PROBLEM \(\PageIndex{1}\))

Heat is added to boiling water. Explain why the temperature of the boiling water does not change. What does change?

**Answer**

The heat is absorbed by the water, providing the energy required to partially overcome intermolecular attractive forces in the liquid and causing a phase transition to gaseous water. The solution remains at 100 °C until all the water is boiled. Only the amount of water existing as liquid water changes until the liquid disappears. Then the temperature of the water can rise.

PROBLEM \(\PageIndex{2}\))

Heat is added to ice at 0 °C. Explain why the temperature of the ice does not change. What does change?

**Answer**

The heat is absorbed by the ice, providing the energy required to partially overcome intermolecular attractive forces in the solid and causing a phase transition to liquid water. The solution remains at 0 °C until all the ice is melted. Only the amount of water existing as ice changes until the ice disappears. Then the temperature of the water can rise.

PROBLEM \(\PageIndex{3}\))

What is the relationship between the intermolecular forces in a liquid and its vapor pressure?

**Answer**

The vapor pressure of a liquid decreases as the strength of its intermolecular forces increases.

PROBLEM \(\PageIndex{4}\))

What is the relationship between the intermolecular forces in a solid and its melting temperature?

**Answer**

The stronger the intermolecular forces, the higher the melting point.

PROBLEM \(\PageIndex{5}\))

Why does spilled gasoline evaporate more rapidly on a hot day than on a cold day?

**Answer**

As the temperature increases, the average kinetic energy of the molecules of gasoline increases and so a greater fraction of molecules have sufficient energy to escape from the liquid than at lower temperatures.

PROBLEM \(\PageIndex{6}\))

When is the boiling point of a liquid equal to its normal boiling point?

**Answer**

When the pressure of gas above the liquid is exactly 1 atm
PROBLEM \PageIndex{7}

How does the boiling of a liquid differ from its evaporation?

**Answer**

boiling implies an application of energy in the form of heat.

PROBLEM \PageIndex{8}

Explain the following observations:

a. It takes longer to cook an egg in Klamath Falls, Oregon (altitude, 4200 feet above sea level) than it does in Boston (at sea level).

b. Perspiring is a mechanism for cooling the body.

**Answer**

At 4200 feet, the atmospheric pressure is lower than at sea level, and water will therefore boil at a lower temperature. This lower temperature will cause the physical and chemical changes involved in cooking the egg to proceed more slowly, and a longer time is required to fully cook the egg.

**Answer**

As long as the air surrounding the body contains less water vapor than the maximum that air can hold at that temperature, perspiration will evaporate, thereby cooling the body by removing the heat of vaporization required to vaporize the water.

PROBLEM \PageIndex{9}

Explain why the molar enthalpies of vaporization of the following substances increase in the order CH$_4$ < C$_2$H$_6$ < C$_3$H$_8$, even though all three substances experience the same dispersion forces when in the liquid state.

**Answer**

Dispersion forces increase with molecular mass or size. As the number of atoms composing the molecules in this homologous series increases, so does the extent of intermolecular attraction via dispersion forces and, consequently, the energy required to overcome these forces and vaporize the liquids.

PROBLEM \PageIndex{10}

Explain why the enthalpies of vaporization of the following substances increase in the order CH$_4$ < NH$_3$ < H$_2$O, even though all three substances have approximately the same molar mass.

**Answer**

CH$_4$ is non-polar (dispersion forces only)

NH$_3$ is polar (dipole-dipole interactions)

H$_2$O is polar (hydrogen bonding)
PROBLEM \(\PageIndex{11}\)

Which contains the compounds listed correctly in order of increasing boiling points?

a. \(N_2 < CS_2 < H_2O < KCl\)
b. \(H_2O < N_2 < CS_2 < KCl\)
c. \(N_2 < KCl < CS_2 < H_2O\)
d. \(CS_2 < N_2 < KCl < H_2O\)
e. \(KCl < H_2O < CS_2 < N_2\)

**Answer**

a is correct; \(N_2\) is nonpolar, \(CS_2\) is polar (dipole-dipole), \(H_2O\) is polar (H-bonding), \(KCl\) is ionic (ion-dipole)

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**Have a video solution request?**

Let your professors know [here](#).

***Please know that you are helping future students - videos will be made in time for next term's class.***

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**Feedback**

Think one of the answers above is wrong? Let us know [here](#).