Chemistry M1 Summary

Chemistry is a Physical Science

- Chemistry studies matter, its properties, and interactions through physical principles.

Chemistry :- The study of different material(ions, atoms, etc)

- Is the study of the substances matter is made from , their properties and uses, ant how and why is different substances interact with each other

Types of Data measures :

1. **Qualitative Data**: numbers, measured by tools

- are made with instruments, such as rulers, cylinders, and etc.
- Ex: The balance measured 121.43g

2. **Qualitative Data**: observation

- Using your senses to observe to get the results.
- Ex: The fizz of a soda can

Types of Research(methods) :-

1. **Basic Research**: seek/gain$_{new}$ knowledge

- seeks to gain (new) knowledge.

2. **Applied Research**: use your knowledge

- is carrier out to solve a problem

Chemistry M1 Summary

Properties of Matter

Physical Property :- *no alternating of properties

- is a characteristic that can be observed or measured <u>without changing the identity of the substance .</u>
- the property will remain the same

Chemical Property :- changing the identity's properties

- relates to a substance's ability to undergo changes that <u>transforms it into different substances.</u>
- new substance (could be) → not the object that changes
- ”Substances that affect the identity’s properties, but not the chemical change”

Examples:

Physical Property	Chemical Property
• blue color • solubility (no mixing) • melting paint • sour taste(lemon) • density(Intensive)	- When iron rusts, it changes from elemental iron to iron oxide, altering its chemical identity and properties, such as strength and color. - But it’s still literal metal, but with different substances. • More: flammability, *reactants, etc.

Physical Properties types :

- Think of it as Independent(**intensive**), and Dependent(**extensive**) variable

Extensive :- moss amount, volume, length

- depend on the amount of matter that is present.
- *<u>property varies with amount</u>*
- It varies accordingly to the amount of substance(inputted)

Intensive :- temperature, concentration

- the property that does *<u>substance that does not change</u>*.
- always remains the same
- do not depend on the amount of matter present —> factors don’t affect it

From intensive to extensive :-

- Density (intensive) = multiplied by volume (extensive) gives mass (extensive).

Chemistry M1 Summary

Classification of Matter

Atom :-

- is the <u>smallest unit of an element</u> that maintains the chemical identity of that element.
  - Building black of matter
  - doesn't change into another element

Types of Pure Substances :-

Element :- one type of atom

- is only made up of <u>one type of atom</u>.
- it could have more than one atom —> 1 type only
- Ex : He, O_2

Compound :- more than 2 types of atoms together

- substance that can be broken down into simple stable substances.
- Ex : H_2O => water, HO

Substances :-

1. **PureSubstances** : a fixed composition
   - cannot be created → (from Allah)

→ has exactly the same characteristic properties and exactly the same composition(تكوين).

- meaning that every sample of a pure substance will have the same characteristics regardless of where it is taken from.
- Ex : Pure : water, gold, copper, and etc.

2. **Mixture** : a blend, of two or more kinds of matter, each of which rertains it's own identity.
   - All matters can be identified individuallly

2 Kinds of Mixture/s :-

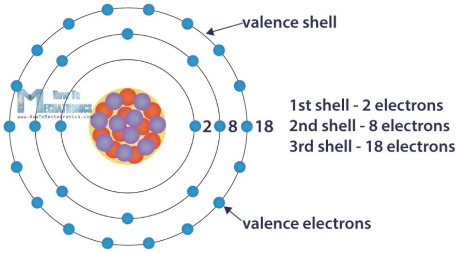
Homogeneous Mixture	Heterogeneous Mixture
- Uniform in composition - Cannot be seperated, and <u>mixed really well</u>. • Ex : Air	- Not unitorm throughout - <u>can be separated</u> • Ex : blood -> (plasma, cell)

Chemistry M1 Summary

The Periodic Table

	Number of elements :
Groups : vertical columns	18
Periods : horizontal columns	7

- Group number and no. of valence electrons in the outer-most layer (shells no.) are the same.
- Perion no. == No. of shells



Metals and Non-metals

- it's all about their position in the periodic table

1. **Metals** : iron, gold
   - is an element that is a good conductor of heat and electricity.

2. **Non-Metals** : CO_2, O, N
   - is an element that is a poor conductor of heat and electricity.

3. **Metalloids** : Silicon, Boron
   - is an element that has some characteristics of metals and some characteristics of nonmetals.

Scientific Method

6 main steps of an Scientific Method :

1. **Identify the Problem** : Recognize and define a specific question or issue.
2. **Gather Information** : Collect background data and existing knowledge related to the problem.
3. Formulate a **Hypothesis** : Develop a testable prediction based on observations.
4. Conduct an **Experiment** : Design and perform tests to gather new data.
5. **Analyze Data** : Examine the results for patterns or insights.
6. **Conclusion** : Determine if the data supports or refutes the hypothesis.

A **hypothesis** is a testable prediction for a specific phenomenon, serving as the starting point for experimentation, and it could be considered as an educated guess. While, a **theory** is a well-supported explanation developed after extensive research and evidence, covering a broad range of phenomena.

Chemistry M1 Summary

Model and Theory

Model : *more or less it's a physical object

- A model in science is more than a physical object of an explanation of how a phenomena occur and how events are related.
- A simplified representation of reality, illustrating key aspects or systems

Theory : *mostly made after an experiment

- is a broad generalization that explains a body of facts or phenomena.
- Explanation of phenomena, predicting relationships and underlying principles(how it works).

SI Units of Measurement

Base(SI) Units :- *complete the blanks

Quantity	**Name of Unit.**	**Abbreviation**
Length	meter	m
Mass	kilogram	kg
Temperature	kelvin	K
Time	second	s
Substance	mole	mol
Current	ampere	A
Intensity	candela	cd

Conversion Factors : used to change one unit into another

- 1L = 1000mL
- 1km = 1000m
- 1kg = 1000 g
- 1m = 100 cm

1km = 1000m

1kg = 1000g

$1m^3 = 10^6 cm^3$ ⇒ (could be considered as) mL -> L

Derived SI Units : *collection of them(units) into one(unit)

- SI Base units combined into one

> Volume = m3 → length x height x width

Chemistry M1 Summary

Accuracy and Precision

Accuracy : *closer to target

- refers to the closeness of measurement to the correct or accepted value of the quantity measured.

Precision : *closer(points) to one another

- refers to the closeness of a set of measurements of the same quantity made in the same way.

Percentage Error/Formula :

$$\% \text{ error} = \left| \frac{\#\text{experimental} - \#\text{actual}}{\#\text{actual}} \right| \times 100$$

Significant Figures

Significant Figures(SF) :

- in a measurement consists of all the digits known with certainty plus one (+ 1) final digit, which is somewhat uncertain or is estimated.
- There's an additional decimal or decimal digit —> 3.68

Rules for determining SF :

1. 40.5 → 3 SF Figs, •it's between non-zeros
2. 0.00056 → 2 SF Figs, • Zeros in front of all non-zeros
3. 89.00 → 4 SF Figs, • Zeros after non-z will be could
4. 7000 → 1 SF Figs, • Has no decimal point, nor zeros after(.)

Scientific Notation

Scientific Notation :

- Used to express very large or very small numbers.
- written in the form → $Mx10^n$

Example + SF :

1. $0.012x10^8$ -> 2 SF(igures)

- You always go on what's write in scientific notation form, and not in integers form

Chemistry M1 Summary

The Atom : From Philosophical Idea to Scientific Theory

3 Laws :

1. **Law of conservation of mass** :

- mass is neither created nor destroyed during ordinary chemical reactions or physical changes.

- Example(in an experiment) : masses will remain the same before and after
  -> like the popcorn lab activity

2. **Law of definite proportions** : *intensive(physical property) in terms of compound ratio

- a chemical compound contains the same elements in exactly the same proportions by mass regardless of the size of the sample or source of the compound.

3. **Law of multiple proportions** :

- if two or more different compounds are composed of the same two elements, then the ratio of the masses of the second element combined with a certain mass of the first element is always a ratio of small whole numbers.

Dalton's Atomic Theory :

- All matter is composed of extremely small particles called atoms.

- Atoms of a given element are identical in size, mass, and other properties; atoms of different elements differ in size, mass, and other properties.

- Atoms cannot be subdivided, created, or destroyed.

- Atoms of different elements combine in simple whole-number ratios to form chemical compounds.

- In chemical reactions, atoms are combined, separated, or rearranged

Not all aspects of Dalton's atomic theory have proven to be correct

Chemistry M1 Summary

The Structure of The Atom

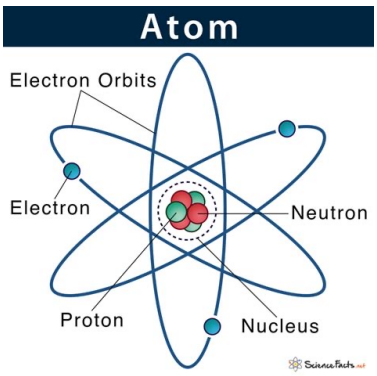
- The subatomic particles of an atom are : proton, neutron, and electron

SubatomicParticle	Relative Mass	Relative Charge	Location
Proton	1	+1	in nucleus
Neutron	1	0	in nucleus
Electron	1/1840	-1	outside the nucleus

Neutral atom :

- an atom that has equal numbers of protons and electrons

The Atom :



- VIP : Don't forget to know Rutherford's Gold Foil experiment

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Counting Atoms

Atomic Number : *also == no. of protons

- the number of protons of each atom of an element; it's always a whole number.

Mass Number : *also called: atomic mass/weight

- the total number of protons and neutrons that make up the nucleus of an atom.
- It is mostly not a whole number

• The bigger number is the (atomic)mass number
• The smaller number is the atomic number in the element card. Element card

Isotopes : *when has element can have multiple masses

- are atoms of some element that have the atomic number, but have different masses.

Formula :

No. of neutrons = mass number - atomic number

Chemistry M1 Summary

Mole, Avogadro's Number and Molar Mass

Mole :

- A quantity of substance containing as many particles as atoms in 12 grams of carbon-12

Avogadro's Number :

- The number of particles in 1 mole of a pure substance → (6.022×10^{23})

Molar mass :

- The mass of one mole of a substance (g/mole)
  - It's the atomic mass number of an element

Relationship : *between all 3

- 1 mole = 6.022×10^{23} —> = 12 grams of C-12

Formula :

$$\text{n (moles)} = \frac{\text{m (mass)}}{\text{M (molar mass)}}$$