College of Science and Technology Education

DEPARTMENT OF SCIENCE EDUCATION

GENERAL CHEMISTRY 2

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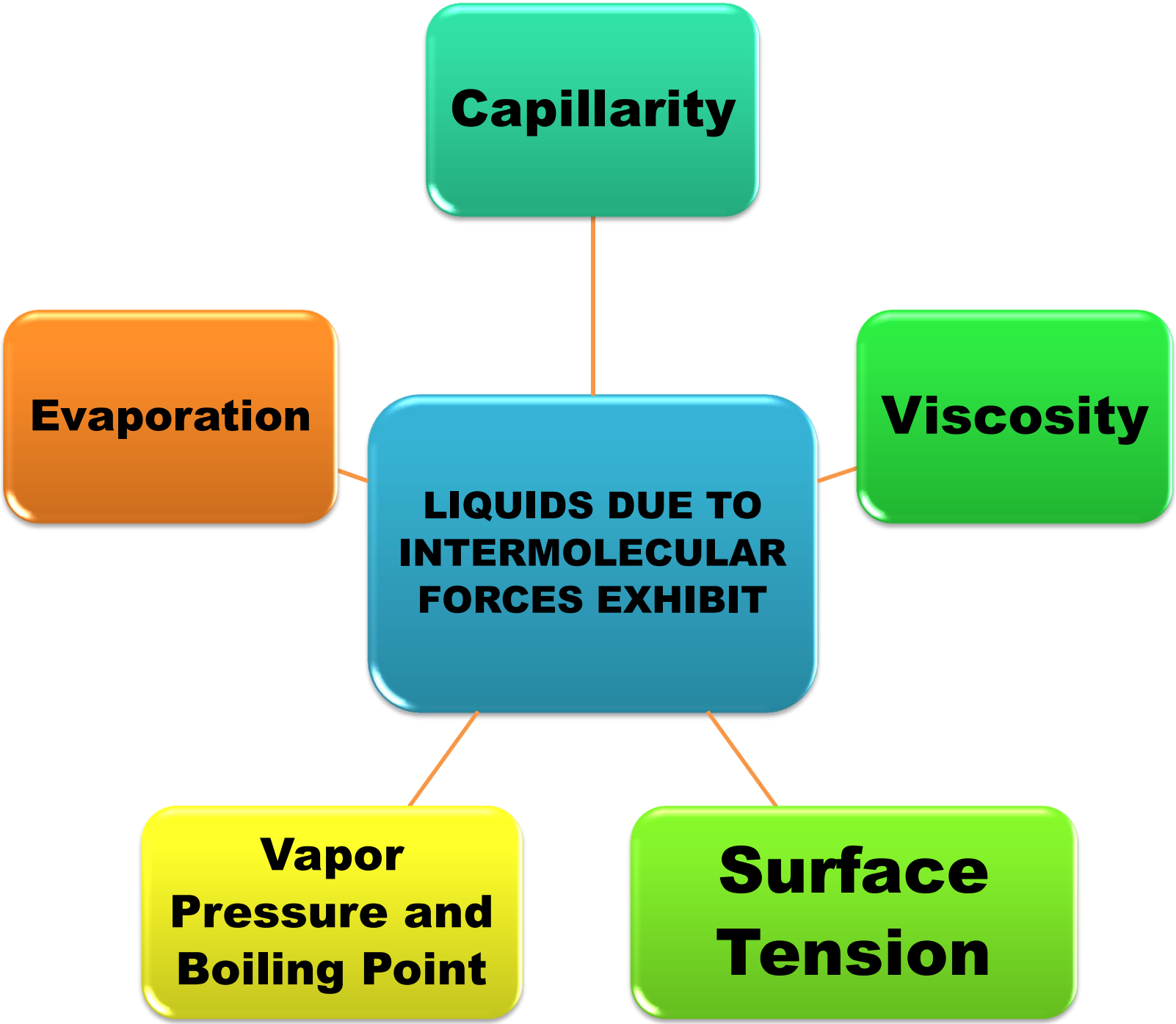
PROPERTIES OF LIQUIDS

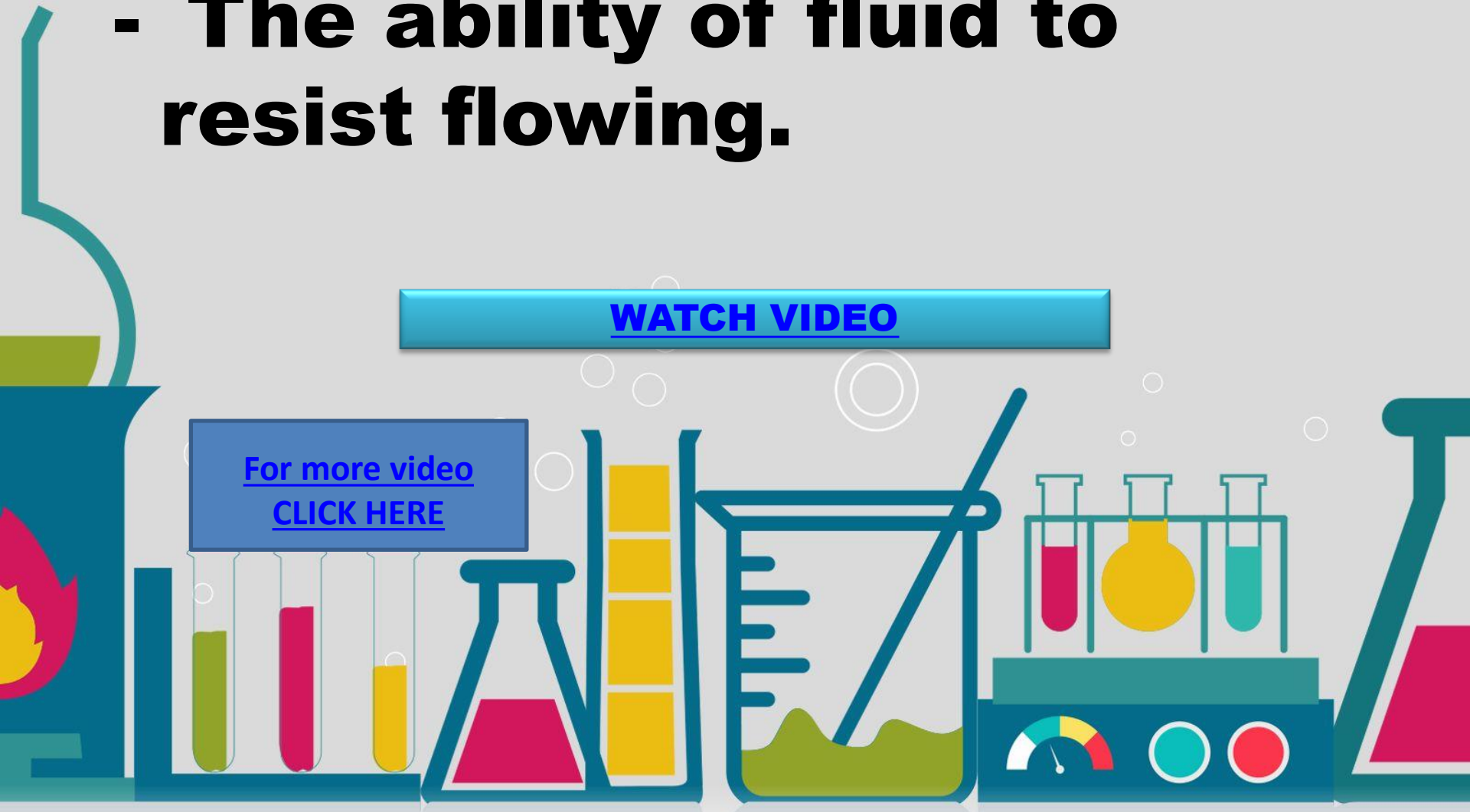

Capillarity
Evaporation
LIQUIDS DUE TO INTERMOLECULAR FORCES EXHIBIT
Viscosity
Vapor Pressure and Boiling Point
Surface Tension

1. VISCOSITY

- **The ability of fluid to resist flowing.**

WATCH VIDEO

For more video
CLICK HERE



WHY?

Which liquid flows faster?

Honey

Water (H_2O)

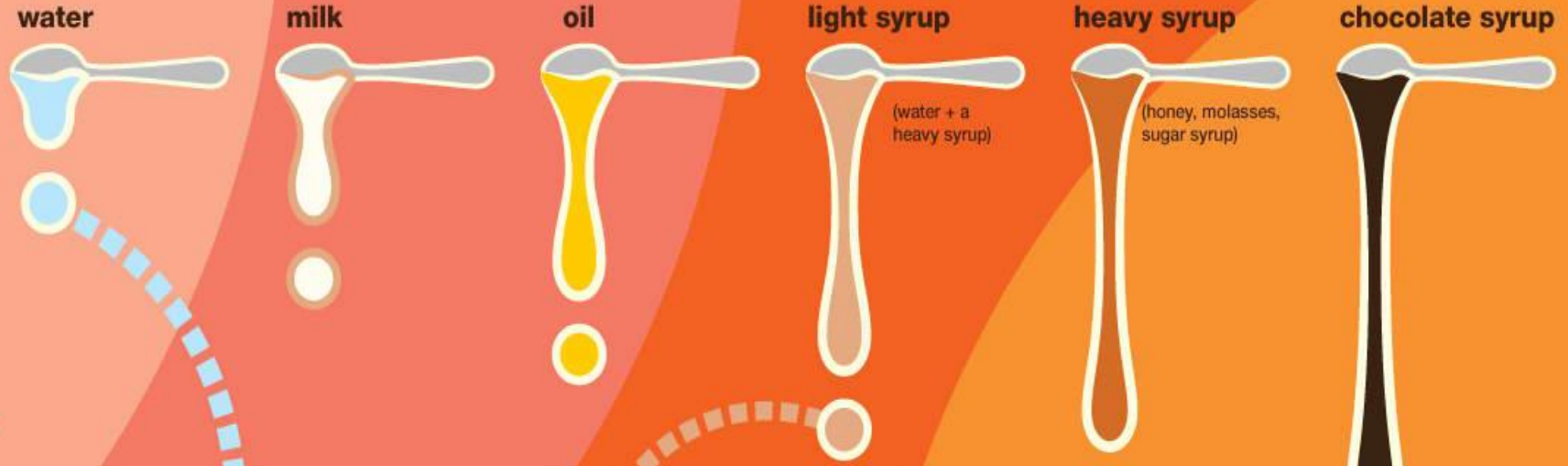
VISCOSITY for liquids

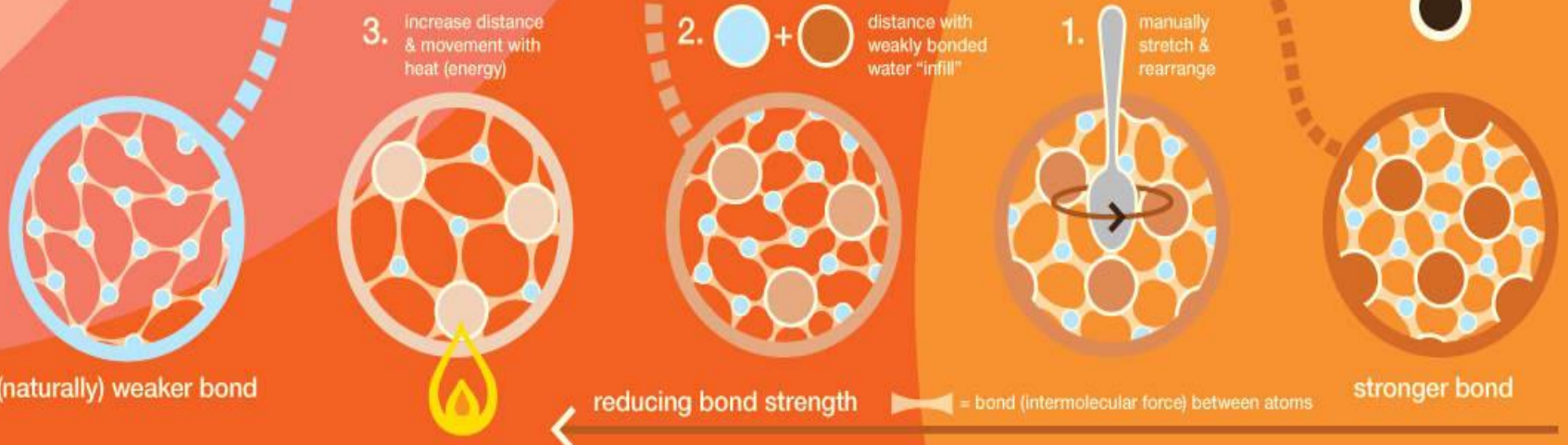
MATERIAL PROPERTY

This stickiness is caused by stronger or more numerous molecule-to-molecule interactions, which cause the molecules to stick together more when pulled upon. In cooking terms, a more viscous solution can appear "clumpier," and a less viscous solution "runny."
-Kevin Miklasz

sticky, **thick**, *viscous* (stronger bonds)

length of drop





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EXAMPLES WHY VISCOSITY IS IMPORTANT

1

Importance of Viscosity

Viscosity of fluid has very important role in industry. For eg: consider a toothpaste. The flow of toothpaste from the tube should be optimized so that we don't have to apply high pressure to take out the toothpaste from the tube or while applying small pressure excess toothpaste should not come. Here the speed of fluid flow is determined by the viscosity. If the viscosity is too high the velocity of flow will be very low to flow through the tube and if the viscosity is very low, the velocity of flow will be high.

In Automobile Industry

In automobile industry oil is having very importance in all machine parts. So the viscosity of oil has an important role in automobile industry. Viscosity effects the heat generation in bearings, cylinders and gears. When machine parts come in contact temperature increases. When temperature increases the viscosity of liquid decreases. If we select wrong oil (having wrong viscosity at high temperature) it will damage the machine parts.

In cold areas when temperature decreases, the viscosity of the liquid increases. If we select wrong oil having wrong viscosity it will also effect cold starting.

So Viscosity is having an important role in Automobile and other mechanical industry.

In Food Industry

In food industry the food parts are flowing through pipes. So that all the pipes should be inclined at angle, which will make the food flow smooth. The food parts will have a viscosity. Since we know the viscosity of the food part, we can calculate the angle of inclination for the flow.

Consider an example of a Ghee production unit. Since the Ghee is having a specific viscosity, its flow through a pipe and its speed can be optimized. So that overflow will not takes place.

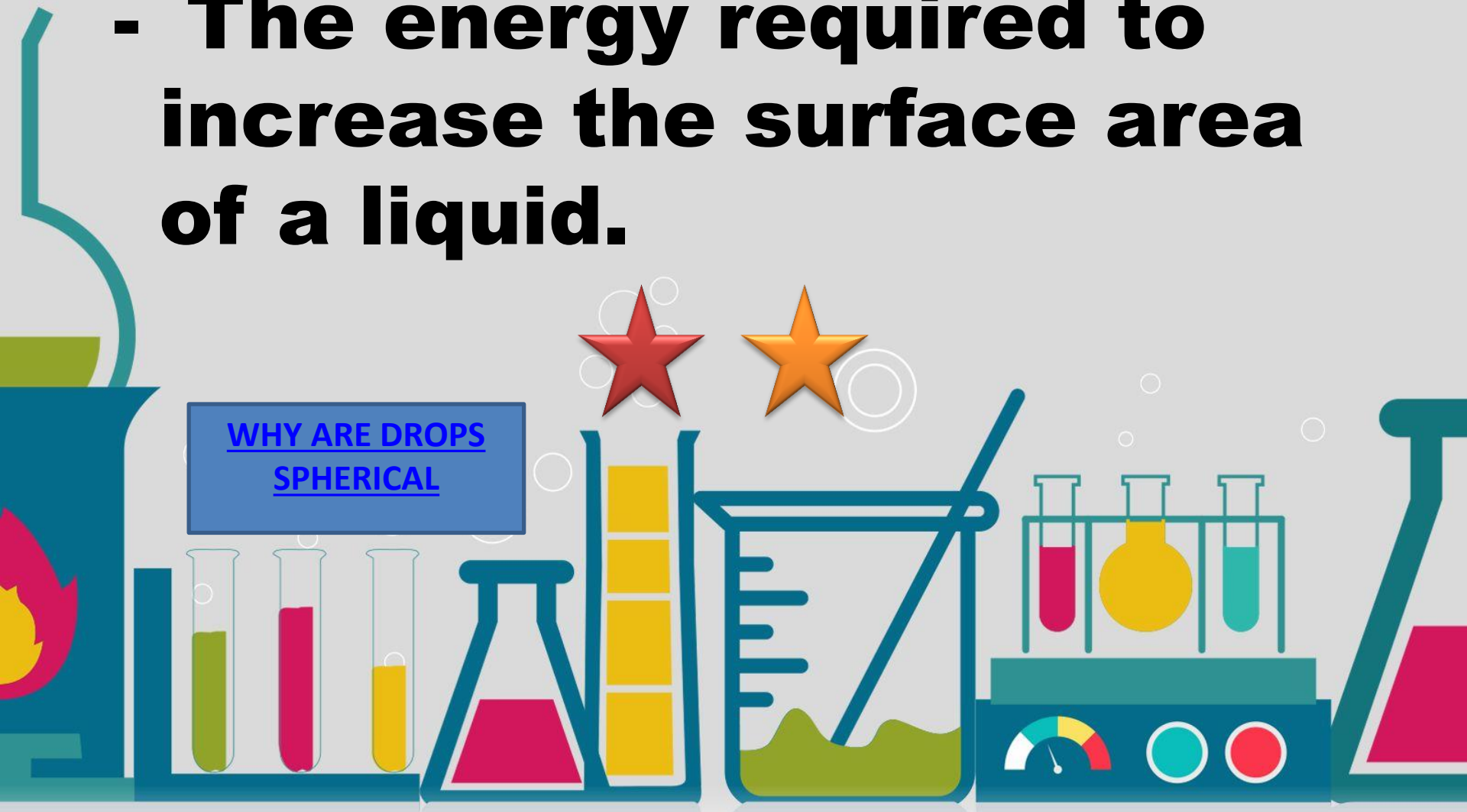
In Adhesives




If we want to use an adhesive at a point, we have to use adhesive having high viscosity. So that it will not spread to whole area while applying adhesives. And if we want to join two planes the adhesive should spread the area. Which means we have to use adhesives with lower viscosity

2. SURFACE TENSION

- **The energy required to increase the surface area of a liquid.**



EXAMPLES OF SURFACE TENSION

1. Dew drops: Have you noticed the drops of water on the leaves in your garden in the early morning? The moisture in the atmosphere condenses in the early morning and beads on the leaves due to surface tension. The surface tension gives spherical shape to water drops.

Dew is water **in** the form of **droplets** that appears on thin, exposed objects **in** the **morning** or evening due to condensation. As the exposed surface cools by radiating its heat, atmospheric moisture condenses **at** a rate greater than that **at** which it **can** evaporate, resulting **in** the formation of water **droplets**

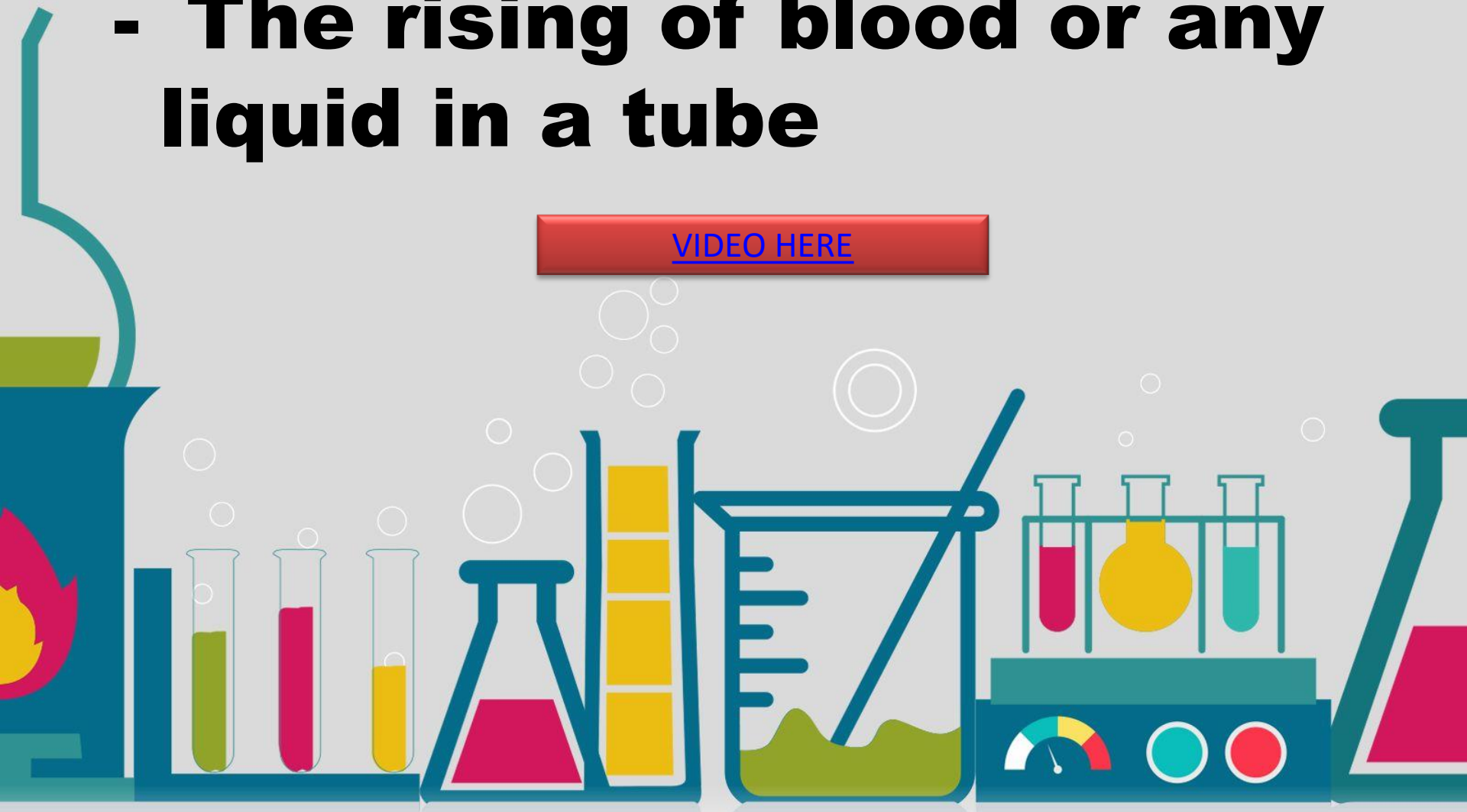
EXAMPLES OF SURFACE TENSION

2. Mercury used in the thermometer: The mercury used in the thermometer does not stick to the wall of the capillary tube because of the surface tension. Had it stuck to the walls the measurement of temperature would not have been correct.

2. CAPILLARITY

- **The rising of blood or any liquid in a tube**

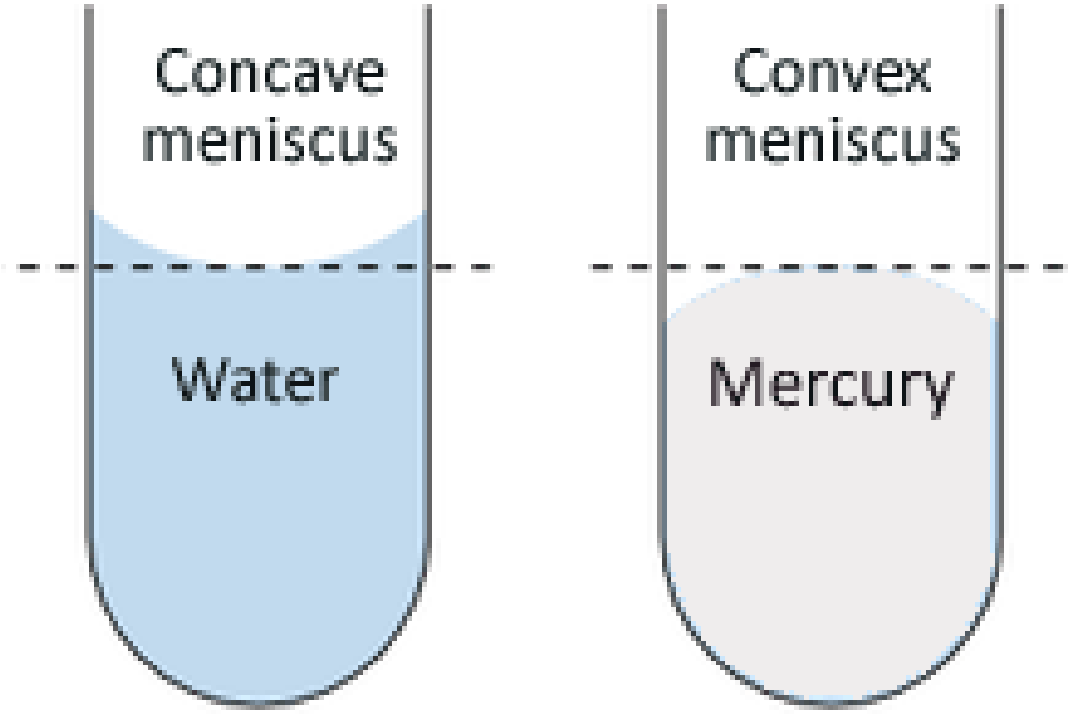
VIDEO HERE



TWO TYPES OF CAPILLARITY FORCES

- **Adhesion** and **cohesion** are both based on the root word "hesion," which means to stick. They are nouns that describe a state of molecules sticking together.
- The **difference between** them is that **adhesion** refers to the clinging of unlike molecules and **cohesion** refers to the clinging of like molecules.

- When liquid **water is** confined in a tube, its surface (**meniscus**) **has** a concave **shape** because **water** wets the surface and creeps up the side.
- When liquid **mercury is** confined in a tube, its surface (**meniscus**) **has** a **convex shape**because the cohesive forces in liquid **mercury** tend to draw it into a drop.



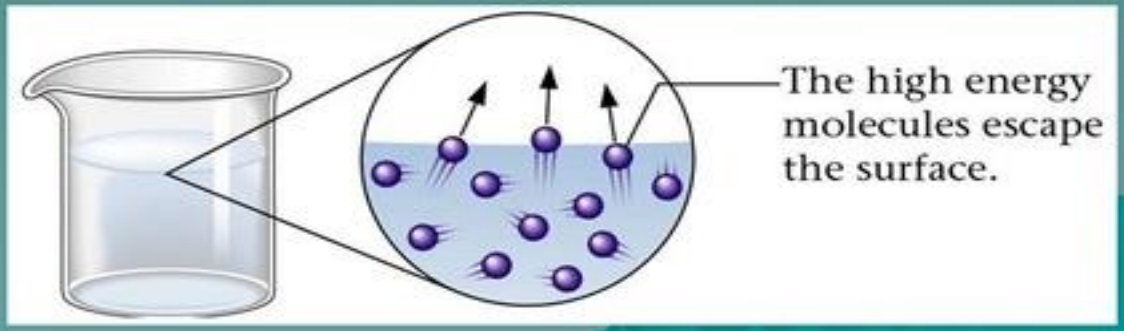
LET'S WATCH THIS!

Other Properties

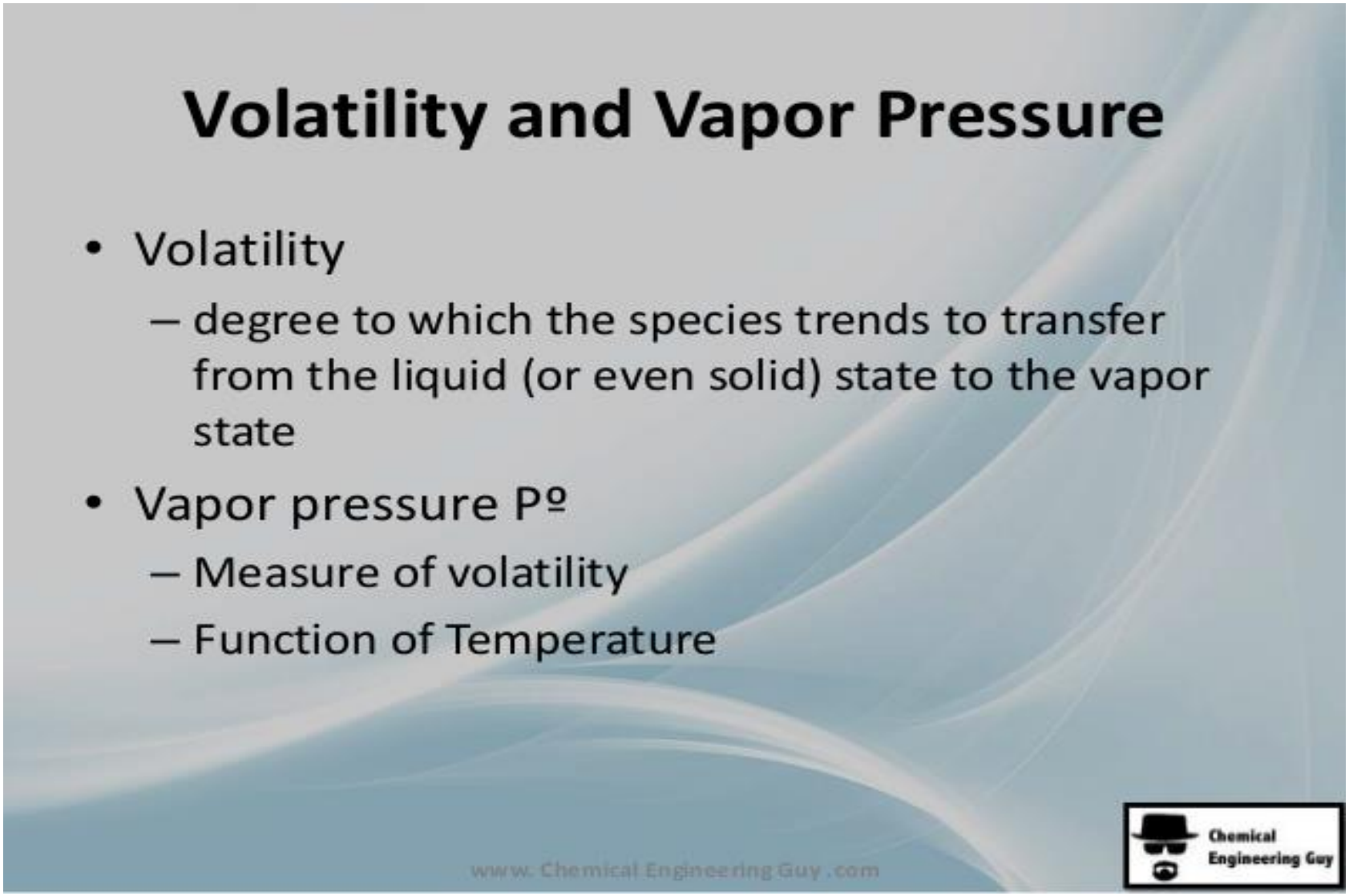
- Evaporation

Evaporation

- Evaporation occurs when molecules at the liquids surface are moving fast enough to escape into the gas phase
  - Also called **vaporization**
- Evaporation requires energy to overcome intermolecular forces between the molecules of the liquid



- Volatility


Volatility and Vapor Pressure
• Volatility
– degree to which the species trends to transfer from the liquid (or even solid) state to the vapor state
• Vapor pressure Pº
– Measure of volatility
– Function of Temperature
www. Chemical Engineering Guy .com
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- Vapor Pressure

What is Vapour pressure ?

- Vapour pressure is defined as the pressure exerted by a vapour in thermodynamic equilibrium with its condensed phases (solid or liquid) at a given temperature in a closed system.
- Vapour pressure is nothing but the tendency of particles to escape from the liquid (or a solid).
- At normal temperatures, substance with a high vapour pressure is often referred to as volatile.

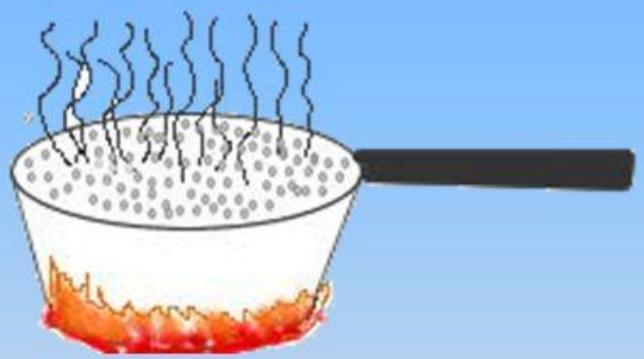
VOLATILE SUBSTANCES
VERSUS
NONVOLATILE SUBSTANCES

Volatile substances	Nonvolatile substances
Volatile substances readily transfer into the gaseous phase	Nonvolatile substances do not readily transfer into the gaseous phase
Have a high vapour pressure	Have a low vapour pressure
Have a low boiling point	Have a high boiling point
Have weaker intermolecular attractions	Have strong intermolecular attractions

- Boiling Point

BOILING POINT

- The temperature at which a liquid boils.
- The temperature at which a liquid changes into a gas.
- The boiling point is dependent on pressure.



FAST FACT!

The boiling point of water at sea level is 100° Celsius. On top of Mount Everest the boiling point of water is 69° Celsius. This happens because of the difference in pressure.

Explain each of the following phenomena

- A freely falling drop of water is spherical in shape
- Your arm feels cool when alcohol evaporates from your skin
- The vapor pressure of water increases with increasing temperature
- Boiling point varies with location