



PHYCS101

PhySc101

Chapter 1

1.1 Standards of length, mass, and time

Base Quantity	Si Unit	CGS
Length	meter	centimeter
Mass	Kilogram	gram
Time	seconds	second

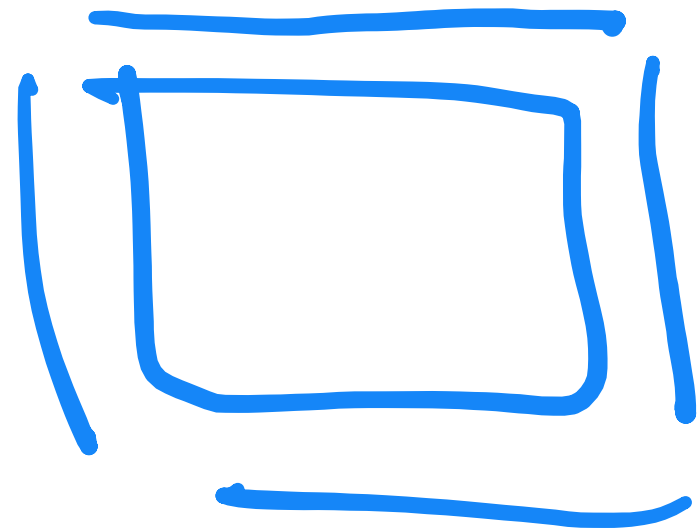
What is the meaning of the Si & CGS?

Si	System international
CGS	Centimeter - gram - second

1.2 Quantities and their unit:

Quantity	Si Unit	Symbol
Distance	meter	m
Area	meter	m
Circumference	meter	m
Speed	meter per sec	m/s
Momentum	kg . meter per	kg . m / s

→ length → meter
mass → kg
time → second



1.3 Some Prefixes for SI units:

Some Prefixes for Powers of Ten

Power	Prefix	Abbreviation	Power	Prefix	Abbreviation
10^{-24}	yocto	y	10^1	deka	da
10^{-21}	zepto	z	10^2	hecto	h
10^{-18}	atto	a	10^3	kilo	k
10^{-15}	femto	f	10^6	mega	M
10^{-12}	pico	p	10^9	giga	G
10^{-9}	nano	n	10^{12}	tera	T
10^{-6}	micro	μ	10^{15}	peta	P
10^{-3}	milli	m	10^{18}	exa	E
10^{-2}	centi	c	10^{21}	zetta	Z
10^{-1}	deci	d	10^{24}	yotta	Y

Example: Introduced the following quantities using a suitable prefixes:

1) $0.03 \text{ m} = 3 \times 10^{-2} \text{ cm} = 3 \text{ cm}$

$\frac{003. \text{ m}}{= 3}$

2) $0.005 \text{ m} = 5 \times 10^{-3} \text{ mm} = 5 \text{ mm}$

$0005.$

3) $20000 \text{ g} = 20 \times 10^3 \text{ kg} = 20 \text{ kg}$

4) $7100000 \text{ ohms} = 7.1 \times 10^6 \text{ M}\Omega = 7.1 \text{ M}\Omega$

10^1	deka	da
10^2	hecto	h
10^3	kilo	k
10^6	mega	M
10^9	giga	G
10^{12}	tera	T
10^{15}	peta	P
10^{18}	exa	E
10^{21}	zetta	Z
10^{24}	yotta	Y

1.4 Conversation of units

Examples:

$$\begin{array}{ccc} \text{in} & \longrightarrow & \text{cm} \\ (15) \text{ in} & \times & \frac{2.54 \text{ cm}}{1 \text{ in}} \end{array}$$

1- Convert 15 inch into cm knowing that (1 in = 2.54 cm).

$$(15) \text{ in} \times \frac{2.54 \text{ cm}}{1 \text{ in}} = 38.1 \text{ cm}$$

2- Convert 127cm into inch knowing that (1 in = 2.54 cm).

$$127 \text{ cm} \times \frac{1 \text{ in}}{2.54 \text{ cm}} = 50 \text{ in}$$

3- Convert 1228 km/h into m/s.

$$127 \text{ cm} \longrightarrow \frac{1 \text{ in}}{2.54 \text{ cm}}$$

3- Convert 1228 km/h into m/s.

hour $\rightarrow$ sec

$$1228 \frac{\cancel{\text{km}}}{\cancel{\text{h}}} \times \frac{1 \cancel{\text{h}}}{3600 \text{ s}} \times \frac{1000 \text{ m}}{1 \cancel{\text{km}}} = 341 \frac{\text{m}}{\text{s}}$$

$$\frac{1228 \times 1000}{3600}$$

1 Km $\rightarrow$ 1000 m

Convert time

1 h $\rightarrow$ 60 min
1 min $\rightarrow$ 60 sec

1 h $\rightarrow$ 3600 s

Exercise:

1- A car travelled 380 m. How many km that the car travelled ? 0.38 km

2- A train travelled 2.64 Km. how many meters did it travelled? 2640 m

3- Area of a small rug is 0.5 m^2 . find the rug area in mm^2 .

0.50000000

$$0.5 \text{ m}^2 \times (10^{-3})^2 = 0.5 \times 1000000 \text{ m}^2 = 500000 \text{ mm}^2$$

Additional questions for unit Conversion:

1- 867000 cm to m $m \times 10^{-2} = \text{cm}$, then $\text{cm} \div 10^2 = m$

$$\frac{867000}{100} = 8670 \text{ m}$$

2- 125.3 m/s to km/h. Ans. 451.08 km/h

3- On an interstate in a rural region of Wyoming, a car is traveling at a speed of 38.0 m/s. Is the driver exceeding the speed limit of 75.0 mi/h?

$1 \text{ hr} \rightarrow 3600 \text{ s}$
 $1 \text{ mi} \rightarrow 1609 \text{ m}$

$$38 \frac{\text{m}}{\text{s}} \times \frac{1 \text{ mi}}{1609 \text{ m}} \times \frac{3600 \text{ s}}{1 \text{ hr}} = 85 \frac{\text{mi}}{\text{hr}}$$

1 year

Conservation of time units:

year	365 days
1 day	24 hours
1 hour	60 minutes
1 minute	60 seconds

Exercise:

1 day $\rightarrow$ 24 hr

1 min $\rightarrow$ 60 s

1- How many seconds in 2 days?

$$\textcircled{2} \text{ days} \times \frac{\textcircled{24} \text{ hr}}{\textcircled{1} \text{ day}} \times \frac{\textcircled{60} \text{ min}}{\textcircled{1} \text{ hr}} \times \frac{\textcircled{60} \text{ s}}{\textcircled{1} \text{ min}} = 172800 \text{ sec}$$

2- A car moving with a speed of 25 m/s. Find the speed of the car in:

a. Km/h

90 Km/h

b. cm/min

150000 cm/min

Some important mathematical skills!

Differentiation:

Let a and c be a constant, then $\frac{d}{dx}(a) = 0$, $\frac{d}{dx}(ax^n) = na(x^{n-1})$

Examples:

Find the differentiation for the following examples:

$$3x^2 = \underline{2 \times 3} x^{2-1} = 6x' = 6x$$

$$5 = \text{zero} = 0$$

$$100x = 100$$

Integration:

$$\int ax^n dx = a \frac{x^{n+1}}{n+1} + C$$

Find the Integration for the following examples:

$$\int \underline{3x^2} dx = \frac{3x^{2+1}}{2+1} = \frac{3x^3}{3} = x^3$$

$$\int \textcircled{5} dx = 5x$$

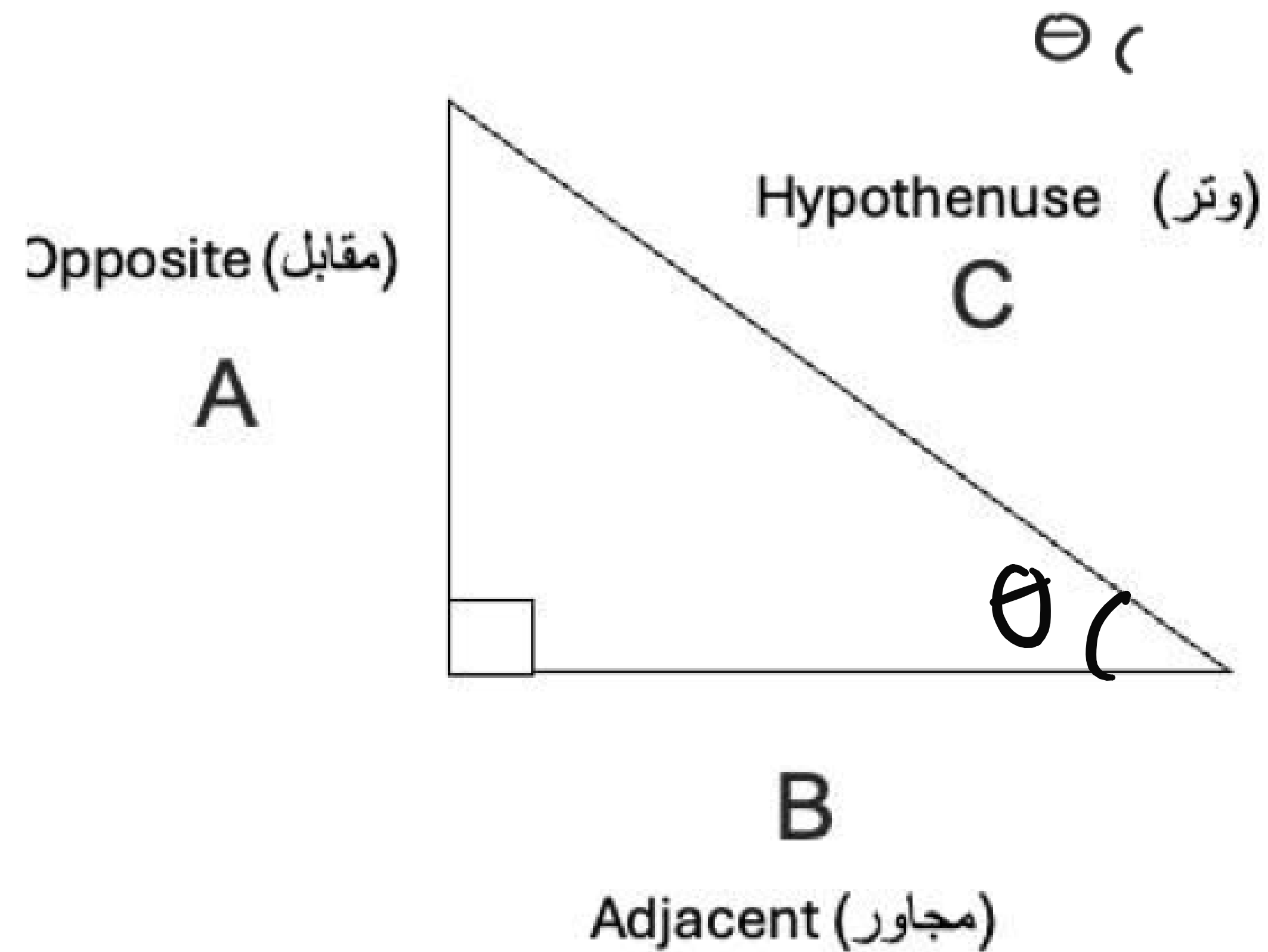
$$\int \underline{100x} dx = \frac{100x^{\textcircled{1+1}}}{1+1} = 50x^2$$

Quadratic equation:

$$ax^2 + bx + c = 0$$

To solve it we use $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ or using the calculator!

Geometric:



$$C^2 = A^2 + B^2$$

$$\cos \theta = \frac{\text{مجاور } A}{\text{وتر } C}$$

$$\sin \theta = \frac{\text{مقابل } B}{\text{وتر } C}$$

$$\tan \theta = \frac{\text{مقابل } B}{\text{مجاور } A}$$

$$\theta = \tan^{-1} \left(\frac{\text{مقابل } B}{\text{مجاور } A} \right)$$

Additional questions:

1- How many The mass of the sun is $1.99 \times 10^{30} kg$ and the mass of the Hydrogen atom is $1.66 \times 10^{-27} kg$. How many atoms are in the sun?

2- The volume of wallet is 8.5 in^2 . Convert to cm^3 . Hint (1 in = 2.54 cm).

3- One gallon of paint (volume = $3.78 \times 10^{-3} \text{ m}^3$). Convert the area of 25 m^2 . What is the thickness of paint on the wall?