**11.1 Measuring Solubility**

* The solubility of a substance is the **maximum** amount of that substance that can be dissolved in a given quantity of solvent at a certain temperature.
* A solution in which no more solute can be dissolved at a certain temperature is described as a **saturated solution**.
* One way of measuring solubility is to determine the maximum mass of solute that can be dissolved in 100 grams of solvent at a given temperature.

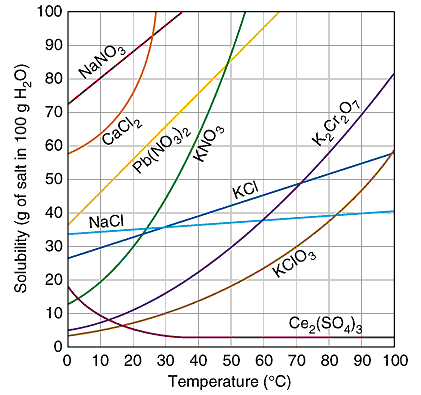
**Worked Example.**

**A maximum of 8 grams of solute can be dissolved in 25g of water at 22oC. What is the solubility of this solute in water at 22oC.**

**Solubility curves.**

* The relationship between solubility and temperature can be represented by a **solubility curve**.
* Each point on the solubility curve represents a saturated solution.
  + No more solute can be dissolved at that temperature
* Any point below the curve represents an unsaturated solution.
  + An unsaturated solution contains less solute than is needed to make a solution saturated at that temperature.

**Solubility Curve for some Common Salts**



1. What is solubility of the following solutes?

a. Sodium chloride at 40oC.

b. KClO3 at 80 oC.

c. Calcium chloride at 0 oC.

2. A 20g sample of KNO3 is added to 200g of water at 20oC. Use the solubility curve to calculate how much more KNO3 needs to be added to make the solution saturated at 20oC?

**Crystallisation**

* Crystallisation will occur when the solute can longer stay dissolved in the solute due to a drop in temperature and comes out of the solution as crystals.
  + Crystallisation of honey at cold temperatures is one example.

**Worked Example**

**What happens if a solution containing 50g of potassium nitrate in 100g of water is allowed to cool from 40oC to 20oC?**

**Supersaturation**

* A supersaturated solution contains more dissolved solute than in a saturated solution.
* Any point above a solubility curve represents a supersaturated solution for that solute.

**Temperature and Gas Solubility**

* Gases become less soluble as the temperature increases.

***The Changes in Solubility of some Common Gases in Water with Changing Temperature***

|  |  |  |  |
| --- | --- | --- | --- |
| Gas | Solubility (g of gas per kg of water)  0oC 20oC 60oC | | |
| Oxygen | 0.069 | 0.043 | 0.023 |
| Carbon dioxide | 3.4 | 1.7 | 0.58 |
| Nitrogen | 0.029 | 0.019 | 0.011 |
| Methane | 0.040 | 0.023 | 0.011 |
| Ammonia | 987 | 529 | 168 |

**Worked Example**

**Using the table above calculate the percentage of oxygen that would be lost from a lake where the temperature rises from 0oC to 20oC.**

**Pressure and Gas Solubility**

* The solubility of gas increases with increasing pressure
* Carbon dioxide is forced into soft-drinks under high pressure.
* Can hear the gas escaping in the top of the bottle when opened and see the carbon dioxide escaping the liquid (bubbles) as the solubility of the CO2 of the drink is lowered.

Textbook Questions 1 - 8