CasanovaStudy
Study Guide Generator

Marine Science Lesson 1.2 - Solubility (Outline)

Generated Study Guide

Subject: science **Grade Level:** 12th **Format:** flashcards

Generated: September 12, 2025

WATER SOLUBILITY STUDY GUIDE - FLASHCARDS
Grade 12 Chemistry | Intermediate Level

🎯 LEARNING OBJECTIVES
By the end of this study guide, you should be able to:
- Define solubility and explain factors affecting it
- Predict solubility using solubility rules and principles
- Calculate solubility quantities and concentrations
- Explain the relationship between molecular structure and solubility
- Apply "like dissolves like" principle to real-world scenarios

---

🔴 ESSENTIAL CONCEPTS (Exam Critical)

Q: What is solubility?

A: The maximum amount of solute that can dissolve in a given amount of solvent at a specific temperature and pressure, usually expressed in g/100mL or mol/L.

Q: State the "like dissolves like" rule.

A: Polar solvents dissolve polar solutes, and nonpolar solvents dissolve nonpolar solutes. This is because similar intermolecular forces allow for better mixing.

Q: What are the three main factors that affect solubility?

A: 1) Temperature, 2) Pressure (for gases), and 3) Nature of solute and solvent (polarity, molecular size, intermolecular forces).

Q: How does temperature affect the solubility of most solids in water?

A: For most solids, solubility increases with increasing temperature because higher kinetic energy helps break apart the solute structure.

Q: How does temperature affect gas solubility in water?

A: Gas solubility decreases as temperature increases because gas molecules have more kinetic energy to escape from solution.

Q: What is Henry's Law?

A: The solubility of a gas in a liquid is directly proportional to the pressure of the gas above the liquid: C = kP (where C = concentration, k = Henry's constant, P = pressure).

🟡 IMPORTANT DETAILS (Likely Tested)

Q: What intermolecular forces make water an excellent solvent for ionic compounds?

A: Water's polarity creates dipole-ion interactions, and hydrogen bonding allows water molecules to surround and stabilize ions through hydration.

Q: Why are alcohols with short carbon chains soluble in water?

A: Short-chain alcohols have a polar -OH group that can form hydrogen bonds with water, and the small nonpolar carbon chain doesn't significantly interfere with water's structure.

Q: What happens to alcohol solubility as the carbon chain length increases?

A: Solubility decreases because the nonpolar hydrocarbon portion becomes dominant, disrupting water's hydrogen bonding network.

Q: Define saturated, unsaturated, and supersaturated solutions.

A: Saturated: contains maximum dissolved solute at equilibrium. Unsaturated: can dissolve more solute. Supersaturated: contains more solute than normally possible (unstable).

Q: What is the difference between solubility and miscibility?

A: Solubility refers to how much solute dissolves in solvent. Miscibility refers to liquids that mix in all proportions (like water and ethanol).

Q: How do you calculate mass percent concentration?

A: Mass % = (mass of solute / mass of solution) × 100%

Q: What is molarity and how is it calculated?

A: Molarity (M) = moles of solute / liters of solution. It's temperature-dependent because volume changes with temperature.

🟢 SUPPORTING INFORMATION (Helpful Context)

Q: Why does soap work to clean grease?

A: Soap molecules have both polar (hydrophilic) and nonpolar (hydrophobic) ends, allowing them to interact with both water and grease, forming micelles that suspend grease in water.

Q: What is the salting-out effect?

A: Adding salt to a solution can decrease the solubility of other solutes because the salt competes for water molecules, reducing the water available to solvate other substances.

Q: Why do some medications require fat-soluble vitamins?

A: Fat-soluble vitamins (A, D, E, K) are nonpolar and require lipid environments for absorption and transport in the body, unlike water-soluble vitamins (B, C).

Q: What is a colligative property related to solubility?

A: Properties that depend on the number of dissolved particles, not their identity. Examples: boiling point elevation, freezing point depression, osmotic pressure.

Q: How does molecular size affect solubility?

A: Larger molecules generally have lower solubility because they disrupt the solvent structure more and have weaker solute-solvent interactions relative to their size.

📊 QUICK REFERENCE TABLE

Q: Which compounds are generally soluble in water according to solubility rules?

A:
- All nitrates (NO_3^-)
- All acetates (CH_3COO^-)
- Most chlorides, bromides, iodides (except AgX, PbX_2, Hg_2X_2)
- Most sulfates (except $BaSO_4$, $PbSO_4$, $CaSO_4$)

Q: Which compounds are generally insoluble in water?

A:
- Most carbonates (except Group 1)
- Most phosphates (except Group 1 and NH_4^+)
- Most hydroxides (except Group 1, $Ba(OH)_2$, $Ca(OH)_2$)
- Most sulfides (except Group 1, 2, and NH_4^+)

🔗 CONNECTION POINTS

Q: How does solubility relate to Le Chatelier's principle?

A: For endothermic dissolution, increasing temperature shifts equilibrium right (more soluble). For exothermic dissolution, increasing temperature shifts equilibrium left (less soluble).

Q: Connect solubility to environmental chemistry.

A: Thermal pollution increases water temperature, decreasing oxygen solubility and affecting aquatic life. Also, "like dissolves like" explains how pollutants move through different environmental compartments.

Q: How does solubility relate to crystal formation?

A: Slow cooling of saturated solutions allows controlled crystallization, while rapid cooling can create supersaturated solutions that precipitate quickly with smaller crystals.

✅ EXAM SUCCESS TIPS

Remember for exams:
- Always specify temperature when discussing solubility
- Use proper units (g/100mL, mol/L, etc.)
- Consider both kinetic and thermodynamic factors
- Practice predicting solubility using molecular structure
- Know when to apply Henry's Law vs. temperature effects

Common exam mistakes to avoid:
- Confusing solubility with rate of dissolution
- Forgetting that gas solubility decreases with temperature
- Mixing up saturated vs. concentrated solutions
- Not considering intermolecular forces when predicting solubility