PHYS 1

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Chapter 1 :- "Measurement"

1 .. The international system of units "SI-Units" :

(النظام الدولي للوحدات).

Physical Quantities :

Basic (أساسية)

There are seven "basic Quantities", that forming the basis of international system of units.

Examples:-
1. Length. (m).
2. Mass. (kg).
3. time. (sec).

Derived (مشتقة) ← (تتكون بدلالة الكميات الأساسية)

Many SI derived units are defined in terms of the base units.

Examples:-
1. Speed = $\frac{\text{distance}}{\text{time}}$. (m/s).
2. density = $\frac{\text{Mass}}{\text{Volume}}$. (kg/m^3).
3. Area = $(\text{length})^2$. (m^2).
4. Force = $\frac{\text{Mass} * \text{Length}}{(\text{time})^2}$. ($kg.m/sec^2$).

2 .. Scentific notation :

The scientific notation is used to simplify writing very small or very large numbers.

- ex: 3560 000 000 m. = 3.56×10^9 m.

  0.000 000 492 s. = 4.92×10^{-7} s.

Prefixes for SI Units : (بعض الـ)

Factor.	Prefix.	Symbol
10^9	Giga.	G
10^6	Mega.	M
10^3	Kilo.	k
10^{-2}	Centi-	c
10^{-3}	milli.	m
10^{-6}	Micro.	μ
10^{-9}	nano.	n
10^{-12}	Pico-	p

3 .. Dimensional Analysis :

لما نعرف أشتق وحدة بكمية فيزيائية من خلال العمليات.

ex: let $D = \alpha t$, $[D] = m$, $[t] = s$, Find $[\alpha]$??

$[D] = [\alpha][t]$

$m = [\alpha]\, s \longrightarrow [\alpha] = m/s.$

ex: $V = V_0 + \beta t$, $[V] = m/s$, $[V_0] = m/s$, $[t] = s$, Find $[\beta]$??

$[V] = [V_0] + [\beta t]$

$m/s = m/s + \underbrace{[\beta t]}_{m/s} \Rightarrow [\beta]s = m/s$

$[\beta] = m/s^2.$

4 .. Changing units :

Conversion Factor :- is a ratio of units that is equal to unity.

⇒ conversion Factor = 1 (معامل التحويل).

ex: min ⟶ sec

$1\,min = 60\,sec \longrightarrow \frac{1\,min}{60\,sec} = 1.$ or $\frac{60\,sec}{1\,min} = 1.$

* 3 min ⟶ ?? sec

$3\,min \left(\frac{60\,sec}{min}\right) = 180\,sec$

ex:- $1m = 100\,cm$

$\therefore \frac{1m}{100\,cm} = \frac{100\,cm}{1m} = 1$

* Find, $3m \longrightarrow ??\ cm$

$3m \left(\frac{100\,cm}{m}\right) = 300\ cm.$

5.. Estimation :

* Find the number of times your heart brats in a life time ??

# of breat / min ≈ 80

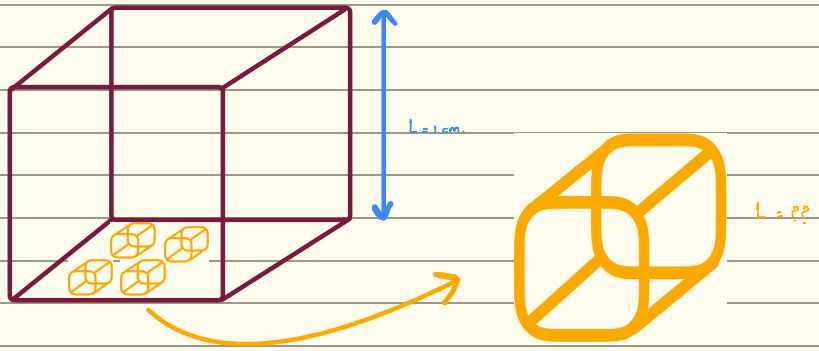
life time ≈ 80 years

# of breats $\approx 80 \times 365 \times 24 \times 60 \times 80$

$\approx 3.3 \times 10^{9}$ breat.

Lecture problems:

9 A cubical object has an edge length of 1.00 cm. If a cubical box contained a mole of cubical objects, find its edge length (one mole = 6.02×10^{23} units).



# of cubical objects $= 6.02 \times 10^{23}$.

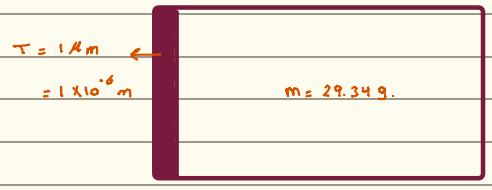
$\therefore 6.02 \times 10^{23} = \frac{V}{V}$

بالعربي $V = 6.02 \times 10^{23}$ (1)

$L^3 = 6.02 \times 10^{23}$

$L = 8.4 \times 10^{7}\ cm$

22 Gold, which has a density of 19.32 g/cm^3, is the most ductile metal and can be pressed into a thin leaf or drawn out into a long fiber. (a) If a sample of gold with a mass of 29.34 g is pressed into a leaf of 1.000 μm thickness, what is the area of the leaf? (b) If, instead, the gold is drawn out into a cylindrical fiber of radius 2.500 μm, what is the length of the fiber?



a) $D = \frac{m}{V}$

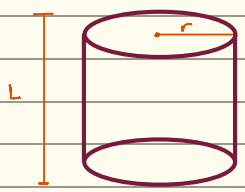
$19.32 = \frac{29.34}{V} \longrightarrow V = 1.518\ cm^3.$

$V = T \times A$ $\quad 1m \longrightarrow 100\ cm$

$1.518\ cm^3 = (1 \times 10^{-6} m)\left(\frac{10^2\ cm}{m}\right) A$

$A = 15180\ m^2.$

b) $R = 2.5\ \mu m \longrightarrow 2.5 \times 10^{-4}\ cm.$



$V = \pi r^2 \times L$

$1.518 = \pi (2.5 \times 10^{-4})^2 L \longrightarrow L = 7.7 \times 10^{6}\ cm.$

Discussion problems:

3 How many m/s are there in 1.0 mi/h? → mi = 1609 m

$$\frac{1\text{ mi}}{\text{h}} \times \frac{1609\text{ m}}{\text{mi}} \times \frac{\text{h}}{3600\text{ sec}} \rightarrow 0.46\text{ m/s}.$$

7 Assume the legal limit of speed is 70.0 mi/h. If driving day and night without stopping for 1.00 year, what is the maximum number of miles one can drive?

$$\frac{70\text{ mi}}{\text{h}} \times \frac{1\text{ year}}{} \times \frac{365\text{ day}}{\text{year}} \times \frac{24\text{ h}}{\text{day}}$$

$$= 6.132 \times 10^{5}$$

12 The age of the universe is approximately 10^{10} years and mankind has existed for about 10^{6} years. If the age of the universe were "1.0 day," how many "seconds" would mankind have existed?

10^{10} years → 10^{6} years

1 day → ? c

$$(10^{10}\text{ years})(c) = (1\text{ day})(10^{6}\text{ years})$$

$$c = 10^{-4}\text{ day}$$

$$= 10^{-4}\text{ day} \times \frac{24\text{ h}}{\text{day}} \times \frac{3600\text{ sec}}{\text{h}}$$

$$= 8.64\text{ sec}.$$

28 Einstein's mass–energy equation relates mass m to energy E as $E = mc^2$, where c is speed of light in vacuum. The energy at nuclear level is usually measured in MeV, where 1 MeV = $1.602\,18 \times 10^{-13}$ J; the masses are measured in unified atomic mass unit (u), where 1 u = $1.660\,54 \times 10^{-27}$ kg. Prove that the energy equivalent of 1 u is 931.5 MeV.

$$E = mc^2$$

$$= (1.66054 \times 10^{-27})(2.998 \times 10^{8})^2$$

$$= 1.492 \times 10^{-10}\text{ J}$$

$$= (1.492 \times 10^{-10})\text{ J} \times \left(\frac{\text{Mev}}{1.60218 \times 10^{-13}\text{ J}}\right)$$

$$= 931.5\text{ Mev}$$

لاحظ وضع الطلوب .