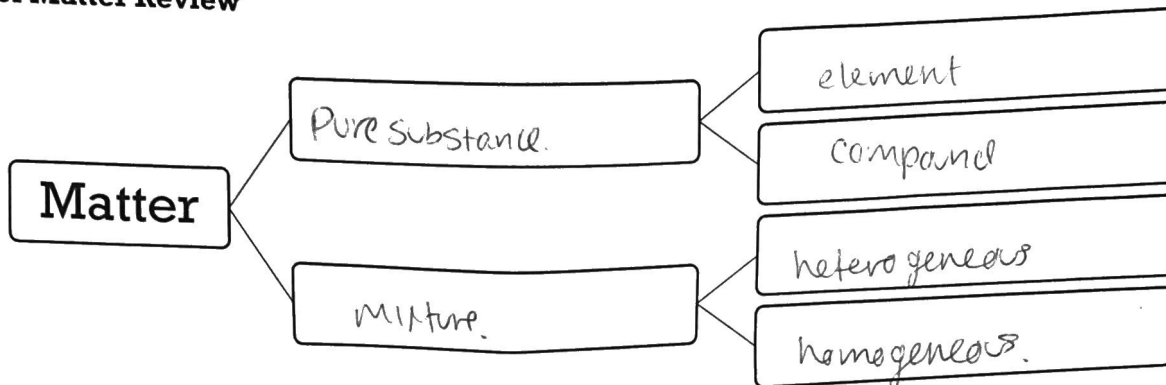


KEY

Mid-Solutions Unit Review

Types of Matter Review



• **Questions:**

- Which formula represents a mixture?
 - $C_6H_{12}O_6(l)$
 - $C_6H_{12}O_6(s)$
 - $LiCl(aq)$
 - $LiCl(s)$
- A dilute, aqueous potassium nitrate solution is best classified as a
 - Homogenous compound
 - Homogeneous mixture
 - Heterogeneous compound
 - Heterogeneous mixture
- Which must be a mixture of substances
 - Solid
 - Liquid
 - Solution
 - Gas

Separation Techniques

Technique	Separates	(What does it separate?)	Based on	Property
Evaporation	separates	soluble solid from liquid	based on	solubility
Filtration	separates	insoluble solid from liquid	based on	size
Distillation	separates	2 liquids	based on	boiling pt
Chromatography	separates	dyes	based on	polarity

• **Questions:**

- A mixture of crystals of salt and sugar is added to water and stirred until all solids have dissolved. Which statement best describes the resulting mixture?
 - The mixture is homogeneous and can be separated by filtration.
 - The mixture is homogeneous and cannot be separated by filtration.
 - The mixture is heterogeneous and can be separated by filtration.
 - The mixture is heterogeneous and cannot be separated by filtration.
- When a mixture of water, sand, and salt is filtered, what passes through the filter paper?
 - Water only
 - Water and sand only
 - Water and salt only
 - Water, sand, and salt
- When sample X is passed through a filter paper a white residue, Y, remains on the paper and a clear liquid, Z, passes through. When liquid Z is vaporized, another white residue remains. Sample X is best classified as
 - An element
 - A compound
 - A heterogeneous mixture
 - A homogeneous mixture

insoluble solid = heterogeneous

Name: KEY Official Class: _____ Date: _____
 Teacher: _____ Period: _____ Class: _____

Factors That Affect Solubility

Factors That Affect Solubility	Effect on Gases	Effect on Solids/Liquids
Increase Temperature	↓	↑
Decrease Temperature	↑	↓
Increase Pressure	↑	n/a
Decrease Pressure	↓	n/a
Increase Surface Area	<i>n/a</i>	↑
Decrease Surface Area		↓
Increase Agitation/Stirring		↑
Decrease Agitation/Stirring		↓
Increase Particle Size		↓
Decrease Particle Size		↑

affects the rate it dissolves not the amount

Nature of Solvent (does the dissolving)		Nature of Solute (what gets dissolved)
Ionic	dissolves	ionic / polar
Polar	dissolves	polar / ionic
Non-polar	dissolves	non polar

Note: nature of solvent and solute, temperature, and pressure, affect how MUCH of something can be dissolved and surface area and stirring affects how FAST something dissolves

Questions:

- Under which conditions of temperature and pressure is a gas most soluble in water?
 - High temperature and low pressure
 - High temperature and high pressure
 - Low temperature and low pressure
 - Low temperature and high pressure
- The solubility of KCl(s) in water depends on the
 - Pressure of the solution
 - Rate of stirring
 - Size of the KCl sample
 - Temperature of the water
- At room temperature, the solubility of which solute on water would be most affected by a change in pressure?
 - Methanol
 - Sugar
 - Carbon dioxide
 - Sodium nitrate

Table F: Solubility Guidelines for Aqueous Solutions

- Compounds containing alkali metal cations or the ammonium ion (NH₄⁺) are soluble
- Compounds containing nitrate (NO₃⁻), chlorate (ClO₃⁻), and acetate (C₂H₃O₂⁻) anions are soluble.
- Chlorides, bromides, and iodides are soluble except those containing Ag⁺, Pb²⁺, or Hg₂²⁺
- Sulfates are soluble except those containing Hg₂²⁺, Pb²⁺, Sr²⁺, Ca²⁺, or Ba²⁺
- Hydroxides (OH) are insoluble except compounds of the alkali metals, Ca²⁺, Sr²⁺, and Ba²⁺
- Compounds containing PO₄³⁻, S²⁻, CO₃²⁻, SO₃²⁻ ions are insoluble except those that also contain alkali metals or NH₄⁺

Name: _____ Official Class: _____ Date: _____

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- Compounds that are soluble (can dissolve) are also electrolytes meaning they can conduct electricity
- Compounds that are insoluble (cannot dissolve) are also non-electrolytes meaning they cannot conduct electricity

Ions That Form Soluble Compounds	Exceptions	Ions That Form Insoluble Compounds*	Exceptions
Group 1 ions (Li ⁺ , Na ⁺ , etc.)		carbonate (CO ₃ ²⁻)	when combined with Group 1 ions or ammonium (NH ₄ ⁺)
ammonium (NH ₄ ⁺)		chromate (CrO ₄ ²⁻)	when combined with Group 1 ions, Ca ²⁺ , Mg ²⁺ , or ammonium (NH ₄ ⁺)
nitrate (NO ₃ ⁻)		phosphate (PO ₄ ³⁻)	when combined with Group 1 ions or ammonium (NH ₄ ⁺)
acetate (C ₂ H ₃ O ₂ ⁻ or CH ₃ COO ⁻)		sulfide (S ²⁻)	when combined with Group 1 ions or ammonium (NH ₄ ⁺)
hydrogen carbonate (HCO ₃ ⁻)		hydroxide (OH ⁻)	when combined with Group 1 ions, Ca ²⁺ , Ba ²⁺ , Sr ²⁺ , or ammonium (NH ₄ ⁺)
chlorate (ClO ₃ ⁻)			
halides (Cl ⁻ , Br ⁻ , I ⁻)	when combined with Ag ⁺ , Pb ²⁺ , or Hg ₂ ²⁺		
sulfates (SO ₄ ²⁻)	when combined with Ag ⁺ , Ca ²⁺ , Sr ²⁺ , Ba ²⁺ , or Pb ²⁺		

*compounds having very low solubility in H₂O

• **Questions:**

1. When PbI₂(s) is added to Na₂CO₃(aq), a white precipitate is formed. According to Reference Table F, the white precipitate most likely is

- a. KNO₃
 b. PbCO₃ $PbI_2 + Na_2CO_3 \rightarrow NaI + PbCO_3$
 c. NaI
 d. Na₂CO₃

2. Which precipitate does the reaction Ba(NO₃)₂(aq) + Na₂SO₄(aq) → 2 NaNO₃(aq) + BaSO₄(s) form?

- a. Nitrogen
 b. Barium sulfate
 c. Barium nitrate
 d. Soluble salt

3. Based on Reference Table F, which of these saturated solutions has the lowest concentration of dissolved ions?

- a. NaCl(aq)
 b. MgCl₂(aq)
 c. NiCl₂(aq)
 d. AgCl(aq)

Table G: Solubility Curves at Standard Pressure

- Table G is a graph that shows the solubility of numerous solutes and their ability to dissolve in 100 g of H₂O
 - 1 g H₂O = 1 mL H₂O
- Each curve represents the greatest amount of solute that can dissolve at the given temperature which is known as solubility
- Measurements below the curve are known as unsaturated because more solute can be dissolved.
- Measurements on the curve are known as saturated because no more solute can be dissolved at the given conditions and still be a stable solution.
- Measurements above the curve are known as super saturated because an unstable solution as formed, and the excess solute will crystallize or precipitate out of solution
- Since the graph is based on 100 g of water, if the question asks about 200 g of water, you must double your answer.
- Since the graph is based on 100 g of water, if the question asks about 50 g of water, you must half your answer.

- The amount of substance that precipitates out of solution can be measured by taking data from both temperatures and calculating the difference.

• **Questions:**

- Based on the graph, how much KNO_3 can dissolve in 100g of H_2O at 20°C ? $\sim 35\text{g}$
- Based on the graph, how much KNO_3 can dissolve in 50g of H_2O at 60°C ? $\sim 52.5\text{g}$ $\frac{15}{2}$
- Based on the graph, how much KCl can dissolve in 200g of H_2O at 90°C ? $\sim 110\text{g}$
- In 100g of H_2O , how many grams of NH_4Cl will precipitate out of solution if the temperature decreases from 80°C to 50°C ? $67 - 52 = \sim 15\text{g}$ $\frac{5}{2}$
- 72g of NH_4Cl at 90°C represents what type of solution? saturated.
- 10g of NH_3 at 70°C represents what type of solution? unsaturated.
- 90g of HCl at 50°C represents what type of solution? super saturated.
- Based on Reference Table G, what is the maximum number of grams of $\text{KCl}_{(s)}$ that will dissolve in 200 grams of water at 50°C to produce a saturated solution?
 a. 38 g b. 42 g c. 58 g 42×2 **d. 84 g**
- How many grams of KCl must be dissolved in 200 grams of water to make a saturated solution at 60°C ?
 a. 30 g b. 45 g c. 56 g **d. 90 g**
- Which is a saturated solution?
 a. 40 g NH_4Cl in 100 g water at 50°C \checkmark
 b. 2 g SO_2 in 100 g water at 10°C \checkmark
c. 52 g KCl in 100 g water at 80°C SAT
 d. 120 g KI in 100 g water at 20°C \checkmark

