3u Review – Unit 2 (quantities)

Percentage Composition

- Element mass ÷ compound mass x 100%
- E.g. in H_2O, H = 11% (2 g ÷ 18 g x 100%)

Significant Digits and Isotopic Abundance

- All digits to right of the first # are significant
- In scientific notation all digits are significant
- For addition/subtraction: line up decimal
- For multiplication/division: # digits = fewest
- Average atomic mass is equal to the sum of individual isotope masses multiplied by their %

The mole

- There are 6.02×10^{23} particles in one mole
- Molar mass is calculated from periodic table

Simplest and molecular formulae

- Definitions of simplest & molecular formula
- Determining simplest formula from % composition, grams of reactants, or moles
- Calculating molecular formula from simplest formula and molar mass

Balancing Chemical and Nuclear Equations

- Balancing equations by inspection
- Balancing nuclear equations: α and β decay
- 3 types of radiation: alpha, beta, gamma
- H_2, N_2, O_2, F_2, Cl_2, Br_2, I_2 are diatomic gases

The factor label method

- Creating conversion factors
- How to use the factor label method

Stoichiometry

- grams x → moles x → moles y → grams y
- Factor label method to solve stoichiometry

Limiting reagents

- Actual/Ideal chart for limiting reagents
- The limiting reagent is the "given quantity"
- Shortcut method of determining limiting reagent

Percentage yields

- Percentage yield = actual/theoretical x100%
- Actual yield is given, theoretical is calculated
- 4 reasons why actual yield falls short

Review questions

For all questions calculate molar masses to two decimal places and give answers with the correct number of significant digits (remember: do not round your values until writing the final answer).

1. Give the percentage composition for each compound: a) H_2SO_4, b) $Ca(OH)_2$.
2. Mg has 3 isotopes: ^{24}Mg(78.7%), ^{25}Mg(10.1%), ^{26}Mg(11.2%). Give the average atomic mass.
3. Calculate the molar mass of a) H_2SO_4, b) $Fe_2(Cr_2O_7)_3$.
4. a) How many moles are in 16 grams of $CuCl_2$? b) How much does 70 moles of NaCl weigh?
5. a) How many molecules are in exactly 4 moles of H_2O? b) How many hydrogen atoms are in exactly 4 moles of H_2O? c) How many hydrogen atoms are in 0.173 moles of H_2O?
6. What mass of magnesium oxide results when 56.3 g O_2 combines with excess magnesium?
7. Label as simplest formula, molecular formula, or both: a) $CuCl_2$, b) CO_2, c) O_2, d) C_4H_{10}.
8. A substance is 80% C and 20% hydrogen by mass. a) What is the simplest formula? b) What is the molecular formula of the compound if the molar mass is 30 g/mol?
9. Balance these equations: a) $C_{40}H_{82} + O_2 \rightarrow CO_2 + H_2O$, b) $H_2O + Al_4C_3 \rightarrow CH_4 + Al(OH)_3$
10. Complete these nuclear equations: a) the alpha decay of ^{150}Gd, b) the beta decay of ^{60}Co.
11. What four things may cause actual yields to differ from theoretical yields?
12. Given the reaction $3O_2 + 4NH_3 \rightarrow 2N_2 + 6H_2O$, if 20.58 g of O_2 combines with 26 g NH_3 …
    a) What is the limiting reagent? b) What mass of water can theoretically form?
    c) If 15 g of water is the actual yield, what is the percentage yield?
13. In a reaction, copper is heated with sulphur, forming cuprous sulphide. What is the % yield if 97 g of cuprous sulphide forms from the combination of 100 g of Cu with 50 g of sulphur?