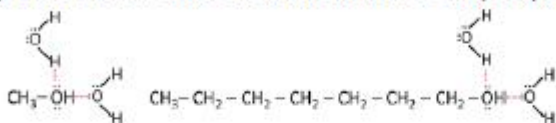


## Solutions worksheet 1

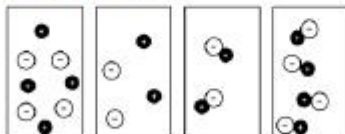
### Worksheet

- 1) Draw one representation that shows the intermolecular interactions between  $\text{NH}_3$  and water and another that shows the intermolecular interactions between  $\text{SbH}_3$  and water. Use your representations to help explain why  $\text{NH}_3$  has a higher solubility in water than  $\text{SbH}_3$ .

- 2) Explain why  $\text{CH}_3\text{OH}$  is miscible in water whereas  $\text{CH}_3(\text{CH}_2)_6\text{OH}$  is not.

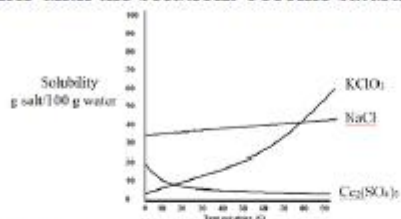


- 3) Which of the compounds below is most soluble in water? Justify your answer.  
 $\text{HOCH}_2\text{CH}_2\text{OH}$  or  $\text{CH}_3\text{CH}_2\text{OH}$
- 4) Potassium bromide is least soluble in which of the two liquids from each set below. Justify your choice.
- a.  $\text{H}_2\text{O}$  or  $\text{CH}_4$       b.  $\text{CH}_3\text{OH}$  or  $\text{CH}_3\text{CH}_2\text{OH}$       c.  $\text{NH}_3$  or  $\text{Br}_2$
- 5) In the following images, a single unit represents one mole of a particle and the boxes represent one liter containers. Circle the illustration that provides the best representation a 4 M solution of  $\text{NaCl}$ .



- 6) The following questions pertain to a pure sample of iron and a sample of steel.
- Create an illustration of pure iron which shows the iron atoms and provides a visual representation of the electron sea model.
  - Create a representation of steel that shows the iron and carbon atoms.
  - In what way have some of the bonds changed when this alloy was formed?
  - What type of alloy is steel?
  - Identify four properties that change when carbon is added to pure iron in order to make steel?
  - Explain how carbon changes the properties outlined in part e.
- 7) A 9.98 g sample of glucose,  $\text{C}_6\text{H}_{12}\text{O}_6$ , is dissolved in enough water to produce a 1395 mL solution. What is the molarity of the solution?
- 8) How many grams of  $\text{MgSO}_4 \cdot 9\text{H}_2\text{O}$  are needed to prepare 125 mL of 0.200 M magnesium sulfate?

- 9) A 251 mL sample of 0.45 M HCl is added to 455 mL of distilled water. What is the molarity of the final solution? Assume the volumes are additive.
- 10) How many millilitres of 0.250 M  $\text{KMnO}_4$  are needed to deliver 0.00450 moles of  $\text{KMnO}_4$  in a titration?
- 11) Suppose you needed to prepare a 100.0 mL of 1.05 M NaOH using 1.50 M NaOH, distilled water, and a 100 mL graduated cylinder. How would you do this?
- 12) Find the mole fraction of glucose,  $\text{C}_6\text{H}_{12}\text{O}_6$ , in a solution that contains 2.1 moles of glucose and 55.49 moles of water.
- 13) 200 mL of 2.0 M copper (I) nitrate is mixed with 150 mL of 2.5 M sodium chloride. The mixture produces a precipitate.
- Identify the precipitate.
  - What is the limiting reactant? Justify your answer.
  - What is the maximum mass of precipitate that can be formed in this reaction?
  - What is the percent yield if 31 g of precipitate is formed in the reaction?
  - The percentage yield increases when the temperature of the solution is reduced. Explain why this is.
- 14) The following questions refer to the solubility curve shown below. Suppose you have four beakers containing equal volumes of water. You then add one type of salt to each beaker until the solutions become saturated.



- Which of the three saturated solutions above would produce the greatest mass of precipitate when cooled from  $90^\circ\text{C}$  to  $60^\circ\text{C}$ ?
  - The molarity of which solutions would increase by the greatest degree when it is cooled from  $20^\circ\text{C}$  to  $0^\circ\text{C}$ ?
- 15) Explain how solutes can be separated through paper chromatography based on intermolecular forces.
- 16) Fractional distillation was used to isolate an unknown volatile substance that had contaminated the well water at a rural property.
- Is the boiling point of the unknown substance greater than, less than, or equal to  $100^\circ\text{C}$  at 1.0 atm? Justify your answer.
  - What can be said about the relative strengths of intermolecular interactions among and between the components in question (contaminant and water)?