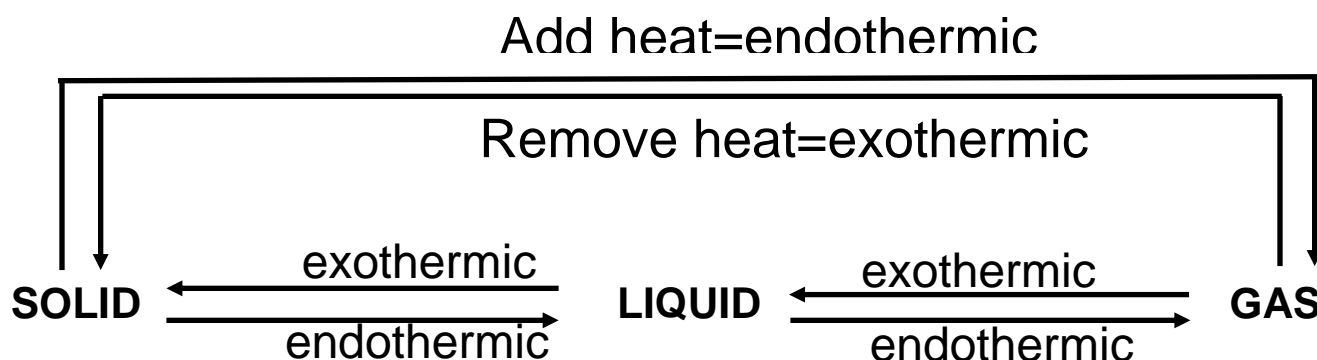
Property	Solid	Liquid	Gas
			
Shape	Has a definite shape	Takes the shape of the container	Takes the shape of its container
Volume	Has a definite volume	Has a definite volume	Fills the volume of the container
Arrangement of particles	Fixed, very close	Random, close	Random, far apart
Interaction between particles	Very strong	Strong	Essentially none
Movement of particles	Very slow	Moderate	Very fast
Examples	Ice, salt, iron	Water, oil, vinegar	Water vapor, helium, air

## 11.8 CHANGES OF STATE (Chp 4.4)



	CHANGES OF STATE		PHYSICAL PROPERTY
<b>solid</b>	$\xleftarrow{\text{freezing}}$ $\xrightarrow{\text{melting or fusion}}$	<b>liquid</b>	melting point or freezing point
<b>liquid</b>	$\xleftarrow{\text{condensation}}$ $\xrightarrow{\text{evaporation}}$	<b>vapor</b>	boiling point
<b>solid</b>	$\xleftarrow{\text{deposition}}$ $\xrightarrow{\text{sublimation}}$	<b>vapor</b>	sublimation point

## 11.8 ENERGY CHANGES IN CHANGES OF STATE



	CHANGES OF STATE		PHYSICAL PROPERTY
<b>solid</b>	$\xleftarrow{\text{exothermic}}$ $\xrightarrow{\text{endothermic}}$	<b>liquid</b>	<b>melting point</b> <b>freezing point</b>
<b>liquid</b>	$\xleftarrow{\text{exothermic}}$ $\xrightarrow{\text{endothermic}}$	<b>vapor</b>	<b>boiling point</b>
<b>solid</b>	$\xleftarrow{\text{exothermic}}$ $\xrightarrow{\text{endothermic}}$	<b>vapor</b>	<b>sublimation point</b>