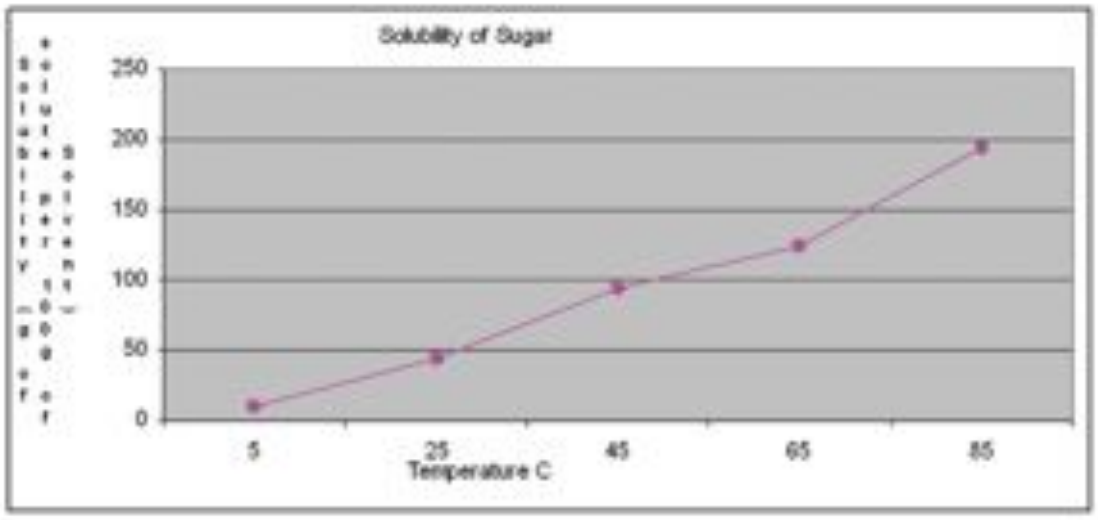
Macroscopic Properties of Matter

Problem solving and quantities in chemistry

Set 2: Solutions Exercises

1. A student recorded the solubility of sugar at different temperatures.
(a) Draw a solubility curve for sugar with temperature on the horizontal axis.
(b) Describe the pattern shown by the graph.
(c) Determine the solubility of sugar at:
(i) 30 °C
(ii) 70 °C
(d) Use the information in the student's table to describe an unsaturated, saturated and a super saturated solution of sugar at 20 °C?
(e) Classify the following sugar solutions as unsaturated, saturated or supersaturated.
(i) 200 g of sugar dissolved in 100 g of water at 40 °C
(ii) 200 g of sugar dissolved in 50 g of water at 60 °C
(iii) 50 g of sugar dissolved in 20 g of water at 100 °C

(a)



(b) As temperature increases the solubility of sugar increases
(c) (i) 220 g/100 g of water (ii) 320g/100 g of water
(d) At 20°C: ***unsaturated*** *anything less than 204 g/100 g of water;* ***saturated*** *= 204 g/100 g of water;* ***supersaturated*** *solution >204 g/100 g of water*
(e) (i) unsaturated (ii) supersaturated (iii) unsaturated

2. A 2.000 kg (approximately 2.0 L) sample of recycled water on a property was examined for total dissolved solids, TDS. The purpose was to see if after treatment its TDS concentration was at an acceptable level for use in irrigation. The sample was evaporated to dryness and the total dissolved solids remaining weighed 3.45 g.
(a) Given that water up to 2,500 ppm can be used for irrigation determine the acceptability of the wastewater sample. Parts per million can be calculated as follows:mg of solute ppm =kg of solution
(b) Use the information right to classify the salinity of the sample:

(a) 1 725 ppm
(b) slightly saline water

3. Seawater contains about 35,000 ppm of salt. How many grams of salt would be obtained if 1.000 kg (approximately 1 L) of seawater were evaporated to dryness?
35 g salt

4. Describe the chemical tests that would allow you to distinguish between solid samples of the following barium salts:
$BaCO_3$, $Ba(NO_3)_2$, $BaCl_2$ and $BaSO_4$.
Add acid to a little of each in a test tube. The one with a gas evolving is $BaCO_3$.
Add water to a little of each in a test tube of remaining three. The insoluble one is $BaSO_4$.
Add $AgNO_3$ to remaining solutions, the white precipitate is BaC_2 the other will be $Ba(NO_3)_2$.

5. Use the solubility table (Appendix 1) and or your results from Experiment 4 to identify and describe any precipitate that forms when the following solutions are mixed.
(a) NaCl and $AgNO_3$
(b) $Pb(NO_3)_2$ and KI
(c) K_2SO_4 and $Ba(OH)_2$
(d) $CuSO^4$ and NaOH
(e) $(NH_4)_3PO_4$ and $FeCl_2$
(a) $AgC_{(s)}$ white precipitate
(b) $PbI_{2(s)}$ yellow solid
(c) $BaSO_{4(s)}$ white crystalline solid
(d) $Cu(OH)_{2(s)}$ pale blue, gelatinous solid
(e) $Fe_3(PO_4)_2$ light tan solid

6. Proceed to Set 13: Ionic equations. Read the explanations and examples.
Write ionic equations for any precipitation reactions occurring in question 5.
(a) $Ag^+(aq) + C^-(aq)\ AgC\ (s)$
(b) $Pb^{2+}(aq) + 2I^-(aq)\ PbI_2(s)$
(c) $Ba^{2+}(aq) + SO_4^{2-}(aq)\ BaSO_4(s)$
(d) $Cu^{2+}(aq) + OH^-(aq)\ Cu(OH)_2(s)$
(e) $Fe^{2+}(aq) + PO_4^{3-}(aq)\ Fe_3(PO_4)_2(aq)$

7. Classify the following as strong, weak or non-electrolytes: tap water, sea water, sugar solution, copper sulfate solution, hydrochloric acid solution.
*Tap water, sea water **strong**, sugar solution **non-electrolyte**, copper sulfate solution **strong**, hydrochloric acid **strong***