

This print-out should have 8 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

Mlib 00 6041

001 10.0 points

The specific heat of liquid water is 4.184 J/g·°C, and of steam 2.03 J/g·°C. The heat of vaporization of water (ℓ) is 2.26 kJ/g and its boiling point is 100°C. What is the total heat flow when 18 grams of water at 12°C are heated to become steam at 109°C?

- 48.9 kJ
- 47.6 kJ **correct**
- over 55 kJ
- 44.4 kJ
- 40.7 kJ
- under 28 kJ
- 31.7 kJ

Explanation:

$$\begin{array}{c}
 \begin{array}{ccc}
 \begin{array}{c} 18 \text{ g} \\ \text{H}_2\text{O}(\ell) \\ 12^\circ\text{C} \end{array} & \xrightarrow{\text{step 1}} & \begin{array}{c} 18 \text{ g} \\ \text{H}_2\text{O}(\ell) \\ 100^\circ\text{C} \end{array} & \xrightarrow{\text{step 2}} & \begin{array}{c} 18 \text{ g} \\ \text{H}_2\text{O}(\text{g}) \\ 100^\circ\text{C} \end{array} & \xrightarrow{\text{step 3}} & \begin{array}{c} 18 \text{ g} \\ \text{H}_2\text{O}(\text{g}) \\ 109^\circ\text{C} \end{array}
 \end{array} \\
 \\
 \text{Step 1: } & \frac{4.184 \text{ J}}{\text{g} \cdot ^\circ\text{C}} \cdot (18 \text{ g}) \cdot (100 - 12)^\circ\text{C} & & & & & \\
 & & & & & & = 6,627 \text{ J} \\
 \text{Step 2: } & \frac{2.26 \text{ kJ}}{\text{g}} \cdot (18 \text{ g}) \cdot \frac{1000 \text{ J}}{1 \text{ kJ}} & & & & & \\
 & & & & & & = 40,680 \text{ J} \\
 \text{Step 3: } & \frac{2.03 \text{ J}}{\text{g} \cdot ^\circ\text{C}} \cdot (18 \text{ g}) \cdot (109 - 100)^\circ\text{C} & & & & & \\
 & & & & & & = 329 \text{ J} \\
 \text{Total} & = 6627 \text{ J} + 329 \text{ J} + 40,680 \text{ J} & & & & & \\
 & = 47,636 \text{ J} = 47.636 \text{ kJ}
 \end{array}$$

Mlib 04 4045

002 10.0 points

The maximum amount of solute that dissolves in a given amount of solvent and forms a

stable solution is called the

- solubility. **correct**
- coefficient of solution.
- molality.
- molarity.
- freezing point elevation.

Explanation:

The solubility of a solute in a given solvent is the maximum amount of it that can dissolve at the given temperature.

Mlib 04 5041x

003 10.0 points

Consider two liquids A and B. The vapor pressure of pure A (molecular weight = 50 g/mol) is 225 torr at 25°C and the vapor pressure of pure B (molecular weight = 75 g/mol) is 90 torr at the same temperature. What is the total vapor pressure at 25°C of a solution that is 25% A and 75% B by weight?

- 135 torr **correct**
- 335 torr
- 108 torr
- 203 torr
- 191 torr
- 124 torr
- 225 torr
- 76 torr
- 115 torr

Explanation:

For A,	
$P^0 = 225 \text{ torr}$	MW = 50 g/mol
For B,	
$P^0 = 90 \text{ torr}$	MW = 75 g/mol

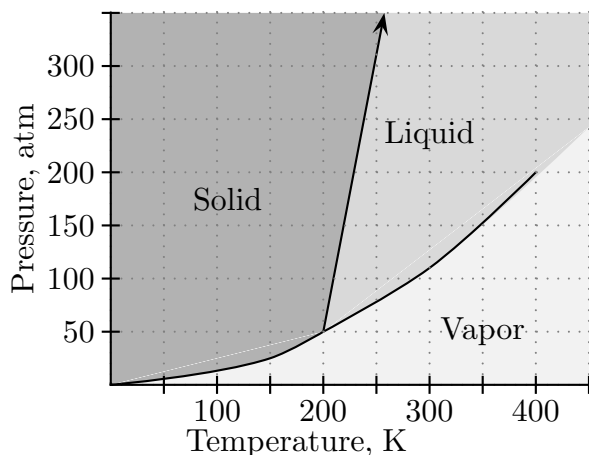
The mole fractions are $\frac{1}{3}$ for A and $\frac{2}{3}$ for B.

$$\left(\frac{1}{3}\right)(225) + \left(\frac{2}{3}\right)(90) = 135 \text{ torr}$$

ChemPrin3e T08 23

004 10.0 points

The phase diagram for a pure substance is shown below.



What is the highest temperature at which the substance can exist as a liquid?

1. 350 K
2. 400 K **correct**
3. 200 K
4. any temperature above 200 K
5. 250 K

Explanation:

ChemPrin3e T08 06

005 10.0 points

Estimate the enthalpy of vaporization of CCl_4 given that at 25°C and 58°C its vapor pressure is 107 and 405 torr, respectively. Assume that the enthalpy of vaporization is independent of the temperature.

1. 48.6 $\text{kJ}\cdot\text{mol}^{-1}$
2. 142 $\text{kJ}\cdot\text{mol}^{-1}$
3. 486 $\text{J}\cdot\text{mol}^{-1}$

4. 3.98 $\text{kJ}\cdot\text{mol}^{-1}$

5. 33.1 $\text{kJ}\cdot\text{mol}^{-1}$ **correct**

Explanation:

ChemPrin3e T08 70

006 10.0 points

Blood, sweat, and tears are about 0.15 M in sodium chloride. Estimate the osmotic pressure of these solutions at 37°C . The gas constant is $0.0821 \text{ L}\cdot\text{atm}\cdot\text{mol}^{-1}\cdot\text{K}^{-1}$.

1. 1.8 atm
2. 3.8 atm
3. 7.6 atm **correct**
4. 11 atm
5. 0.91 atm

Explanation:

Msci 14 0500

007 10.0 points

The formation of tiny bubbles when a beaker of water is mildly heated indicates that

1. air is less soluble in water at higher temperatures. **correct**
2. the lattice energy of water is large.
3. the liquid is at its boiling point.
4. water is being extensively hydrogen bonded.
5. water is being decomposed into hydrogen and oxygen.

Explanation:

The bubbles are tiny pockets of air that were dissolved in the water at the lower temperature. As the gas molecules acquired more energy they were able to escape from the solvent.

008 10.0 points

Each of the following samples was placed in 1 liter of water.

- I) 0.6 mol NaOH
- II) 0.7 mol KCl
- III) 0.5 mol Na₂NO₃
- IV) 1 mol of sugar

Rank the solutions that are made in terms of increasing order of boiling point elevation. (Remember your solubility rules.)

1. II, IV, I, III
2. IV, I, II, III **correct**
3. III, I, II, IV
4. III, I, IV, II
5. IV, II, I, III

Explanation:

Colligative properties of a solution depend on the number of solute particles in solution, not the type.

I) will have 1.2 mol of particles because NaOH completely dissociates in water.

II) will have 1.4 mol of particles because KCl completely dissociates in water.

III) will have 1.5 mol of particles because Na₂CO₃ completely dissociates in water.

IV) will have 1 mol of sugar in solution because it is soluble but does not dissociate.

The higher the concentration, the greater the boiling point elevation, so

$$IV > I > II > III.$$