



Properties of Solutions

EXERCISES

A. Determine whether the following statements are true or false. If the answer is "false", explain why:

1) In a solution, the solute is the substance that is dissolved, and the solvent is the substance doing the dissolving.

2) Solubility describes the amount of one substance that will dissolve into another substance.

3) Ionic compounds dissolve in polar solvents.

4) Polar substances dissolve in polar solvents.

5) Nonpolar substances dissolve in polar solvents.

6) When $\text{NaCl}_{(s)}$ is dissolved in water, the sodium ions and chloride ions become hydrated ions in solution.

7) When $\text{NaCl}_{(s)}$ is dissolved in water, the sodium ions attract the positive end of the water dipole.

8) Bromine is more soluble in polar water than in nonpolar cyclohexane because the polar water molecules help it form ions.

9) For most solids or liquids dissolved in a liquid solvent, an increase of temperature results in an increase of solubility.

10) The solubility of gases in liquids increases with increasing temperature.

11) During the summer months, the concentration of dissolved oxygen in streams, lakes and rivers is decreased.

12) The solubility of a gas in a liquid is increased as the pressure of that gas above the liquid is increased.

13) Pressure has almost no effect on the solubility of solids in liquids.

14) An increase in particle size will increase the rate of solution of a solid in a liquid.

15) An increase in temperature almost always increases the rate at which a solid will dissolve in a liquid.



- 16) The less concentrated a solution is, the faster it will dissolve additional solute.
- 17) A supersaturated solution contains dissolved solute in equilibrium with undissolved solute.
- 18) If 40 mL of benzene is added to 30 mL of toluene, the volume percent of benzene in the mixture would be 57%.
- 19) A 1.00 M solution contains 1.00 mol of solute per litre of solution.
- 20) A 0.500 M solution contains 0.500 mol of solute per 500 mL of solution.
- 21) When a solute is dissolved in a solvent, the freezing point of the solution will be higher than that of the pure solvent.
- 22) In a sugar solution, sugar molecules will eventually settle out because they are heavier than water molecules.
- 23) Liquids which mix with water in all proportions are usually ionic in solution or are polar substances.
- 24) Salt water has a higher normal boiling point than distilled water.
- 25) The volume percent of a compound in a solution is the volume of that compound divided by the volume of the solvent multiplied by 100%.
- 26) A saturated solution contains dissolved solute in equilibrium with undissolved solute.
- 27) Molecular compounds which react with water to produce ions are undergoing a process called dissociation.
- 28) When $\text{NaCl}_{(s)}$ breaks apart in solution, the ions become independent in solution. This is called ionization.
- 29) The vapour pressure of a solution is always more than that of the pure solvent.
- 30) Solvation refers to saving a person from sin.
- 31) Hydration is the general name for the process by which solvent particles surround solute particles for any solvent.
- 32) Properties which depend on the specific chemical nature of a solute in a solution are called colligative properties.



- 33) Solutions freeze at a lower temperature than pure solvents.
- 34) A dilute solution has less solute compared to an undiluted solution.
- 35) For any solution, the amount of solution is equal to the amount of solvent.
- 36) Saltwater freezes at a lower temperature than freshwater.

SOLUTIONS

A. (1) true (2) true (3) true (4) true (5) false; nonpolar substances dissolve in *nonpolar* solvents. (6) true (7) false; sodium ions are positive and they attract the *negative* end of the dipole. (8) false; bromine is nonpolar and it is more soluble in *cyclohexane*. (9) true (10) false; the solubility of gases *decreases* with increasing temperature, or increases with *decreasing* temperature. (11) true (12) true (13) true (14) false; A *decrease* in particle size will increase the rate of solution, since smaller particles offer less surface area for the solute to act on. (15) true (16) false; concentration has no effect on the rate of solution. (17) false; a supersaturated solution contains more solute than is normally soluble in a particular solvent. (18) true (19) true (20) false; the solution described is a *0.250 M* solution. A *0.500 M* solution would be *0.250 mol* of solute in *0.500 mL* of solution, or *0.500 mol* in *1.00 L*. (21) false; the freezing point would be *lower* for the solution compared to the pure solvent. (22) false; sugar molecules will not settle out of solution without outside influence. (23) true (24) true (25) false; the volume of the compound is divided by the volume of *solution*. (26) true (27) false; it's called *ionization*. (28) false; it's called *dissociation*. (29) false; the vapour pressure of a solution is *less* than that of pure solvent. (30) false; that's *salvation*. Solvation is the general name for the process where solvent particles surround solute particles. (31) false; hydration is specifically solvation in water. (32) false; colligative properties depend on the number of dissolved particles. (33) true (34) false; a dilute solution has less solute *per unit of volume* than an undiluted solution. (35) false; the amount of solution is the amount of solvent plus the amount of solute. (36) true

