Vapor Pressure

Topic 4
Vapor Pressure Explained

Atmospheric Pressure

Vapor Pressure

Milk

Gasoline

How can we tell?

Table H
Vapor Pressure Explained

Table H

**What do you notice about water's vapor pressure at its boiling point?**

**Draw a particle diagram for each of the four liquids at 50°C.**

**Think about it…**

- If more particles are escaping the liquid (higher VP), the intermolecular forces are **weaker**.
- If the intermolecular forces are weaker, the boiling point is **higher**.

**$H_2O$ VP @ BP?**
Vapor Pressure Explained

Low Vapor Pressure (ethanoic acid)

High Vapor Pressure (propanone)
What do you notice about water’s vapor pressure at its boiling point?

Draw a particle diagram for each of the four liquids at 50°C.

Think about it…

• If more particles are escaping the liquid (higher VP), the intermolecular forces are _____________

• If the intermolecular forces are weaker, the boiling point is ____________

Consider this …

What can you say about the IMFs for a liquid with a high VP (more particles escaping)?

If IMFs are weak, the boiling point will be …?
When the vapor pressure of a liquid in an open container equals the atmospheric pressure, the liquid will
(1) freeze   (2) crystallize
(3) melt     (4) boil
Phase Changes - Topic 5

Temperature $H_2O$ (°C)

Solid $mc\Delta T$

Liquid-Solid $\Delta H^0_{fus}$

Liquid $mc\Delta T$

Gas - Liquid $\Delta H^0_{vap}$

Gas $mc\Delta T$

Heat Added
Things to Consider…

Horizontal (plateaus) = phase change

1. Melting (0°C)
2. Boiling (100°C)

Notice! Temperature remains constant during the phase changes!!
Things to Consider...

Heating Curve of Iron (Fe)
Cooling Curves

Fill this in!

Thinking question…

Why does it take longer to boil than to melt the same amount of a substance?
Why does it take longer to boil than to melt the same amount of a substance?
Which term represents the change of a substance from the solid phase to the liquid phase?
(1) condensation (2) vaporization (3) evaporation (4) fusion

Which change of phase is exothermic?
(1) gas to liquid (2) solid to liquid (3) solid to gas (4) liquid to gas

As ice melts at standard pressure, its temperature remains at 0°C until it has completely melted. Its potential energy
(1) decreases (2) increases (3) remains the same
1. Identify the process that takes place during line segment DE of the heating curve.

2. Identify a line segment in which the average kinetic energy is increasing.
Unit Essentials
ESSENTIALS: Know, Understand, and Be Able To…

- The three phases of matter (solids, liquids and gases) have different properties.
- Use a simple particle model to differentiate among properties of solids, liquids, and gases (organization of matter and how they fill their containers).
- Describe the differences in the types of particle motion (vibrating, rotating and sliding) for the 3 phases.
- Describe which phases are described as “fluids,” and explain what it means to be a fluid at the particle level.
- Describe which phase is compressible, and explain why from a particle perspective.
- Temperature is not a form of energy. Temperature is not the same thing as “heat.”
- The temperature of a sample of matter is determined by the amount of movement its particles have. More particle motion = higher temperature.
- Kinetic energy is energy due to the motion of the particles in a material. The particles in a sample of matter have three possible ways of moving: vibrating in place, rotating (spinning), and sliding past one another.
- Potential energy is energy that is “stored” in a material, the amount of which is determined by the structure of the particles and/or their positions relative to each other.
- Absolute zero is the temperature at which all particle motion ceases (kinetic energy becomes zero); this is therefore the lowest possible temperature in the universe.
- Chemists primarily use the Celsius and Kelvin temperature scales.
- Convert temperatures in Celsius degrees (°C) to Kelvin (K), and Kelvin to Celsius.

TEXT REFERENCES: p. 385-396
Topic 2 - Particle Attractions (IMFs)

**ESSENTIALS: Know, Understand, and Be Able To…**
- How particles are arranged (what phase they are in) is dependent on their energy and the effect this has on their attractions for each other.
- As particles gain energy, the attractions between them decrease.
- The strength of attractions between particles can be evaluated based on the property of viscosity.
- Viscosity is a property related to how easily a liquid pours, or flows.

**TEXT REFERENCES:** p. 385-396

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Topic 3 - Kinetic Molecular Theory & Gases

**ESSENTIALS: Know, Understand, and Be Able To…**
- Kinetic molecular theory describes the relationships of pressure, volume, temperature, velocity, and frequency and force of collisions among gas molecules.
- Pressure is force per area.
- Convert units of pressure from atmospheres to mmHg to kiloPascals. Be familiar with others, including torr and lb/in² (aka “psi”).
- Explain the source of atmospheric pressure, why it changes with elevation, and how it is measured (barometers).
- Explain the source/cause of P, V, and T for gases, using KMT (Kinetic Molecular Theory).
- Explain various phenomena from a KMT perspective (factors affecting rate of evaporation, effect of changes in P and T on gas volume, expansion of hot air balloons with increasing elevation in the atmosphere.

**TEXT REFERENCES:** p. 413-429
Topic 4 - Vapor Pressure

**ESSENTIALS:** Know, Understand, and Be Able To...

- Explain the source of vapor pressure, what conditions must be met in order to measure it, and why it always increases with temperature.
- The strength of attractions between particles can be evaluated based on the property of vapor pressure.
- Use Table H in order to determine normal and reduced pressure boiling point temperatures and relative strengths of the particle attractions for the four liquids.

**TEXT REFERENCES:** p. 413-429

Topic 5 - Heating Curves

**ESSENTIALS:** Know, Understand, and Be Able To...

- The strength of attractions between particles can be evaluated based on properties such as melting and boiling points, heat of fusion and heat of vaporization, vapor pressure and viscosity.
- The structure and arrangement of particles and their interactions determines the physical state of a substance at a given temperature and pressure.
- Phase changes are physical changes.
- Phase changes can be either exothermic or endothermic.
- Explain phase change in terms of the changes in particle energy and attractions.
- Distinguish between endothermic and exothermic phase changes, by writing “heat energy” correctly into a phase change equation, or by using experimental data.
- The concepts of kinetic and potential energy can be used to explain physical processes that include: fusion (melting), solidification (freezing), vaporization (boiling, evaporation), condensation, sublimation and deposition.
- Interpret heating or cooling curves in order to determine melting/boiling points, energy absorption as KE or PE, particle movement, arrangement and interactions.

**TEXT REFERENCES:** p. 523, 385-396, 413-429