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SOLUTIONS

Reviewing Content

42. The solvent is the substance in which the solute is dissolved.
43. Random collisions of the solvent molecules with the solute particles provide enough force to overcome gravity.
44. **solubility**: the amount of a substance that dissolves in a given quantity of solvent at specified conditions of temperature and pressure to produce a saturated solution.
saturated solution: a solution containing the maximum amount of solute for a given amount of solvent at a constant temperature and pressure. **unsaturated solution**: a solution that contains less solute than a saturated solution at a given temperature and pressure. **miscible**: describes liquids that dissolve in each other. **immiscible**: describes liquids that are insoluble in each other.
45. Particles of solute crystallize.
46. No; if there were undissolved solute, the excess solute would come out of a supersaturated solution.
47. 5.55×10^2 g AgNO_3
48. Solubility increases with pressure.
49. a. 1.6×10^{-2} g/L
b. 4.7×10^{-2} g/L
50. *Dilute* and *concentrated* are relative terms and are not quantitative. Molarity provides the exact number of moles of solute per liter of solution.
51. Molarity is the number of moles of solute dissolved in one liter of solution.
a. 1.3M KCl
b. 3.3×10^{-3} M MgCl_2
52. 2.00×10^3 mL
53. a. 5.0×10^{-3} mol NaCl, 29 g NaCl
b. 1.0 mol KNO_3 , 1.0×10^2 g KNO_3
c. 2.5×10^2 mol CaCl_2 , 2.8 g CaCl_2
54. a. 2.3×10^3 g NaCl
b. 2.0 g MgCl_2
55. a. 16% (v/v) ethanol
b. 63.6% (v/v) isopropyl alcohol
56. Colligative properties are properties of a solution that depend only on the number of solute particles; boiling-point elevation, freezing-point depression, and vapor-pressure lowering. Boiling points are elevated because shells of solvent form around solute particles, reducing the amount of solvent molecules that have sufficient energy to escape the solution; relative to the pure solvent, the amount of energy required to cause vaporization or boiling increases. Solutes disrupt the ordering of the solvent structure, so more kinetic energy must be withdrawn from a solution for it to solidify. This lowers the freezing point of the solution.
57. a. sea water
b. 1.5M KNO_3
c. 0.100M MgCl_2
58. The effective molality of the $\text{Ca}(\text{NO}_3)_2$ solution is 3m. The effective molality of the NaNO_3 solution is 2m.
59. When vapor pressure is lowered relative to pure solvent, more energy must be supplied to reach the boiling point; thus the boiling point is increased relative to pure solvent.
60. The salt lowers the freezing point of the ice-water cooling mixture.
61. 1M solution: 1 mol of solute in 1 L of solution; 1m solution: 1 mol of solute in 1000 g of solvent
62. Add 27.0 g H_2O to 32.0 g CH_3OH .
63. a. 100.26°C
b. 101.54°C
64. a. -4.46°C
b. -2.2°C
65. a. -1.1°C
b. -0.74°C
c. -1.5°C

Understanding Concepts

66. a. The freezing-point depression is twice as great for solute B; solute B must provide twice as many particles in solution.

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