Chapter 1

Measurements and Experimentation

Exercise 1(A) — Very Short Answer Type

Question 1

What is meant by measurement?

Answer

Measurement is the process of comparison of the given quantity with the known standard quantity of the same nature.

Question 2

What do you understand by the term unit?

Answer

Unit is the quantity of a constant magnitude which is used to measure the magnitudes of other quantities of the same nature.

Question 3

How is a physical quantity expressed?

Answer

A physical quantity is expressed in terms of the following parameters:

The unit in which the quantity is being measured, and

The numerical value which expresses, how many times the above selected unit is contained in the given quantity.

Thus, the magnitude of physical quantity is expressed as : Physical quantity = (numerical value) x (unit)

Question 4

Name the three fundamental quantities.

Answer

The three fundamental quantities are —

Mass

Length

Time

Question 5

What is the S.I. unit of Luminous intensity?

Answer

The S.I. unit of Luminous intensity is candela (cd).

Question 6

Define one parsec.

Answer

One parsec is the distance from where the semi major axis of orbit of earth (1 A.U.) subtends an angle of one second.

Question 7

Define a fundamental unit.

Answer

A fundamental unit is that which is independent of any other unit or which can neither be changed nor can be related to any other fundamental unit.

Example – Units of mass, length, time, temperature, current etc.

Question 8

Define a derived unit.

Answer

Derived units are those which depend on the fundamental units or which can be expressed in terms of fundamental units.

Example: For the measurement of area, we need to measure length and breadth in the unit of length and then express area in a unit which is length x length or (length)2

Question 9

Define standard metre.

Answer

The standard metre is defined in terms of speed of light, according to which, one metre is the distance travelled by light in 1/299,792,458 of a second in air (or vacuum).

Question 10

How is nanometer related to Angstrom ?

Answer

Relation between nanometer (nm) and Angstrom (Å) is expressed as:

1 nanometer = 10 Å

Question 11

Complete the following —

1 light year = _____ m

1 m = _____ Å

1 m = _____ µ

1 micron = _____ Å

1 fermi = _____ m

Answer

1 light year = 9.46 x 1015 m

1 m = 1010 Å

1 m = 106 µ

1 micron = 104 Å

1 fermi = 10-15 m

Question 12

Complete the following —

1g = _____kg

1mg = _____kg

1 quintal = _____kg

1 a.m.u (or u) = _____kg

Answer

1 g = 10-3 kg

1 mg = 10-6 kg

1 quintal = 100 kg

1 a.m.u (or u) = 1.66 x 10-27 kg

Question 13

What is a leap year?

Answer

A leap year is the year in which the month of February is of 29 days.

1 Leap year = 366 days

Every fourth year (i.e., the year divisible by 4) has one day extra in the month of february (i.e., February has 29 days) and so it is the leap year.

Question 14

'The year 2024 will have February of 29 days'. Is this statement true?

Answer

Yes the statement is true.

We know that, if any year is divisible by 4, then it is a leap year and in a leap year, February has 29 days. As, the year 2024 is divisible by 4, so it will have 29 days in February.

Question 15

What is a lunar month?

Answer

A lunar month is the time of one lunar cycle, i.e., it is the amount of time it takes for the Moon to complete one orbit around the Earth and it is nearly equal to 29.5 days.

Question 16

Complete the following —

1 nano second = _____s

1 µs = _____s

1 mean solar day = _____s

1 year = _____s

Answer

1 nano second = 10-9 s

1 µs = 10-6 s

1 mean solar day = 86400 s

1 year = 3.15 x 107 s

Question 17

Name the physical quantities which are measured in the following units —

Answer

Physical quantity related to the unit are as follows —

Unit	Physical quantity
u	Mass
ly	Distance
ns	Time
nm	Length

Question 18

Write the derived units of the following —

Speed

Force

Work

Pressure

Answer

The derived units of the following quantities are as follows —

Quanity	Derived unit
Speed	ms-1
Force	kg m s-2
Work.	kg m2s-2
Pressure	kg m-1s-2

Question 19

How are the following derived units related to the fundamental units?

Newton

Watt

Joule

Pascal

Answer

Derived unit	Fundamental unit
Newton	kg m s-2
Watt	kg m2s-3
Joule	kg m2s-2
Pascal.	kg m-1s-2

Question 20

Name the physical quantities related to the following units —

km2

newton

joule

pascal

watt

Answer

The physical quantities related to the following units are —

Unit	Physical quantity
km2	area
newton	force
joule	energy
pascal.	pressure
watt	power

Exercise 1(A) — Short Answer Type

Question 1

What are the three requirements for selecting a unit of a physical quantity?

Answer

The three requirements for selecting a unit of a physical quantity are —

The unit should be of convenient size.

It should be possible to define the unit without any ambiguity.

The unit should be reproducible.

The value of unit should not change with space and time. (i.e. it must always remain same everywhere).

Question 2

What are the fundamental units in S.I. system? Name them along with their symbols.

Answer

The fundamental units in S.I. system along with their symbols are as follows —

Quantity.	Unit.	Symbol
Length.	metre.	m
Mass	kilograms	kg
Time.	seconds.	s
Temperature.	kelvin	K
Luminous intensity	candela	cd
Electric current	ampere	A
Amount of substance.	mole	mol
Angle	radian	rd
Solid angle	steradian.	st-rd

Question 3

Explain the meaning of derived unit with the help of one example.

Answer

The units of quantities other than those measured in fundamental units, can be expressed interms of the fundamental units and they are called derived units.

Thus, derived units are those which depend on the fundamental units or which can be expressed in terms of the fundamental units.

Example – For the measurement of area, we need to measure length and breadth in the unit of length and then express area in a unit which is:

length x length or (length)2.

Question 4

Name two units of length which are bigger than a metre. How are they related to the metre?

Answer

The units of length which are bigger than a metre are —

Astronomical Unit (A.U.) — One astronomical unit is equal to the mean distance between the earth and the sun. Relation between metre and astronomical unit is expressed as:

$A.U. = 1.496 \times 10^{11} m$

Light year (ly) — A light year is the distance travelled by light in vacuum, in one year. Relation between metre and light year is expressed as:

1 light year = 9.46 x 1015m

Question 5

Name the three convenient units used to measure length ranging from very short to very long value. How are they related to the S.I. unit ?

Answer

The 3 convenient units used to measure length ranging from very short to very long value are —

Centimeter (cm)

Metre (m)

Kilometer (km)

S.I. unit of length is meter (m). Relation between meter (m) and centimeter is —

1 m = 100cm

Relation between meter (m) and kilometer is —

1 km = 1000m

Question 6

Name the S.I. unit of mass and define it.

Answer

The S.I. unit of mass is Kilogram (Kg).

One kilogram is defined as the mass of a cylindrical piece of platinum-iridium alloy kept at International Bureau of Weights and Measures at Serves near Paris.

Question 7

State two units of mass smaller than a kilogram. How are they related to kilogram ?

Answer

The two units of mass smaller than a kilogram (kg) are:

gram (g) — Relation between gram and kilogram is:

1 g = 10-3 kg

milligram (mg) — Relation between miligram and kilogram is:

1 mg = 10-6 kg

Question 8

State two units of mass bigger than a kilogram. Give their relationship with the kilogram.

Answer

The two units of mass bigger than a kilogram (kg) are:

Quintal — It is one hundred times a kilogram. Relation between quintal and kilogram is:

1 quintal = 100 kg

Metric tonne — It is one thousand times a kilogram. Relation between metric tonne and kilogram is:

1 metric tonne = 1000 kg

Question 9

Name the S.I. unit of time and define it.

Answer

The S.I. unit of time is second (s).

A second can be defined as 1/86400th part of a mean solar day,

i.e.,1s=1÷ 86400×one mean solar day

Question 10

Name two units of time bigger than a second. How are they related to second?

Answer

The two units of time bigger than a second (s) are:

Minute (min) — One minute is the duration of 60 seconds. Relation between minute and second is:

1 min = 60s

Hour (h) — One hour is the duration of 60m minutes. Relation between hour and second is:

1 h = 3600s