**Colligative Properties:**

**Freezing Point Depression & Boiling Point Elevation**

**YOYO:**

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| 1. What are the units for molarity
 | 1. How many moles of NaCl are there in 1L of a 2M solution?
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Molecules vs. Ionic Compounds in Aqueous Solutions

* Some molecular compounds dissolve but do not dissociate into ions.
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		- 1 mole of sugar gives 1 mole of sugar when dissolved in water
* Many ionic compounds dissociate into independent ions when dissolved in water
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		- 1 mole of NaCl solid gives 1 mole of sodium ions and 1 mole of chloride ions when dissolves (total of 2 moles of dissolved particles).
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		- Total of 3 moles of dissolved particles

Colligative Properties

* Colligative properties refer to properties of a solution that depend on the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Vapor Pressure Lowering

* The presence of any solute (salt or sugar) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the vapor pressure of the solvent.
* The more moles of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (greater concentration of solute), the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the vapor pressure.

Boiling Point Elevation

* The presence of a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (salt or sugar) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the boiling point of the solvent.
	+ Nonvolatile: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the concentration (more moles of dissolved particles) of the solute, the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ it raises the boiling point.

Freezing Point Depression

* The presence of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (salt or sugar) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the freezing point of the solvent.
* The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (greater concentration of solute), the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the freezing point.

Other Things to Remember

* Low vapor pressure = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* High vapor pressure = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* The stronger the intermolecular forces the lower the vapor pressure/higher the boiling point.

Increasing strength of intermolecular forces of attraction

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| London Forces | Dipole-Dipole Interactions | Ion-Dipole Interactions | Hydrogen Bonding |

Summary

* The addition of solutes in water:
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Practice Questions

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| 1. How are the boiling and freezing point of a sample of water affected when a salt is dissolved in the water?
2. BP decreases/FP decreases
3. BP decreases/FP increase
4. BP increase/FP decreases
5. BP increase/FP increases
 | 1. Which solution containing 1 mole of solute dissolved in 100 grams of water has the lowest freezing point?
2. KOH (aq)
3. C6H12O6 (aq)
4. C2H5OH (aq)
5. C12H12O11 (aq)
 |
| 1. Which sample, when dissolved in 1.0 liter of water, produces a solution with the highest boiling point?
2. 0.1 mole KI
3. 0.2 mole KI
4. 0.1 mole MgCl2
5. 0.2 mole MgCl2
 | 1. Which solution has the highest boing point at standard pressure?
2. 0.10M KCl (aq)
3. 0.10M K2SO4 (aq)
4. 0.10M K3PO4 (aq)
5. 0.10M KNO3 (aq)
 |
| 1. Which aqueous solution of KI freezes at the lowest temperature?
2. 1 mol of KI in 500 g of water
3. 2 mol of KI in 500 g of water
4. 1 mol of KI in 1000 g of water
5. 2 mole of KI in 1000 g of water
 | 1. Which solution has the lowest freezing point?
2. 10 g of KI dissolved in 100 g of water
3. 20 g of KI dissolved in 200 g of water
4. 30 g of KI dissolved in 100 g of water
5. 40 g of KI dissolved in 200 g of water
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