

S. I. UNIT

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Introduction: -

The internationally agreed version of the metric system is known as Systeme International d' units or S. I. Unit in short.

We are familiar with many S. I. Units e. g., meter, second, kilogram. The S. I. Units were approved in 1960 by the General Conference of Weights and Measurements. They are being adopted by scientific laboratories throughout the world. In the U. K., S. I. Units were introduced in the National Health Service Laboratories during 1975. In May of 1977, the Thirtieth World Health Assembly endorsed the use in medicine of S. I. Units. The resolution, WHA 20-39, recommended its adoption by the entire scientific community and particularly the medical community throughout the world. All the medical books and journals presently available now use S. I. Units.

The introduction of the metric system, S. I. Unit, means industry and science throughout the world will be using the same units of measurement. In fact many branches of science are already using S. I. Units. School children should learn metric units so that error or confusion will be diminished. In medicine, it will be possible to compare numerical data internationally to the benefit of both the patient and doctor.

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Units

There are seven basic units on which all others are based.

Quantity	Unit	Symbol
Length	meter	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Amount of substance	mole	mol
Luminous Intensity	Candela	cd

Some important derived S. I. Units are as follows.

Quantity	Unit	Symbol
Force	newton	N
Work, energy, quantity of heat	joule	J
Power	watt	W

Others used in S. I. Units are;

Quantity	Unit	Symbol
Temperature	degree, celsius	$^{\circ}\text{C}$
Volume	litre	l

The coherent S. I. Unit for volume is cubic meter, but litre is used as a unit of volume which is equal to one cubic decimeter i. e.: 1000 litres = 1 cubic meter.

Prefixes:-

Sometimes units may be too large or too small, so to avoid writing many zeros, a prefix is placed before the symbol of the unit. The recommended multiple of fractions of a unit change by 1000 each time, thus 0.000015 mol is written as 15 μmol , and 13,400 m is written as 13.4 Km.

So you will appreciate the indices can be used for statement of value instead of a cumbersome series of noughts. The full table of prefixes, symbols and values can therefore be expressed as follows.

Prefix	Symbol		Value
tera	T	10^{12}	1,000,000,000,000
giga	G	10^9	1,000,000,000
mega	M	10^6	1,000,000
kilo	k	10^3	1,000
hecto	h	10^2	100
deca	da	10^1	10
deci	d	10^{-1}	0.1
centi	c	10^{-2}	0.01
milli	m	10^{-3}	0.001
micro	u	10^{-6}	0.000001
nano	n	10^{-9}	0.000,000,001
pico	p	10^{-12}	0.000,000,000,001
femto	f	10^{-15}	0.000,000,000,000,001
atto	a	10^{-18}	0.000,000,000,000,000,001

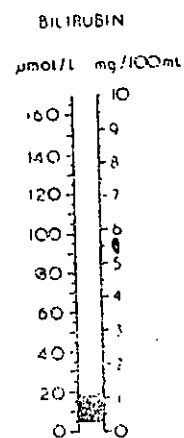
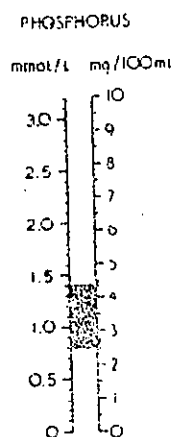
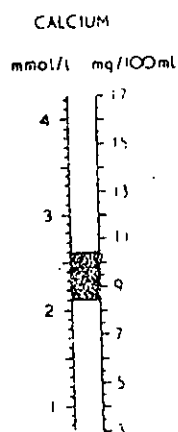
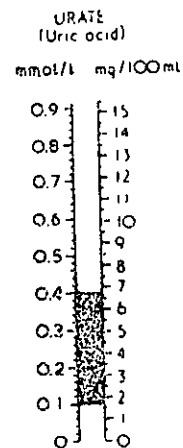
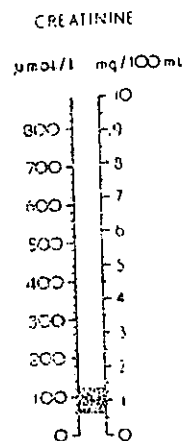
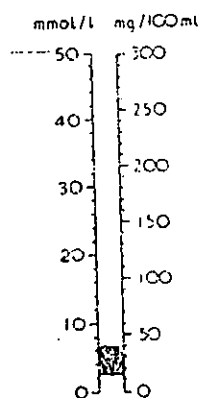
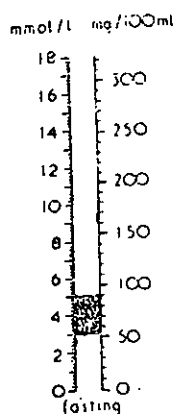
Note, $10^{-1} = \frac{1}{10} = 0.1$; $10^{-2} = \frac{1}{100} = 0.01$; $10^{-3} = \frac{1}{1000} = 0.001$ etc.

The S. I. System permits the use of indices and many people in laboratories and similar establishments will find them extremely useful. However, anyone using indices should not only fully understand the mathematics themselves, but should also be certain that colleagues with whom they are communicating understand them.

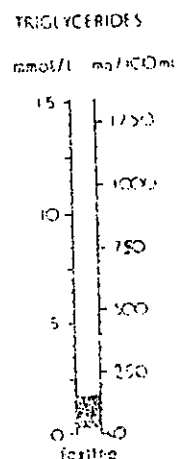
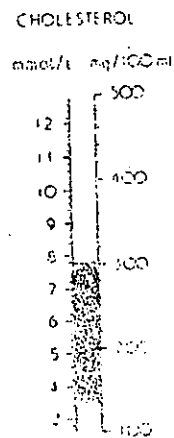
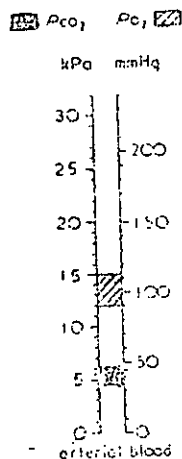
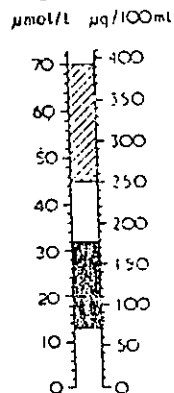
Indices should not be used when stating doses.

CONVERSION SCALES (1) Traditional to SI units

CHEMICAL PATHOLOGY: BLOOD PLASMA GLUCOSE UREA



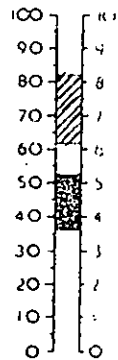
IRON and IRON BINDING CAPACITY



CONVERSION SCALES (2) (traditional to SI units)

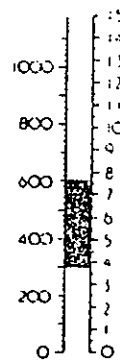
CHEMICAL PATHOLOGY PROTEINS [%] Total and Albumin I I

g/L g/100ml



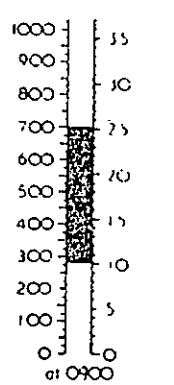
BLOOD PLASMA

nmol/L μ g/100ml



CORTISOL

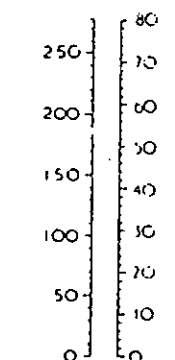
nmol/L μ g/100ml



at 0900

URINE OESTROGENS ("Oestrogens")

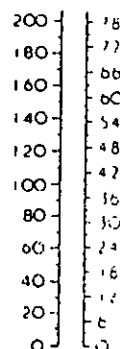
μ mol/24h mg/24h



GENERAL MEASUREMENTS

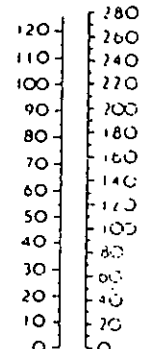
HEIGHT

cm inches



MASS

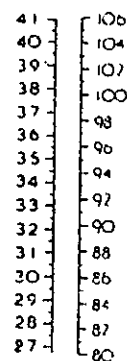
kg lb



Normal ranges

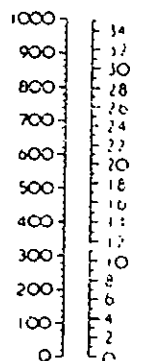
TEMPERATURE

$^{\circ}$ C $^{\circ}$ F



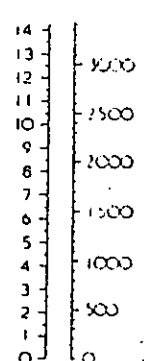
VOLUME

ml fluid ounces



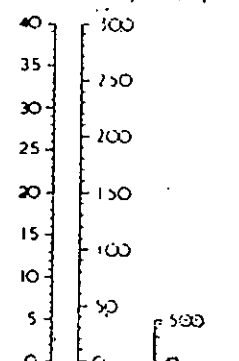
ENERGY

MJ (medical Calories) kcal



PRESSURE

kPa mmHg mmH₂O



CHEMICAL PATHOLOGY CONVERSION SCALES ARE BASED ON THOSE PUBLISHED BY THE UNITED KINGDOM DEPARTMENT OF HEALTH

Some conversions for S. I. Unit

	From S. I. Unit	To S. I. Unit
Glucose	$\text{mmol/l} \times 18 = \text{mg/dl}$	$\text{mg/dl} \div 18 = \text{mmol/l}$
Urea	$\text{mmol/l} \times 6 = \text{mg/dl}$	$\text{mg/dl} \div 6 = \text{mmol/l}$
Creatine (plasma)	$\text{umol/l} \times 0.011 = \text{mg/dl}$	$\text{mg/dl} \div 0.011 = \text{umol/l}$
(urine)	$\text{umol/24h} \times 0.11 = \text{mg/dl}$	$\text{mg/24h} \div 0.11 = \text{umol/24h}$
Bilirubin	$\text{umol/l} \times 0.058 = \text{mg/dl}$	$\text{mg/dl} \div 0.058 = \text{umol/l}$
Urate	$\text{mmol/l} \times 17 = \text{mg/dl}$	$\text{mg/dl} \div 17 = \text{mmol/l}$
Calcium (plasma)	$\text{mmol/l} \times 4 = \text{mg/dl}$	$\text{mg/dl} \div 4 = \text{mmol/l}$
(urine)	$\text{mmol/24h} \times 40 = \text{mg/24h}$	$\text{mg/24} \div 40 = \text{mmol/24h}$
Phosphorus	$\text{mmol/l} \times 3 = \text{mg/dl}$	$\text{mg/dl} \div 3 = \text{mmol/l}$
Protein (serum)		
total, Albumin, immunoglobulin	$\text{g/l} \div 10 = \text{g/dl}$	$\text{g/dl} \times 10 = \text{g/l}$
(urine)		
concentration	$\text{g/l} \times 100 = \text{mg/dl}$	$\text{mg/dl} \div 100 = \text{g/l}$
daily output	g/24h	no change
Cholesterol	$\text{mmol/l} \times 39 = \text{mg/dl}$	$\text{mg/dl} \div 39 = \text{mmol/l}$
Gases		
PO_2 } PCO_2 }	$\text{kPa} \times 7.5 = \text{mm Hg}$	$\text{mm Hg} \div 7.5 = \text{kPa}$
Iron, TIBC	$\text{umol/l} \times 5.6 = \text{ug/dl}$	$\text{ug/dl} \div 5.6 = \text{umol/l}$
Cortisol (plasma)	$\text{nmol/l} \times 0.036 = \text{ug/dl}$	$\text{ug/dl} \div 0.036 = \text{nmol/l}$
(urine)	$\text{nmol/24h} \times 0.36 = \text{ug/24h}$	$\text{ug/24h} \div 0.36 = \text{nmol/24h}$
Oestriol	$\text{umol/24h} \times 0.3 = \text{mg/24h}$	$\text{mg/24} \div 0.3 = \text{umol/24h}$
17 Oxosteroids		
Total 17-Oxogenic steroids		
5-HIAA } HMMA }	$\text{umol/24h} \times 0.2 = \text{mg/24h}$	$\text{mg/24h} \div 0.2 = \text{umol/24h}$
Fecal Fat	$\text{mmol/24h} \times 0.3 = \text{g/24h}$	$\text{g/24h} \div 0.3 = \text{mmol/24h}$

Haematological Values expressed in S. I. Units

examples

	Traditional Unit	S. I. Unit
Haemoglobin	149 %	14g/dl (decilitre)
Packed cell volume (PCV)	45 %	0.45
Red cell count	5,000,000/cu mm.	$5.0 \times 10^{12} / l$
Mean cell volum (MCV)	85 cuu	85 ft (femtolitre)
Mean cell haemoglobin (MCH)	30 uug	30 pg (Pecogramme)
Mean cell haemoglobin concentration (MCHC)	33 %	33/dl
Platelet count	2,50,000/cu mm	$250 \times 10^9 / l$
Leucocyte count	7,500/cumim	$7.5 \times 10^9 / l$
	others are	
Mean cell diameter	7.0 um	
Differential leucocyte count	}	in percentage or sometime expressed as count/lit for example of Total count
Reticulocyte count		

Bleeding & coagulation time in minutes (min)

Prothrombin time in second (s)

Blood volume in ml/kg

Plasma fibrinogen } in g/l
Transferin }

Serum B₁₂ in ng/l

(nanogram)

Serum folate } in ug/l
Red cell folate }

Plasma haemoglobin in mg/l

The problem on conversion affect first of all, pathology and other branches of laboratory medicine. The results, expressed in S. I. Units will appear unfamiliar for some time

The litre will be used as the reference unit for volume in all concentrations and cell counts. 1 molar solution = molecular weight in grammes per litre of solution = 1 mol/l. The physiological and pharmacological activity of a substance is due to the molecules or ions present, but not to the mass concentration. So the use of mole in expressing concentration gives biological activity. Molar concentration will be used for almost all substances measured except those whose molecular mass (mainly protein) is variable. Therefore the concentration of haemoglobin in blood will be expressed as g/dl, a decilitre is 100 millilitres. PCV (packed cell volume) is unit l, so PCV 44% = 0.44. Heat energy produced from food is changed from calorie to joule, unit of pressure (i. e. mm Hg) is expressed as pascal or kilopascals (kPa, 1 kPa = 7.5 mm. So that a po, of 7.5 mmHg is 10 kPa).

The measurement of blood pressure will remain the same at mmHg. Enzyme units also are not to be changed at this time.

Conclusion

The change over will come in the near futures. We need your co-operation. The introduction of S. I. Units will need local discussion and consideration of requirements for new forms and conversion tables. Local education programmes are important as is the need for having organizers for these tasks.

References:--

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