**Chemistry 20 – Lesson 17**

**Solubility**

**/69**

1. **The classification of a solution depends on the state of the solvent and not the solute**.

a) sugar and water **liquid**

/3 b) air **gas**

c) copper and zinc **solid**

d) carbonated beverage **liquid**

e) alcohol and water **liquid**

f ) table salt and water **liquid**

2. What is an alloy?

/1 **An alloy is a solid solution of two or more metals**.

3. Why are water and gasoline (C8H18) mutually insoluble?

1/ **Water is polar, gasoline is non-polar. Polar and non-polar compounds tend to not mix**.

4. Explain why iodine has a low solubility in water but high solubility in cyclohexane (C6H12)?

1/ **Iodine is non-polar. Therefore it dissolves in non-polar cyclohexane but not in polar water.**

5. From the list below, select those substances which have good solubility in water and those that have good solubility in carbon tetrachloride:

/3

 Cl2 **soluble in CCl4**

CH3OH **soluble in H2O**

C6H14 **soluble in CCl4**

NH3 **soluble in H2O**

Br2 **soluble in CCl4**

HCl **soluble in H2O**

6. How does the solubility of CO2 in water vary with:

/3

A. an increase in pressure of CO2 (g)? Explain your answer.

 **The solubility of the CO2 will increase since an increase in gas pressure increases solubility.**

B. an increase in water temperature? Explain your answer.

 **The solubility of CO­2 will decrease since an increase in solvent temperature decreases the solubility of gases**.

C. a decrease in water temperature? Explain your answer.

 **The solubility of CO­2 will increase since a decrease in solvent temperature increases the solubility of gases**.

7. How does the solubility of washing soda (Na2CO3) in water vary with:

/2

A. an increase in pressure? Explain your answer.

 **The solubility of Na­2CO3 does not depend on pressure, therefore its solubility will not be affected.**

B. an increase in temperature? Explain your answer.

**The solubility of Na­2CO3 will increase since an increase in temperature increases the solubility of solids in liquids.**

8. Silver chloride has very low solubility in water. Will stirring increase the solubility of silver chloride in water? Explain.

/2 **No. Solubility is independent of stirring. Stirring may increase the rate of dissolving, but it will not affect if the compound is soluble or not**.

9. (24 marks)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Name of compound | Chemical Formula | Phase at STP | Soluble in water? |
| eg. | sodium chloride | NaCl(aq) | solid | yes |
| 1 | silver iodide | **AgCl(s)** | **solid** | **no** |
| 2 | methanol | **CH3OH(aq)** | **liquid**  | **yes** |
| 3 | tin (II) phosphate | **Sn3(PO4)2 (s)** | **solid** | **no** |
| 4 | lithium sulphide | **Li2S(aq)** | **solid** | **yes** |
| 5 | hydrogen carbonate | **H2CO3(aq)** | **solid** | **yes** |
| 6 | zinc hydroxide | **Zn(OH)2 (s)** | **solid** | **no** |
| 7 | sucrose | **C12H22O11 (aq)** | **solid** | **yes** |
| 8 | gold (I) bromide | **AuBr(aq)** | **solid** | **yes** |
| 9 | lead (IV) acetate | **Pb(CH3COO)4 (s)** | **solid** | **no** |
| 10 | calcium sulphate | **CaSO4 (s)** | **solid** | **no** |
| 11 | ammonium hydroxide | **NH4OH (aq)** | **solid** | **yes** |
| 12 | aluminum sulphide | **Al2S3 (s)** | **solid** | **no** |
| 13 | barium hydroxide | **Ba(OH)2 (aq)** | **solid** | **yes** |
| 14 | paraffin wax | **C25H52 (s)** | **solid** | **no** |
| 15 | mercury (I) carbonate | **Hg2CO3 (s)** | **solid** | **no** |
| 16 | manganese (IV) bromide | **MnBr4 (aq)** | **solid** | **yes** |
| 17 | iron (III) sulphite | **Fe2(SO3)3 (s)** | **solid** | **no** |
| 18 | antimony (III) sulphide | **Sb2S3 (s)** | **solid** | **no** |
| 19 | barium sulphide | **BaS (s)** | **solid** | **no** |
| 20 | ammonia | **NH3 (aq)** | **gas** | **yes** |
| 21 | nickel (III) sulphide | **Ni2S3 (s)** | **solid** | **no** |
| 22 | francium thiosulphate | **Fr2S2O3 (aq)** | **solid** | **yes** |
| 23 | ammonium sulphide | **(NH4)2S(aq)** | **solid** | **yes** |
| 24 | lead (II) bromide | **PbBr2 (s)** | **solid** | **no** |

10. What is a *saturated solution*?

/1 **A saturated solution is a solution where no more solute can dissolve.**

11. What is a *supersaturated solution*?

/2 **A supersaturated solution is a solution where more solute is dissolved than should be at that temperature. A supersaturated solution is formed when a saturated solution is cooled to a lower temperature. As it cools the molar saturation decreases, but the amount of dissolved solute remains the same. When the solution crystallises it is no longer supersaturated.**

12. What is *dynamic equilibrium*?

/2 **Dynamic equilibrium refers to the process where the overall concentration of a saturated solution does not change, but there is still an active process of dissolving and crystallization still taking place**.

13. Give examples of two liquids that are immiscible and two that are miscible with water.

/2 **immiscible – oil and gasoline**

 **miscible – ethanol and methanol**

14. Can more oxygen dissolve in a litre of water in a cold stream or a litre of water in a warm lake? Include your reasoning.

/1 **The cooler the liquid the greater the solubility of a gas in the liquid. Therefore the cool water will contain more dissolved oxygen**.

15. State why you think clothes might be easier to clean in hot water.

/1 **Both soap and dirt are more soluble in water**.

16. Why do carbonated beverages go “flat” when opened and left at room temperature and pressure?

/1 **At room temperature gases are not very soluble. In addition, the pressure inside a closed can is greater than in an open can. Less pressure translates into lower solubility**.

17. Write a balanced chemical equation to represent the simultaneous dissolving and crystallizing of sodium chloride for a saturated solution in contact with excess solute.

/1 **NaCl(s) NaCl(aq)**

18. Give definitions for the following terms:

/1 **Qualitatively, solubility is whether one substance can dissolve in another substance**.

/1 **Quantitatively, solubility is the concentration of a saturated solution at a given temperature**.

19.

/4

20.

/4

21.

/4

22.

/4