# Solutions: Chapter Introduction

Soda fizzes when opened and the sea does not freeze at 0 °C: both are solution behaviour. The chapter covers concentration, Henry's and Raoult's laws and colligative properties.

Name: Date: Score: ____ / 21

## A. Fill in the blanks

**1.** A solution is a ____ mixture of two or more components.

**2.** The component present in the largest amount is the ____.

**3.** Molarity is moles of solute per litre of ____.

**4.** The solubility of a gas in a liquid is proportional to its partial pressure: this is ____'s law.

**5.** Properties that depend only on the number of solute particles are called ____ properties.

## B. True or False

**6.** Molality changes with temperature. True / False

**7.** A non-volatile solute lowers the vapour pressure of the solvent. True / False

**8.** Adding salt raises the freezing point of water. True / False

**9.** Soda fizzes on opening because the pressure above it falls. True / False

## C. Assertion and reason

**10. Assertion (A):** Molality is preferred to molarity for precise work at varying temperature.
**Reason (R):** Volume changes with temperature but mass does not.

(a) Both A and R are true, and R explains A
(b) Both A and R are true, but R does not explain A
(c) A is true, R is false
(d) A is false, R is true

Answer: _____

**11. Assertion (A):** Divers use air diluted with helium.
**Reason (R):** At high pressure underwater, more nitrogen dissolves in blood (Henry's law).

(a) Both A and R are true, and R explains A
(b) Both A and R are true, but R does not explain A
(c) A is true, R is false
(d) A is false, R is true

Answer: _____

## D. Choose the correct option

**12.** Molality is expressed as:

(a) mol $L^{-1}$
(b) mol $kg^{-1}$ of solvent
(c) g $L^{-1}$
(d) no unit

Answer: _____

**13.** Which is a colligative property?

(a) colour
(b) osmotic pressure
(c) density
(d) taste

Answer: _____

**14.** Opening a soda bottle releases $CO_2$ because:

(a) temperature rises
(b) pressure falls
(c) the sugar burns
(d) water boils

Answer: _____

**15.** Sea water freezes:

(a) above 0 °C
(b) exactly at 0 °C
(c) below 0 °C
(d) never

Answer: _____

## E. Numerical problems

**16.** Find the molarity of a solution with 0.5 mol of NaCl in 2 L of solution.

**17.** Find the molality of 4 g of NaOH (molar mass 40 g $mol^{-1}$) in 500 g of water.

**18.** 18 g of glucose (180 g $mol^{-1}$) is dissolved in 90 g of water (18 g $mol^{-1}$). Find the mole fraction of glucose.

## F. Short answer questions

**19.** State Henry's law and use it to explain why soda fizzes on opening.

**20.** Why does sea water not freeze at 0 °C?

## G. Match the columns

**21. Match each item in Column A with the correct item in Column B.**

| Column A | Column B | Your answer |
|---|---|---|
| 1. Molarity | (a) Gas solubility and pressure | 1 → ____ |
| 2. Molality | (b) mol per kg of solvent | 2 → ____ |
| 3. Henry's law | (c) Vapour pressure of solutions | 3 → ____ |
| 4. Raoult's law | (d) mol per litre of solution | 4 → ____ |

## Detailed solutions

**1.** homogeneous

**2.** solvent

**3.** solution

**4.** Henry

**5.** colligative

**6.** False. It uses the mass of solvent, which does not change with temperature.

**7.** True. It occupies part of the surface, so fewer solvent molecules escape.

**8.** False. It lowers (depresses) the freezing point.

**9.** True. Lower pressure means lower $CO_2$ solubility.

**10.** (a) R explains A.

**11.** (a) Helium is less soluble, avoiding the bends.

**12.** (b) mol $kg^{-1}$ of solvent. m = moles of solute / kg of solvent.

**13.** (b) osmotic pressure. It depends on the number of particles only.

**14.** (b) pressure falls. Henry's law.

**15.** (c) below 0 °C. Dissolved salt depresses the freezing point (about −1.9 °C).

**16.** M = n / V = 0.5 / 2. **Answer: 0.25 M**

**17.** n = 4 / 40 = 0.1 mol; m = 0.1 / 0.5 kg. **Answer: 0.2 mol $kg^{-1}$**

**18.** n(glucose) = 18 / 180 = 0.1; n(water) = 90 / 18 = 5; x = 0.1 / 5.1. **Answer: about 0.0196**

**19.** The partial pressure of a gas above a solution is proportional to its mole fraction in the solution (p = K_H x). Soda is bottled under high $CO_2$ pressure; opening lowers the pressure, so less $CO_2$ stays dissolved and the excess escapes as bubbles.

**20.** Dissolved salts depress the freezing point (a colligative property): the more solute particles, the lower it goes. Sea water freezes at about −1.9 °C.

**21.** 1 → (d), 2 → (b), 3 → (a), 4 → (c). Each term matches its meaning from the chapter introduction.