STANDARDS OF MEASUREMENT

REVIEW – CLASS-7

Statistical Analysis of Measurement Data

CONTENT-CLASS-8

Review Answers for worksheet-7

Standards of measurement

Video Show-Tanjore Temple Secrets Part-2

Activity

Class work Problem

M&I Star of the week contest

Summary

Worksheet-8

STANDARDS OF MEASUREMENT

- A standard is a physical representation of a _____.
- A _____ of physical quantity is termed as standard.
- These standards are used to determine the values of other physical quantities by _____.

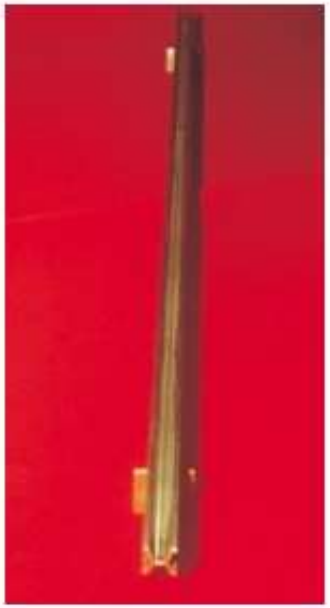
STANDARDS OF MEASUREMENT

- A standard is a physical representation of a unit of measurement.
- A known accurate measure of physical quantity is termed as standard.
- These standards are used to determine the values of other physical quantities by comparison methods.

STANDARDS OF MEASUREMENT

- **Fundamental unit of length in SI system is <u>metre</u>**
- **Can you define 1 metre?**

- Defined as the distance between two lines engraved on gold plugs near the ends of a platinum-iridium alloy at zero degree Celsius and mechanically supported in a prescribed manner

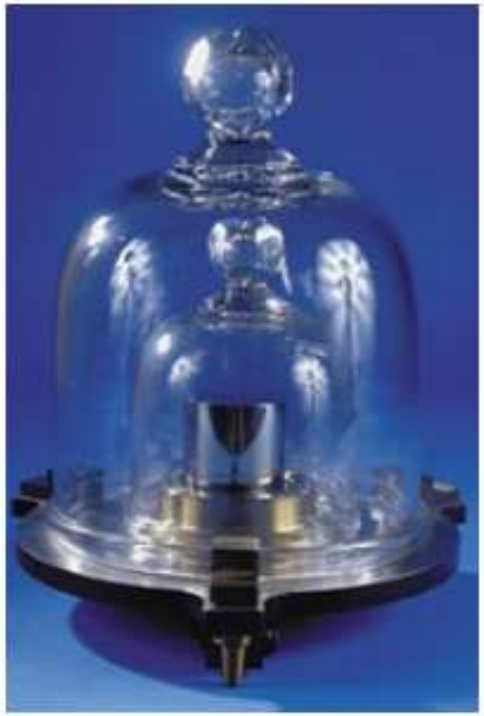


meter, (SI unit symbol: **m**), is the fundamental unit of length in the International System of Units (SI).

Originally intended to be one ten-millionth of the distance from the Earth's equator to the North Pole (at sea level).

Since 1983, it has been defined as **"the length of the path travelled by light in vacuum during a time interval of 1/299,792,458 of a second."**

National Prototype Metre Bar (alloy of ninety percent platinum and ten percent iridium) in International Bureau of Weights and Measures (BIPM: *Bureau International des Poids et Mesures*) to be located in Sèvres, France.



kilogramme (**kg**), is the base unit of mass in the International System of Units (SI)

Is defined as being equal to the mass of the *International Prototype of the Kilogram* (platinum–iridium alloy) in International Bureau of Weights and Measures in Sèvres, France

Second (**sec** or **s**)

The second is the duration of 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the caesium 133 atom.

Table 1.2: Fundamental physical quantities

Fundamental Quantity	SI unit	SI unit symbol	Dimension
Length			
Mass			
Time			
Electric current			
Temperature			
Light intensity			

VIDEO SHOW

Tanjore Temple Secrets Part-2

https://www.youtube.com/watch?v=JkQzAnojtvI

How many figures can you see in the image below?

How many figures can you see in the image below?

Answer: If you look closely, you can see both a young and an elderly woman.

MATH TRICK

MULTIPLY ANY TWO DIGIT NUMBER BY 11

Table 1.2: Fundamental physical quantities

Fundamental Quantity	SI unit	SI unit symbol	Dimension
Length	meter	m	L
Mass	kilogram	kg	M
Time	second	s	T
Electric current	ampere	A	I
Temperature	kelvin	k	θ
Light intensity	candela	cd	

Table 1.3: Standard units and symbols

Unit	Symbol	Dimension	Unit	Symbol	Dimension
ampere	A	I	kelvin	K	θ
ampere-hour	Ah	IT	lambert	L	
Ampere-turn	At	I	lumen	lm	
band	Bd	1/T	lux	lx	
bel	B		maxwell	Mx	I/M^2
Coulomb	C	IT	meter	m	M
decibel	dB		mho	mho	T^3I^2/L^2M
degree (angle)	...		neper	Np	
degree (temperature)		θ	newton	N	LM/T
degree (Celsius)	°C	θ	nit	nt	
degree (Fahrenheit)	°F	θ	oersted	Oe	I/M
kelvin	K	θ	ohm	Ω	$L^2 M/T^3 I^2$
dyne	dyn	LM/T	radian	rad	
electronvolt	eV	$L^2 M/T^3 I$	second	s	T
farad	F	T^4I^2/L^2M	siemen	S	T^3I^2/L^2M
foot candle	fc	tesla	T	$M/T^2 I$	
gauss	G	L^2/T^2IM	var	var	L^2M/T^3
gilbert	Gb	I	volt	V	$L^2M/T^3 I$
henry	H	$L^2 I^2 M/T$	voltampere	VA	$L^2 MI/T^3$
hertz	Hz	1/T	watt	W	$L^2 M/T^3$
horsepower	hp	L^2M/T^3	watt-hour	Wh	L^2M/T^2
hour	h	T	weber	Wb	$L^2M/T^2 I$
joule	J	L^2M/T^2			

Table 1.4: Multiplier prefixes

Prefix	Symbol	Multiplier	Decimal Value
atto-	a	10^{-18}	0.000 000 000 000 000 001
femto-	f	10^{-15}	0.000 000 000 000 001
pico-	p	10^{-12}	0.000 000 000 001
nano-	n	10^{-9}	0.000 000 001
micro-	μ	10^{-6}	0.000 001
milli-	m	10^{-3}	0.001
centi-	c	10^{-2}	0.01
deci-	d	10^{-1}	0.1
deca-	da	10^{1}	10
hecto-	h	10^{2}	100
kilo-	k	10^{3}	1000
mega-	M	10^{6}	1000,000
giga-	G	10^{9}	1000,000,000
tera-	T	10^{12}	1000,000,000,000
peta-	P	10^{15}	1000,000,000,000,000
exa-	E	10^{18}	1000,000,000,000,000,000

CLASSIFICATION OF STANDARDS

1. International standards
2. Primary standards
3. Secondary standards
4. Working standards

INTERNATIONAL STANDARDS

- Defined by international agreement
- Periodically evaluated and checked by absolute measurements in terms of fundamental units of physics
- Not available to ordinary users for measurements and calibration

Example:

1. International Ohms
2. International Amperes

INTERNATIONAL STANDARDS

1. International Ohms

- A unit of resistance, equal to that of a column of mercury of uniform cross section that has a length of 160.3 centimeters and a mass of 14.4521 grams at the temperature of melting ice; it has been superseded by the ohm, and is equal to 1.00049 ohms.

PRIMARY STANDARDS

- Principle function of primary standards is the calibration and verification of secondary standards
- Maintained at national standards laboratories in different countries
- Not available for use outside the national laboratory
- Absolute standards of high accuracy
- Used as ultimate standards

SECONDARY STANDARDS

- Basic reference standards used by measurement and calibration laboratories in industries
- Each industry has its own secondary standard
- Periodically calibrated and compared against primary standard at national laboratories
- Certificate issued by national laboratory includes measuring accuracy in terms of primary standard

WORKING STANDARDS

- **Principle tools** of measurement laboratory
- Used to check and calibrate laboratory instrument for accuracy and performance

Example:

Standard resistor

Standard capacitor, etc.,

NATIONAL LABORATORIES

- http://www.nplindia.org
- http://www.npl.co.uk
- https://www.nist.gov

CLASS WORK PROBLEM

1. A _____ is an exact quantity that people agree to use to compare measurements.

2. Which one is accurate? (Primary Standard Quantity / Secondary Standard Quantity)

3. What are the SI unit of the following :

(i) Temperature

(ii) Current

(iii) Luminous intensity of light

(iv) Amount of substance

4. International units of electrical systems are _____

THANK YOU