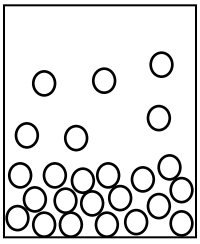
# Solutions Review

1. Define *solution*.

2. How can one separate a solute from a solution?

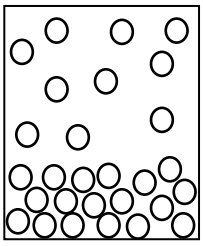
3. Describe what happens when $Na_2SO_4(s)$ dissolves in water.

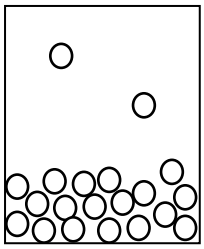
4. A microscopic representation of pure water is shown in the diagram below,

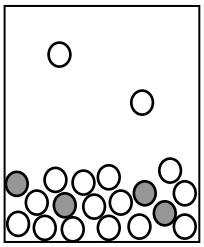


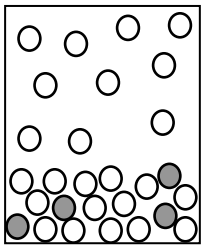
Which one of the following diagrams **best** illustrates the microscopic representation after sucrose, (or table sugar) has been dissolved in the water?

○ = water molecule
● = sucrose molecule


(A)


(B)


(C)


(D)

5. When calcium chloride dissolves in a beaker of water, the following occurs:

$$CaCl_2(s) \rightarrow Ca^{2+}(aq) + 2Cl^{-}(aq) + \text{heat}$$

Is this exothermic or endothermic? Will the beaker heat up or cool off?

6. What is meant by the term *saturated solution*?

7. Briefly explain how you would make a supersaturated solution.

8. Is a solution that contains 45 g of potassium nitrate in 50 g of water at $50^{o}C$ unsaturated, saturated, or supersaturated?

9. A student uses 200 grams of water at a temperature of 60°C to prepare a saturated solution of potassium chloride, KCl.
   (a) Identify the **solute** in this solution.
   (b) How many grams of KCl must be used to create this saturated solution?
   (c) This solution is cooled to 10°C and the excess KCl precipitates (settles out). The resulting solution is saturated at 10°C. How many grams of KCl precipitated out of the original solution?

10. Determine the approximate mass of solute that could be added to a $NaNO_3$ solution that is saturated at $10^oC$ when heated to $60^oC$.

11. Explain, at the molecular level, why adding salt to water causes the boiling temperature for water to increase. Diagrams may be used in your response.

12. How does the solubility of $CO_2$ gas in pure water change with temperature?

13. Describe the meaning of the following methods of stating concentration:
   (a) Calomine Lotion : pramoxine 1% w/w
   (b) Otrivin® Nasal Mist : sodium chloride 0.9% w/v
   (c) Fluoride ion concentration in water: 2 ppb

14. If the percent (mass/mass) for a solute is 4% and the mass of the solution is 200 g, what is the mass of the solute?

15. What is the concentration of a solution of $H_3PO_4$ that contains 9.8 grams of this acid per liter?

16. Calculate the mass of solute dissolved in 250 mL of 0.2 mol/L sodium hydroxide solution.

17. A 10.00 mL solution which is 6.0 mol/L HCl is pipetted into a 250 mL volumetric flask and the flask is filled to the mark. What is the final molarity of HCl in the flask?

18. What is the concentration of solution that contains $8.5 \times 10^{18}$ molecules of silver chlorate dissolved in enough solvent to make 5 mL of this homogeneous mixture?

19. Describe how you would prepare a 500 mL solution of ammonium chloride that has a concentration of 2.75 mol/L. List the equipment and show all calculations you would need.

20. You need to prepare 2.50 L of a 0.125 mol/L solution of hydrochloric acid, but the only solution available is 12.0 M. What volume of the 12.0 mol/L solution must be diluted?