

Chapter 1 Chemistry - study of physical properties of matter matter - anything that has mass or takes up space Areas of chemistry - organic, inorganic, biochemistry, analytical, and physical organic chemistry - study of chemicals containing carbon inorganic chemistry - study of chemicals not containing carbon biochemistry - study of processes taking place in organisms analytical chemistry - study of composition of matter physical chemistry - study of the mechanism, rate, and energy transfer that occurs when matter changes	Chapter 1 pure - pursuit of knowledge for itself applied - research directed to a specific goal macroscopic - visible to human eye microscopic - only visible with microscope Antoine Lavoisier - made chemistry become a measurable, observable science scientific method - observe, test hypothesis, and develop theories hypothesis - proposed explanation experiment - test a hypothesis manipulated variable - variable changed intentionally during experiment responding variable - variable observed theory - well tested explanation for a broad set of observations scientific law - concise statement that summarises results of observations and experiments	Chapter 2 (cont) physical property - a substance that a person can measure without changing the material physical change - properties of a material change, but not composition vapour - a gas state of substance that is liquid or solid at room temp Solids - fixed volume, fixed shape, close particles Liquids - free shape, fixed volume, medium particle space Gas - free shape, easy to compress, far particles	Chapter 3 (cont) accuracy a measurement of how close a measurement comes to the actual/true precision - a measure of how close a series of measurement are to each other sig figs - in measurement includes all digits that are known plus an estimated digit Error = Experimental Value - Accepted Value $\% = \frac{\text{error}}{\text{accepted value}} \times 100\%$
Chapter 1 pure - pursuit of knowledge for itself applied - research directed to a specific goal macroscopic - visible to human eye microscopic - only visible with microscope Antoine Lavoisier - made chemistry become a measurable, observable science scientific method - observe, test hypothesis, and develop theories hypothesis - proposed explanation experiment - test a hypothesis	Chapter 2 extensive property - property depending on amount of matter in sample intensive property - property depending on type of matter in sample mass - a measure of amount matter (SI unit = kg) volume - a measure of space occupied by matter	Chapter 3 Addition and Subtraction of Sig Figs - round to the same number of decimal places as the measurement with the least number of decimal places $12.345 + 6.1 = 18.4$ $(1.502)(3.8) = 5.7076 = 5.7$	Chapter 3 density - intensive property b/c it has to do with type of substance, not amount and density decreases with increasing temperatures $\text{density} = \frac{\text{mass}}{\text{volume}}$ in g/cm ³
		Chapter 3 Multiplication and Division - round answer to the same number of sig figs as the measurement with the least amount of sig figs $12.345 + 6.1 = 18.4$ $(1.502)(3.8) = 5.7076 = 5.7$	Chapter 2 reactant - substance present at start of chemical reaction product - substance present at end of chemical reaction participate - a solid that forms and settles out of liquid mixture Conservation of Mass - in any physical/chemical reaction, the mass of reactants must = the mass of the products ---- (10g H ₂ + 8g O ₂ = 18 H ₂ O) Clues that a chemical change has occurred: - transfer energy - color change - production of gas - participate forms



Chapter 3

temperature - kelvin (0C = 273 K)

units of energy - is measured in calories or joules (joules is SI)

conversion factor - ratio of equivalent measurement

dimensional analysis - way to solve problems using units, dimensions, or measurements

5 Base of SI

meter = length

kilograms = mass

kelvin = temperature

second = time

mole = number of molecules

litre = volume

1 J = 0.2390 cal

1 cal = 4.184 Joules

mole = number of molecules

litre = volume

Converting - 8.351 g to mg

smaller = multiply

bigger = divide

Chapter 4

Atom - smallest particle of element that retains its identity in a chemical reaction

Subatomic particles - protons, neutrons, electrons

Electrons - negatively charged, located outside the nucleus, tiny (9.11×10^{-24} g), discovered by J.J. Thompson

Protons - positively charged, located in the nucleus, large in comparison to electrons (1.67×10^{-24} g), discovered by Eugen Goldstein

Neutrons - no charge, in nucleus, same mass as protons, discovered by James Chadwick

Chapter 4 (cont)

Cathode Rays - the high-speed electrons emitted in a stream from the heated cathode of a vacuum tube

J.J. Thompson's Plum Pudding Model - atoms were positively charged masses with negatively charged electrons distributed throughout the mass.

Rutherford's Atomic Model/Theory - The atom is mostly empty space, there is a small negatively charged nucleus, electrons are located outside of and around the nucleus

Democritus believed atoms were indivisible and indestructible.

Chapter 2

substance - uniform and definite composition of matter

mixture - a physical blend of 2+ components (can be homogeneous or heterogeneous)

heterogeneous - mixture not uniform throughout

homogeneous - mixture uniform throughout

phase - any part of a solution that is uniform throughout

filtration - process separates a solid from liquid in a heterogeneous mixture

distillation - separates dissolved solids from liquid, which is boiled to produce vapour that has condensed into liquid

Sig Fig Rules

1. every non zero digit is significant

2. zeros b/w non zero digits are significant

3. zeros appearing in front of non zeros (place holders) are not significant

4. zeros at end of number and right of a decimal are significant

5. zeros on right end of measurement that lie left of a decimal are not significant

6. there are unlimited sig figs if: you are counting or situations involving exactly defined quantities

Chapter 4

Dalton's Atomic Theory

1. all elements are composed of tiny indivisible particles called atoms

2. atoms of the same element are identical, atoms of any one element are different from those of another element

3. atoms of different elements can mix together or chemically combine in simple whole number ratios

Chapter 4 (cont)

4. chemical reactions occur when atoms are separated, joined, or arranged. atoms of one element are never changed into atoms of another element.

Summary of Principle Energy Levels, and, Orbitals

Principle Energy Level	Number of Sublevels	Type of Sublevels
n = 1	1	1s (1 orbital)
n = 2	2	2s (1 orbital), 2p (3 orbitals)
n = 3	3	3s (1 orbital), 3p (3 orbitals), 3d (5 orbitals)
n = 4	4	4s (1 orbital), 4p (3 orbitals), 4d (5 orbitals), 4f (7 orbitals)

Chapter 4

Atomic Number - number of protons in nucleus in atom

Mass Number - protons + neutrons = total mass #

neutrons = atomic # - mass

Maximum Numbers of Electrons

Energy Level N	Maximum Number of Electrons
1	2
2	8
3	18
4	32

Chapter 2

element - simplest form of matter that has unique properties

compound - substance containing 2+ elements in fixed proportion

Compounds can be broken down, but elements cannot.
Scientists use chemical symbols to represent elements.
Chemical symbols are always 1 or 2 letters with first letter capitalized

Chapter 5

Quantum of Energy - is amount of energy required to move an electron from one energy level to another

Orbit - each is associated with an energy level. The orbit an electron is in, determines energy of electron. Electrons can change orbits by gaining or losing energy

Aufbau Principle - electrons occupy orbitals of lowest energy first

**Electron Configuration* - ways electron are arranged in various orbitals

Chapter 5 (cont)

Pauli Exclusion Principle - atomic orbital can hold at most 2 electrons with opposite spin direction $\uparrow \downarrow$

Hunds Rule - electrons occupy orbitals of same energy in way that makes # of electrons w/ same spin direction as large as possible

Chapter 4

Atomic Number - number of protons in nucleus in atom

Mass Number - protons + neutrons = total mass # (total # of protons in nucleus of an element)

neutrons = atomic # - mass#

isotopes - atoms same element that have same atomic number, but different atomic masses due to difference of neutrons

atomic mass - a unit of mass to $= \frac{1}{12}$ the mass of a carbon 12 atom

period - horizontal row of elements in periodic table

group - vertical column of elements in periodic table

