ATHERTON HIGH SCHOOL

Introduction to Quantitative Chemistry Knowledge Organiser

Chemical reactions

1. **Chemical reactions** always involve the formation of one or more new substances.
2. Chemical reactions often involve a **temperature change**.
3. **Formulae** are used to show the elements bonded together in a compound e.g. H_2O contains 2 hydrogen atoms and one oxygen atom.
4. **Compounds** can only be separated into their **elements** by a chemical reaction
   - **a.** e.g. $2H_2O \rightarrow 2H_2 + O_2$
5. In **chemical equations** the three **states of matter** are shown as:
   - **a.** solid = (s); liquid = (l) and gas = (g)
   - b. **aqueous solutions** are shown as (aq)
   - c. e.g.
   - d. $2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$
6. An aqueous solution is a substance dissolved in water.

Relative formula mass

16
O
oxygen
8

7. The **relative atomic mass** (**A_r**) is the average mass of the atoms of an element compared to the mass of carbon-12.
8. The **relative formula mass** (**Mr**) of s substance is the sum of the A_r of all the atoms in the formula.
   - a. e.g. What is the M_r of water (H_2O)?
   - b. (A_r H = 1.0; O = 16.0)
   - c. There are 2 x H and 1 x O in the formula
   - d. (2 x 1.0) + (1 x 16.0) = 18.0
9. A_r and M_r have **no units** as they are relative masses.
10. In a balanced chemical equation:
    - **a. sum M_r reactants = sum M_r products**
    - **b.** e.g. $2H_2O_2 \rightarrow 2H_2O + O_2$
    - c. Mr reactants = 2 x 34 = 68
    - d. Mr products = (2 x 18) + 32 = 68
11. The percentage mass of an element in a compound can be calculated using the relative atomic mass and the relative formula mass.

$$\% \text{ by mass} = \frac{A_r \text{ x number of atoms in a compound}}{M_r \text{ of the compound}} \text{ x } 100$$

Conservation of mass and balancing equations

12. No atoms are lost or made during a chemical reaction.
13. **mass of products = mass of reactants**
14. Chemical reactions can be represented by symbol equations which are **balanced**.
15. This means the number of atoms of each element is balanced e.g.
16. $2Mg + O_2 \rightarrow 2MgO$
17. there are 2 magnesium atoms on each side of the equation.
18. Some reactions may appear to involve a change in mass, but this is normally because a reactant or a product is a **gas** e.g.
19. $Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$
20. During the reaction hydrogen gas is produced. If the gas is free to leave

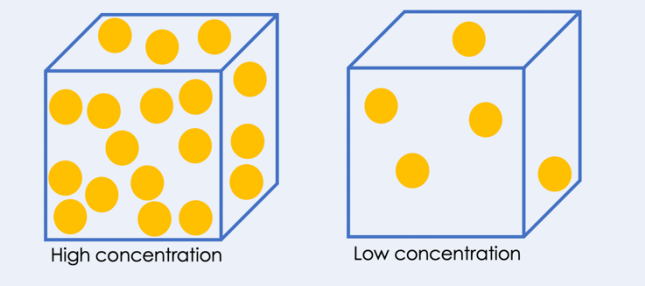
the reaction container then the measured mass will decrease.

Uncertainty

21. Scientific uncertainty means there is a range of possible values within which the true value of a measurement lies.
22. Whenever a measurement is made, there is always some uncertainty about the result obtained.

Concentration

23. Many chemical reactions take place in solutions.



24. The more concentrated a solution the more particles it contains in a given volume.
25. The concentration of a solution can be measured in mass per given volume of solution e.g. grams per dm^3 (g/dm^3).
    a. **$\frac{\text{mass of solute}}{\text{volume of solution}}$ = concentration**
26. Volumes need to be in **dm^3**
27. 1 dm^3 = 1000 cm^3

Making soluble salts

28. Soluble substances dissolve in a solvent
29. Insoluble substances cannot dissolve in a solvent
30. Neutralisation reaction general equation is acid + base → salt + water
31. Metal + acid → salt + hydrogen
32. Metal oxide + acid → salt + water
33. Metal hydroxide + acid → salt + water
34. Metal carbonate + acid → salt + water + carbon dioxide
35. Soluble salts can be made from acids by reacting them with solid insoluble substances, such as metals, metal oxides, hydroxides, or carbonates.
36. The solid is added to the acid until no more reacts and the excess solid I filtered off to produce a solution of the salt.
37. Salt solutions can be crystallised to produce solid salts.
38. Copper oxide reacts with sulfuric acid solution to produce copper sulfate and water
39. This reaction can be represented with the equation $CuO(s) + H_2SO_4(aq) \rightarrow CuSO_4(aq) + H2O(l)$
40. Copper sulfate solution is a blue liquid
41. Copper sulfate crystals are blue