UNIT 1

PHYSICAL QUANTITIES AND MEASUREMENT

SHORT QUESTIONS

Q.1 What is Science?

Ans: The knowledge gained through observations and experimentations is called science. The word science is derived from the Latin work scientia which mean knowledge.

Q.2 What Physics?

Ans: Physics is that branch of science in which we study matter, energy and their interaction. The laws and principles of physics help us to understand nature.

Q.3 What are the physical quantities?

All measurable quantities are called physical quantities. These are characteristics of every object which are used to be measured to specify them. These characteristics of the object are known as physical quantities.

Example

Length, time, mass, force, speed, volume, density etc.

Q.4 What are the basic characteristics of physical quantities?

A physical quantity possesses at least two characteristics in common.

(i) Numerical magnitude

(ii) Unit in which it is measured.

Q.5 What are the base quantities? (LHR 2012, GRW 2013)

Ans: The physical quantities which form the foundation for other physical quantities are called base quantities. Base quantities are the quantities on the basis of which other quantities are expressed.

Example

These are length, time, mass, electric current, intensity of light, quantity of matter, and temperature. These are seven quantities in total.

Q.6 What are the derive quantities? (LHR 2012, 2013, 2015)

Ans: All the quantities, which can be described in terms of base quantities, are known as derived quantities. The quantities that are expressed in term of base quantities are called derived quantities.

Example

Force, area, volume, density etc.

Q.7 Why a standard unit is needed to measure a quantity correctly?

Ans: To measure a quantity, we need to compare it with some standard quantity. While measuring the physical quantity, we have to see that how many times this quantity is bigger or smaller than the standard quantity. Therefore stand unit is needed to measure a quantity correctly.

Q.8 What do you know about International System of Units (SI)?

Ans: With the development in the field of science and technology, the need for commonly acceptable system of units was seriously felt all over the world particularly to exchange scientific and technical information. The eleventh General Conference on weight and

Measures held in Paris in 1960 adopted a world wide system of measurements called International system of units. The International system of units referred as SI.

Q.9 What are the base units? Write their names and symbols. (GRW 2013)

Ans: The units that describe the base quantities are called base units. Each base quantity has its SI unit. There are seven base units. The following table shows the base quantities and its units.

Quantities		Units	
Name	**Symbol**	**Name**	**Symbol**
Length	*l*	Meter	m
Mass	m	Kilogram	kg
Time	t	Second	s
Electric current	I	Ampere	A
Intensity of light	L	Candela	cd
Temperature	T	Kelvin	K
Amount of a substance	n	Mole	mol

Q.10 What are derived units?

Ans: The units used to measure derived quantities, which are derived from base units, are called derived units.

Example

- Unit of speed is meter per second (ms^{-1}).
- Unit of force is Newton (N).
- Unit of volume is meter cube (m^3)
- Unit of charge is coulomb (C)

Q.11 Why multiples and submultiples are used? Describe some standard prefixes, which are internationally used.

Ans: "The terms used internationally for the multiples and submultiples for various units are known as prefixes". These prefixes are used when we have to measure very small or very large quantities in the Physics. Some of the multiples and submultiples are given as under:

Multiples	Prefix	Symbol
10^{-18}	Atto	a
10^{-15}	Femto	f
10^{-12}	Pico	p
10^{-9}	Nano	n
10^{-6}	Micro	n
10^{-3}	Milli	m
10^{-2}	Centi	c
10^{-1}	Desi	d
10^{1}	Deca	da
10^{2}	Hector	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

Q.12 What do you know about prefixes?

Ans: Multiples and sub-multiples of units can be expressed in terms of prefixes. Prefixes are the words or letters added before SI units.

Examples

- Kilo (k) = 10^3
- Mega (M) = 10^6
- Giga (G) = 10^9
- Milli (m) = 10^{-3}
- Nano (n) = 10^{-9}

Examples of usage of Prefixes

200 000 ms^{-1}	= 200 x 10^3 ms^{-1}	= 200 k ms^{-1}	
4 800 000 W	= 4 800 x 10^3 W	= 4 800 k W	
	= 4.8 x 10^6 W	= 4.8 M Hz	
3 300 000 000 Hz	= 3 300 x 10^6 Hz	= 3 300 M Hz	= 3.3 x 10^9 Hz
			= 3.3 GHz

Q.13 How numbers are expressed in Scientific Notation?

Ans: Very small or very large numbers are expressed conveniently by using the scientific method based as some power of ten multiplied by a number between 1 and 10.

OR

A simple but scientific way to write large or small numbers is to express in some power of ten.

Example

- Distance of moon from the Earth is 384000000 meters which is written in scientific notation as 3.84 x 10^8m
- 0.0045 is written in scientific notation as 4.5 x 10^{-2}

Q.14 What do you know about Meter Rule?

Ans: It is an instrument which is used in laboratories to measure the length of an object or distance between two points.

Scale

It is one meter long which is equal to 100 centimeters. Each centimeter is divided into 10 small divisions called millimeter (mm).

Least count

The least count of meter rule is 1mm. This is the minimum length that can be accurately measured by the meter rule.

Precautions

While measuring the length, or distance with the help of meter rule, we should kept the eye vertically above the reading point. The reading becomes doubtful if the eye is positioned either left or right to the reading point.

Q.15 Explain the statement, "A micrometer screw gauge measures more accurately than a vernier calipers". (GRW 2014)

Ans: A micrometer screw gauge can measure more accurately than a vernier calliper because a micrometer screw gauge can accurately measure up to one hundredth part of a millimeter whereas vernier calipers can only measure accurately up to one tenth part of a millimeter.

Q.16 What do you know about Lever balance?

A lever balance consists of a system of levers. When lever is lifted placing an object in one pan and standard masses on the other pan, the pointer of the lever system move. The pointer is brought to zero by varying standard masses.

Q.17 What is electronic balance? What is its range? And how mass is measured by using electronic balance?

It is an instrument used to measure the mass of the body electronically.

Range

Electronic balance comes in various ranges; milligram ranges, gram ranges and kilogram ranges.

Procedure to measure mass

- Before measuring the mass of the body, it is switched on, and its reading is set to zero.
- Next place the object to be weighted.
- The reading on the balance gives you the mass of the body placed over it.

Q.18 What do you know about Measuring Tape?

Ans: Measuring tapes are used to measure length in meters and centimeters. Measuring tapes are used by blacksmith and carpenters.

Formation

A measuring tape consists of a thin long strip of cotton, metal or plastic. It can measure generally 10 m, 20 m, 50 m, 100 m. Measuring tapes are marked in centimeters as well as in inches.