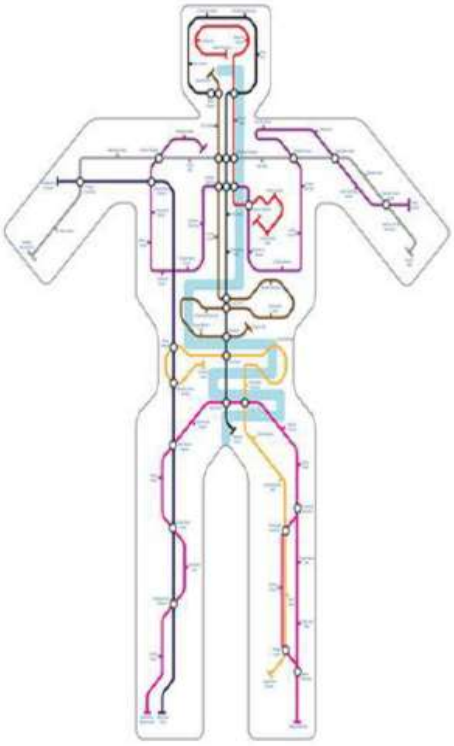
What is Medical Physics?



Medical physics is the application of physics to medicine. All areas of physics can be applied to medicine (Mechanics, electromagnetism thermodynamics, nuclear physics, optics, fluids).

Medical physics is mainly involved in the development of new instrumentation and technology used for diagnosis and also for treatments. The human body is a very complex system. Concepts of modeling in physics can be applied to simulate different activities of the human body systems: For example, the modeling of the blood flow in the study of the body's circulatory system.

why the practical work?

Practical work in physics intended to teach the student how to select and set up apparatus skillfully and well. to make careful observations and accurate measurement while at the same time realizing the limitations of measuring instrument employed, and to use the experimental results obtained to best advantage.

عزيزي الطالب .. نشكر لك لطفك لالتزامك بالتعليمات المختبرية المدرجة في أدناه .. حيث إن التزامك دليل وعيك وثقافتك وذوقك .. أتمنى لكم عاماً دراسياً مكللاً بالموفقية والنجاح.

تـعليـمـات مـختبريـــة

1. الالتزام بقواعد السلامة والأمن ألمختبري وكافة الإرشادات المثبتة داخل المختبر حفاظا على سلامتكم لكونها مهمة لنا.
2. الحفاظ على الهدوء وتجنب المزاح و الأحاديث الجانبية التي ليس لها علاقة بموضوع المختبر.
3. الالتزام بلبس صدرية المختبر.
4. الالتزام بجلب كافة المستلزمات الضرورية داخل المختبر والتي تشمل:
   - ✓ محفظة أوراق لحفظ تقارير التجارب مع دفتر للرسم البياني.
   - ✓ دفتر ملاحظات لتدوين نتائج التجارب مباشرة وعدم الاستعانة بوريقات متناثرة كمسودة.
   - ✓ مسطرة شفافة، قلم رصاص، أقلام جاف، ممحاة، مبراة.
   - ✓ حاسبة يدوية.
5. الحفاظ على الأجهزة داخل المختبر وعدم العبث بها.
6. قراءة التجربة بدقة قبل تنفيذها داخل المختبر.
7. تنظيف مكانك قبل مغادرة المختبر.
8. إطفاء الجهاز وتنظيف مكان التجربة قبل مغادرة المختبر.
9. إكمال التقرير الخاص بالتجربة ونتائجها داخل المختبر في نفس اليوم الذي تؤدي به التجربة.
10. عزيزي الطالب .. بعد تنفيذك للتجربة سوف تكون مهيأ للخضوع إلى اختبار بها في المحاضرة القادمة.
11. عزيزي الطالب .. الالتزام بجميع التعليمات أعلاه سوف يكون جزءا من تقييمك والذي يشمل درجة السعي السنوي.

Lab. (1)
Graphs Types

The majority of experiments in physics require the drawing of a graph for not only does give an immediate visual picture of results and information (e.g. how variable quantity varies with another) but it is also usually providing the most convenient way of obtaining the average of a set of readings.

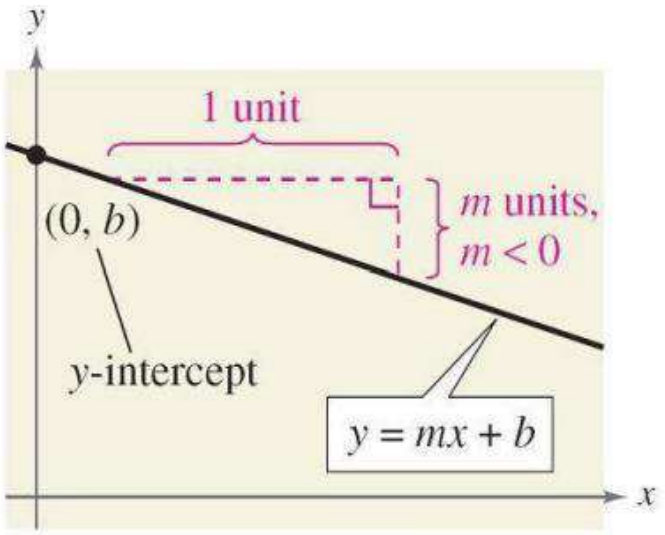
It is better to draw a graph of the different values as ordinates (Y- axis) against the corresponding values as abscissa (X-axis).

Types of Lines in Graphs

- ❖ Straight.
- ❖ Curved.
- ❖ Irregular.

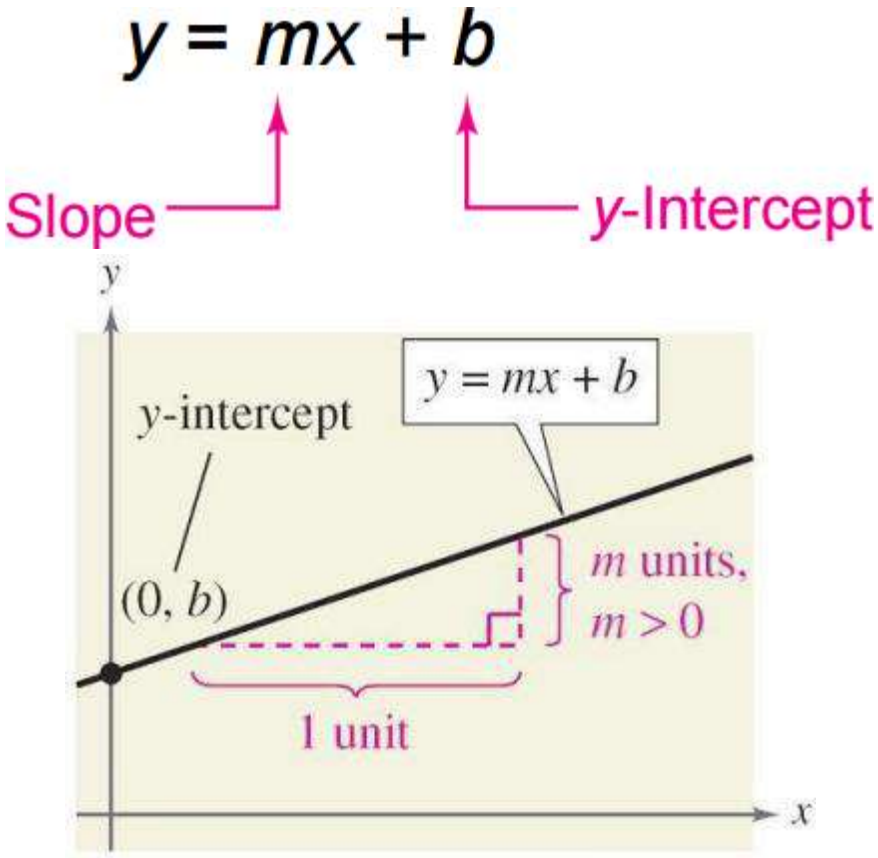
Straight Line

The simplest mathematical model for relating two variables is the linear equation in two variables y = m X + b. The equation is called linear because its graph is a line. (In mathematics, the term line means straight line.)



Negative slope, line falls.

By letting x = 0, you obtain y = m(0) + b
y= b.
So, the line crosses the y-axis at y = b, as shown in Figure 1. In other words, the y-intercept is (0, b). The steepness or slope of the line is m.



Positive slope, line rises.

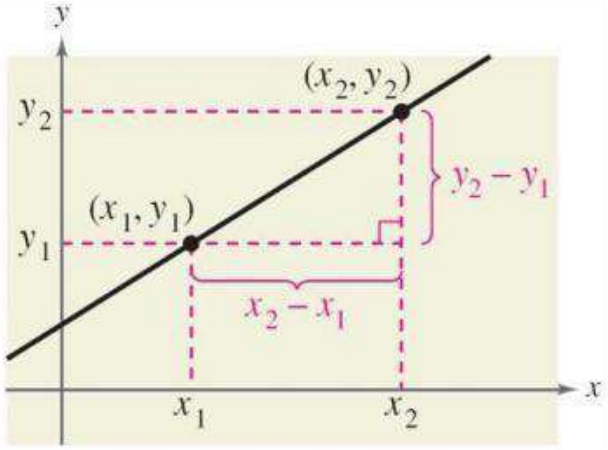
Finding the Slope of a Line:

Given an equation of a line, you can find its slope by writing the equation in slope- intercept form. If you are not given an equation, you can still find the slope of a line. For instance, suppose you want to find the slope of the line passing through the points (x1 , y1) and (x2 , y2).
As you move from left to right along this line, a change of (y2 – y1) units in the vertical direction corresponds to a change of (x2 – x1) units in the horizontal direction.
y2 – y1 = the change in y = rise and

x2 – x1 = the change in x = run

The ratio of (y2 – y1) to (x2 – x1) represents the slope of the line that passes through the points (x1 , y1) and (x2 , y2).

$$\text{Slope} = \frac{\text{change in } y}{\text{change in } x} = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$$



The Slope of a Line Passing Through Two Points

The **slope** m of the nonvertical line through (x_1, y_1) and (x_2, y_2) is

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

where $x_1 \neq x_2$.

The scientific notation

A number is said to be in scientific notation when it is written as a number between 1 and 10, times a power of 10. for example 521 can be written as 5.21×10^{2}, or a small number like 0.000000521 can be written as 5.21×10^{-7}. The advantage of this notation is its compactness, it also facilitates numerical calculations. When a number is written with the powers of 10, we can use the following **prefixes.**

Multiples		Prefix	symbol	Sub-multiples		Prefix	symbol
10		deca	da	0.1	10^{-1}	deci	d
100	10^2	hecto	h	0.01	10^{-2}	centi	c
1000	10^3	kilo	k	0.001	10^{-3}	milli	m
1000 000	10^6	Mega	M	0.000001	10^{-6}	micro	μ
1000 000 000	10^9	Giga	G	0.000 000 001	10^{-9}	nano	n
1000 000 000 000	10^{12}	Tera	T	0.000 000 000 001	10^{-12}	pico	p

Conversion of units

To convert quantities from a unit system to another, we can use the following **systematic method:**

Suppose we want to convert a length L=1.75 m into foot. The conversion factor between the two units is given by: 1 ft. =0.3048 m

To convert from meter to foot we have to follow these steps:

1-Multiply the quantity to convert by one:

L=1.75 m ×1

2 **Rearrange the conversion factor in quotient equal to 1 that allows the elimination of the unit from which we want to convert**:

1 ft.=0.3048 m⇒ 1 ft. / 0.3048m=1

3-Replace this form in the first step:

L=1.75m×1=1.75m×1ft/0.3048m=5.74ft

Example 1: Convert 100 ft. in to meters.

100 ft. =100 ft. ×1=100ft×(0.3048m/1ft) =30.48m

Example 2: Convert the velocity of 24 m/s into km/h.

We have 1km=10^3 m and 1 h=3600s

Then 24 m/s=24m/s× (1) × (1) {1 is written twice because we have two units to convert}

24 m/s=24m/s×1km/$10^3$$m$×3600 s/1h=24×3600/$10^3$$km/h$=86.4 km/h

Example 3: The skin is the largest organ in the human body; for a human adult the average area of the skin surface is about $1.8m^2$, how much squared foot is this area?

Solution: $Given\ that\ 1ft$=0.3048m, $then 1ft$= $(0.3048)^2m^2$

A=$1.8m^2$=$1.8m^2$× $(1ft^2 / (0.3048)^2m^2)$ =$19ft^2$

Example 4: an ampoule contains a solution of drug of $300\mu g/5ml$, convert this dose into g/l.

Solution: $300\mu g/5ml$=$300\times10^{-6}g/5\times10^{-3}l$=$0.06g/l$

Measure	Derived unit		Derivation from basic unit or supplementary unit, or derivation from another derived unit
	Name	Symbol	
Frequency	Hertz	Hz	1 Hz = 1 s^{-1}
Force	Newton	N	1 N = 1 kg·m/s^2
Pressure, stress	Pascal	Pa	1 Pa = 1 N/m^2
Energy, work, heat quantity	Joule	J	1 J = 1 N·m
Work rate, process rate, power, electric power	Watt	W	1 W = 1 J/s
Electric charge, quantity of electricity	Coulomb	C	1 C = 1 A·s
Electric potential, potential difference, voltage, electromotive force	Volt	V	1 V = 1 J/C
Electrostatic capacity, capacitance	Farad	F	1 F = 1 C/V
Electric resistance	Ohm	Ω	1 Ω = 1 V/A
Conductance	Siemens	S	1 S = 1 $Ω^{-1}$
Magnetic flux	Weber	Wb	1 Wb = 1 V·s
Magnetic flux density (magnetic induction)	Tesla	T	1 T = 1 Wb/m^2
Inductance	Henry	H	1 H = 1 Wb/A
Celsius temperature	Degrees Celsius or degrees	℃	1 t℃ = (t+273.15) K
Luminous flux	Lumen	lm	1 lm = 1 cd·sr
Illumination	Lux	lx	1 lx = 1 lm/m^2
Radioactivity	Becquerel	Bq	1 Bq = 1 s^{-1}
Absorbed dose	Gray	Gy	1 Gy = 1 J/kg
Dose equivalent	Sievert	Sv	1 Sv = 1 J/kg

How to write a report?

Name of experiment ✓

Date of experiment ✓

The Purpose of experiment ✓

Apparatus ✓

Theory ✓

The method of work ✓

Results and calculation ✓

Discussion ✓