Chapter 7 Review Problems

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7.1) When two or more pure substances are combined, we refer to the combination as a _______________.

a) homogeneous state

b) solution

c) mixture

d) compound

e) soup

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7.1) When two or more pure substances are combined, we refer to the combination as a _______________.

HINT:

a) ~~homogeneous state~~

b) solution

c) mixture

d) compound

e) ~~soup~~

For more help: see chapter 7 part 1 video or chapter 7 section 2 in the textbook.

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7.1) When two or more pure substances are combined, we refer to the combination as a ______________.

a) homogeneous state — When two or more pure substances are combined, the resulting mixture will be either *homogeneous* **or** *heterogeneous*.

b) solution — A solution is a ***homogeneous mixture*** of two or more pure substances.

c) mixture

d) compound — A compound is a ***pure substance***, not a mixture.

e) soup — I hope this was not your selection.

For more details: see chapter 7 part 1 video or chapter 7 section 2 in the textbook.

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7.2) One way in which mixtures are classified is by their macro-scale, visually observed homogeneity. Write an explanation of the difference between homogeneous mixtures and heterogeneous mixtures.

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7.2) One way in which mixtures are classified is by their macro-scale, visually observed homogeneity. Write an explanation of the difference between homogeneous mixtures and heterogeneous mixtures.

HINT: You could adequately explain this in one or two sentences.

For more help: see chapter 7 part 1 video or chapter 7 section 2 in the textbook.

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7.2) One way in which mixtures are classified is by their macro-scale, visually observed homogeneity. Write an explanation of the difference between homogeneous mixtures and heterogeneous mixtures.

A homogeneous mixture appears to be the same throughout the entire sample/object.
A heterogeneous mixture has visible regions of varying composition.

FURTHER EXPLANATION: If you dissolve a spoon of sugar in water, the resulting mixture would be homogenous. If you were to repeatedly withdraw one drop of the sugar-water from various random regions in the glass, each of the drops would be identical. This can be contrasted with a heterogeneous mixture. An example of a heterogeneous mixture is a chocolate chip cookie. In some small regions of the chocolate chip cookie, a chocolate chip can be seen; in other small regions a chocolate chip is not seen. If you were to use tweezers/forceps to repeatedly withdraw a small sample of the cookie form various random regions of the cookie, the samples that you withdrew may not all appear to be identical. The amount of chocolate in each sample could vary. You may see that a few of the samples are 100% chocolate, some may contain both chocolate and non-chocolate parts, and in other samples you may not observe any chocolate parts at all.

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7.3) **Solutions** are mixtures of pure substances in which the pure substance particles (molecules, ions, or noble gas atoms) are *evenly distributed* throughout the entire volume of the mixture.

Consider a solution composed of 5.0 grams of sodium chloride and 100.0 grams of water.

i) What is the *solvent*?

ii) What is the *solute*?

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7.3) **Solutions** are mixtures of pure substances in which the pure substance particles (molecules, ions, or noble gas atoms) are *evenly distributed* throughout the entire volume of the mixture.

Consider a solution composed of 5.0 grams of sodium chloride and 100.0 grams of water.

i) What is the *solvent*?

ii) What is the *solute*?

HINT: The pure substance that is in the greatest abundance is referred to as the solvent. The other pure substance components of a solution are called solutes.

For more help: see chapter 7 part 1 video or chapter 7 section 3 in the textbook.

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7.3) **Solutions** are mixtures of pure substances in which the pure substance particles (molecules, ions, or noble gas atoms) are *evenly distributed* throughout the entire volume of the mixture.

Consider a solution composed of 5.0 grams of sodium chloride and 100.0 grams of water.

i) What is the *solvent*? ***water***

ii) What is the *solute*? ***sodium chloride***

EXPLANATION: The pure substance that is in the greatest abundance is referred to as the solvent. Typically, especially in biological systems, and in this problem, the ***solvent is water***. The other pure substance components of a solution are called solutes.

For more details: see chapter 7 part 1 video or chapter 7 section 3 in the textbook.

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7.4) When two liquids mix with each other in any ratio, we say that the substances are ________________.”

a) polar

b) nonpolar

c) hydrophilic

d) miscible

e) adult beverages

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7.4) When two liquids mix with each other in any ratio, we say that the substances are ________________.”

HINT:

a) polar

b) ~~nonpolar~~

c) miscible

d) hydrophilic

e) ~~adult beverages~~

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7.4) When two liquids mix with each other in any ratio, we say that the substances are ________________."

a) polar

b) nonpolar

c) hydrophilic

d) miscible

e) adult beverages

EXPLANATION: Some liquid-in-liquid solutions can be made at any ratio of the liquids. For example, water and ethyl alcohol will mix no matter what the ratio is of water to ethyl alcohol. When two liquids mix with each other in any ratio, we say that the substances are "**miscible**." Some pairs of liquids will not mix with each other at all. For example, oil will not significantly dissolve in water, this is why we see oil floating on the top of water when oil spills occur. When two liquids will ***not mix*** with each other we say that the substances are "**immiscible**."

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7.5) Label each of the following statements as **true** or **false**.

a) The solubility of a dissolved gas depends on both temperature and pressure.

b) Whenever a gas is present above a liquid, some of the gas will dissolve in the liquid.

c) The solubilities of most solids in water decrease as the temperature increases.

d) The solubilities of gases in water increase as the temperature increases.

e) The solubility of a gas increases as the partial pressure of that gas above the solution increases.

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7.5) Label each of the following statements as **true** or **false**.

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c) The solubilities of most solids in water decrease as the temperature increases.

d) The solubilities of gases in water increase as the temperature increases.

e) The solubility of a gas increases as the partial pressure of that gas above the solution increases.

HINT: The information needed to answer these questions is given in chapter 7 part 2 video and chapter 7 section 3 in the textbook.

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7.5) Label each of the following statements as **true** or **false**.

a) The solubility of a dissolved gas depends on both temperature and pressure. **true**

b) Whenever a gas is present above a liquid, some of the gas will dissolve in the liquid. **true**

c) The solubilities of most solids in water decrease as the temperature increases. **false**

- The solubilities of most solids in water ***increase*** as the temperature increases.

d) The solubilities of gases in water increase as the temperature increases. **false**

- The solubilities of gases in water ***decrease*** as the temperature increases.

e) The solubility of a gas increases as the partial pressure of that gas above the solution increases. **true**

For more details: See chapter 7 part 2 video or chapter 7 section 3 in the textbook.

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7.6) Some ionic compounds dissolve to a significant extent in water; some do not. It is difficult to use theoretical methods to predict the extent to which an ionic compound will dissolve. It is therefore convenient to use "***solubility rules***" in order to know which ionic compounds will significantly dissolve in water.

Use the **solubility rules table** to determine which of the following compounds are ***water soluble***.

a) potassium bromide

b) silver bromide

c) sodium sulfate

d) sodium hydroxide

e) copper(II) chromate

f) lead(II) hydroxide

g) iron(III) nitrate

h) copper(I) hydroxide

Solubility Rules Table

Water Soluble			
Compound	**Example**	**Exceptions**	**Exception Example**
Nitrates	$NaNO_3$	None	None
Chlorides, Bromides, and Iodides	$NaCl$	Compounds containing Ag^+, Pb^{2+}, or Hg^+, and HgI_2	$AgCl$
Sulfates	K_2SO_4	Compounds containing Pb^{2+}, Sr^{2+}, Ba^{2+}, or Hg^+	$PbSO_4$
Water Insoluble			
Compound	**Example**	**Exceptions**	**Exception Example(s)**
Hydroxides	$Mg(OH)_2$	Compounds containing alkali (Group I) metals *or* Ca^{2+}, Sr^{2+}, Ba^{2+}, NH_4^+	$NaOH$
Phosphates, Carbonates, and Chromates	$FePO_4$	Compounds containing alkali (Group I) metals *or* NH_4^+	K_2CO_3, Li_3PO_4, Na_2CrO_4

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7.6) Some ionic compounds dissolve to a significant extent in water; some do not. It is difficult to use theoretical methods to predict the extent to which an ionic compound will dissolve. It is therefore convenient to use "***solubility rules***" in order to know which ionic compounds will significantly dissolve in water.

Use the **solubility rules table** to determine which of the following compounds are ***water soluble***.

a) potassium bromide

b) silver bromide

c) sodium sulfate

d) sodium hydroxide

e) copper(II) chromate

f) lead(II) hydroxide

g) iron(III) nitrate

h) copper(I) hydroxide

HINT:

STEP 1: Find the solubility classification in the table based on the identity of the anion.

STEP 2: Check to see if the compound's cation indicates that the compound is an exception for the solubility class.

Solubility Rules Table

Water Soluble			
Compound	**Example**	**Exceptions**	**Exception Example**
Nitrates	$NaNO_3$	None	None
Chlorides, Bromides, and Iodides	NaCl	Compounds containing Ag^+, Pb^{2+}, or Hg^+, and HgI_2	AgCl
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Water Insoluble			
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For more help: See chapter 7 part 2 video or chapter 7 section 3 in the textbook.

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Use the **solubility rules table** to determine which of the following compounds are ***water soluble***.

a) potassium bromide ***water soluble***

b) silver bromide ***water insoluble*** (Ag^+ is an *exception*)

c) sodium sulfate ***water soluble***

d) sodium hydroxide ***water soluble*** (sodium is in Group I)

e) copper(II) chromate ***water insoluble***

f) lead(II) hydroxide ***water insoluble***

g) iron(III) nitrate ***water soluble***

h) copper(I) hydroxide ***water insoluble***

Solubility Rules Table

Water Soluble			
Compound	**Example**	**Exceptions**	**Exception Example**
Nitrates	$NaNO_3$	None	None
Chlorides, Bromides, and Iodides	NaCl	Compounds containing Ag^+, Pb^{2+}, or Hg^+, and HgI_2	AgCl
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Water Insoluble			
Compound	**Example**	**Exceptions**	**Exception Example(s)**
Hydroxides	$Mg(OH)_2$	Compounds containing alkali (Group I) metals *or* Ca^{2+}, Sr^{2+}, Ba^{2+}, NH_4^+	NaOH
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For more details: See chapter 7 part 2 video or chapter 7 section 3 in the textbook.

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7.7) Determine if a *precipitation reaction* would occur when a **silver nitrate** solution is mixed with a **magnesium bromide** solution and, if a reaction does occur, write the balanced chemical equation.

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7.7) Determine if a *precipitation reaction* would occur when a **silver nitrate** solution is mixed with a **magnesium bromide** solution and, if a reaction does occur, write the balanced chemical equation.

HINT:

Method for Predicting if a Precipitation Reaction will Occur and Writing the Balanced Chemical Equation for Precipitation Reactions

Step 1: Write ***reactants*** and arrow for the chemical equations using ***word form*** (not formulas):

silver nitrate + magnesium bromide →

Step 2: Add the "*possible*" **products** to the word equation by switching ***anions***:

silver nitrate + magnesium bromide → silver bromide + magnesium nitrate

Step 3: Convert the ***word*** equation to a ***formula*** equation.

Step 4: ***Balance*** the equation.

Step 5: Add the phases of the reactants and "possible" products to the equation.

For more help: See chapter 7 part 3 video or chapter 7 section 4 in the textbook.

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7.7) Determine if a *precipitation reaction* would occur when a **silver nitrate** solution is mixed with a **magnesium bromide** solution and, if a reaction does occur, write the balanced chemical equation.

ANSWER: $2\ AgNO_3\ (aq) + MgBr_2\ (aq) \rightarrow 2\ AgBr\ (s) + Mg(NO_3)_2\ (aq)$

Method for Predicting if a Precipitation Reaction will Occur and Writing the Balanced Chemical Equation for Precipitation Reactions:

Step 1: Write ***reactants*** and arrow for the chemical equations using ***word form*** (not formulas):

silver nitrate + magnesium bromide →

Step 2: Add the "*possible*" **products** to the word equation by switching ***anions***:

silver nitrate + magnesium bromide → silver bromide + magnesium nitrate

Step 3: Convert the ***word*** equation to a ***formula*** equation:

$$AgNO_3 + MgBr_2 \rightarrow AgBr + Mg(NO_3)_2$$

Step 4: ***Balance*** the equation:

$$2\ AgNO_3 + MgBr_2 \rightarrow 2\ AgBr + Mg(NO_3)_2$$

Step 5: Add the phases of the reactants and "possible" products to the equation.

$$2\ AgNO_3\ (aq) + MgBr_2\ (aq) \rightarrow 2\ AgBr\ (s) + Mg(NO_3)_2\ (aq)$$

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For more details: See chapter 7 part 3 video or chapter 7 section 4 in the textbook.

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7.8) Determine if a precipitation reaction would occur when a aluminum bromide solution is mixed with a lithium phosphate solution and, if a reaction does occur, write the balanced chemical equation.

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HINT:

Method for Predicting if a Precipitation Reaction will Occur and Writing the Balanced Chemical Equation for Precipitation Reactions

Step 1: Write ***reactants*** and arrow for the chemical equations using ***word form*** (not formulas).

aluminum bromide + lithium phosphate →

Step 2: Add the "*possible*" **products** to the word equation by switching ***anions***.

Step 3: Convert the ***word*** equation to a ***formula*** equation.

Step 4: ***Balance*** the equation.

Step 5: Add the phases of the reactants and "possible" products to the equation.

For more help: See chapter 7 part 3 video or chapter 7 section 4 in the textbook.

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7.8) Determine if a aluminum bromide solution is mixed with a lithium phosphate solution and, if a reaction does occur, write the balanced chemical equation.

ANSWER: $AlBr_3\ (aq) + Li_3PO_4\ (aq) \rightarrow AlPO_4\ (s) + 3LiBr\ (aq)$

Method for Predicting if a Precipitation Reaction will Occur and Writing the Balanced Chemical Equation for Precipitation Reactions:

Step 1: Write reactants and arrow for the chemical equations using word form (not formulas):

aluminum bromide + lithium phosphate →

Step 2: Add the "possible" products to the word equation by switching anions:

aluminum bromide + lithium phosphate → aluminum phosphate + lithium bromide

Step 3: Convert the word equation to a formula equation:

$$AlBr_3 + Li_3PO_4 \rightarrow AlPO_4 + LiBr$$

Step 4: Balance the equation:

$$AlBr_3 + Li_3PO_4 \rightarrow AlPO_4 + 3\ LiBr$$

Step 5: Add the phases of the reactants and "possible" products to the equation.

$$AlBr_3\ (aq) + Li_3PO_4\ (aq) \rightarrow AlPO_4\ (s) + 3LiBr\ (aq)$$

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For more details: See chapter 7 part 3 video or chapter 7 section 4 in the textbook.

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7.9) A ***gas producing double replacement reaction*** is a special type of *double replacement* in which a **gas** is produced. The gas producing double replacement reaction that is typically encountered in the health sciences field and, therefore the only gas producing reaction with which I would like you to be familiar, is the reaction of aqueous hydrogen monochloride (**HCl**, also know as hydrochloric acid) and aqueous sodium bicarbonate (**$NaHCO_3$**).

In order for you to review this gas producing reaction, complete the chemical equation below by adding the three products of this reaction:

$$\mathbf{HCl}\ (aq) + \mathbf{NaHCO_3}\ (aq) \rightarrow \boxed{?} + \boxed{?} + \boxed{?}$$

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In order for you to review this gas producing reaction, complete the chemical equation below by adding the three products of this reaction:

HINT: $HCl\ (aq) + NaHCO_3\ (aq) \rightarrow H_2O\ (l) +$ **?** $+ NaCl\ (aq)$

For more help:
See chapter 7 part 4 video or chapter 7 section 4 in the textbook.

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7.9) A ***gas producing double replacement reaction*** is a special type of *double replacement* in which a **gas** is produced. The gas producing double replacement reaction that is typically encountered in the health sciences field and, therefore the only gas producing reaction with which I would like you to be familiar, is the reaction of aqueous hydrogen monochloride (**HCl**, also know as hydrochloric acid) and aqueous sodium bicarbonate (**$NaHCO_3$**).

In order for you to review this gas producing reaction, complete the chemical equation below by adding the three products of this reaction:

ANSWER: $HCl\,(aq) + NaHCO_3\,(aq) \rightarrow H_2O\,(l) + CO_2\,(g) + NaCl\,(aq)$

EXPLANATION:

double replacement: $HCl\,(aq) + NaHCO_3(aq) \rightarrow HHCO_3\,(aq) + NaCl\,(aq)$

carbonic acid

$HCl\,(aq) + NaHCO_3(aq) \rightarrow H_2CO_3\,(aq) + NaCl\,(aq)$

Carbonic acid decomposes to H_2O (*l*) and CO_2(*g*).

$HCl\,(aq) + NaHCO_3(aq) \rightarrow H_2O\,(l) + CO_2\,(g) + NaCl\,(aq)$

Gas Producing Double Replacement Reaction

For more details:
See chapter 7 part 4 video or chapter 7 section 4 in the textbook.

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7.10) List the following alcohols in order of increasing solubility in water (least soluble to most soluble).

$CH_3CH_2CH_2CH_2CH_2CH_2—OH$
hexanol

$CH_3CH_2—OH$
ethanol

$CH_3CH_2CH_2CH_2—OH$
butanol

least soluble

____

____

____

most soluble

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$CH_3CH_2CH_2CH_2CH_2CH_2—OH$
hexanol

$CH_3CH_2—OH$
ethanol

$CH_3CH_2CH_2CH_2—OH$
butanol

least soluble

____

____

____

most soluble

HINT:

Water molecules are attracted to alcohols and many other families of organic molecules through hydrogen bonding and/or dipole-dipole interactions.

- As the hydrocarbon part of various alcohol molecules gets larger, the water solubility ***decreases***.
- As the hydrocarbon part of a molecule gets larger, London forces become more important (stronger), the molecule becomes ***less*** polar, and the organic molecules are more attracted to each other than they are to water molecules. When this occurs, it is lower in energy for the organic molecules to be surrounded by other organic molecules and therefore the water solubility drastically decreases.

For more help:

See chapter 7 part 5 video or chapter 7 section 5 in the textbook.

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7.10) List the following alcohols in order of increasing solubility in water (least soluble to most soluble).

$CH_3CH_2CH_2CH_2CH_2CH_2-OH$
hexanol

CH_3CH_2-OH
ethanol

$CH_3CH_2CH_2CH_2-OH$
butanol

least soluble

hexanol

butanol

ethanol

most soluble

EXPLANATION:

Water molecules are attracted to alcohols and many other families of organic molecules through hydrogen bonding and/or dipole-dipole interactions.

- As the hydrocarbon part of various alcohol molecules gets larger, the water solubility ***decreases***.
- As the hydrocarbon part of a molecule gets larger, London forces become more important (stronger), the molecule becomes ***less*** polar, and the organic molecules are more attracted to each other than they are to water molecules. When this occurs, it is lower in energy for the organic molecules to be surrounded by other organic molecules and therefore the water solubility drastically decreases.

For more details:

See chapter 7 part 5 video or chapter 7 section 5 in the textbook.

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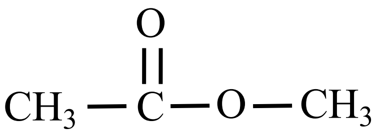
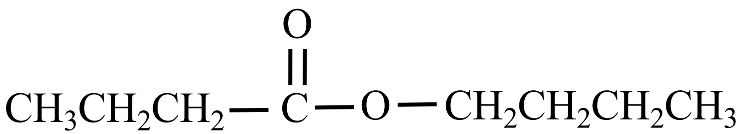
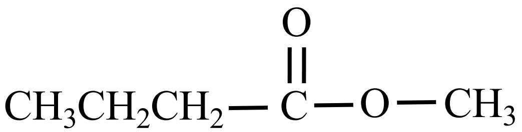
7.11) List the following esters in order of increasing solubility in water (least soluble to most soluble).



methyl ethanoate



butyl butanoate



methyl butanoate

least soluble

____

____

____

most soluble

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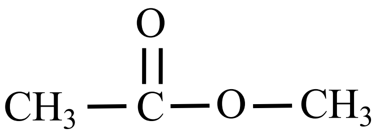
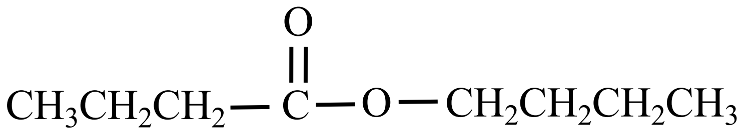
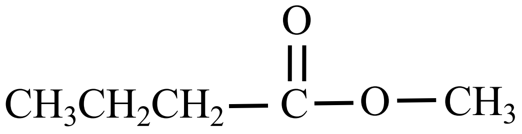


methyl ethanoate



butyl butanoate



methyl butanoate

least soluble

____

____

____

most soluble

HINT:

Water molecules are attracted to esters and many other families of organic molecules through hydrogen bonding and/or dipole-dipole interactions. As the hydrocarbon parts of various esters molecules get larger, the water solubility ***decreases***.

- As the hydrocarbon part of a molecule gets larger, London forces become more important (stronger), the molecule becomes ***less*** polar, and the organic molecules are more attracted to each other than they are to water molecules. When this occurs, it is lower in energy for the organic molecules to be surrounded by other organic molecules and therefore the water solubility drastically decreases.

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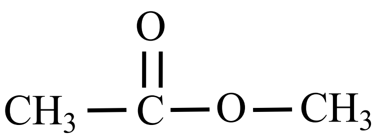
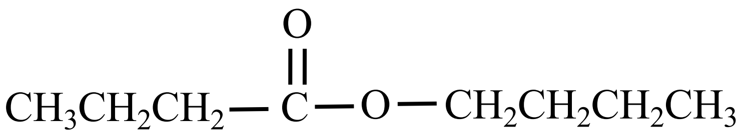
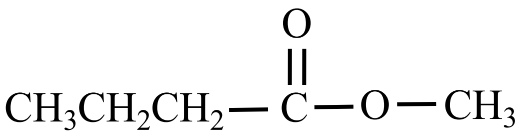


methyl ethanoate



butyl butanoate



methyl butanoate

least soluble

butyl butanoate

methyl butanoate

methyl ethanoate

most soluble

EXPLANATION:

Water molecules are attracted to esters and many other families of organic molecules through hydrogen bonding and/or dipole-dipole interactions. As the hydrocarbon parts of various ester molecules get larger, the water solubility ***decreases***.

- As the hydrocarbon part of a molecule gets larger, London forces become more important (stronger), the molecule becomes ***less*** polar, and the organic molecules are more attracted to each other than they are to water molecules. When this occurs, it is lower in energy for the organic molecules to be surrounded by other organic molecules and therefore the water solubility drastically decreases.

For more details:

See chapter 7 part 5 video or chapter 7 section 5 in the textbook.

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7.12) Match each of the **concentrations** (on the left) with its **description** (on the right).

% (w/w)	$\left(\dfrac{\text{moles of } solute}{\text{liters (L) of } solution}\right)$
% (v/v)	$\left(\dfrac{\text{volume of } solute}{\text{volume of } solution}\right)\times 100$
% (w/v)	$\left(\dfrac{\text{mass of } solute}{\text{mass of } solution}\right)\times 100$
Molarity	$\left(\dfrac{\text{osmoles of } solute}{\text{kg of } solvent}\right)$
Molality	$\left(\dfrac{\text{osmoles of } solute}{\text{liter (L) of } solution}\right)$
Osmolarity	$\left(\dfrac{\text{grams of } solute}{\text{mL of } solution}\right)\times 100$
Osmolality	$\left(\dfrac{\text{moles of } solute}{\text{kg of } solvent}\right)$

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Click here for a **hint**

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7.12) Match each of the **concentrations** (on the left) with its **description** (on the right).

HINT: Molarity = $\left(\frac{\text{moles of } solute}{\text{liters (L) of } solution}\right)$

% (w/w)	$\left(\frac{\text{volume of } solute}{\text{volume of } solution}\right)\times 100$
% (v/v)	$\left(\frac{\text{mass of } solute}{\text{mass of } solution}\right)\times 100$
% (w/v)	$\left(\frac{\text{osmoles of } solute}{\text{kg of } solvent}\right)$
Osmolarity	$\left(\frac{\text{osmoles of } solute}{\text{liter (L) of } solution}\right)$
Osmolality	$\left(\frac{\text{grams of } solute}{\text{mL of } solution}\right)\times 100$

HINT: Molality = $\left(\frac{\text{moles of } solute}{\text{kg of } solvent}\right)$

For more help:
See chapter 7 part 6 video, chapter 7 part 7 video, ***and*** chapter 7 part 8 video, or chapter 7 section 6 in the textbook.

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7.12) Match each of the **concentrations** (on the left) with its **description** (on the right).

EXPLANATION: The term "concentration" refers to the amount of a solute in a solution.

The concentration of a solution is the numeric quantity of solute that is dissolved in a particular quantity of solution (or solvent).

As seen in this problem, there are several units of measure that are commonly used to report concentration. The descriptions here are the definitions, written in equation form, for the concentration units of measure.

$$\text{Molarity} = \left(\frac{\text{moles of } solute}{\text{liters (L) of } solution}\right)$$

$$\%\text{ (v/v)} = \left(\frac{\text{volume of } solute}{\text{volume of } solution}\right) \times 100$$

$$\%\text{ (w/w)} = \left(\frac{\text{mass of } solute}{\text{mass of } solution}\right) \times 100$$

$$\text{Osmolality} = \left(\frac{\text{osmoles of } solute}{\text{kg of } solvent}\right)$$

$$\text{Osmolarity} = \left(\frac{\text{osmoles of } solute}{\text{liter (L) of } solution}\right)$$

$$\%\text{ (w/v)} = \left(\frac{\text{grams of } solute}{\text{mL of } solution}\right) \times 100$$

$$\text{Molality} = \left(\frac{\text{moles of } solute}{\text{kg of } solvent}\right)$$

For more details:

See chapter 7 part 6 video, chapter 7 part 7 video, and chapter 7 part 8 video, or chapter 7 section 6 in the textbook.

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7.13) 2.00 grams of acetone (C_3H_6O) is dissolved in enough water to make 0.150 L of solution.

a) What is the **molarity (M)** of the solution?

b) How many ***moles*** of acetone are contained in 0.067 L of this acetone ***solution***?

c) What **volume (L)** of this acetone solution would contain 0.015 ***moles*** of acetone?

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7.13) 2.00 grams of acetone (C_3H_6O) is dissolved in enough water to make 0.150 L of solution.

a) What is the **molarity (M)** of the solution?

HINT for part (a):

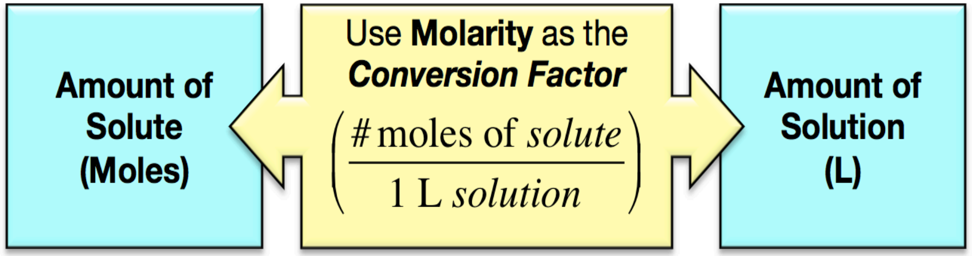
$$\textbf{molarity} = \left(\frac{\text{moles of } \textit{solute}}{\text{liters (L) of } \textit{solution}} \right) = \textbf{?}$$

You were given the volume (L) of *solution*.

How many ***moles*** of acetone (C_3H_6O) are contained in 2.00 grams?

b) How many ***moles*** of acetone are contained in 0.067 L of this acetone ***solution***?

HINT for parts (b) and (c): Because **molarity** is the *relationship between moles of solute and liters of solution*, we use it as a conversion factor to convert between liters of solution and moles of solute (glucose).



c) What **volume (L)** of this acetone solution would contain 0.015 ***moles*** of acetone?

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7.13) 2.00 grams of acetone (C_3H_6O) is dissolved in enough water to make 0.150 L of solution.

a) What is the **molarity (M)** of the solution? **ANSWER: 0.229 mole/L** (or **0.229 M**)

b) How many ***moles*** of acetone are contained in 0.067 L of this acetone ***solution***? **ANSWER: 0.015 moles C_3H_6O**

c) What **volume (L)** of this acetone solution would contain 0.015 ***moles*** of acetone? **ANSWER: 0.066 L**

CLICK HERE to see the **complete solution** for this problem

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7.13) 2.00 grams of acetone (C_3H_6O) is dissolved in enough water to make 0.150 L of solution.

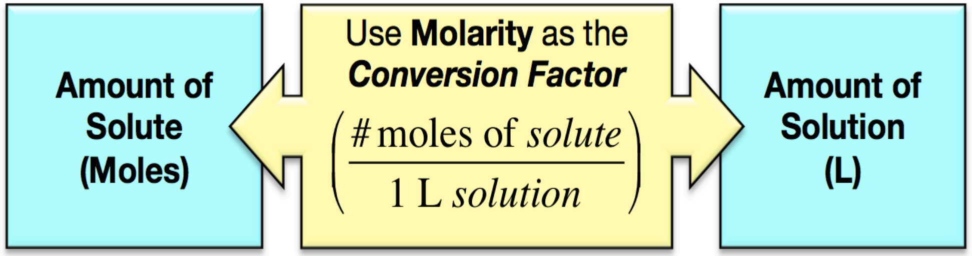
a) What is the **molarity (M)** of the solution? **ANSWER: 0.229 mole/L** (or **0.229 M**)

$$\frac{2.00\ \text{grams } C_3H_6O}{} \left| \frac{1\ \text{mole } C_3H_6O}{58.09\ \text{grams } C_3H_6O} \right| = 0.0344\ \text{moles } C_3H_6O$$

$$\text{molarity} = \left(\frac{\text{moles of } \textit{solute}}{\text{liters (L) of } \textit{solution}}\right) = \left(\frac{0.0344\ \text{moles } C_3H_6O}{0.150\ \text{L of } \textit{solution}}\right) = \textbf{0.229 mole/L} \text{ (or } \textbf{0.229 M}\text{)}$$

b) How many ***moles*** of acetone are contained in 0.067 L of this acetone ***solution***? **ANSWER: 0.015 moles C_3H_6O**

For parts (b) and (c): Because **molarity** is the *relationship between moles of solute and liters of solution*, we use it as a conversion factor to convert between liters of solution and moles of solute (glucose).



$$\frac{0.067\ \text{L solution}}{} \left| \frac{0.229\ \text{mole } C_3H_6O}{1\ \text{L solution}} \right| = \textbf{0.015 moles } C_3H_6O$$

c) What **volume (L)** of this acetone solution would contain 0.015 ***moles*** of acetone? **ANSWER: 0.066 L**

$$\frac{0.015\ \text{mole } C_3H_6O}{} \left| \frac{1\ \text{L solution}}{0.229\ \text{moles } C_3H_6O} \right| = \textbf{0.066 L}$$

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7.14) 5.75 grams of LiCl is dissolved in enough water to make 0.970 L of solution.

a) What is the **molarity (M)** of the solution?

b) How many ***moles*** of LiCl are contained in 0.010 L of this ***solution***?

c) What **volume (L)** of this solution would contain 0.0078 ***moles*** of LiCl?

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7.14) 5.75 grams of LiCl is dissolved in enough water to make 0.970 L of solution.

a) What is the **molarity (M)** of the solution?

HINT for part (a):

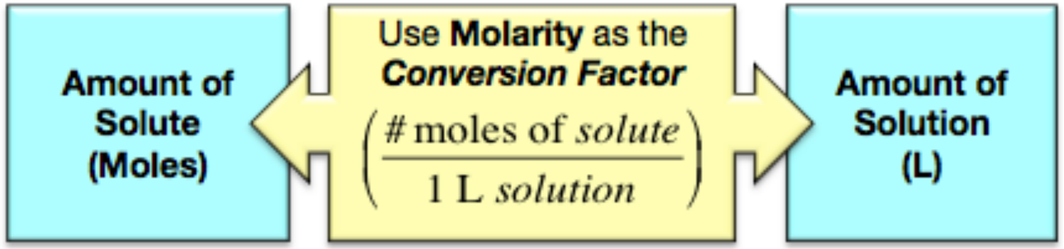
$$\textbf{molarity} = \left(\frac{\text{moles of } \textit{solute}}{\text{liters (L) of } \textit{solution}}\right) = \textbf{?}$$

You were given the volume (L) of *solution*.

How many ***moles*** of LiCl are contained in 5.75 grams of LiCl?

b) How many ***moles*** of LiCl are contained in 0.010 L of this ***solution***?

HINT for parts (b) and (c): Because **molarity** is the *relationship between moles of solute and liters of solution*, we use it as a conversion factor to convert between liters of solution and moles of solute (and vice versa).



c) What **volume (L)** of this solution would contain 0.0078 ***moles*** of LiCl?

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Go to next question

7.14) 5.75 grams of LiCl is dissolved in enough water to make 0.970 L of solution.

a) What is the **molarity (M)** of the solution? **ANSWER: 0.140 mole/L** (or **0.140 M**)

b) How many ***moles*** of LiCl are contained in 0.010 L of this ***solution***? **ANSWER: 0.0014 moles LiCl**

c) What **volume (L)** of this solution would contain 0.0078 ***moles*** of LiCl? **ANSWER: 0.056 L**

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7.14) 5.75 grams of LiCl is dissolved in enough water to make 0.970 L of solution.

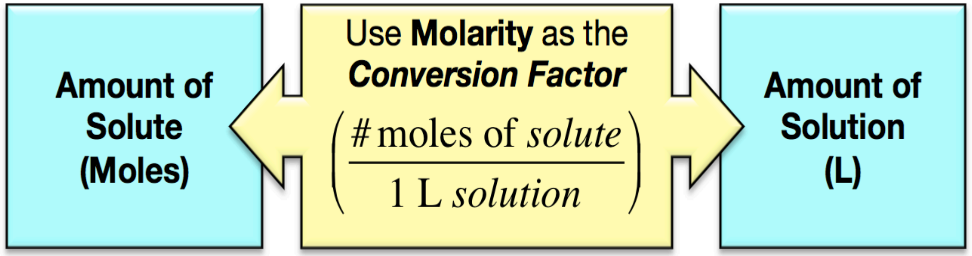
a) What is the **molarity (M)** of the solution? **ANSWER: 0.140 mole/L** (or **0.140 M**)

$$\frac{5.75\ \cancel{\text{grams LiCl}}}{} \left| \frac{1\ \text{mole LiCl}}{42.39\ \cancel{\text{grams LiCl}}} \right| = 0.136\ \text{mole LiCl}$$

$$\text{molarity} = \left(\frac{\text{moles of } \textit{solute}}{\text{liters (L) of } \textit{solution}}\right) = \left(\frac{0.136\ \text{mole LiCl}}{0.970\ \text{L of } \textit{solution}}\right) = \mathbf{0.140\ mole/L}\ (\text{or } \mathbf{0.140\ M})$$

b) How many ***moles*** of LiCl are contained in 0.010 L of this ***solution***? **ANSWER: 0.0014 moles LiCl**

For parts (b) and (c): Because **molarity** is the *relationship between moles of solute and liters of solution*, we use it as a conversion factor to convert between liters of solution and moles of solute (and vice versa).



$$\frac{0.010\ \cancel{\text{L solution}}}{} \left| \frac{0.140\ \text{mole LiCl}}{1\ \cancel{\text{L solution}}} \right| = \mathbf{0.0014\ moles\ LiCl}$$

c) What **volume (L)** of this solution would contain 0.0078 ***moles*** of LiCl? **ANSWER: 0.056 L**

$$\frac{0.0078\ \cancel{\text{mole LiCl}}}{} \left| \frac{1\ \text{L solution}}{0.140\ \cancel{\text{moles LiCl}}} \right| = \mathbf{0.056\ L}$$

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7.15) 6.78 grams of magnesium chloride is dissolved in 1.37 kg of water.

a) What is chemical formula for magnesium chloride? ________________

a) What is the **molality (*m*)** of the solution?

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7.15) 6.78 grams of magnesium chloride is dissolved in 1.37 kg of water.

HINT: Mg ? Cl ?

a) What is chemical formula for magnesium chloride? ____________

a) What is the **molality (*m*)** of the solution?

HINT:

$$\textbf{molality } (m) = \left(\frac{\text{moles of } solute}{\text{kg of } solvent} \right) = \textbf{?}$$

You were given the kg of *solvent*.

How many ***moles*** of magnesium chloride are contained in 6.78 grams?

7.15) 6.78 grams of magnesium chloride is dissolved in 1.37 kg of water.

a) What is chemical formula for magnesium chloride? **$MgCl_2$**

a) What is the **molality (*m*)** of the solution? **ANSWER: 0.0520 mole/ kg** (or **0.0520 *m***)

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7.15) 6.78 grams of magnesium chloride is dissolved in 1.37 kg of water.

a) What is chemical formula for magnesium chloride? **$MgCl_2$**

a) What is the **molality (*m*)** of the solution? **ANSWER: 0.0520 mole/ kg** (or **0.0520 *m***)

$$\frac{6.78 \text{ grams } MgCl_2}{} \left| \frac{1 \text{ mole } MgCl_2}{95.21 \text{ grams } MgCl_2} \right| = 0.0712 \text{ mole } MgCl_2$$

$$\text{molality} = \left(\frac{\text{moles of } solute}{\text{kg of } solvent} \right) = \left(\frac{0.0712 \text{ mole } MgCl_2}{1.37 \text{ kg of } solvent} \right) = \mathbf{0.0520 \text{ mole/ kg}} \text{ (or } \mathbf{0.0520}\ m\text{)}$$

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7.16) 11.5 grams of NaCl is dissolved in enough water to make 5.30 L of solution.

a) What is the **osmolarity** of the solution?

b) How many ***osmoles*** are contained in 2.00 L of this ***solution***?

c) What **volume (L)** of this solution would contain 3.50 ***osmoles***?

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7.16) 11.5 grams of NaCl is dissolved in enough water to make 5.30 L of solution.

a) What is the **osmolarity** of the solution?

HINT for part (a): $$\textbf{osmolarity} = \left(\frac{\text{osmoles of } \textit{solute}}{\text{liters (L) of } \textit{solution}}\right) = \textbf{?}$$

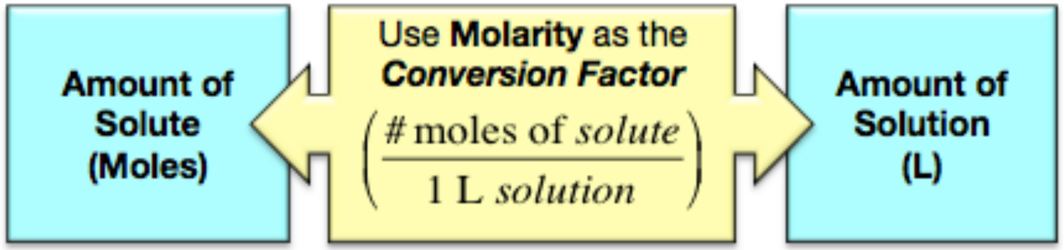
You were given the volume (L) of *solution*.

Convert 11.5 grams of NaCl to moles of NaCl, then convert moles of NaCl to osmoles.

- An osmole is a mole of dissolved particles; how many osmoles are present for each mole of NaCl that dissolved?

b) How many ***osmoles*** are contained in 2.00 L of this ***solution***?

HINT for parts (b) and (c): Because **osmolarity** is the *relationship between osmoles of solute and liters of solution*, we use it as a conversion factor to convert between liters of solution and osmoles of solute (and vice versa).



c) What **volume (L)** of this solution would contain 3.50 ***osmoles***?

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7.16) 11.5 grams of NaCl is dissolved in enough water to make 5.30 L of solution.

a) What is the **osmolarity** of the solution? **ANSWER: 0.0743 osmole/L** (or **0.0743 osmolar**)

b) How many ***osmoles*** are contained in 2.00 L of this ***solution***? **ANSWER: 0.149 osmoles**

c) What **volume (L)** of this solution would contain 3.50 ***osmoles***? **ANSWER: 47.1 L**

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7.16) 11.5 grams of NaCl is dissolved in enough water to make 5.30 L of solution.

a) What is the **osmolarity** of the solution? **ANSWER: 0.0743 osmole/L** (or **0.0743 osmolar**)

Determine the ***osmoles*** of NaCl:

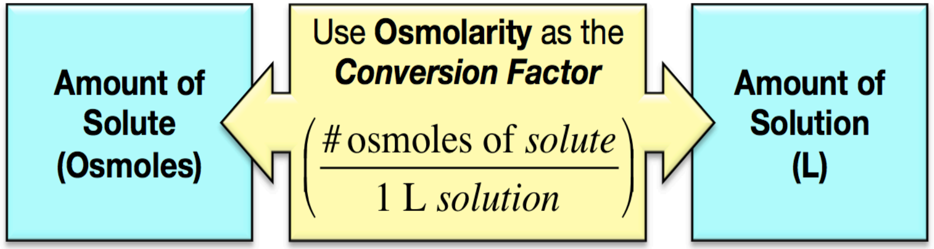
$$\frac{11.5\ \text{grams NaCl}}{} \times \frac{1\ \text{mole NaCl}}{58.44\ \text{grams NaCl}} \times \frac{2\ \text{osmoles}}{1\ \text{mole NaCl}} = 0.394\ \text{osmole}$$

One mole of NaCl dissociates into *two moles of particles* (one mole of Na^+ and one mole of Cl^-) when placed in water. ***One mole*** of dissolved NaCl results in ***two osmoles***. This relationship is used as a conversion factor to convert ***moles*** of NaCl to ***osmoles***.

$$\text{osmolarity} = \left(\frac{\text{osmoles of } \textit{solute}}{\text{liters (L) of } \textit{solution}}\right) = \left(\frac{0.394\ \text{osmoles NaCl}}{5.30\ \text{L of } \textit{solution}}\right) = \mathbf{0.0743\ osmole/L}\ (\text{or } \mathbf{0.0743\ osmolar})$$

b) How many ***osmoles*** are contained in 2.00 L of this ***solution***? **ANSWER: 0.149 osmoles**

For parts (b) and (c): Because **osmolarity** is the *relationship between* ***osmoles*** *of solute and liters of solution*, we use it as a conversion factor to convert between liters of solution and osmoles of solute (and vice versa).



$$\frac{2.00\ \text{L solution}}{} \times \frac{0.0743\ \text{osmoles}}{1\ \text{L solution}} = \mathbf{0.149\ osmoles}$$

c) What **volume (L)** of this solution would contain 3.50 ***osmoles***? **ANSWER: 47.1 L**

$$\frac{3.50\ \text{osmoles}}{} \times \frac{1\ \text{L solution}}{0.0743\ \text{osmoles}} = \mathbf{47.1\ L}$$

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7.17) 1.38 grams of 2-propanol (C_3H_8O) is dissolved in enough water to make 2.25 L of solution.

a) What is the **osmolarity** of the solution?

b) How many ***osmoles*** are contained in 600.0 **mL** of this ***solution***?

c) What **volume (L)** of this solution would contain 0.200 ***osmoles***?

7.17) 1.38 grams of 2-propanol (C_3H_8O) is dissolved in enough water to make 2.25 L of solution.

a) What is the **osmolarity** of the solution?

HINT for part (a): **osmolarity** $= \left(\frac{\text{osmoles of } \textit{solute}}{\text{liters (L) of } \textit{solution}}\right) =$ **?**

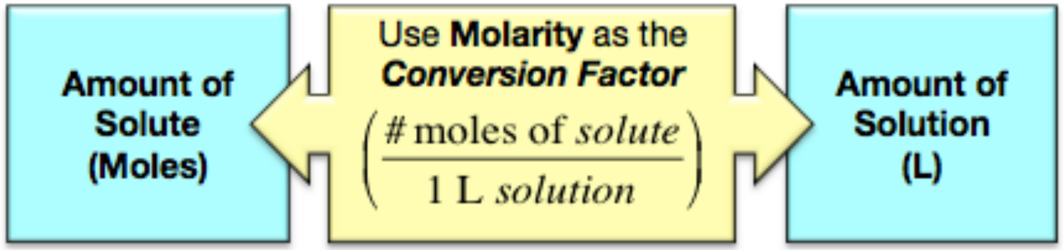
You were given the volume (L) of *solution*.

Convert 1.38 grams of C_3H_8O to moles of C_3H_8O, then convert moles of C_3H_8O to osmoles.

- An osmole is a mole of dissolved particles; how many osmoles are present for each mole of C_3H_8O that dissolved?

b) How many ***osmoles*** are contained in 600.0 **mL** of this ***solution***?

HINT for parts (b) and (c): Because **osmolarity** is the *relationship between osmoles of solute and liters of solution*, we use it as a conversion factor to convert between liters of solution and osmoles of solute (and vice versa).



c) What **volume (L)** of this solution would contain 0.200 ***osmoles***?

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7.17) 1.38 grams of 2-propanol (C_3H_8O) is dissolved in enough water to make 2.25 L of solution.

a) What is the **osmolarity** of the solution? **ANSWER: 0.0102 osmole/L** (or **0.0102 osmolar**)

b) How many ***osmoles*** are contained in 600.0 **mL** of this ***solution***? **ANSWER: 0.00612 osmoles**

c) What **volume (L)** of this solution would contain 0.200 ***osmoles***? **ANSWER: 19.6 L**

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7.17) 1.38 grams of 2-propanol (C_3H_8O) is dissolved in enough water to make 2.25 L of solution.

a) What is the **osmolarity** of the solution? **ANSWER: 0.0102 osmole/L** (or **0.0102 osmolar**)

Determine the ***osmoles*** of C_3H_8O:

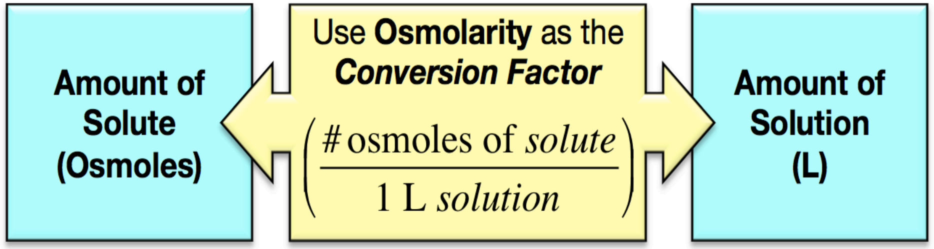
$$\frac{1.38 \text{ grams } C_3H_8O}{} \times \frac{1 \text{ mole } C_3H_8O}{60.09 \text{ grams } C_3H_8O} \times \frac{1 \text{ osmoles}}{1 \text{ mole } C_3H_8O} = 0.0230 \text{ osmoles}$$

Because C_3H_8O is a molecule, it does not dissociate when it dissolves. ***One mole*** of dissolved C_3H_8O results in ***one mole of dissolved particles (one osmole)***. This relationship is used as a conversion factor to convert ***moles*** of C_3H_8O to ***osmoles***.

$$\text{osmolarity} = \left(\frac{\text{osmoles of } solute}{\text{liters (L) of } solution}\right) = \left(\frac{0.0230 \text{ osmoles}}{2.25 \text{ L of } solution}\right) = \mathbf{0.0102 \text{ osmole/L}} \text{ (or } \mathbf{0.0102 \text{ osmolar}})$$

b) How many ***osmoles*** are contained in 600.0 **mL** of this ***solution***? **ANSWER: 0.00612 osmoles**

For parts (b) and (c): Because **osmolarity** is the *relationship between **osmoles** of solute and liters of solution*, we use it as a conversion factor to convert between liters of solution and osmoles of solute (and vice versa).



$$\frac{0.6000 \text{ L solution}}{} \times \frac{0.0102 \text{ osmoles}}{1 \text{ L solution}} = \mathbf{0.00612 \text{ osmoles}}$$

c) What **volume (L)** of this solution would contain 0.200 ***osmoles***? **ANSWER: 19.6 L**

$$\frac{0.200 \text{ osmoles}}{} \times \frac{1 \text{ L solution}}{0.0102 \text{ osmoles}} = \mathbf{19.6 \text{ L}}$$

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Go to next question

7.18) 3.25 grams of $MgCl_2$ is dissolved in enough water to make 10.0 L of solution. What is the **osmolarity** of the solution?

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7.18) 3.25 grams of $MgCl_2$ is dissolved in enough water to make 10.0 L of solution. What is the **osmolarity** of the solution?

HINT:

$$\textbf{osmolarity} = \left[\frac{\text{osmoles of } \textit{solute}}{\text{liters (L) of } \textit{solution}}\right] = \textbf{?}$$

You were given the volume (L) of *solution*.

Convert 3.25 grams of $MgCl_2$ to moles of $MgCl_2$, then convert moles of $MgCl_2$ to osmoles.

- An osmole is a mole of dissolved particles; how many osmoles are present for each mole of $MgCl_2$ that dissolved?

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Go to next question

7.18) 3.25 grams of $MgCl_2$ is dissolved in enough water to make 10.0 L of solution. What is the **osmolarity** of the solution?

ANSWER: 0.0102 osmole/L (or **0.0102 osmolar**)

CLICK HERE to see the **complete solution** for this problem

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7.18) 3.25 grams of $MgCl_2$ is dissolved in enough water to make 10.0 L of solution. What is the **osmolarity** of the solution?

ANSWER: 0.0102 osmole/L (or **0.0102 osmolar**)

$$\frac{3.25\ \text{grams}\ MgCl_2}{} \times \frac{1\ \text{mole}\ MgCl_2}{95.21\ \text{grams}\ MgCl_2} \times \frac{3\ \text{osmoles}}{1\ \text{mole}\ MgCl_2} = 0.102\ \text{osmole}$$

One mole of $MgCl_2$ dissociates into ***three*** *moles of particles* when placed in water.

$$MgCl_2 \rightarrow 1\ Mg^{2+} + 2\ Cl^-$$

One mole of dissolved $MgCl_2$ results in ***three osmoles***. This relationship is used as a conversion factor to convert ***moles*** of $MgCl_2$ to ***osmoles***.

$$\textbf{osmolarity} = \left[\frac{\text{osmoles of } \textit{solute}}{\text{liters (L) of } \textit{solution}}\right] = \left[\frac{0.102\ \text{osmoles}}{10.0\ \text{L of } \textit{solution}}\right] = \textbf{0.0102 osmole/L (or 0.0102 osmolar)}$$

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7.19) A glucose solution is prepared by adding 1.47 grams of glucose to enough water to make 300.0 mL of solution.

a) What is the **%(w/v)** of the solution?

b) How many ***grams*** are contained in 345 **mL** of this ***solution***?

c) What ***volume*** **(mL)** of this solution would contain 0.0500 grams of glucose?

7.19) A glucose solution is prepared by adding 1.47 grams of glucose to enough water to make 300.0 mL of solution.

a) What is the **%(w/v)** of the solution?

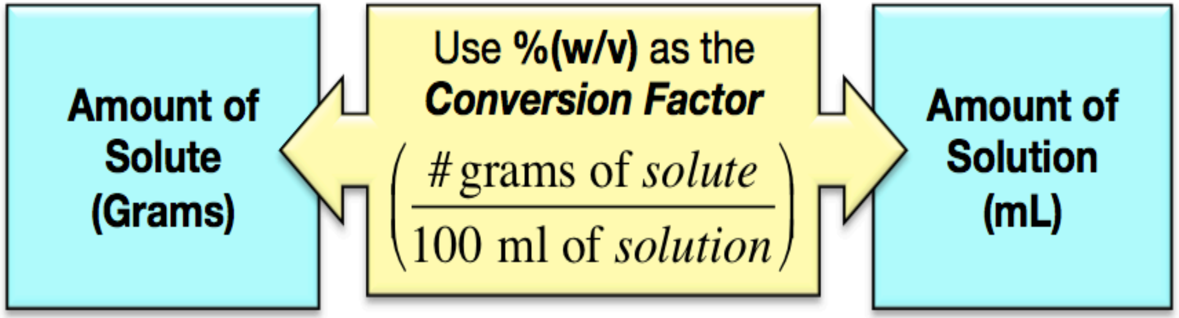
HINT for part (a):

$$\%(w/v) = \left(\frac{\text{grams of } \textit{solute}}{\text{mL of } \textit{solution}} \right) \times 100\%$$

You were given the grams of solute (glucose) and mL of *solution*.

b) How many ***grams*** are contained in 345 **mL** of this ***solution***?

For parts (b) and (c): Because **%(w/v)** is the ***grams of*** *solute in 100 mL of solution*, we use this relationship as a conversion factor to convert between mL of solution and grams of solute (and vice versa).



c) What ***volume*** **(mL)** of this solution would contain 0.0500 grams of glucose?

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7.19) A glucose solution is prepared by adding 1.47 grams of glucose to enough water to make 300.0 mL of solution.

a) What is the **%(w/v)** of the solution? **ANSWER: 0.490 %(w/v)**

b) How many ***grams*** are contained in 345 **mL** of this ***solution***? **ANSWER: 1.69 grams glucose**

c) What ***volume*** **(mL)** of this solution would contain 0.0500 grams of glucose? **ANSWER: 10.2 mL**

CLICK HERE to see the **complete solution** for this problem

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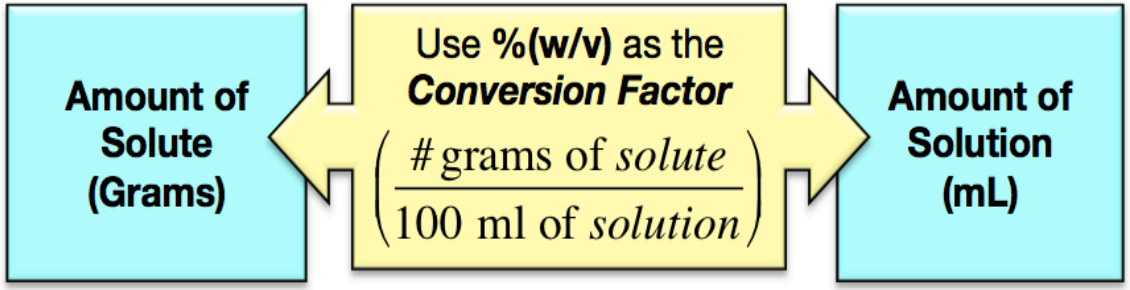
7.19) A glucose solution is prepared by adding 1.47 grams of glucose to enough water to make 300.0 mL of solution.

a) What is the **%(w/v)** of the solution? **ANSWER: 0.490 %(w/v)**

$$\textbf{\%(w/v)} = \left(\frac{\text{grams of } \textit{solute}}{\text{mL of } \textit{solution}}\right) \times 100\% = \left(\frac{1.47 \text{ grams glucose}}{300 \text{ mL of } \textit{solution}}\right) \times 100\% = \textbf{0.490 \%(w/v)}$$

b) How many ***grams*** are contained in 345 **mL** of this ***solution***? **ANSWER: 1.69 grams glucose**

For parts (b) and (c): Because **%(w/v)** is the ***grams*** *of solute in 100 mL of solution*, we use this relationship as a conversion factor to convert between mL of solution and grams of solute (and vice versa).



$$\frac{345 \text{ mL solution}}{} \times \frac{0.490 \text{ g glucose}}{100 \text{ mL solution}} = \textbf{1.69 grams glucose}$$

c) What ***volume*** **(mL)** of this solution would contain 0.0500 grams of glucose? **ANSWER: 10.2 mL**

$$\frac{0.0500 \text{ g glucose}}{} \times \frac{100 \text{ mL solution}}{0.490 \text{ g glucose}} = \textbf{10.2 mL}$$

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7.20) An ethanol solution is prepared by adding 25.0 grams of ethanol to 100.0 grams of water. What is the %(w/w) concentration?

7.20) An ethanol solution is prepared by adding 25.0 grams of ethanol to 100.0 grams of water. What is the %(w/w) concentration?

HINT:

$$\%(w/v) = \left(\frac{\text{grams of } \textit{solute}}{\text{grams of } \textit{solution}}\right) \times 100\%$$

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Click here to **check your answer**

Go to next question

7.20) An ethanol solution is prepared by adding 25.0 grams of ethanol to 100.0 grams of water. What is the %(w/w) concentration? **ANSWER: 20.0 %(w/w)**

CLICK HERE to see the **complete solution** for this problem

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7.20) An ethanol solution is prepared by adding 25.0 grams of ethanol to 100.0 grams of water. What is the %(w/w) concentration? **ANSWER: 20.0 %(w/w)**

$$\textbf{\%(w/v)} = \left(\frac{\text{grams of } \textit{solute}}{\text{grams of } \textit{solution}}\right) \text{x } 100\% = \left(\frac{25.0 \text{ grams glucose}}{125.0 \text{ grams of } \textit{solution}}\right) \text{x } 100\% = \textbf{20.0 \%(w/w)}$$

A solution is a **mixture**. It contains both the ***solute*** **and** the ***solvent***.
The mass of the solution in this problem is: **25.0 g + 100.0 g = 125.0 g**

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7.21) How many grams of $AgNO_3$ are contained in 500.0 mL of a 0.100 M solution?

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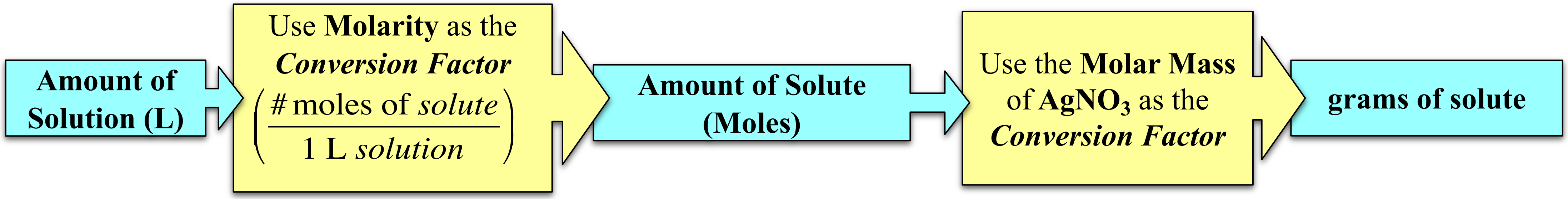
7.21) How many grams of $AgNO_3$ are contained in 500.0 mL of a 0.100 M solution?

HINT:



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7.21) How many grams of $AgNO_3$ are contained in 500.0 mL of a 0.100 M solution?

ANSWER: **8.49 grams $AgNO_3$**

CLICK HERE to see the **complete solution** for this problem

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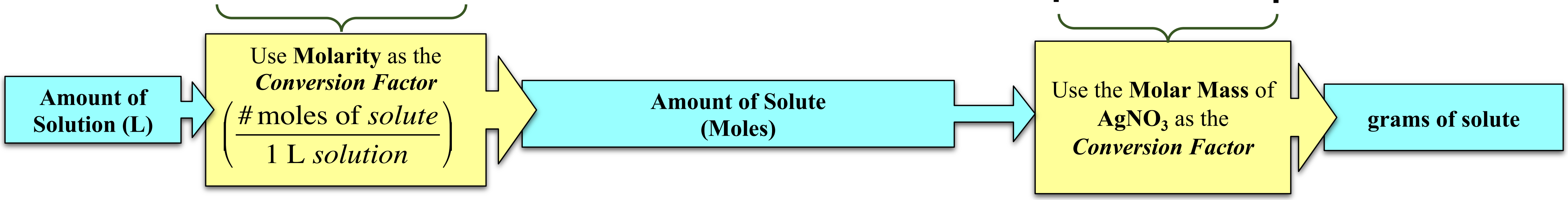
7.21) How many grams of $AgNO_3$ are contained in 500.0 mL of a 0.100 M solution?

ANSWER: **8.49 grams $AgNO_3$**

$$\frac{0.500\ \text{L solution}}{} \left| \frac{0.100\ \text{mole } AgNO_3}{1\ \text{L solution}} \right| = 0.0500\ \text{mole AgNO}$$

$$\frac{0.0500\ \text{mole } AgNO_3}{} \left| \frac{169.88\ \text{g } AgNO_3}{1\ \text{mole } AgNO_3} \right| = \mathbf{8.49\ grams\ AgNO_3}$$



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7.22) 134.7 g of KCl is dissolved in enough water to make 1.2 L of solution.

a) What is the **Eq/L** concentration of ***potassium ions***?

Note that you are looking for **Eq of K^+** ions only, **not** equivalents from Cl^-.

b) How many equivalents (Eq) of K^+ are contained in 0.070 **L** of this ***solution***?

c) What **volume (L)** of this solution would contain 3.5 **Eq of K^+**?

Go back

Click here for a **hint**

Click here to **check your answer**

Go to next question

7.22) 134.7 g of KCl is dissolved in enough water to make 1.2 L of solution.

a) What is the **Eq/L** concentration of ***potassium ions***?

HINT for part (a):

$$\textbf{Eq/L} = \left(\frac{\text{Eq of } \textit{solute}}{\text{liters (L) of } \textit{solution}}\right) = \textbf{?}$$

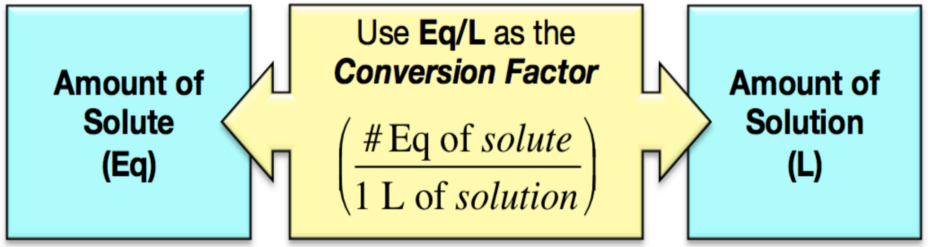
You were given the volume (L) of *solution*.

Convert 134.7 grams of KCl to moles of KCl, then convert moles of KCl to **Eq of K^+**.

- ***One mole*** of dissolved KCl results in ***one mole*** *of dissolved* K^+ *ions* ***and*** *one mole of* Cl^- *ions*. In this problem, we are only concerned with the K^+ ions. Because K^+ ions have a 1+ charge, one mole of K^+ ions is equal to **one Eq**. One mole of KCl contains one **Eq** of K^+.

b) How many equivalents (Eq) of K^+ are contained in 0.070 **L** of this ***solution***?

HINT for parts (b) and (c): Because **Eq/L** concentration is the *relationship between* **Eq** *of solute and liters of solution*, we use it as a conversion factor to convert between liters of solution and **Eq** of solute (and vice versa).



c) What **volume (L)** of this solution would contain 3.5 **Eq of K^+**?

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Click here to check your answer

Go to next question

7.22) 134.7 g of KCl is dissolved in enough water to make 1.2 L of solution.

a) What is the **Eq/L** concentration of ***potassium ions***? **ANSWER: 1.5 Eq/L**

b) How many equivalents (Eq) of K^+ are contained in 0.070 **L** of this ***solution***? **ANSWER: 0.11 Eq K^+**

c) What **volume (L)** of this solution would contain 3.5 **Eq of K^+**? **ANSWER: 2.3 L**

CLICK HERE to see the **complete solution** for this problem

Go back

Go to next question

7.22) 134.7 g of KCl is dissolved in enough water to make 1.2 L of solution.

a) What is the **Eq/L** concentration of ***potassium ions***? **ANSWER: 1.5 Eq/L**

Determine the ***Eq*** of **K^+**:

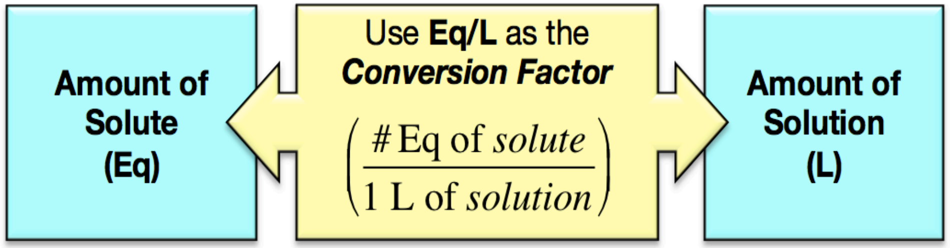
$$\frac{134.7\ \text{g KCl}}{} \times \frac{1\ \text{mole KCl}}{74.55\ \text{g KCl}} \times \frac{1\ \text{Eq}\ K^+}{1\ \text{mole KCl}} = 1.807\ \text{Eq}\ K^+$$

An **equivalent** (**Eq**) is defined as a **mole of charge** in solution. ***One mole*** of dissolved KCl results in ***one mole*** *of dissolved* K^+ *ions **and** one mole of* Cl^- *ions*. In this problem, we are only concerned with the K^+ ions. Because K^+ ions have a 1+ charge, one mole of K^+ ions is equal to **one Eq**. One mole of KCl contains one **Eq** of K^+.

$$(\text{Eq/L}) = \left(\frac{\text{Eq of } solute}{\text{liters (L) of } solution}\right) = \left(\frac{1.807\ \text{Eq}\ K^+}{1.2\ \text{L of } solution}\right) = \mathbf{1.5\ Eq/L}$$

b) How many equivalents (Eq) of K^+ are contained in 0.070 **L** of this ***solution***? **ANSWER: 0.11 Eq K^+**

For parts (b) and (c): Because **Eq/L** concentration is the *relationship between* **Eq** *of solute and liters of solution*, we use it as a conversion factor to convert between liters of solution and **Eq** of solute (and vice versa).



$$\frac{0.070\ \text{L solution}}{} \times \frac{1.5\ \text{Eq}\ K^+}{1\ \text{L solution}} = \mathbf{0.11\ Eq\ K^+}$$

c) What **volume (L)** of this solution would contain 3.5 **Eq of K^+**? **ANSWER: 2.3 L**

$$\frac{3.5\ \text{Eq}\ K^+}{} \times \frac{1\ \text{L solution}}{1.5\ \text{Eq}\ K^+} = \mathbf{2.3\ L}$$

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7.23) 0.500 grams of iron(III) sulfate is dissolved in enough water to make 75 **mL** of solution.

a) What is the **Eq/L** concentration of ***sulfate ions***?

Note that you are looking for **Eq of sulfate ions** only, **not** equivalents from **Fe^{3+}.**

b) How many equivalents (Eq) of SO_4^{2-} are contained in 7.80 **L** of this ***solution***?

c) What **volume (L)** of this solution would contain 0.95 **Eq of SO_4^{2-}**?

Go back

Click here for a **hint**

Click here to **check your answer**

Go to next question

7.23) 0.500 grams of iron(III) sulfate is dissolved in enough water to make 75 **mL** of solution.

a) What is the **Eq/L** concentration of ***sulfate ions***?

HINT for part (a):

$$\textbf{Eq/L} = \left(\frac{\text{Eq of } \textit{solute}}{\text{liters (L) of } \textit{solution}}\right) = \textbf{?}$$

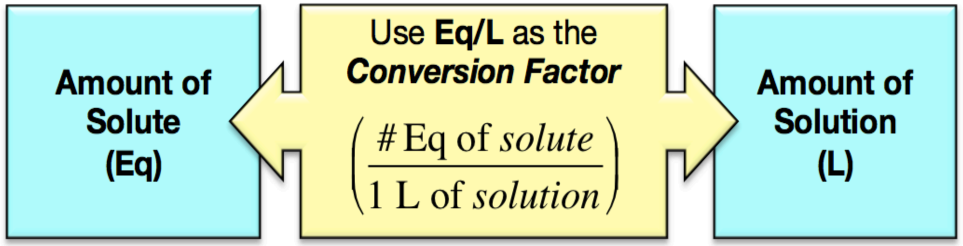
You were given the volume (L) of *solution*.

Convert 0.500 grams of $Fe_2(SO_4)_3$ to moles of $Fe_2(SO_4)_3$, then convert moles of $Fe_2(SO_4)_3$ to **Eq of SO_4^{2-}**.

- How many **Eq of SO_4^{2}** are contained in ***one mole*** of dissolved $Fe_2(SO_4)_3$?

b) How many equivalents (Eq) of SO_4^{2-} are contained in 7.80 **L** of this ***solution***?

HINT for parts (b) and (c): Because **Eq/L** concentration is the *relationship between* **Eq** *of solute and liters of solution*, we use it as a conversion factor to convert between liters of solution and **Eq** of solute (and vice versa).



c) What **volume (L)** of this solution would contain 0.95 **Eq of SO_4^{2-}**?

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Go to next question

7.23) 0.500 grams of iron(III) sulfate is dissolved in enough water to make 75 **mL** of solution.

a) What is the **Eq/L** concentration of ***sulfate ions***? **ANSWER: 0.10 Eq SO_4^{2-} /L**

b) How many equivalents (Eq) of SO_4^{2-} are contained in 7.80 **L** of this ***solution***? **ANSWER: 0.78 Eq SO_4^{2-}**

c) What **volume (L)** of this solution would contain 0.95 **Eq of SO_4^{2-}**? **ANSWER: 9.5 L**

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CLICK HERE to see the **complete solution** for this problem

Go to next question

7.23) 0.500 grams of iron(III) sulfate is dissolved in enough water to make 75 **mL** of solution.

a) What is the **Eq/L** concentration of ***sulfate ions***? **ANSWER: 0.10 Eq SO_4^{2-} /L**

$$Fe_2(SO_4)_3\,(s) \rightarrow 2\,Fe^{3+}\,(aq) + \underbrace{3\,SO_4^{2-}\,(aq)}_{6\text{ Eq of }SO_4^{2-}}$$

There are **three** sulfate ions in **one mole** of $Fe_2(SO_4)_3$. Because each SO_4^{2-} ion has a 2- charge, one mole of $Fe_2(SO_4)_3$ contains **six Eq** of SO_4^{2-}.

- (3 moles SO_4^{2-}) x (2- charge) = six moles of charge = 6 Eq SO_4^{2-}

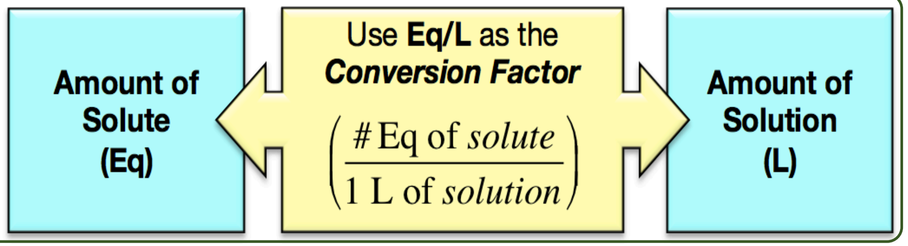
Determine the **Eq of SO_4^{2-}** :

$$\frac{0.500\ \cancel{g\ Fe_2(SO_4)_3}}{} \times \frac{1\ \cancel{mole\ Fe_2(SO_4)_3}}{399.91\ \cancel{g\ Fe_2(SO_4)_3}} \times \frac{6\ Eq\ SO_4^{2-}}{1\ \cancel{mole\ Fe_2(SO_4)_3}} = 0.00750\ Eq\ SO_4^{2-}$$

$$(Eq/L) = \left(\frac{\text{Eq of } solute}{\text{liters (L) of } solution}\right) = \left(\frac{0.00750\ Eq\ SO_4^{2-}}{0.075\ L\ \text{of } solution}\right) = \mathbf{0.10\ Eq\ SO_4^{2-}/L}$$

b) How many equivalents (Eq) of SO_4^{2-} are contained in 7.80 **L** of this ***solution***? **ANSWER: 0.78 Eq SO_4^{2-}**

For parts (b) and (c): Because **Eq/L** concentration is the *relationship between* **Eq** *of solute and liters of solution*, we use it as a conversion factor to convert between liters of solution and **Eq** of solute (and vice versa).



$$\frac{7.80\ \cancel{L\ solution}}{} \times \frac{0.10\ Eq\ SO_4^{2-}}{1\ \cancel{L\ solution}} = \mathbf{0.78\ Eq\ SO_4^{2-}}$$

c) What **volume (L)** of this solution would contain 0.95 **Eq of SO_4^{2-}**? **ANSWER: 9.5 L**

$$\frac{0.95\ \cancel{Eq\ SO_4^{2-}}}{} \times \frac{1\ L\ solution}{0.10\ \cancel{Eq\ SO_4^{2-}}} = \mathbf{9.5\ L}$$

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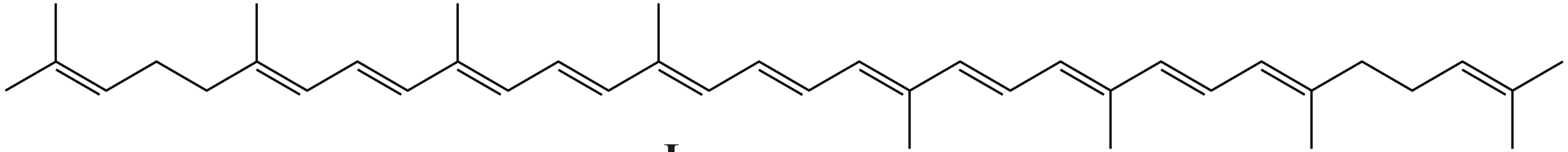
7.24) Predict whether each of the following biological compounds is **hydrophilic** or **hydrophobic**?

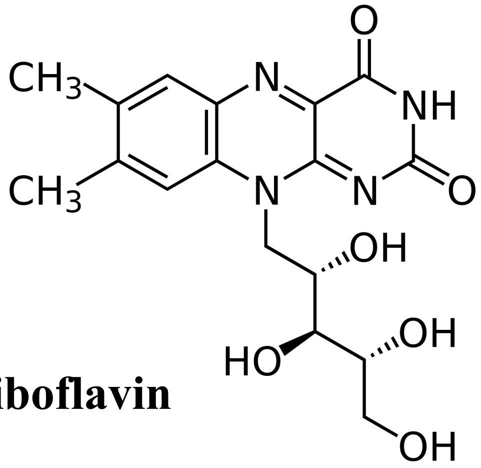
a)



Lycopene

Lycopene is a bright red carotenoid pigment and phytochemical found in tomatoes and some other red fruits and vegetables, such as red carrots, watermelons, and papayas.

b)



Riboflavin

Riboflavin, also known as vitamin B_2, is a vitamin found in food and used as a dietary supplement. Food sources include eggs, green vegetables, milk and other dairy product, meat, mushrooms, and almonds.

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Click here for a **hint**

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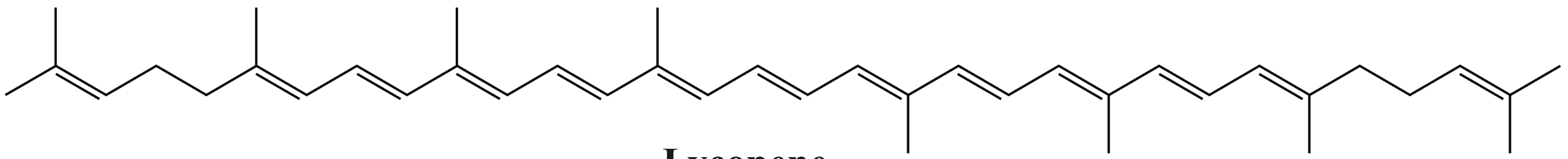
Go to next question

7.24) Predict whether each of the following biological compounds is **hydrophilic** or **hydrophobic**?

a)



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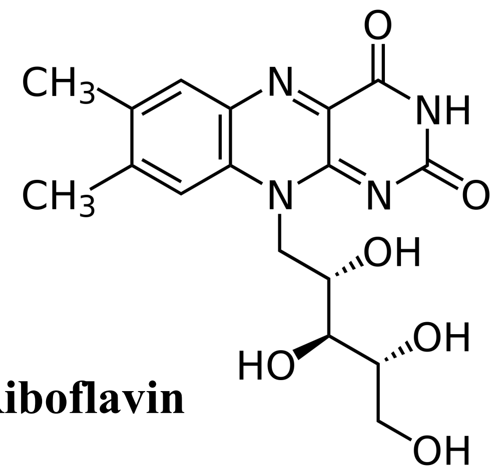
b)



Riboflavin

Riboflavin, also known as vitamin B_2, is a vitamin found in food and used as a dietary supplement. Food sources include eggs, green vegetables, milk and other dairy product, meat, mushrooms, and almonds.

HINT: Hydrophilic compounds dissolve in water. Compounds that are significantly polar and/or can hydrogen bond with water tend to be water soluble. As a general rule, molecules that have at least one polar functional group for every five carbon atoms are water soluble, and therefore classified as hydrophilic. You saw four polar functional groups in chapter 4: the hydroxyl group (-OH), the carbonyl group (C=O), the carboxyl group (-COOH), and the carboxylate group (COO).

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For more help:

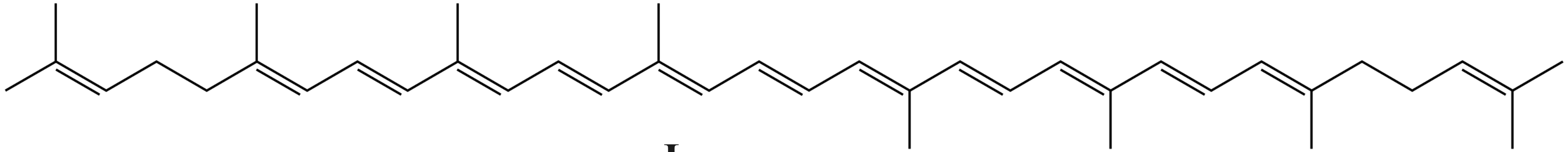
See chapter 7 part 11 video or chapter 7 section 8 in the textbook.

Click here to check your answer

Go to next question

7.24) Predict whether each of the following biological compounds is **hydrophilic** or **hydrophobic**?

a)

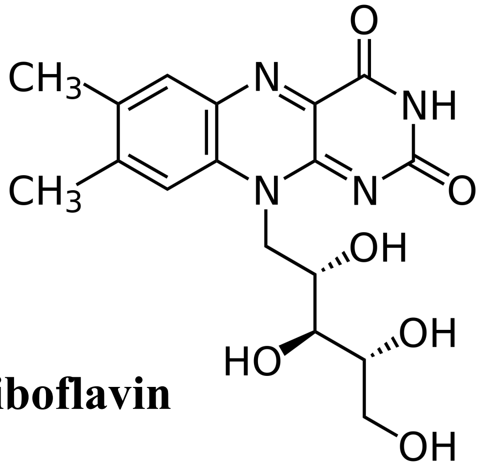


hydrophobic

Lycopene

Lycopene is a bright red carotenoid pigment and phytochemical found in tomatoes and some other red fruits and vegetables, such as red carrots, watermelons, and papayas.

b)



Riboflavin

Riboflavin, also known as vitamin B_2, is a vitamin found in food and used as a dietary supplement. Food sources include eggs, green vegetables, milk and other dairy product, meat, mushrooms, and almonds.

hydrophilic

EXPLANATION: Hydrophilic compounds dissolve in water. Compounds that are significantly polar and/or can hydrogen bond with water tend to be water soluble. As a general rule, molecules that have at least one polar functional group for every five carbon atoms are water soluble, and therefore classified as hydrophilic. You saw four polar functional groups in chapter 4: the hydroxyl group (-OH), the carbonyl group (C=O), the carboxyl group (-COOH), and the carboxylate group (COO).

For more details:

See chapter 7 part 11 video or chapter 7 section 8 in the textbook.

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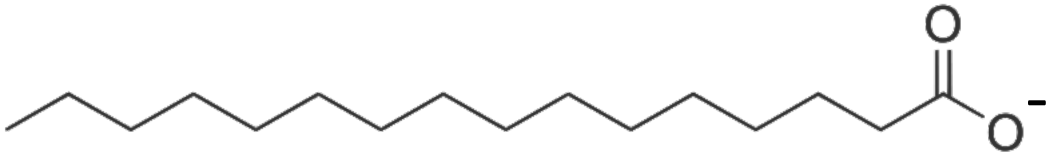
Go to next question

7.25) The compound below is **amphipathic**.

a) Which end (left or right) of this compound would be most attracted to water?

b) Which end (left or right) of this compound would be most attracted to oil?



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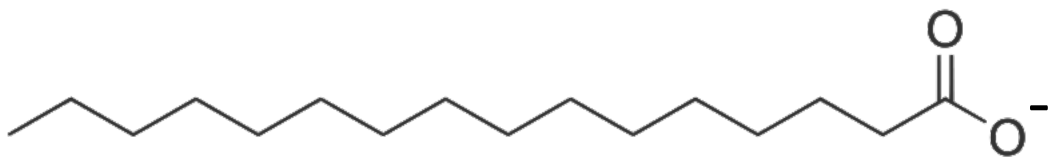
Go to next question

7.25) The compound below is **amphipathic**.

a) Which end (left or right) of this compound would be most attracted to water?

b) Which end (left or right) of this compound would be most attracted to oil?



HINT: Amphipathic compounds have both a large nonpolar region, which is not strongly attracted to water, and an extremely polar and/or formally-charged region, which is quite strongly attracted to water.

For more help:

See chapter 7 part 11 video or chapter 7 section 8 in the textbook.

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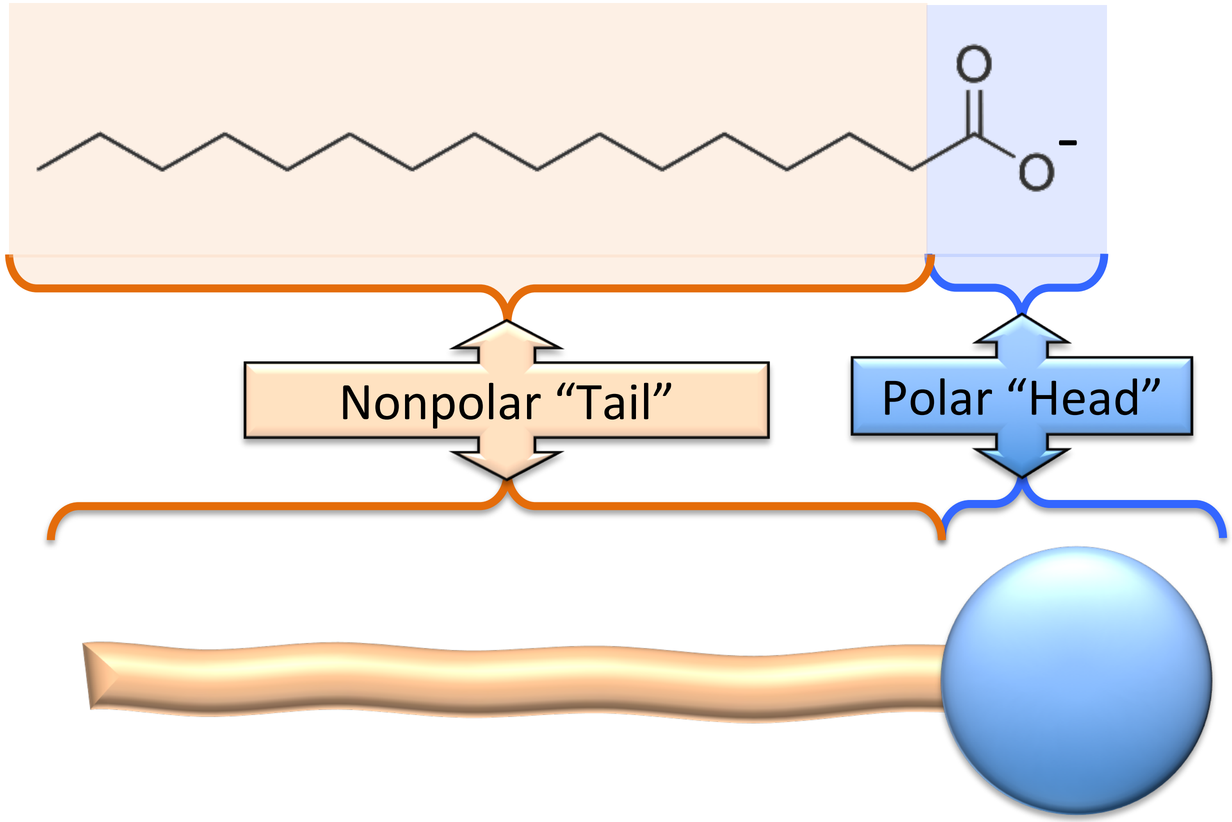
Click here to **check your answer**

Go to next question

7.25) The compound below is **amphipathic**.

a) Which end (left or right) of this compound would be most attracted to water? **right-hand end**

b) Which end (left or right) of this compound would be most attracted to oil? **left-hand end**



EXPLANATION: Although lone pairs are not shown explicitly in skeletal structures, the oxygens do have lone pairs that can hydrogen bond with water. In addition, there is a formal charge on one of the the oxygens. Water molecules' dipoles are strongly attracted to the charged region of the compound through ion dipole interactions. Furthermore, there are two highly-polar carbon-oxygen bonds which are strongly attracted to water molecules. The region of an amphipathic compound that is attracted to water is called the polar "head." The left-hand end of the molecule is a nonpolar region that does not have significant attractive interactions with water, however this nonpolar region is strongly attracted to large nonpolar regions of other particles (such as oil).

Amphipathic compounds are often illustrated using a sphere for the polar head that is attached to one or more long tubular structures that represent the carbon chains in the nonpolar tail, as shown on the bottom of the figure.

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For more details:
See chapter 7 part 11 video or chapter 7 section 8 in the textbook.

Go to next question

7.26) Soaps are amphipathic compounds. Which statement best describes them?

a) Soaps have a hydrophobic end which will attract nonpolar substances, such as oil on clothing.

b) Soaps are necessary for removing water soluble polar substances from skin or other objects to be cleaned.

c) Soaps dissolve best in polar solvents, which is why they can remove dirt.

d) Soaps cannot be attracted to either polar or nonpolar compounds.

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Go to next question

7.26) Soaps are amphipathic compounds. Which statement best describes them?

a) Soaps have a hydrophobic end which will attract nonpolar substances, such as oil on clothing.

HINT: b) ~~Soaps are necessary for removing water soluble polar substances from skin or other objects to be cleaned.~~

- Soaps are ***not necessary*** for removing water soluble polar substances because water alone would do so.

c) Soaps dissolve best in polar solvents, which is why they can remove dirt.

d) Soaps cannot be attracted to either polar or nonpolar compounds.

For more help:

See chapter 7 part 11 video or chapter 7 section 8 in the textbook.

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Click here to **check your answer**

Go to next question

7.26) Soaps are amphipathic compounds. Which statement best describes them?

BEST: a) Soaps have a hydrophobic end which will attract nonpolar substances, such as oil on clothing.
- Soap forms micelles that encapsulate nonpolar substances within their nonpolar tail interiors. Micelles containing the oil can move into the rinse water and away from the object that is being washed.

b) Soaps are necessary for removing water soluble polar substances from skin or other objects to be cleaned.
- Soaps are ***not necessary*** for removing water soluble polar substances because water alone would do so.

c) Soaps dissolve best in polar solvents, which is why they can remove dirt.
- Soaps DO NOT dissolve, they form micelles that enable them to emulsify nonpolar substances.

d) Soaps cannot be attracted to either polar or nonpolar compounds.
- The "polar heads" of soaps are attracted to polar compounds. The "nonpolar tails" of soaps are attracted to nonpolar compounds.

For more details:
See chapter 7 part 11 video or chapter 7 section 8 in the textbook.

7.27) If 0.250 L of a 0.500 M solution is diluted to a final volume of 1.50 L, what is the final concentration?

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7.27) If 0.250 L of a 0.500 M solution is diluted to a final volume of 1.50 L, what is the final concentration?

HINT: Recognize that this is a **dilution** problem. The ***dilution equation*** must be used.

For more help:

See chapter 7 part 12 video or chapter 7 section 9 in the textbook.

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Click here to **check your answer**

Go to next question

7.27) If 0.250 L of a 0.500 M solution is diluted to a final volume of 1.50 L, what is the final concentration?

ANSWER: 0.0833 M

CLICK HERE to see the **complete solution** for this problem

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Go to next question

7.27) If 0.250 L (V_1) of a 0.500 M (M_1) solution is diluted to a final volume of 1.50 L (V_2), what is the final concentration?

ANSWER: 0.0833 M

EXPLANATION: Recognize that this is a **dilution** problem.

The ***dilution equation*** must be used:

$$M_1 \bullet V_1 = M_2 \bullet V_2$$

V_1, **M_1**, and **V_2** are given; solve for **M_2**:

$$\frac{M_1 \bullet V_1}{V_2} = M_2$$

$$M_2 = \frac{M_1 \bullet V_1}{V_2} = \frac{(0.500\ M)\ (0.250\ \text{L})}{(1.50\ \text{L})} = \mathbf{0.0833\ M}$$

For more details:

See chapter 7 part 12 video or chapter 7 section 9 in the textbook.

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7.28) What volume of a 0.500 M solution should be diluted in order to obtain 2.00 L of a 0.100 M solution?

Click here for a **hint**

Click here to **check your answer**

7.28) What volume of a 0.500 M solution should be diluted in order to obtain 2.00 L of a 0.100 M solution?

HINT: Recognize that this is a **dilution** problem. The ***dilution equation*** must be used.

For more help:

See chapter 7 part 12 video or chapter 7 section 9 in the textbook.

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Click here to **check your answer**

Go to next question

7.28) What volume of a 0.500 M solution should be diluted in order to obtain 2.00 L of a 0.100 M solution?

ANSWER: 0.400 L

CLICK HERE to see the **complete solution** for this problem

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7.28) What volume of a 0.500 M (M_1) solution should be diluted in order to obtain 2.00 L (V_2) of a 0.100 M (M_2) solution?

ANSWER: 0.400 L

EXPLANATION: Recognize that this is a **dilution** problem.

The ***dilution equation*** must be used:

$$M_1 \bullet V_1 = M_2 \bullet V_2$$

M_1, **V_2**, and **M_2** are given; solve for **V_1**:

$$V_1 = \frac{M_2 \bullet V_2}{M_1}$$

$$V_1 = \frac{(0.100\ \text{M})\ (2.00\ \text{L})}{(0.500\ \text{M})} = \mathbf{0.400\ L}$$

For more details:
See chapter 7 part 12 video or chapter 7 section 9 in the textbook.

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7.29) When particles that are larger than typical molecules or ions are put into another medium, typically water, the resulting mixture is classified as either a ***colloid*** or a ***suspension***. Describe the difference between a ***colloid*** and a ***suspension.***

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HINT: Consider the effect that gravity has on ***colloids*** vs. ***suspensions***.

For more help:

See chapter 7 part 13 video or chapter 7 section 10 in the textbook.

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7.29) When particles that are larger than typical molecules or ions are put into another medium, typically water, the resulting mixture is classified as either a ***colloid*** or a ***suspension***. Describe the difference between a ***colloid*** and a ***suspension.***

EXPLANATION:

In ***colloids***, the dispersed particles (colloidal particles) are small enough that they do not *settle to the bottom of their container*. Conversely, in ***suspensions***, the solid particles are large enough that gravity causes them to settle to the bottom of their container unless the mixture is repeatedly or constantly stirred or shaken.

For more details:

See chapter 7 part 13 video or chapter 7 section 10 in the textbook.

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7.30) Diffusion is defined as the net transport of a substance, due to Brownian motion, from ________________________________.

a) one side of a membrane to another.

b) within an evenly dispersed mixture to the bottom of the container.

c) a region of lesser concentration of the substance to a region of greater concentration of the substance.

d) a region of greater concentration of the substance to a region of lesser concentration of the substance.

7.30) Diffusion is defined as the net transport of a substance, due to Brownian motion, from ______________________________.

HINT:

a) ~~one side of a membrane to another.~~

b) ~~within an evenly dispersed mixture to the bottom of the container.~~

c) a region of lesser concentration of the substance to a region of greater concentration of the substance.

d) a region of greater concentration of the substance to a region of lesser concentration of the substance.

For more help:

See chapter 7 part 14 video or chapter 7 section 11 in the textbook.

7.30) Diffusion is defined as the net transport of a substance, due to Brownian motion, from ________________________________.

a) one side of a membrane to another.

b) within an evenly dispersed mixture to the bottom of the container.

c) a region of lesser concentration of the substance to a region of greater concentration of the substance.

d) a region of greater concentration of the substance to a region of lesser concentration of the substance.

EXPLANATION: In the ***diffusion*** process, substances will spontaneously move from an area of greater concentration (of the particular substance) to lesser concentration until it is evenly distributed.

For more details:

See chapter 7 part 14 video or chapter 7 section 11 in the textbook.

7.31) In this course, we will only discuss osmosis for aqueous solutions such as biological systems, therefore for our purposes, **osmosis** is the net transport of water molecules from a solution with a *lesser solute particle concentration* through a ***semipermeable membrane*** to a solution with a *greater solute particle concentration*.

Osmosis is very important in biology because cell membranes are semipermeable. The difference in *solute particle concentration* (***osmolarity***) between the inside of the cell and the surrounding solution has important implications in maintaining the viability of the cell. Match each of the ***three terms*** (on the **left**), with its ***description*** for the solution that surrounds a cell (on the **right**):

hypertonic solution	There is a lesser solute particle concentration outside the cell than inside the cell, and there is a net flow of water from the outside to the inside of the cell. This results in the swelling and possible bursting of the cell.
hypotonic solution	The concentration of solute particles is the same on the inside and outside of the cell, therefore the flow of water in and out of the cell are equal and the cell maintains it natural and healthy (viable) shape.
isotonic solution	There is a greater solute particle concentration outside the cell than inside of the cell, so there is a net flow of water from the inside to the outside of the cell. This results in the shrinking of the cell.

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Click here for a **hint**

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hypertonic solution

hypotonic solution

isotonic solution

There is a lesser solute particle concentration outside the cell than inside the cell, and there is a net flow of water from the outside to the inside of the cell. This results in the swelling and possible bursting of the cell.

The concentration of solute particles is the same on the inside and outside of the cell, therefore the flow of water in and out of the cell are equal and the cell maintains it natural and healthy (viable) shape.

There is a greater solute particle concentration outside the cell than inside of the cell, so there is a net flow of water from the inside to the outside of the cell. This results in the shrinking of the cell.

HINT: (isotonic solution ↔ The concentration of solute particles is the same on the inside and outside of the cell…)

For more help:
See chapter 7 part 14 video or
chapter 7 section 11 in the textbook.

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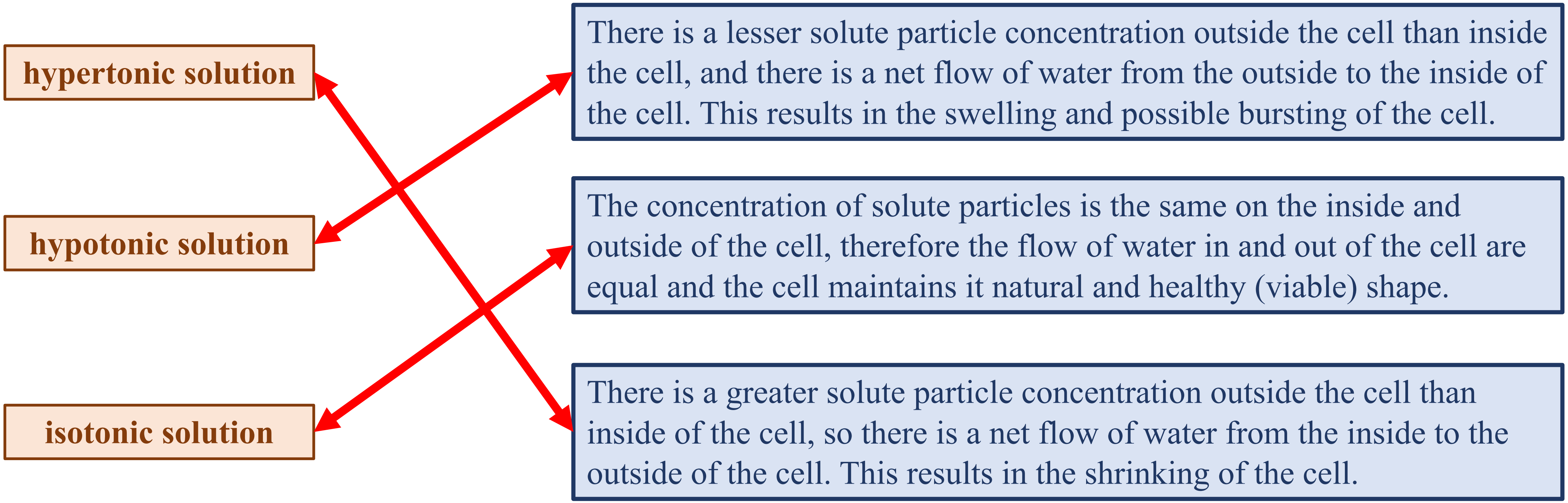

For more details:

See chapter 7 part 14 video or chapter 7 section 11 in the textbook.

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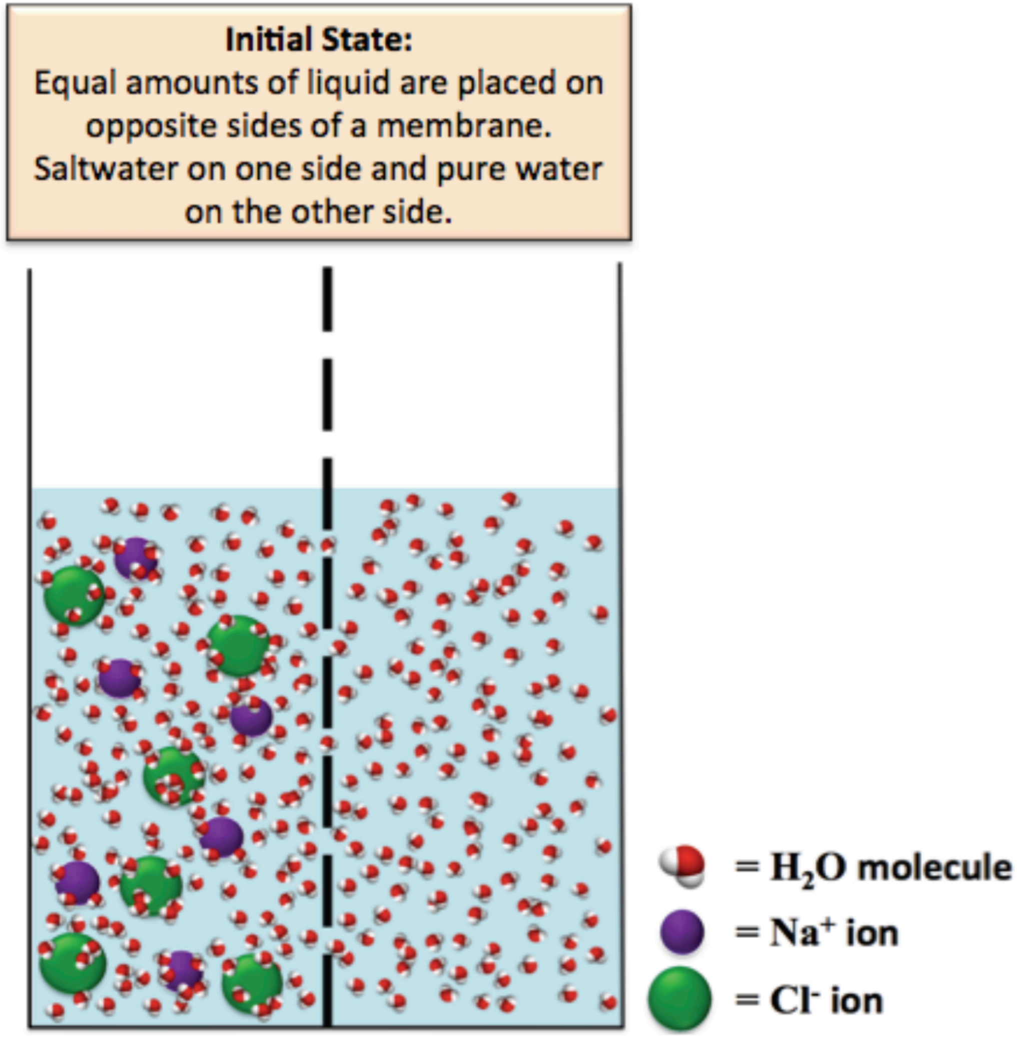
7.32) Consider a container that is divided by a semipermeable membrane. A sodium chloride (NaCl) solution is placed in the chamber on left-hand side of the membrane and an equal volume of pure water is placed in the chamber on the right-hand side of the membrane (as illustrated BELOW). At this point, osmosis begins. Will **osmotic pressure** cause the water level to **rise** on the ***left-hand side*** or the ***right-hand side*** of the membrane?



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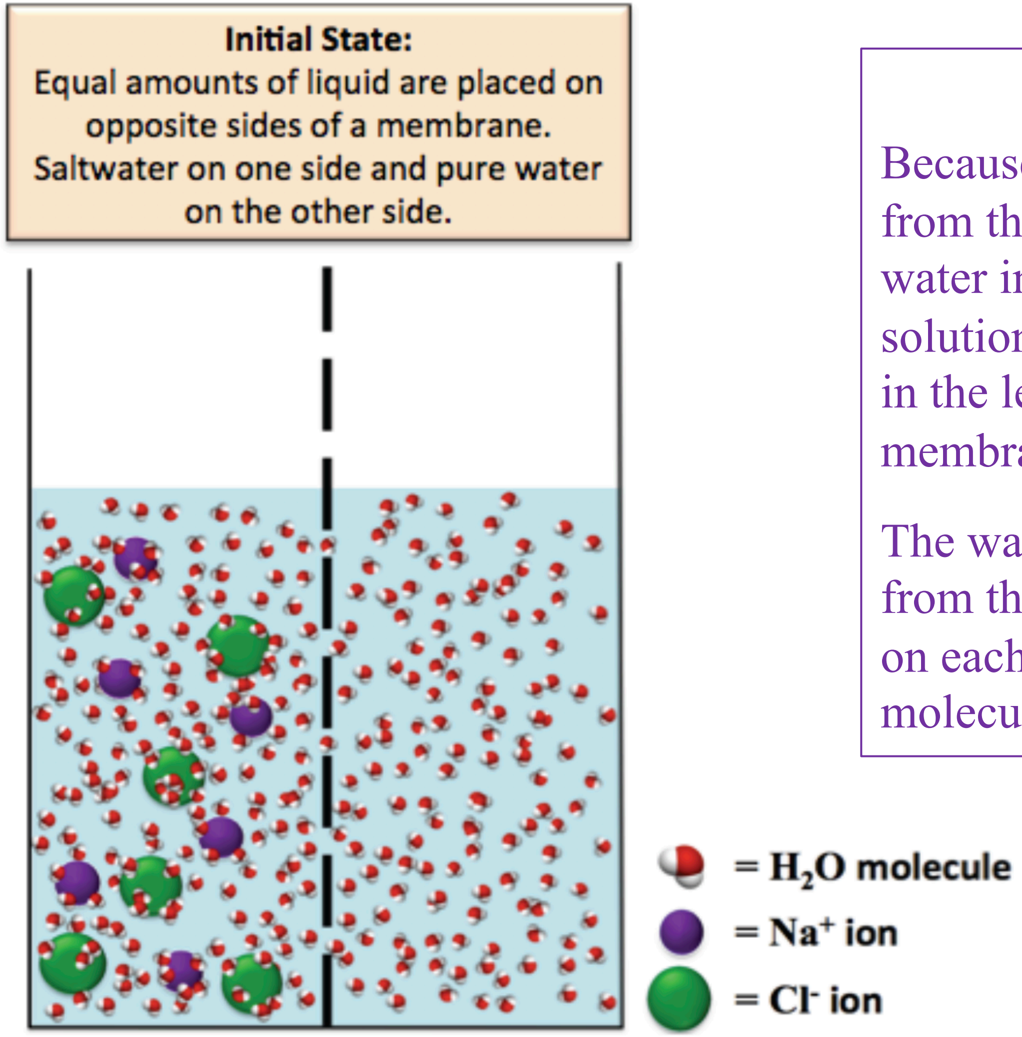

HINT:

Because of *osmosis*, there is a net transport of water molecules from the solution with a lesser solute particle concentration (pure water in this scenario), through the membrane, and into the solution with a greater solute particle concentration. This results in the level of the water column rising on one side of the membrane and falling on the other side.

The water levels will continue to change until the pressure caused from the difference in water column heights (***osmotic pressure***) on each side of the membrane equalizes the transport of water molecules between each side of the membrane.

For more help:

See chapter 7 part 14 video or chapter 7 section 11 in the textbook.

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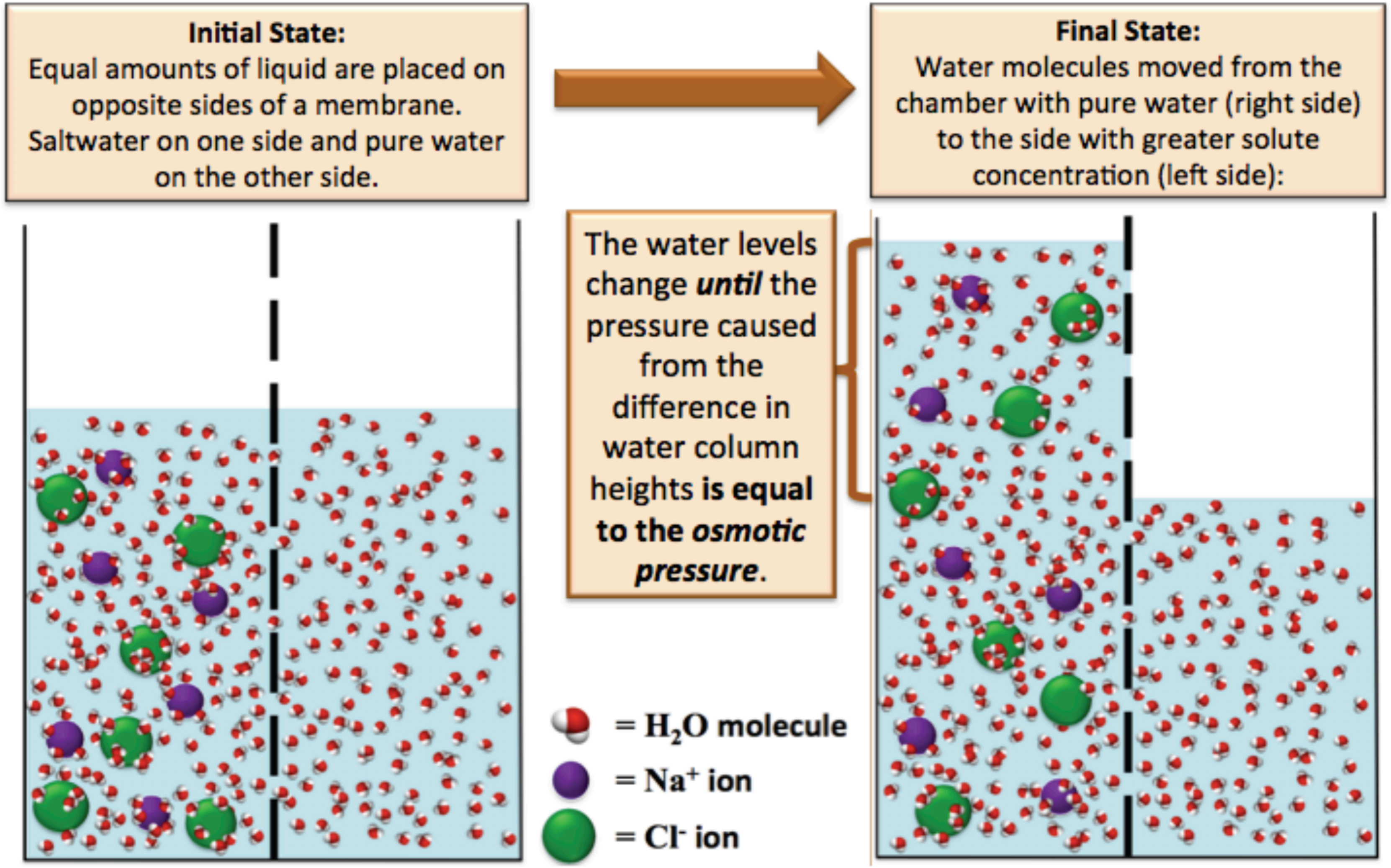
7.32) Consider a container that is divided by a semipermeable membrane. A sodium chloride (NaCl) solution is placed in the chamber on left-hand side of the membrane and an equal volume of pure water is placed in the chamber on the right-hand side of the membrane (as illustrated BELOW). At this point, osmosis begins. Will **osmotic pressure** cause the water level to **rise** on the ***left-hand side*** or the ***right-hand side*** of the membrane?



ANSWER: Osmotic pressure cause the water level rise on the **left-hand side** of the membrane.

EXPLANATION:

There is a net transport of water molecules from the solution with a lesser solute particle concentration (pure water in this scenario), through the membrane, and into the solution with a greater solute particle concentration. This results in the level of the water column rising on the left-hand side of the membrane and falling on the right-hand side.

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For more details:
See chapter 7 part 14 video or chapter 7 section 11 in the textbook.

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7.33 Which of the following scenarios would have a greater osmotic pressure?

a) 0.250 M lithium bromide on one side of a semipermeable membrane and pure water on the other side.

b) 0.500 M lithium bromide on one side of a semipermeable membrane and pure water on the other side.

7.33 Which of the following scenarios would have a greater osmotic pressure?

a) 0.250 M lithium bromide on one side of a semipermeable membrane and pure water on the other side.

b) 0.500 M lithium bromide on one side of a semipermeable membrane and pure water on the other side.

HINT:

The greater the difference in ***osmolarity*** between each side of the semipermeable membrane, the greater the osmotic pressure.

For more help:

See chapter 7 part 14 video or chapter 7 section 11 in the textbook.

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7.33 Which of the following scenarios would have a greater osmotic pressure?

a) 0.250 M lithium bromide on one side of a semipermeable membrane and pure water on the other side.

b) 0.500 M lithium bromide on one side of a semipermeable membrane and pure water on the other side.

EXPLANATION:

The greater the difference in ***osmolarity*** between each side of the semipermeable membrane, the greater the osmotic pressure.

Scenario **(a)** has a **difference** in osmolarity between each side of the membrane of **0.500 osmoles/L**.

- ***Each mole*** of dissolved LiBr results in ***two osmoles***. The LiBr solution has a *molarity* of 0.250 moles/L, so its ***osmolarity*** is **0.500 osmoles/L**.
- Pure water has an ***osmolarity*** = ZERO

Scenario **(b)** has a **difference** in osmolarity between each side of the membrane of **1.00 osmoles/L**.

- The LiBr solution has a *molarity* of 0.500 moles/L, so its ***osmolarity*** is **1.00 osmoles/L**
- Pure water has an ***osmolarity*** = ZERO

Scenario **(b)** has a ***greater difference in osmolarity***, it therefore has a **greater osmotic pressure**.

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For more details:
See chapter 7 part 14 video or chapter 7 section 11 in the textbook.

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7.34 Which of the following scenarios would have a greater osmotic pressure?

a) 0.500 M lithium chloride on one side of a semipermeable membrane and pure water on the other side.

b) 0.250 M aluminum sulfate on one side of a semipermeable membrane and pure water on the other side.

This is the last problem.

7.34 Which of the following scenarios would have a greater osmotic pressure?

a) 0.500 M lithium chloride on one side of a semipermeable membrane and pure water on the other side.

b) 0.250 M aluminum sulfate on one side of a semipermeable membrane and pure water on the other side.

HINT:

The greater the difference in ***osmolarity*** between each side of the semipermeable membrane, the greater the osmotic pressure.

For more help:

See chapter 7 part 14 video or chapter 7 section 11 in the textbook.

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a) 0.500 M lithium chloride on one side of a semipermeable membrane and pure water on the other side.

b) 0.250 M aluminum sulfate on one side of a semipermeable membrane and pure water on the other side.

EXPLANATION:

The greater the difference in ***osmolarity*** between each side of the semipermeable membrane, the greater the osmotic pressure.

Scenario **(a)** has a **difference** in ***osmolarity*** between each side of the membrane of **1.00 osmoles/L**.

- ***Each mole*** of dissolved LiCl results in ***two osmoles***. The LiCl solution has a *molarity* of 0.500 moles/L, so its ***osmolarity*** is **1.00 osmoles/L**.
- Pure water has an ***osmolarity*** = ZERO

Scenario **(b)** has a **difference** in ***osmolarity*** between each side of the membrane of **1.25 osmoles/L**.

- ***Each mole*** of dissolved $Al_2(SO_4)_3$ results in ***five osmoles*** (**two** osmoles of Al^{3+} and **three** osmoles of SO_4^{2-}). The $Al_2(SO_4)_3$ solution has a *molarity* of 0.250 moles/L, so its ***osmolarity*** is **1.25 osmoles/L**.
- Pure water has an ***osmolarity*** = ZERO

Scenario **(b)** has a ***greater difference in osmolarity***, it therefore has a **greater osmotic pressure**.

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For more details:
See chapter 7 part 14 video or chapter 7 section 11 in the textbook.

This is the last problem.