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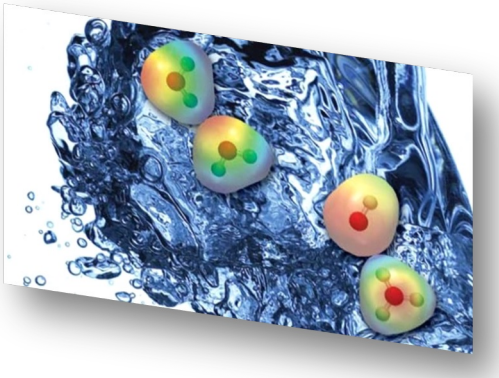
Physics & Chimestry

Chem

Chapter 1
Matter, Energy and Measurements



Lecture 1

General Chemistry

In this course our performance will be assessed according to the following:

1. Home Work	5 Marks
3. Mid Term Exam	20 Marks
4. Final Exam. (Theoretical)	40 Marks
5. Practical	20 Marks
6. Quizes	10 Marks
7. Attendance	5 Marks

Total = 100 Marks

General Chemistry

- **OUTLINE**

✓ Introduction

✓ Properties of matter

✓ Measurements

Objectives

- ***After you have studied this chapter, you should be able to***
- *Use the basic vocabulary of matter and energy*
- *Distinguish between chemical and physical properties and between chemical and physical changes*
- *Apply appropriate units to describe the results of measurement*

1.1 Introduction

Matter is anything that occupies space and has mass

CHEMISTRY is
The study of Matter

Composition – what's in it?

E.g., water is 2 parts Hydrogen and 1 part Oxygen

Structure – how is it assembled?

E.g., crystals

Properties:

E.g., boiling point, density, flammability

Physical and Chemical Changes

Physical Change: changes in appearance but not in composition

e.g., sublimation of ice in the winter

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Chemical Change: changes resulting in altered composition and/or molecular structure

e.g., spoilage of foods

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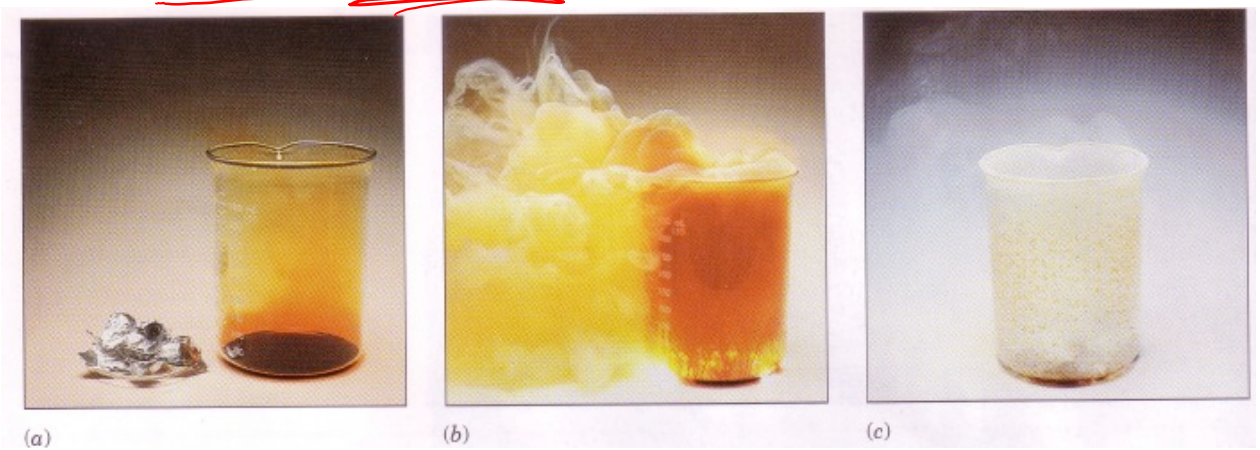
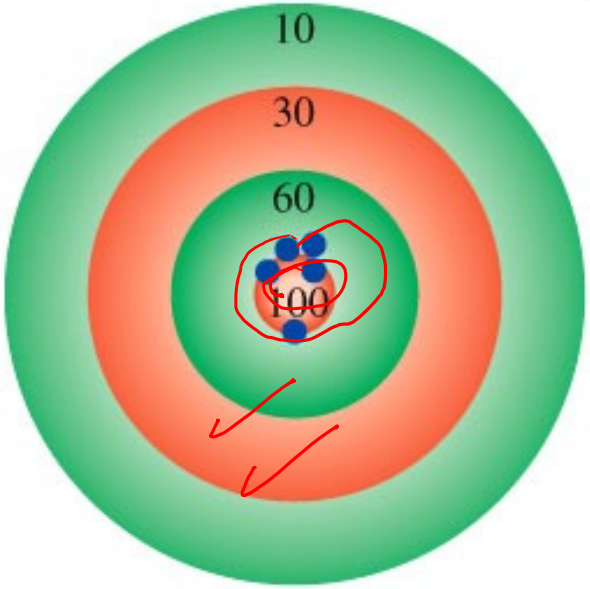
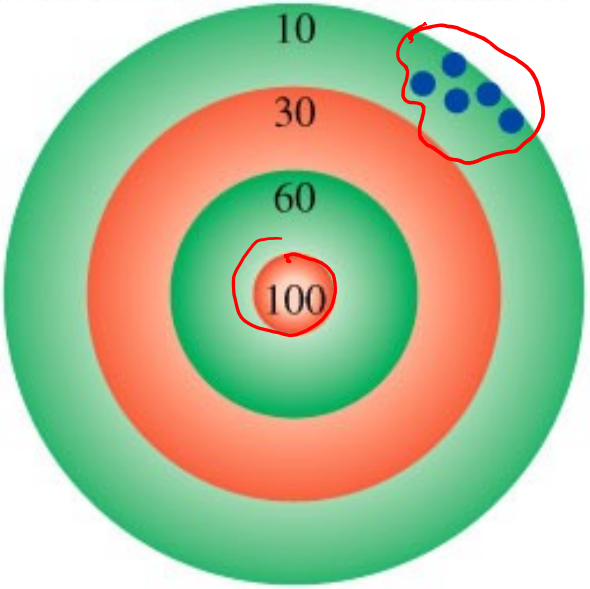


Accuracy – how close a measurement is to the *true* value

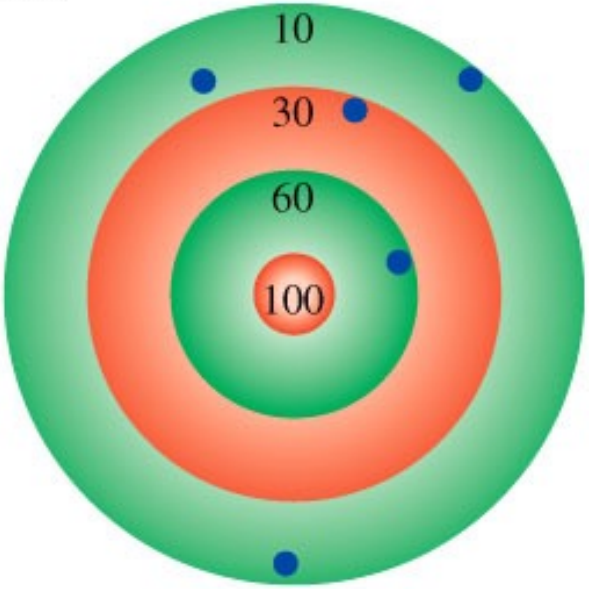
Precision – how close a set of measurements are to each other



accurate
&
precise



precise
but
not accurate



not accurate
&
not precise

1.4 Measurements

- Any measurement consists two parts number and unit.
- The measurement made in the experiment must also specify the units of that measurement.
- A **unit defines the basic quantity of mass, volume, time, or whatever quantity** is being measured.
- A number that is not followed by the correct unit usually conveys no useful information.

International system of units (SI)

- The SI is based on the metric system and uses some of metric units.
- In this chapter we will use the metric system and we will mention the preferred SI unit.

Table 1.1 Base Units in the Metric System	
Length	meter
Volume	liter
mass	gram
time	second
temperature	Celsius
energy	calorie
Amount of substance	mole

A: Length

- In the English system we use the inch, foot, the yard and the mile.
- The conversion factors are:

1 inch = 2.54 cm

- 12 inches = 1 foot
- 3 feet = 1 yard
- 1760 yard = 1 mile

1 mile = 1.60 km

- Example: Express 1.5 yards in cm.

$$1.5 \text{ yard} \times \frac{3 \text{ feet}}{1 \text{ yard}} \times \frac{12 \text{ inch}}{1 \text{ foot}} \times \frac{2.54 \text{ cm}}{1 \text{ inch}} = 137.16 \text{ cm}$$

Example: A pencil is 7.00 in long. What is its length in centimeters?

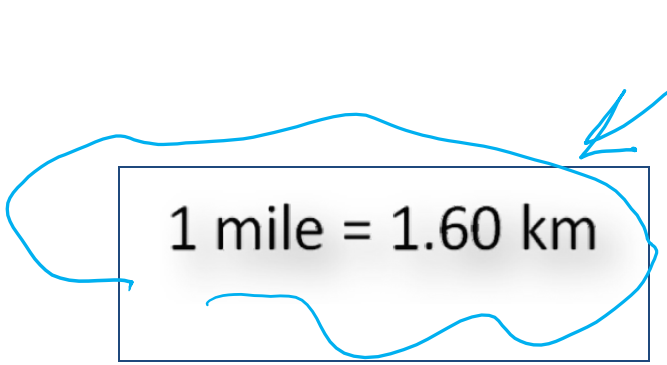
2.54 cm = 1 in

Solution

$$7.00 \text{ in} \times \frac{2.54 \text{ cm}}{1 \text{ in}} = (7.00)(2.54) \text{ cm} = 17.8 \text{ cm}$$

Example: A student has entered a 10.0-km run. How long is the run in miles?

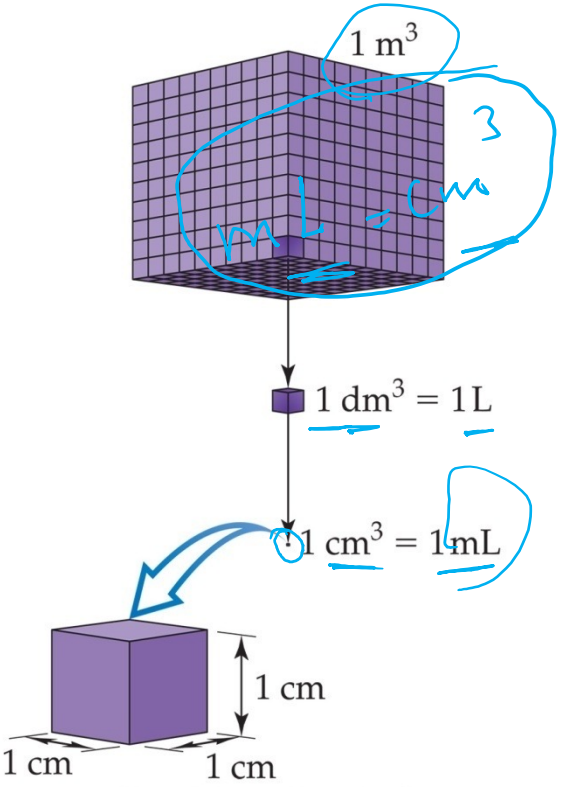
Solution:



$$10.0\ \text{km} \times \frac{1\ \text{mile}}{1.6\ \text{km}} = 6.25\ \text{mile}$$

B: Volume

- Volume is the space occupied by a substance.
- Another common unit of volume is the liter (L). A ***liter is the volume occupied by one*** *cubic decimeter. One liter of volume is equal to 1000 milliliters (mL) or 1000*
  - 1 L = 1000 mL
    - = 1000 cm^3
      - = 1 dm^3



$1\ m^3 = 1000\ L = 10^6\ mL$

Example: Convert each of the following:

$1\ L = 10^3\ mL$

1) 5 gallons to liters

$1\ gal = 3.785\ L$

$5\ gal \times \frac{3.785\ L}{1\ gal} = \_\_\_\_\ L$

2) 2.1 gallons to ml

$2.1\ gal \times \frac{3.785\ L}{1\ gal} \times \frac{10^3\ mL}{1\ L} = \_\_\_\_\ mL$

C: Mass

- Mass is the quantity of matter in an object.
- Weight is the force of a mass experiences under the pull gravity.

1 kilogram (kg) = 1000 g

1 gram = 1000 milligram

or

1 milligram = 0.001 g

1 kg = 2.205 lb

- Example: How many kilograms are there in 241 lb?
- Solution:

$$241\ lb \times \frac{1\ kg}{2.205\ lb} = 109.3\ kg$$

- **Prefixes:** In both the SI and metric systems to convert from larger or smaller unit we use 10, 100, 1/10, 1/100 or other power of 10.
  - 1 kilometer (km) = 1000 meters
  - 1 centimeter (cm) = 0.01 meter
  - 1 nanometer (nm) = 10^{-9} meter

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PREFIX	SYMBOL	MEANING	EXAMPLE
Tera-	T	1,000,000,000,000, or 10^{12}	1 terameter (Tm) = 1×10^{12} m
Giga-	G	1,000,000,000, or 10^{9}	1 gigameter (Gm) = 1×10^{9} m
Mega-	M	1,000,000, or 10^{6}	1 megameter (Mm) = 1×10^{6} m
Kilo-	k	1,000, or 10^{3}	1 kilometer (km) = 1×10^{3} m
Deci-	d	1/10, or 10^{-1}	1 decimeter (dm) = 0.1 m
Centi-	c	1/100, or 10^{-2}	1 centimeter (cm) = 0.01 m
Milli-	m	1/1,000, or 10^{-3}	1 millimeter (mm) = 0.001 m
Micro-	μ	1/1,000,000, or 10^{-6}	1 micrometer (μm) = 1×10^{-6} m
Nano-	n	1/1,000,000,000, or 10^{-9}	1 nanometer (nm) = 1×10^{-9} m
Pico-	p	1/1,000,000,000,000, or 10^{-12}	1 picometer (pm) = 1×10^{-12} m

2500 cm $\Rightarrow$ km

$2500 \times 10^{-2} \times 10^{-3} = 0.025$ km

106 MHz $\Rightarrow$ kHz

$106 \times 10^{6} \times 10^{-3} = 106000$ kHz

1.06×10^{5} kHz

Chemical Connections
Drug Dosage and Body Mass

Drug dosage are prescribed on the bases of body mass and the age.

. E.g. the recommended dose of a drug may be 3 mg for each kilogram of the body weight. In this case 50 kg person will receive 150 mg of the drug.

@chem3_phys

END OF THE LECTURE

م. امير الصوص