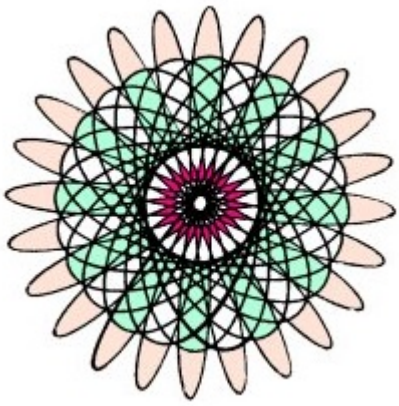

11.7 End-of-Chapter Material

ADDITIONAL EXERCISES

1. One brand of ethyl alcohol (Everclear) is 95% ethyl alcohol, with the remaining 5% being water. What is the solvent and what is the solute of this solution?

2. Give an example of each type of solution from your own experience.

    a. A solution composed of a gas solute in a liquid solvent.
    b. A solution composed of a solid solute in a liquid solvent.
    c. A solution composed of a liquid solute in a liquid solvent.
    d. A solution composed of a solid solute in a solid solvent. (Hint: usually such solutions are made as liquids and then solidified.)

3. Differentiate between the terms *saturated* and *concentrated*.

4. Differentiate between the terms *unsaturated* and *dilute*.

5. What mass of $FeCl_2$ is present in 445 mL of 0.0812 M $FeCl_2$ solution?

6. What mass of SO_2 is present in 26.8 L of 1.22 M SO_2 solution?

7. What volume of 0.225 M $Ca(OH)_2$ solution is needed to deliver 100.0 g of $Ca(OH)_2$?

8. What volume of 12.0 M HCl solution is needed to obtain exactly 1.000 kg of HCl?

9. The World Health Organization recommends that the maximum fluoride ion concentration in drinking water is 1.0 ppm. Assuming water has the

maximum concentration, if an average person drinks 1,920 mL of water per day, how many milligrams of fluoride ion are being ingested?

10. For sanitary reasons, water in pools should be chlorinated to a maximum level of 3.0 ppm. In a typical 5,000 gal pool that contains 21,200 kg of water, what mass of chlorine must be added to obtain this concentration?

11. Given its notoriety, you might think that uranium is very rare, but it is present at about 2–4 ppm of the earth's crust, which is more abundant than silver or mercury. If the earth's crust is estimated to have a mass of 8.50×10^{20} kg, what range of mass is thought to be uranium in the crust?

12. Chromium is thought to be an ultratrace element, with about 8.9 ng present in a human body. If the average body mass is 75.0 kg, what is the concentration of chromium in the body in pptr?

13. What mass of 3.00% H_2O_2 solution is needed to produce 35.7 g of $O_2(g)$ at 295 K at 1.05 atm pressure?
$2H_2O_2(aq) \rightarrow 2H_2O(\ell) + O_2(g)$

14. What volume of pool water is needed to generate 1.000 L of $Cl_2(g)$ at standard temperature and pressure if the pool contains 4.0 ppm HOCl and the water is slightly acidic? The chemical reaction is as follows:
$HOCl(aq) + HCl(aq) \rightarrow H_2O(\ell) + Cl_2(g)$
Assume the pool water has a density of 1.00 g/mL.

15. A 0.500 *m* solution of $MgCl_2$ has a freezing point of −2.60°C. What is the true van't Hoff factor of this ionic compound? Why is it less than the ideal value?

16. The osmotic pressure of a 0.050 M LiCl solution at 25.0°C is 2.26 atm. What is the true van't Hoff factor of this ionic compound? Why is it less than the ideal value?

17. Order these solutions in order of increasing boiling point, assuming an ideal van't Hoff factor for each: 0.10 *m* $C_6H_{12}O_6$, 0.06 *m* NaCl, 0.4 *m* $Au(NO_3)_3$, and 0.4 *m* $Al_2(SO_4)_3$.

18. Order these solutions in order of decreasing osmotic pressure, assuming an ideal van't Hoff factor: 0.1 M HCl, 0.1 M $CaCl_2$, 0.05 M $MgBr_2$, and 0.07 M $Ga(C_2H_3O_2)_3$

ANSWERS

1. solvent: ethyl alcohol; solute: water

3. Saturated means all the possible solute that can dissolve is dissolved, whereas concentrated implies that a lot of solute is dissolved.

5. 4.58 g

7. 6.00 L

9. 1.92 mg

11. 1.7×10^{15} to 3.4×10^{15} kg

13. 2,530 g

15. 2.80; it is less than 3 because not all ions behave as independent particles.

17. 0.10 *m* $C_6H_{12}O_6$ < 0.06 *m* NaCl < 0.4 *m* $Au(NO_3)_3$ < 0.4 *m* $Al_2(SO_4)_3$