S.1 Solutions & Solubility

Practice Worksheet — name: _____ date: _____

FORMULAS FOR THIS TOPIC

CONCENTRATION $c = \frac{\text{mass of solute (g)}}{\text{volume of solution (dm}^3\text{)}}$

SECTION A — MULTIPLE CHOICE

A1. 25 g of salt is dissolved in water to make 0.50 dm³ of solution. The concentration is:

(A) 12.5 g/dm³
(B) 25 g/dm³
(C) 50 g/dm³
(D) 75 g/dm³

A2. A solution is saturated at 60 °C. As it cools to 20 °C, crystals appear because:

(A) The water evaporates
(B) The solubility decreases with temperature, so excess solute leaves the solution
(C) The solute reacts with the water
(D) The solution becomes less dense

A3. The mass of a sealed flask of water does not change when sugar dissolves in it because:

(A) The sugar becomes weightless in solution
(B) The sugar particles still exist, dispersed among the water particles
(C) Dissolving is a chemical reaction that conserves mass
(D) The water absorbs the mass of the sugar

SECTION B — SHORT ANSWER

B1. Using particle theory, describe what happens when a sugar cube dissolves in water. [3 marks]

B2. The solubility of a salt is 110 g per 100 g of water at 70 °C and 60 g per 100 g at 30 °C. A saturated solution containing 100 g of water is cooled from 70 °C to 30 °C. What mass of crystals forms? [2 marks]

B3. Explain why rising ocean temperatures are a concern for fish, in terms of gas solubility. [2 marks]

ANSWER KEY

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Section A

A1: 50 g/dm³ — $c = 25/0.50 = 50\ \text{g/dm}^3$. Watch the volume units: 500 cm³ must be converted to 0.50 dm³ before dividing.

A2: The solubility decreases with temperature, so excess solute leaves the solution — Cooler water can hold less dissolved solid. The amount above the new (lower) solubility limit crystallises out — exactly what a solubility curve lets you calculate.

A3: The sugar particles still exist, dispersed among the water particles — Dissolving is a physical change: the sugar molecules are separated and surrounded by water molecules but not destroyed. Evaporating the water recovers every gram of sugar.

Section B

B1: Water particles collide with the sugar particles at the cube's surface, attract them, and surround individual sugar particles, carrying them away into the spaces between water particles. The process continues layer by layer until the sugar is uniformly dispersed — a solution.

B2: At 70 °C the solution holds 110 g; at 30 °C it can hold only 60 g. Crystals formed = 110 − 60 = 50 g.

B3: The solubility of gases decreases as temperature rises, so warmer oceans hold less dissolved oxygen. Fish depend on that dissolved oxygen for respiration, and lower levels stress or suffocate aquatic life.