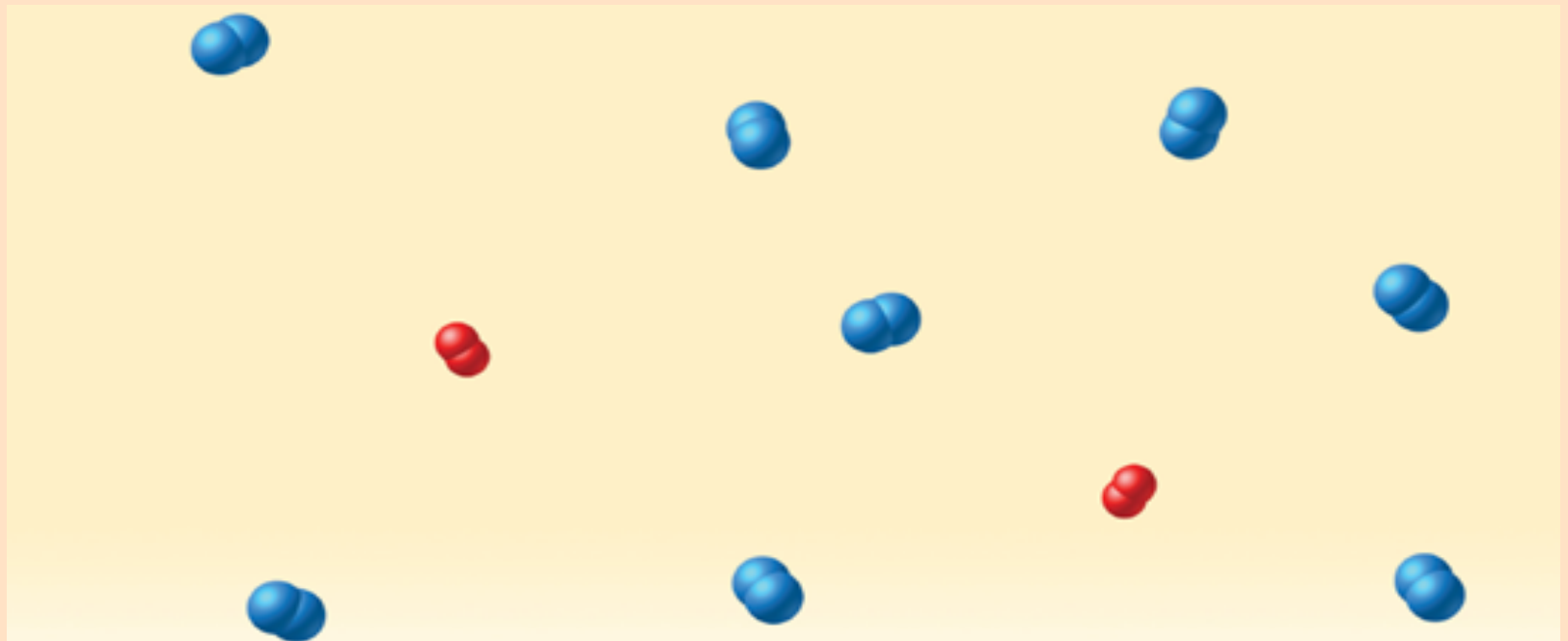
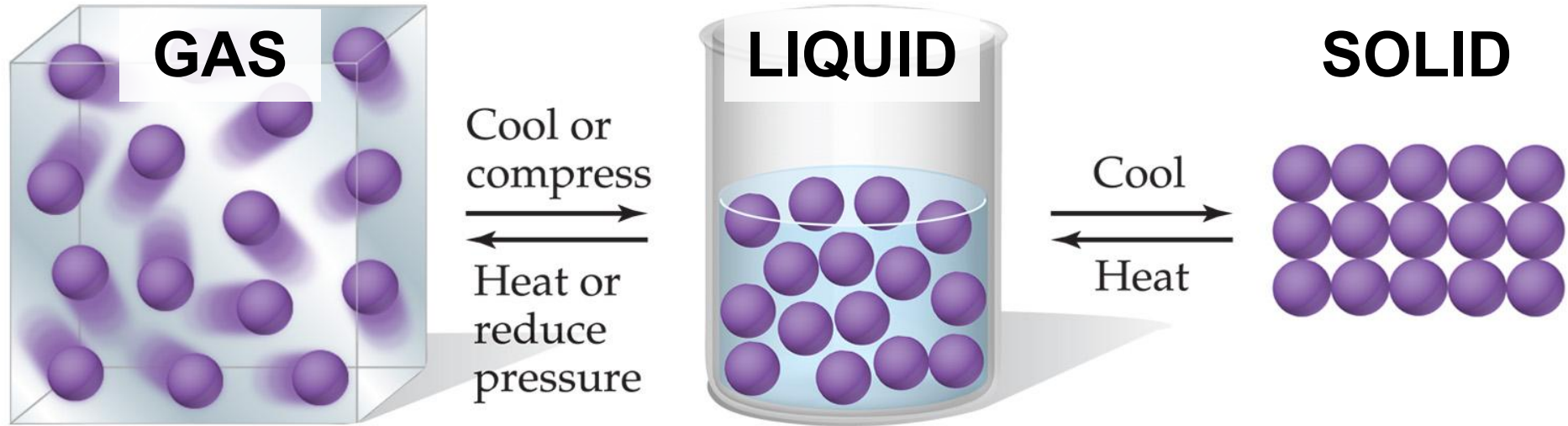


# Unit 11: States of Matter

## Section 1: Kinetic Molecular Theory



# States of Matter



main **difference** between **phases** is...

the **distance** between **particles**...

...which **depends on** two **competing** quantities:

**KE**

(**k**inetic **e**nergy  
of the particles)

**vs.**

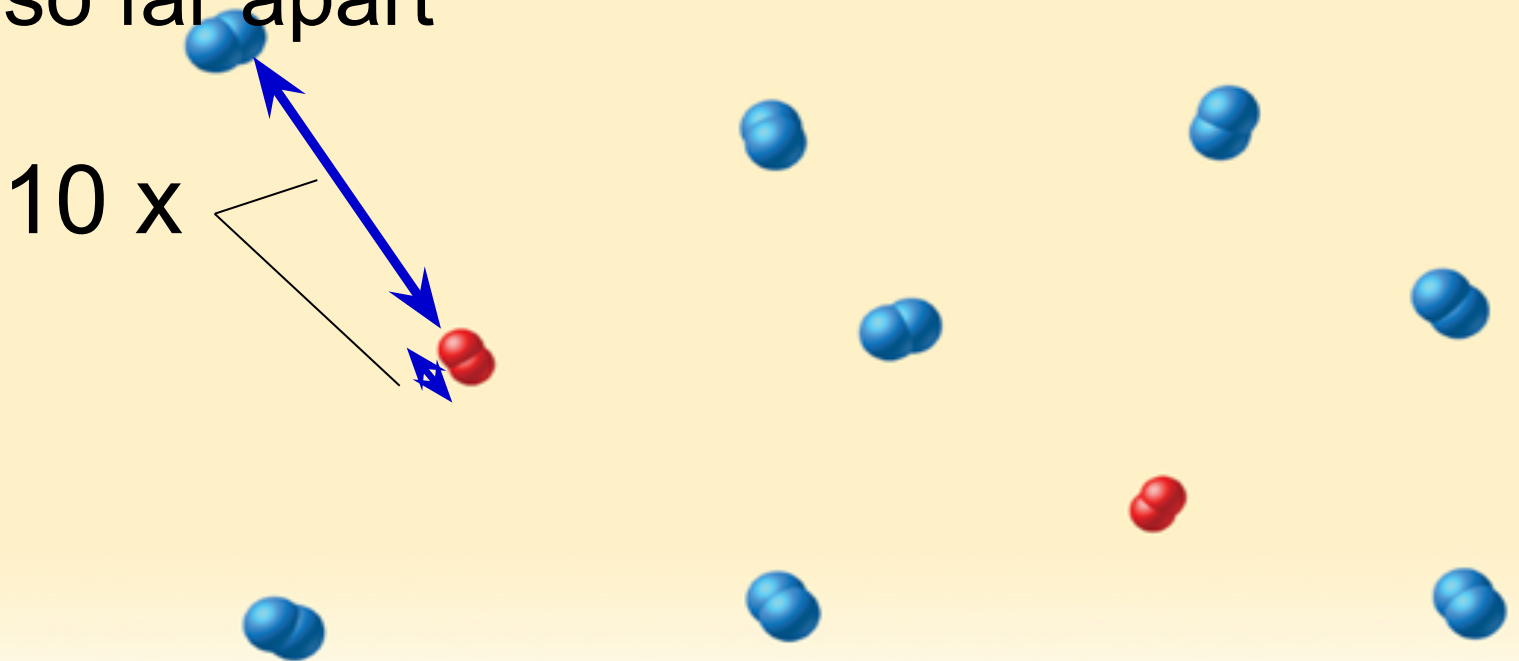
**IMAFs**

(**i**nter**m**olecular  
**a**tttractive **f**orces  
between particles)

# Kinetic-Molecular Theory (of Gases)

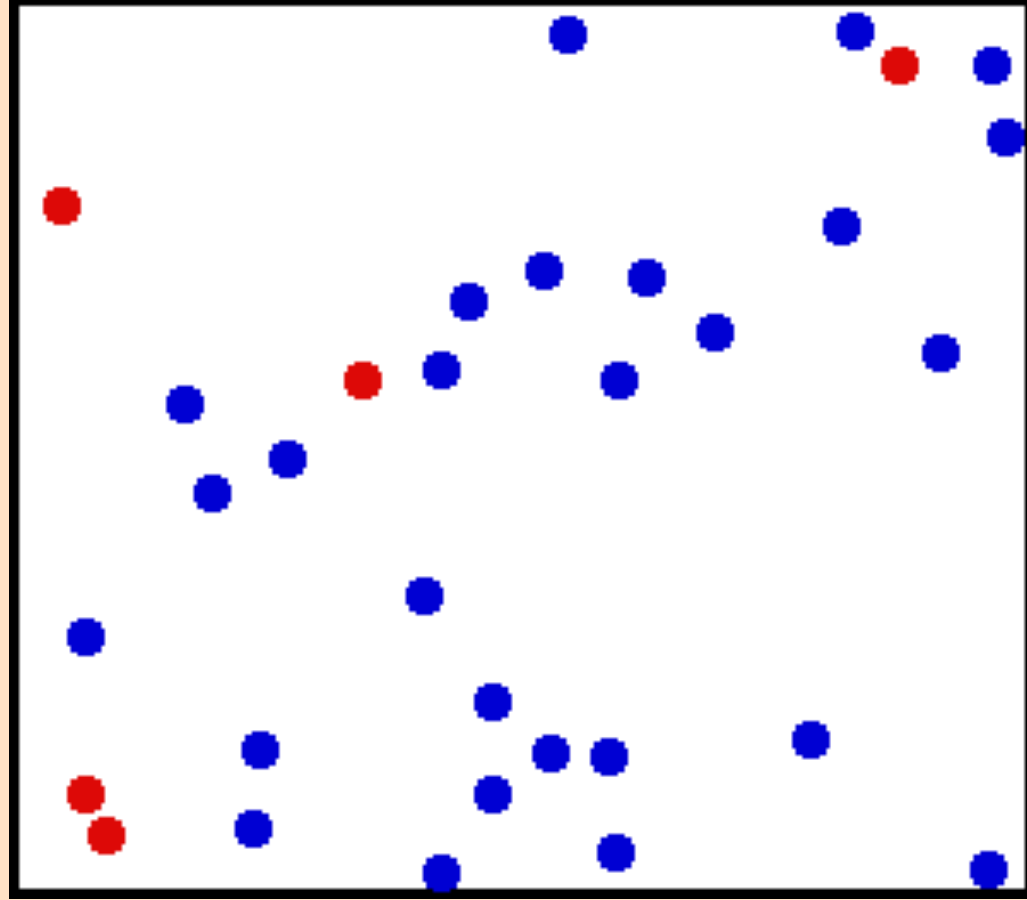
## 5 Parts of KMT

- 1) **have negligible volume** (are **tiny**) compared to the great **distance between**
- 2) **have negligible attractions** because they are so far apart

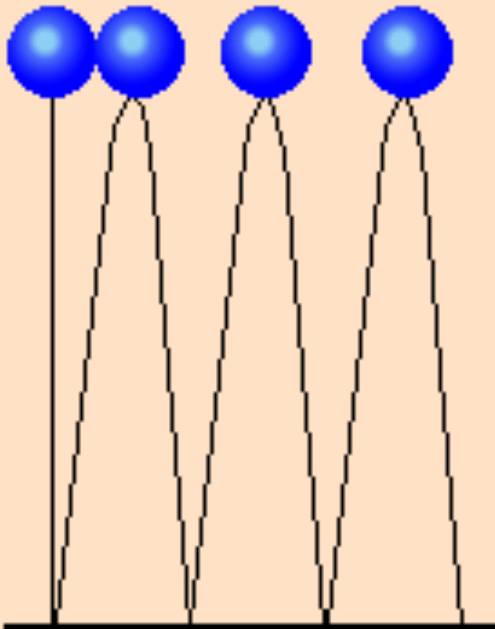


# 5 Parts of KMT

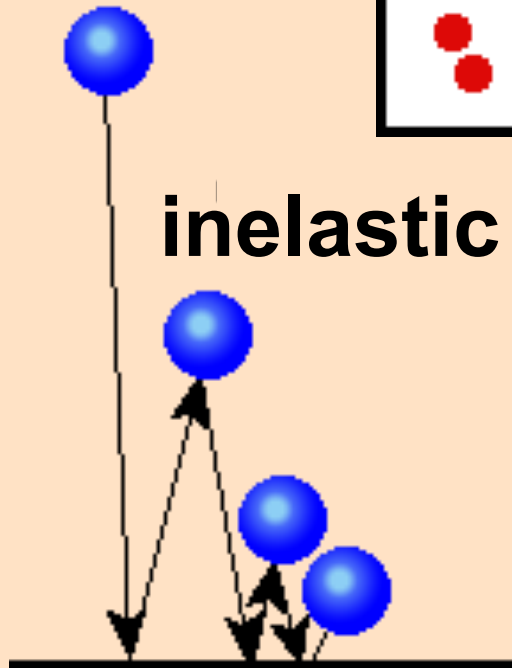
3) are in **constant, random motion**



**elastic**



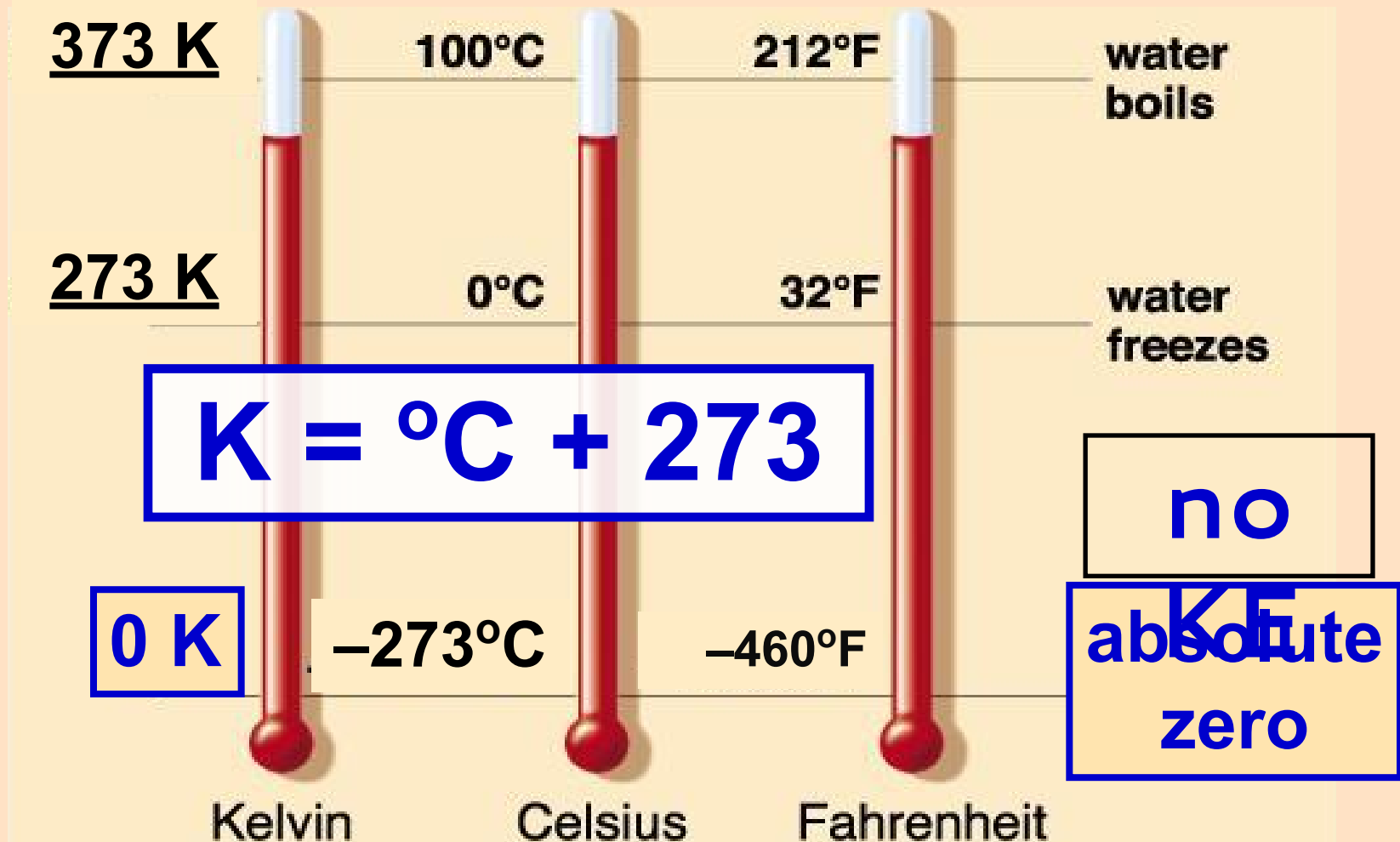
**inelastic**



4) have **perfectly elastic collisions**  
(transfer KE without loss)

# 5 Parts of KMT

5) *average KE* is directly **proportional to temperature** as **Temp** ↑





**low KE,  
vibrates**

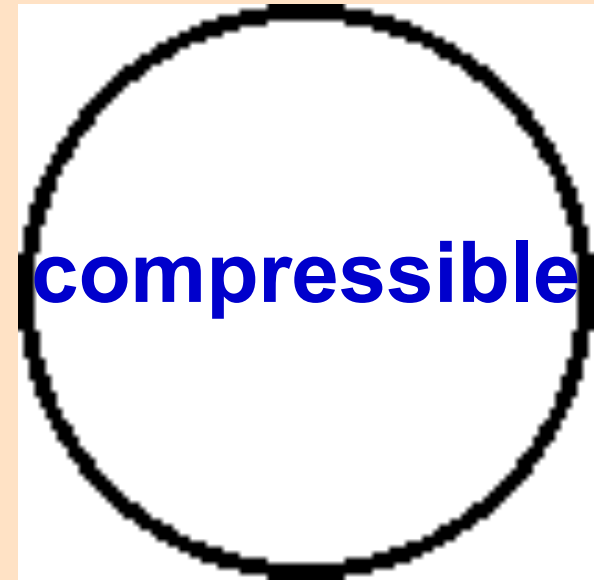
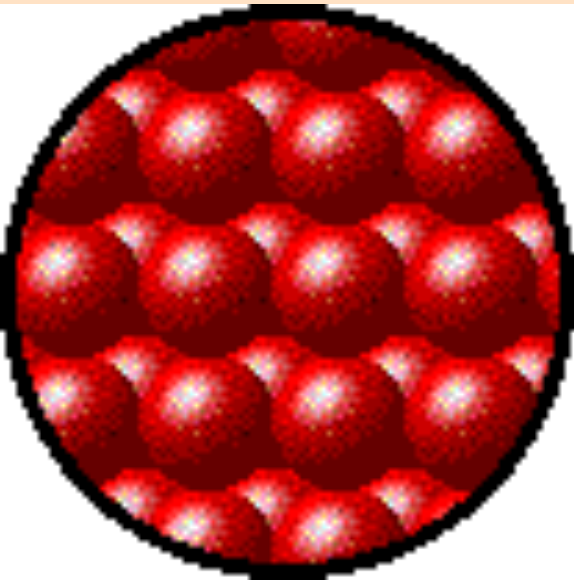


**higher KE,  
flows**

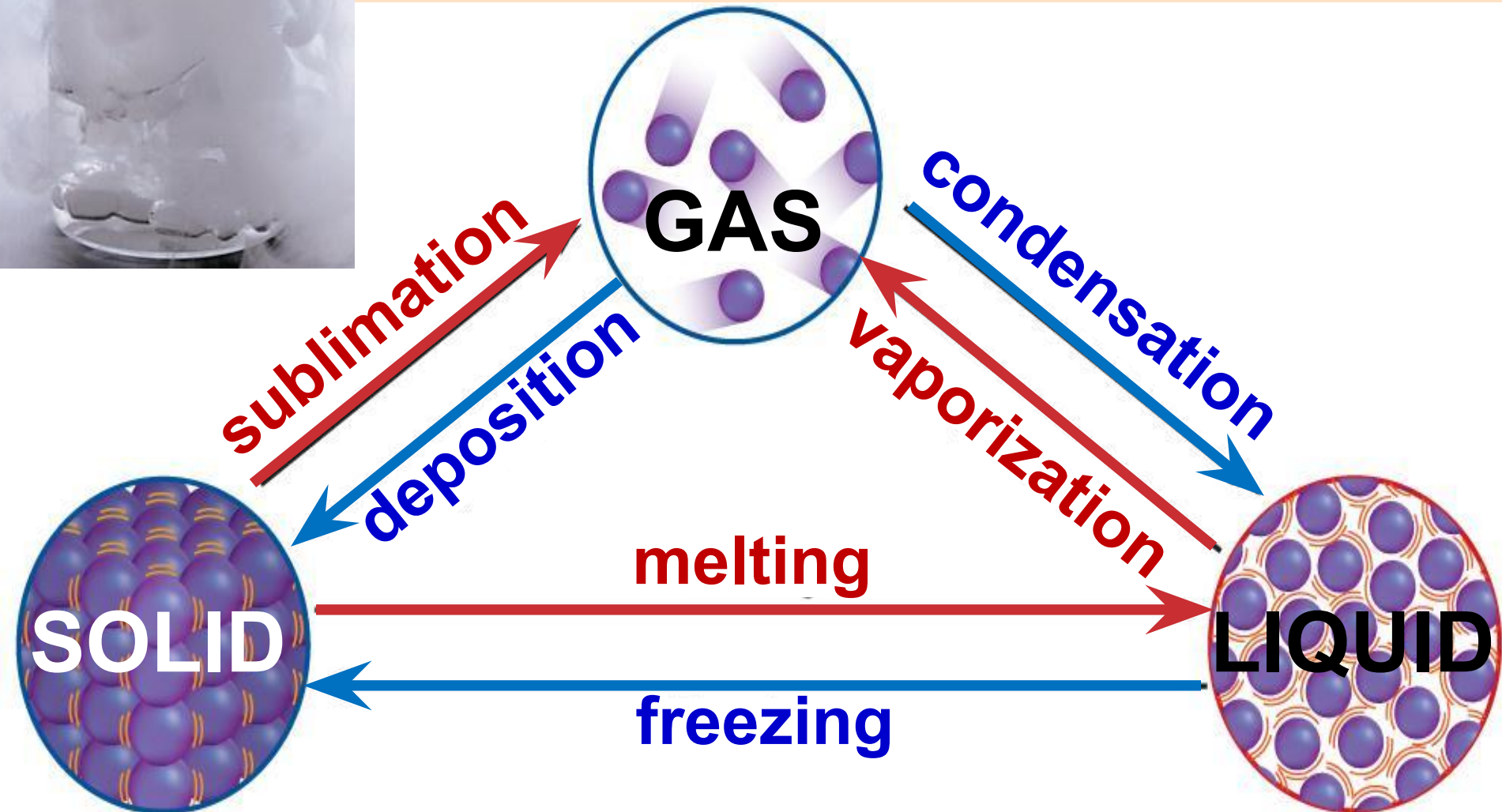
[video clip](#)



**highest KE,  
expands**



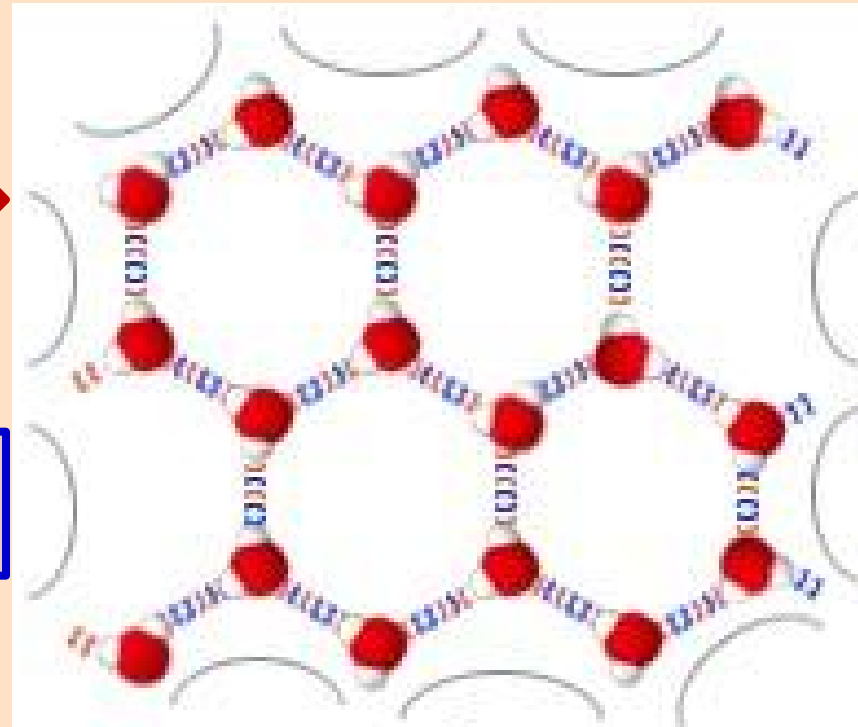
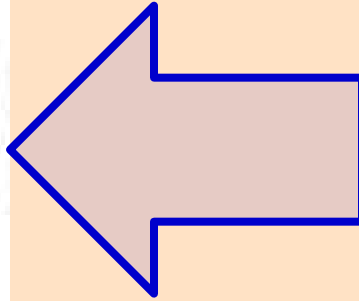
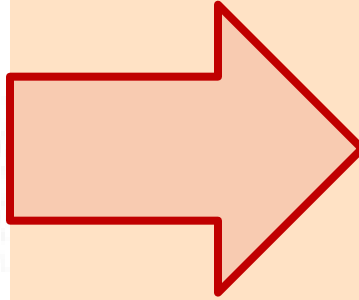
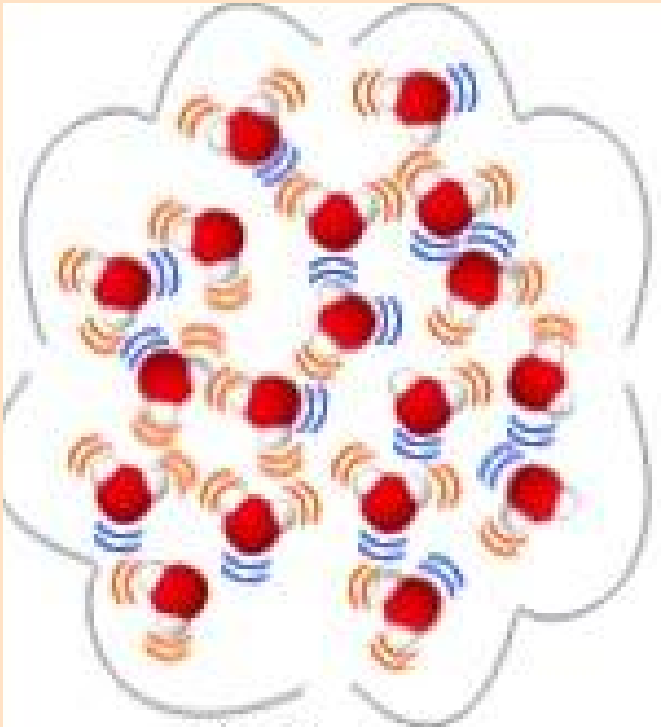
# Phase Changes



freezing:

*l* to *s* (lose KE)

liquid  $\rightarrow$  solid + energy



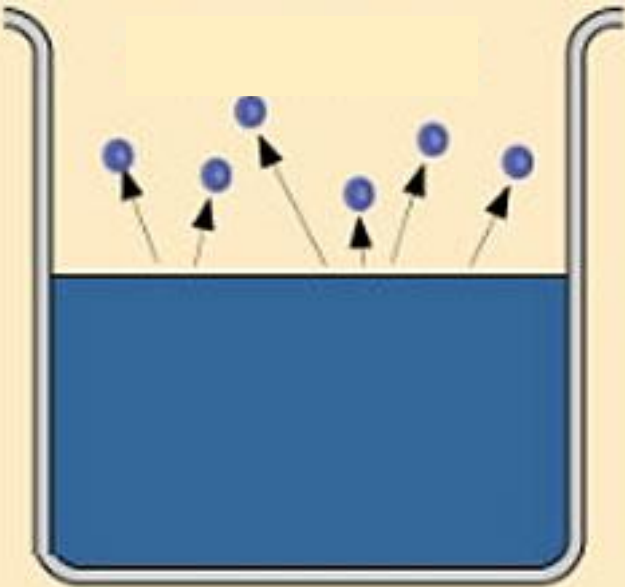
melting:

*s* to *l* (gain KE)

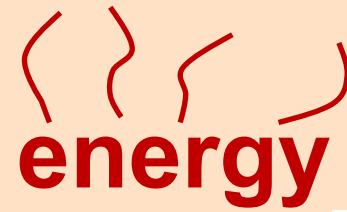
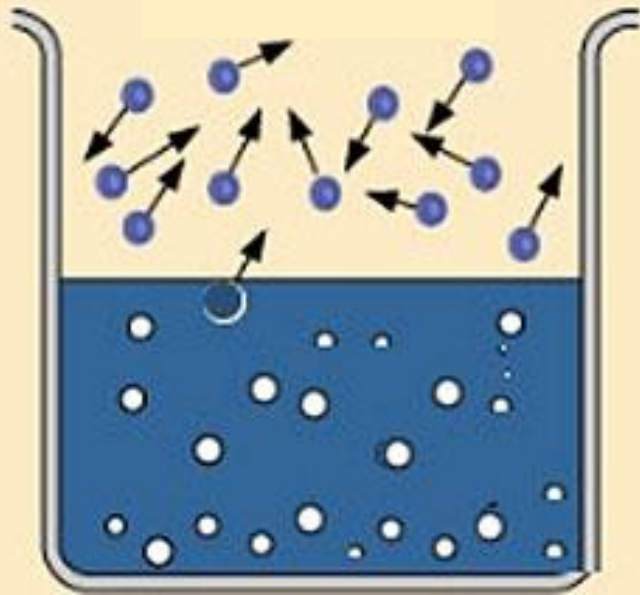
liquid  $\leftarrow$  solid + energy





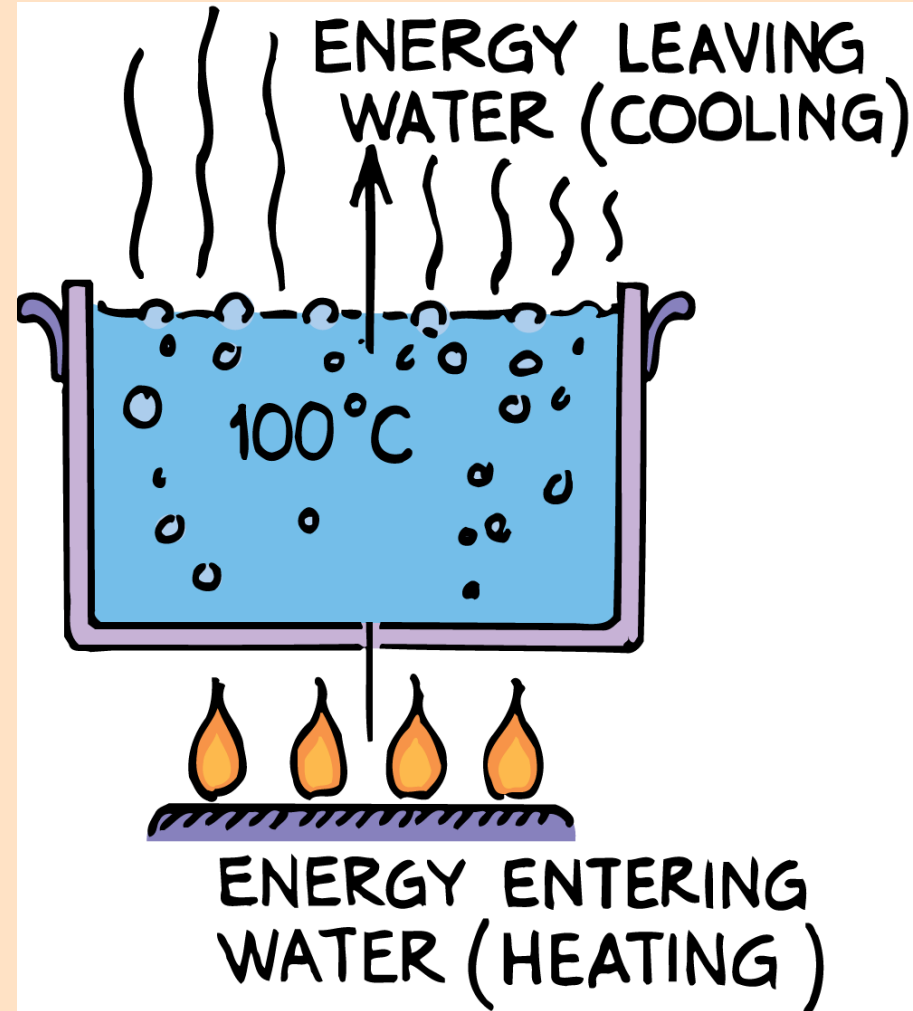


evaporation:  
*l to g at surface*



**energy + liquid → gas**

vaporization:



boiling:

*l to g beneath surface*

# condensation:

*g* to *l* (lose KE)

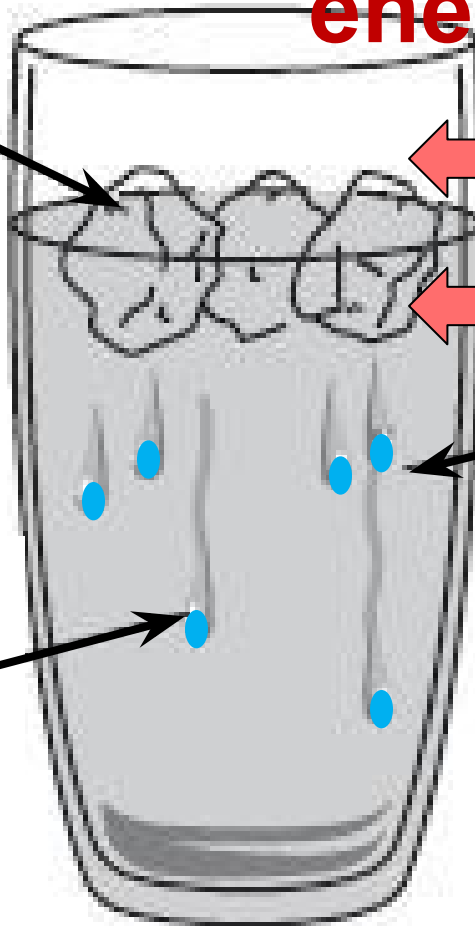
gas →

liquid +

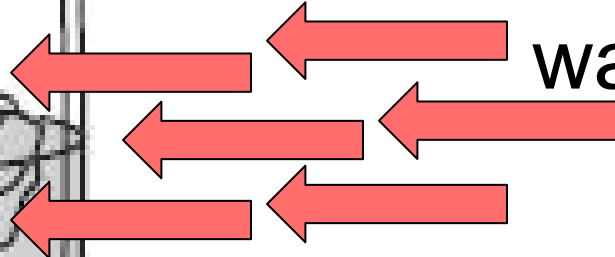


energy

ice cubes



warm  
water vapor  
in air



cold water  
inside glass

condensed  
drops  
outside glass



Is water in glass  
cooler or warmer?

warmer?

# Quick Quiz!

- 1) According to the kinetic molecular theory, gas particles...
- A) are attracted to each other.
  - B) are in constant random motion.
  - C) have the same kinetic energy .
  - D) have a significant volume.

## Quick Quiz.

2) The average kinetic energy of the particles in a substance is directly proportional to the

A) molar mass

B) density

C) temperature

D) size

## Quick Quiz.

3) Compared to liquids and solids, gases are easily compressed because the particles in a gas...

A) attract each other significantly

B) are spaced relatively far apart

C) are extremely small

D) move in constant, random motion

## Quick Quiz.

4) What is  $-88^{\circ}\text{C}$  in Kelvin temperature?

A) 185 K

B) 361 K

C)  $-361$  K

D) 273 K

$$K = ^{\circ}\text{C} + 273$$

$$K = -88 + 273$$

# Quick Quiz.

5) Put a cup of water on a table. A process that will occur is...

- A) evaporation.
- B) condensation.
- C) BOTH A and B
- D) NONE of the above

