

# Marine Science Lesson 1.2 - Solubility (Quiz)

Generated Study Guide

	Subject: science Grade Level: 11th Format: quiz Generated: September 13, 2025
#	AICE Marine Science Chapter 1: Water Solubility - Exam Quiz
В	# © LEARNING OBJECTIVES y the end of this quiz, you should be able to: LO
	1.
	2.1: Explain the molecular structure of water and its polar nature - LO
	1.
	<ul><li>2.2: Describe how polarity affects water's solvent properties</li><li>LO</li></ul>
	1.
	2.3: Analyze factors affecting solubility in marine environments - LO

1.

2.4: Apply solubility principles to marine ecosystem processes

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## QUIZ INSTRUCTIONS

- Total Questions: 25

- Time Limit: 45 minutes

- Sections: Multiple Choice (15), True/False (5), Short Answer (5)

- Materials: Calculator permitted for Section C only

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## SECTION A: MULTIPLE CHOICE (15 questions, 2 marks each)

ESSENTIAL CONCEPTS

- 1. Water is considered the "universal solvent" primarily because:
- a) It has a high boiling point
- b) It is a polar molecule with partial charges
- c) It exists in three states of matter
- d) It has a neutral pH
- 2. The partial negative charge in a water molecule is located on the:
- a) Hydrogen atoms
- b) Oxygen atom
- c) Both hydrogen and oxygen equally
- d) Electron clouds between atoms

- 3. Which property of water is MOST responsible for its excellent solvent capabilities?
- a) High specific heat capacity
- b) Surface tension
- c) Polarity and hydrogen bonding
- d) Density anomaly
- IMPORTANT APPLICATIONS
- 4. Salt (NaCl) dissolves readily in seawater because:
- a) Both are ionic compounds
- b) Water molecules surround and separate the ions
- c) Salt is less dense than water
- d) Temperature increases solubility
- 5. In marine environments, which factor would DECREASE the solubility of gases like oxygen?
- a) Decreasing temperature
- b) Increasing pressure
- c) Increasing temperature
- d) Decreasing salinity
- 6. The process where water molecules surround dissolved ions is called:
- a) Precipitation
- b) Hydration
- c) Ionization
- d) Crystallization
- 7. Which substance would be LEAST soluble in seawater?
- a) Sodium chloride (NaCl)
- b) Carbon dioxide (CO<sub>2</sub>)
- c) Oil (hydrocarbon)
- d) Calcium carbonate (CaCO<sub>3</sub>)
- SUPPORTING KNOWLEDGE

- 8. The solubility of calcium carbonate in seawater is important for:
- a) Fish respiration
- b) Shell and coral formation
- c) Water temperature regulation
- d) Ocean current formation
- 9. As depth increases in the ocean, the solubility of gases generally:
- a) Increases due to higher pressure
- b) Decreases due to lower temperature
- c) Remains constant
- d) Varies unpredictably

10. Polar substances	dissolve best in	solvents,	while nonpolar	substances
dissolve best in	solvents.			

a) nonpolar; polar

b) polar; polar

c) polar; nonpolar

d) ionic; covalent

# **APPLICATION QUESTIONS**

- 11. A marine biologist observes that coral reefs are less abundant in deeper, colder waters. This is likely because:
- a) There is less sunlight for photosynthesis
- b) Calcium carbonate is less soluble in cold water
- c) Water pressure prevents coral growth
- d) Both a and b are correct
- 12. Oil spills spread on the ocean surface rather than dissolving because:
- a) Oil is less dense than water
- b) Oil molecules are nonpolar and water is polar
- c) Oil has a lower boiling point
- d) Both a and b are correct

- 13. The "like dissolves like" rule means that:
- a) Only identical substances can dissolve
- b) Substances with similar polarities dissolve better
- c) All liquids dissolve in water
- d) Solubility depends only on temperature
- 14. Which marine organism would be MOST affected by changes in oxygen solubility?
- a) Marine plants (produce oxygen)
- b) Deep-sea fish (require dissolved oxygen)
- c) Coral polyps (have symbiotic algae)
- d) All would be equally affected
- 15. Supersaturation in seawater can lead to:
- a) Increased fish populations
- b) Precipitation of dissolved minerals
- c) Higher water temperatures
- d) Stronger ocean currents

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## SECTION B: TRUE/FALSE (5 questions, 2 marks each)

Mark T for True or F for False. Correct false statements.

- 16. **T/F**: Water's ability to dissolve substances is equally effective for all types of compounds.
- 17. **T/F**: Increasing the temperature of seawater will always increase the solubility of all dissolved substances.
- 18. **T/F**: The hydrogen bonds between water molecules contribute to water's solvent properties.

19. **T/F**: Marine organisms that build calcium carbonate shells are unaffected by water chemistry changes.

20. **T/F**: The polarity of water molecules allows them to interact with both positive and negative ions.

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## SECTION C: SHORT ANSWER (5 questions, 4 marks each)

- 21. **ESSENTIAL**: Explain why water is called a polar molecule and how this polarity relates to its function as a solvent. Include a diagram showing water's molecular structure. **(4 marks)**
- 22. IMPORTANT: Describe what happens at the molecular level when salt (NaCl) dissolves in seawater. Include the role of water molecules in this process. (4 marks)
- 23. **APPLICATION**: A marine scientist notices that fish are dying in a warm, shallow lagoon, but the same species thrives in deeper, cooler water nearby. Explain this observation using your knowledge of gas solubility. **(4 marks)**
- 24. IMPORTANT: Compare and contrast the solubility of oxygen gas and sodium chloride in seawater. Discuss how temperature affects each differently. (4 marks)

25. ANALYSIS: Predict and explain what would happen to marine ecosystems if water suddenly became a nonpolar molecule. Consider at least three specific impacts. (4 marks) ## 👺 KEY TERMS BOX Master these for the exam: - Polarity: Uneven distribution of charge in a molecule - Hydration: Water molecules surrounding dissolved ions - Solubility: Maximum amount of solute that dissolves in a solvent - Universal Solvent: Water's ability to dissolve many substances - Like Dissolves Like: Polar dissolves polar, nonpolar dissolves nonpolar ## S CONNECTION POINTS - Links to Chapter 2: Ocean chemistry and pH - Links to Chapter 3: Marine food webs and dissolved nutrients - Real-world applications: Ocean acidification, coral bleaching - Remember from Chemistry: Intermolecular forces, electronegativity ## ANSWER KEY ### Section A: Multiple Choice 1. b) It is a polar molecule with partial charges 2. b) Oxygen atom 3. c) Polarity and hydrogen bonding

4. b) Water molecules surround and separate the ions

5. c) Increasing temperature

6. b) Hydration
7. c) Oil (hydrocarbon)
8. b) Shell and coral formation
9. a) Increases due to higher pressure
10. c) polar; nonpolar
11. d) Both a and b are correct
12. d) Both a and b are correct
13. b) Substances with similar polarities dissolve better
14. b) Deep-sea fish (require dissolved oxygen)
15. b) Precipitation of dissolved minerals ### Section B: True/False
16. <b>F</b> - Water dissolves polar and ionic substances well, but not nonpolar substances
17. <b>F</b> - Higher temperature decreases gas solubility but increases solid solubility
18. <b>T</b>

#### 19. F - These organisms are highly sensitive to changes in water chemistry

20. **T** 

### Section C: Short Answer - Sample Responses

#### 21. Water Polarity (4 marks)

- Water is polar because oxygen is more electronegative than hydrogen (1 mark)
- Creates partial negative charge on oxygen, partial positive on hydrogen (1 mark)
- Diagram showing bent molecular structure with δ+ and δ- charges (1 mark)
- Polarity allows water to attract and surround ions, breaking ionic bonds (1 mark)

### 22. Salt Dissolution (4 marks)

- NaCl exists as Na+ and Cl- ions in crystal structure (1 mark)
- Water molecules orient with negative oxygen toward Na+ ions (1 mark)
- Water molecules orient with positive hydrogen toward CI- ions (1 mark)
- Hydration shells form around ions, keeping them separated in solution (1 mark)

#### 23. Fish Deaths Application (4 marks)

- Warm water holds less dissolved oxygen than cold water (1 mark)
- Fish require dissolved oxygen for cellular respiration (1 mark)
- Shallow, warm lagoon has insufficient oxygen to support fish (1 mark)
- Deeper, cooler water has higher oxygen solubility supporting fish survival (1 mark)

## 24. O<sub>2</sub> vs NaCl Solubility (4 marks)

- Both dissolve in water but through different mechanisms (1 mark)
- O<sub>2</sub> is nonpolar gas, dissolves through weak intermolecular forces (1 mark)
- NaCl is ionic, dissolves through ion-dipole interactions with water (1 mark)
- Higher temperature decreases O<sub>2</sub> solubility but increases NaCl solubility (1 mark)

## 25. Nonpolar Water Analysis (4 marks)

- Salt and minerals wouldn't dissolve no ion transport in organisms (1 mark)
- No hydration of biological molecules proteins and DNA couldn't function (1 mark)
- Gases might dissolve better, but ionic processes would cease (1 mark)
- Marine life as we know it couldn't exist fundamental biochemistry would fail (1 mark)

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#### ## 6 EXAM SUCCESS TIPS

- Focus on: Water's molecular structure and its consequences
- **Practice**: Drawing water molecules interacting with ions
- Remember: Temperature effects on gas vs. solid solubility are opposite
- **Connect**: Solubility principles to real marine phenomena

Good luck on your AICE Marine Science exam!