Chapter = 01

INTRODUCTION TO PHYSICS

What is Natural Philosophy?

The study of nature and its phenomenon in orderly manner is called Natural philosophy. It is earlier observations of man about the world around him.

Give the Classes of Study of nature OR What is difference b/w Biological and Physical science

The study of nature is further divided into two branches

Biological sciences	Physical sciences
The study of living things is called biological sciences.	The study of non-living thins is called physical sciences
For example Zoology, botany etc.	For example physics, chemistry, math

Define Physics.

The branch of Science which deals with the study of matter, energy and their relationship is called **physics**.

Write the Main frontiers of fundamental sciences.

There are **three** main frontiers of fundamental sciences

i. The world of**largest** things like universe
ii. The world of**smallest** things like electrons protons etc.
iii. The world of **middle** sized things, from molecule to Earth. These frontiers are heart of fundamental science.

Give the Areas of Physics?

There are two areas of physics

Disciplinary Areas of Physics: These are the pure branches of Physics like Mechanics, optics, sound etc.

Interdisciplinary areas of physics: These are the branches of Physics link with other fields of sciences like Bio Physics, Astro physics, Chemical Physics.

Define the Branches of Physics (Nuclear, solid state, particle physics and Relativistic mechanics).

There are many Branches of Physics, some of branches are as follows

- The branch of physics which deals with study of atomic nuclei is called **nuclear physics**
- The branch of physics which deals with study of structure and properties of solids is called **solid state** physics
- The branch of physics which deals with elementary particles/ultimate particles is called **particle physics**
- The branch of physics which deals with motion of such objects whose speed is approaching the speed of light is called**relativistic mechanics**.

❖ **Mass is form of energy. How much energy is obtained from one kilogram mass?**

$\text{mass} = 1\text{kg}, C = 3*10^8 \text{ m/s}, E = ?$

$E = mc^2 = 1*(3*10^8)^2 = 9*10^{16} \text{J}$

❖ **What is light year? Write its value.**

The distance which light travel in one year is called light year. Its value is $9.5*10^{15}$ m.

Give the Importance/Role Of Physics in few lines.

- Physics plays an important role in the development of science and technology
- information media and fast mean of communication made the world global village
- The computer networks are product of **silicon chips**
- Silicon is obtained from **sand**

1.2 PHYSICAL QUANTITIES

What are Physical Quantities? Give examples

All measurable quantities are called Physical quantities like mass, temperature, force etc. It has two types, base quantities, and derived quantities.

What are Base Quantities? Give examples.

"The quantities which are not derived from other quantities are called base quantities". Like mass, length, time etc.

What are Derived Quantities? Give examples.

The quantities which are derived from base quantities are called derived quantities. For example force, velocity, acceleration etc.

What are the Steps For Measurement Of Physical Quantity?

There are two steps for measurement of physical quantity

i. Choice of standard
ii. To establish procedure to measuring physical quantity

What are the Characteristics Of An Ideal Standard?

There are **two** characteristics of an ideal standard

i. It is accessible
ii. It is invariable

What is International System Of Units? From which types of units it is built up from?

A system that was established in 1960 which describe the units of physical quantities is called SI. It is built up from three types of unit's base, derived and supplementary units.

Define Base Units. Write the table for base units.

The units of base quantities are called base units. There are **seven** base units in SI

No	Quantity	Unit	Symbol
01	Length	Meter	m
02	Mass	Kilogram	kg
03	Time	Second	s
04	Temperature	Kelvin	k
05	Electric current	Ampere	a
06	Intensity of light	Candela	cd
07	Amount of substance	Mole	mol

Define Derived Units. Give examples.

The units of derived quantities are called derived units. Like unit of force is newton, unit of pressure is Pascal.

What are Supplementary Units? OR Define Radian and Steradian.

"The units which were not classified in SI as either base or derived units called supplementary units". There are two types of supplementary units which are as follows.

Radian: Plane angle b/w two radii of a circle whose arc length is equal to radius of circle is called radian. It is two dimensional angle.

Steradian: Solid angle subtended at the center of sphere whose area is equal to square of its radius is called Steradian. It is three dimensional angle whose value is 4π

Quantity	Unit	Symbol	Value	Dimensional
Plane angle	**Radian**	Rad	2π	Two
Solid angle	**Steradian**	Sr	4π	Three

What is Scientific Notation? give example

Such a technique in which numbers are expressed in standard form by using the power of ten is called scientific notation. Like 134.7 is written as $1.347*10^2$, 0.0023 is $2.3*10^{-3}$.

Write the Conventions for indicating units?/ Rules for writing units.

There are following conventions of indicating units

i. Full name of unit does not starts with capital letter if named after scientist e.g newton, ampere etc
ii. The symbol of unit after a scientist has initial capital letter e.g N for newton
iii. Prefixes should be used before unit like mA, micro meter etc
iv. Combination of base unit is written with one space apart e.g N m
v. Compound prefixes are not allowed, $10^{-3}*10^{-3}$ A, we cannot write it mmA. Its correct form is 10^{-6} A (microA)
vi. When a multiple of base unit is raised to power of ten then power is applied to whole multiple not on base unit alone like $1Km^2=(10^3m)^2=10^6m^2$.

PREFIXES TABLE					
Prefix	**Factor**	**Prefix**	**Factor**	**Prefix**	**Factor**
Atto	10^{-18}	Milli	10^{-3}	Killo	10^{3}
Femto	10^{-15}	Centi	10^{-2}	Mega	10^{6}
Pico	10^{-12}	Deci	10^{-1}	Giga	10^{9}
Nano	10^{-9}	Deca	10^{1}	Tera	10^{12}
Micro	10^{-6}	Hecto	10^{2}	Peta	10^{15}
				Exa	10^{18}

What is error? Write causes of error also differentiate b/w Random error and Systematic error.

Error: Difference of actual and observed value is called error. Error=Actual value- observed value

Causes of error: There are following causes of error

i. Negligence of person
ii. Inexperience of a person
iii. Faulty apparatus
iv. Incorrect method or technique

Types of Error: There are following types of errors

Random Error	Systematic error
Such an error which occur when repeated measurements give different values under same condition is called **random error**.	Such an error which occur due to faulty apparatus as zero error in instrument is called **systematic error.**
It is removed by taking the average of several readings.	It is removed by applying correction factor.

What are Significant Figures? Write the rules of significant figures. Also describe the rules for rounding off a number

Definition: In any measurement, the accurately known digit and first doubtful digit are called significant figures.

Rules of significant figures: There are following rules of significant figures

i. All digits 1,2,3,4,5,6,7,8,9 are significant
ii. Zero may or may not be significant
iii. Zero b/w two significant figure is significant like 102, 1.003 etc.
iv. Zero to left of significant figures is not significant like 0.003 has one significant
v. Zero to right of significant figures may or may not be significant, in decimal fraction zero to right is significant like 3.40, in this 0 is significant but in case of integers it is found by accuracy of measuring instrument.
vi. In measurement in scientific notation, the figures other than the power of ten are significant like $8.70*10^3$ has 03 significant figures

Rules for Rounding off a Number: There are following rules of rounding off a number

i. If the first digit is less than 5 then last digit retained should not change. i.e. 3.23 is round off as 3.2
ii. If the first digit is greater than 5 then last digit retained is increased by one like 3.56 is round off as 3.6
iii. If the last digit is 5 then previous digit is increased one if it odd, and no change if it is even like 3.75 as 3.8 and 3.45 as 3.4

Important rule: In multiplying or dividing numbers, keep a number of significant figures in the product or quotients not more than that contained in the factor containing least number of significant figures. Also in addition and subtraction For example

$\frac{5.348*10^{-2}*3.64*10^{4}}{1.336}=1.45768982*10^{3}$, In this the factor $3.64*10^{4}$ least accurate three significant figures so the answer should be written up to three significant figures so correct ans is $1.46*10^{3}$

$72.1+3.42+0.003=75.523$ is rounded off as 75.5, $2.7543+4.10+1.273=8.1273$ is rounded off 8.13

What is Precision And Accuracy? OR What is difference b/w Precision and Accuracy?

Precision	Accuracy
The least count of measuring instrument is called precision and measurement which has less absolute uncertainty is called precise measurement	The measurement which is less fractional or percentage uncertainty is called accurate. This property is called accuracy.
Smaller the least count more precise will be the measurement.	Accuracy means how a measured value is close to the actual value

What are Absolute uncertainty, Fractional uncertainty and Percentage uncertainty?

These have following formulas

Least count= Absolute uncertainty,

For example least count of Vernier calipers is 0.1 cm this is absolute uncertainty or precision

$$\text{Fractional uncertainty} = \frac{\text{least count}}{\text{measurment}}$$

$$\text{Percentage uncertainty} = \frac{\text{least count}}{\text{measurment}} * 100$$

Example 01: For example for instrument L.C=0.1 Cm Measurement=25.5cm calculate uncertainties

Absolute uncertainty= 0.1 cm

$$\text{Fractional uncertainty} = \frac{0.1\,\text{cm}}{25.5\,\text{cm}} = 0.004 \qquad \text{Percentage uncertainty} = \frac{0.1\,\text{cm}}{25.5\,\text{cm}} * 100 = 0.4\%$$

Example 02: For example for instrument L.C=0.01 Cm Measurement=0.45 cm calculate uncertainties

Absolute uncertainty= 0.01 cm

$$\text{Fractional uncertainty} = \frac{0.01\,\text{cm}}{0.45\,\text{cm}} = 0.002 \qquad \text{Percentage uncertainty} = \frac{0.01\,\text{cm}}{0.45\,\text{cm}} * 100 = 2\%$$

Assessment Of Total Uncertainty In Final Result

The total uncertainty in the final result is calculate in different cases, which are as follows

i. In case of Addition and Subtraction

Rule: "Absolute Uncertainties are added".

For example, distance $x_1=10.5\pm0.1$cm, $x_2=26.8\pm0.1$cm, then $x=x_2-x_1=((26.8-10.5)\pm(0.1+0.1))=16.3\pm0.2$cm

ii. In case of Multiplication and Division

Rule: "Percentage uncertainties are added"

For example:

$V = 5.2 \pm 0.1\,\text{V}$ $\quad$ $I = 0.84 \pm 0.05\text{A}$ Calculate the value of of R with uncertainty

$$\%\text{ uncertainty in V} = \frac{0.1}{5.2} * 100 = 2\% \qquad \%\text{ uncertainty in I} = \frac{0.05}{0.84} * 100 = 6\%$$

$$R = \frac{V}{I} = \frac{5.2}{0.84} = 6.19 \approx 6.2 \text{ and in this \% uncertainties are added so total uncertainty} = 2\% + 6\% = 8\%$$

correct value of $R = (6.2 \pm 8\%)$ ohm OR $R = 6.2 \pm 0.5$ ohm $\quad$ As (8% of 6.2 is 0.5)

iii. In Case Of Power Factor

Rule: Multiply the percentage uncertainty by that power

For Example: consider we want to calculate the volume of sphere then % uncertainty in Volume is calculate by the formula as the volume of sphere=$4/3\pi r^3$ so

%uncertainty in volume= 3*%uncertainty in radius(r)

If there area of sphere then $A=4\pi r^2$, %uncertainty in area=2*%uncertainty in r

Suppose if in measurement we have percentage uncertainty in radius is 2%, then we have

%uncertainty in Volume=3*2%=6% and % uncertainty in Area=2*2%=4% etc.

iv. In Case of average value of Many Measurement

Rule: Uncertainty in average value is the mean deviation

This rule is explained by following solved example

Six readings of micrometer screw gauge to measure the diameter are 1.20, 1.22, 1.23, 1.19, 1.22, and 1.21

Step 01: Find the average value of measured values

$$\text{Average} = \frac{1.20+1.22+1.23+1.19+1.22+1.21}{6} = 1.21\,\text{mm}$$

Step 02: Find deviation of each measured value from average value (take difference of each value and average value) which is 0.01, 0.01, 0.02, 0.02, 0.01, and 0.00

Step 03: To calculate the mean deviation

$$\text{Mean Deviation} = \frac{0.01+0.01+0.02+0.02+0.01+0.00}{6} = 0.01\,\text{mm. This is uncertainty}$$

v. In Case of timing Experiment

Rule: The uncertainty in timing experiment is calculated by dividing the least count of stop watch by number of vibrations i.e uncertainty in time period=least count/ No vibrations

For example: Time of 30 vibrations of simple pendulum is 54.6 sec with least count of stop watch 0.1 sec

Uncertainty in time period= least count/ no of vibrations=0.1 sec/30=0.003 sec and

Time period =54.6/30=1.82sec, so correct time period will be T= (1.82±0.003) s

- **How many colors are used in color printing?**

There are four colors are used in color printing cyan, magenta, yellow, black.

- **Give Travel time of light**

Moon to Earth 1 min 20 sec	Sun to Earth 8 min 20 sec	Pluto to Earth 5 h 20 sec

What are the Dimensions of Physical Quantities?

Definition: Such a technique in which each physical quantity is represented by specific symbols written enclosed a square bracket is called dimension.

The dimension of length= [L], The dimension of Mass=[M], The dimension of time=[T]

It stands for qualitative nature of physical quantity

Examples of Dimensions

There are following examples of dimensions

The dimension of speed or velocity, speed=length/time=[L]/[T]=[LT^{-1}]

The dimension of acceleration=a=velocity/time= [L/T]/[T]=[LT^{-2}]

The dimension of force=F=ma=[M] [LT^{-2}]= [MLT^{-2}]

The dimension of work=W=Fd= [MLT^{-2}] [L] = [ML^2T^{-2}], The dimension of power=W/t= [ML^2T^{-2}]/[T]= [ML^2T^{-3}] etc.

Uses of dimension: There are following uses of Dimension

1. To check the homogeneity of physical equation OR Principle of homogeneity

To check the homogeneity of equation, we take dimension on both side of equation, if the equation are same on both sides then it is homogeneous and correct otherwise not. This is called principle of homogeneity.

2. To Derive the possible formula: To derive a relation for physical quantity depends upon the correct JXHVV RI YDULRXV IDFWRU RQ ZKLFK SK\VLFDO TXDQWLW\GHS

Exercise short Questions

1: Name several repetitive phenomenon's occurring in nature which could serve reasonable time standards?

The phenomenon which repeat itself in equal interval of time is called repetitive phenomenon

i. Rotation of Earth around the sun and its own axis
ii. Rotation of moon around Earth
iii. Shadow of an object
iv. Sun rise and sun set

2: Give the drawbacks to use the period of a pendulum as a time standard?

As the time period of simple pendulum is $T = 2\pi\sqrt{\frac{l}{g}}$ the drawbacks to use the time period of a pendulum as a time standard are

i. The value of 'g' changes place to place
ii. Length of pendulum is changed due to change in temperature in different seasons.
iii. Air resistance may affect the time period of simple pendulum

3: Why do we find it useful to have two units for the amount of substance, the kilogram and the mole?

Kilogram is used at macro level and mole is used at micro level. Mole is used when we concerned with number particles as one mole of different substance contain same number of particles but one kilogram of different substa have different number of particles.

4. Three students measured the length of a needle with a scale on which minimum division is 1mm and recorded as (i) 0.2145m (ii) 0.21m (iii) 0.214m which record is correct and why?

The record (iii) is correct.

Reason: As the scale used for measurement has the least count of 1 mm = 0.001 m. So the reading must be taken up to three decimal places when it is written in meters. Therefore, the reading 0.214 m is correct.

5. **An old saying is that "A chain is only as strong as its weakest link". What analogous statement can you make regarding experimental data used in a computation**?

"The results of experimental data are much accurate when its reading contain minimum error". This is analogous statement.

6: The period of simple pendulum is measured by a stop watch. What types of errors are possible in the time period?

There are two types of errors are possible

i. **Systematic error**: (due to fault or zero error in stop watch)
ii. **Personal & Random error**: due to negligence and inexperience of person like at the time to stop or start of stop watch.

7. **Does a dimensional analysis give any information on constant of proportionality that may appear in an** algebraic expression? Explain?

Dimensional analysis does not give any information about constant of proportionality in any expression. This consta can be determined experimentally. It provides the information about units of dimensional constant.

8: Write the dimensions of (i) Pressure (ii) Density?

$$\text{Pressure} = \frac{Force}{area} = \frac{[F]}{[A]} = \frac{[ma]}{[A]} = \frac{[MLT^{-2}]}{[L^2]} = [ML^{-1}T^{-2}]$$

$$Density = \frac{mass}{volume} = \frac{[M]}{[L^3]} = [ML^{-3}]$$

9. The wavelength λ of a wave depends on the speed v of the wave and its frequency f. knowing that $[\lambda] = [L]$ $[V] = [LT^{-1}] and [f] = [T]^{-1}$ **decide which of the following is correct,** $f = v\lambda$ $\quad f = \frac{v}{\lambda}$.

$f = v\lambda$ taking dimension on both sides

$[T^{-1}] = [LT^{-1} * L] = [L^2T^{-1}]$

$L.H.S \neq R.H.S$

$f = \frac{v}{\lambda}$ taking dimensions on both sides

$[T^{-1]} = \frac{[LT^{-1}]}{[L]} = [T^{-1}]$ $\qquad L.H.S = R.H.S$ so it is correct

Numerical problems

1.1: A light year is the distance light travels in one year. How many meters are there in one light year: (speed of light = $3.0 \times 10^8 ms^{-1}$).

Given data : Time = t = 1 year = 365 days = 365 * 24h = 365 * 24 * 60 * 60 s, $c = V = 3 * 10^8$ m/s

Sol : Distance = S = ? , S = Vt = $(3 * 10^8 \text{ m/s})(365 * 24 * 60 * 60 \text{ s}) = 9.46 * 10^{15} \text{ m} \approx 9.5 * 10^{15}$ m

1.2: A) How many seconds are there in 1 year?

Sol : time = 1year = 365 days = 365 * 24 hours = 365 * 24 * 60 min = 365 * 24 * 60 * 60 sec = $3.1536 * 10^7$ sec

B) How many nanoseconds in 1 year?

sol : 1 year = $31536 * 10^7$ sec, As we know that nano = 10^{-9} so divide and multiply by 10^{-9}

$$1year = \frac{31536 * 10^7 * 10^{-9}}{10^{-9}} \sec = \frac{31536 * 10^7 \text{ nano sec}}{10^{-9}} = 31536 * 10^{7+9} \text{ nano sec} = 31536 * 10^{16} \text{ nano sec}$$

C) How many years in 1 second?

sol : As 1 year = $3.1536 * 10^7$ sec, then $1 \sec = \frac{1 \text{year}}{3.1536 * 10^7} = 3.17 * 10^{-8}$ year

1.3: The length and width of a rectangular plate are measured to be 15.3cm and 12.80cm, respectively. Find the area of the plate.

Given data : Length = L = 15.3 cm, Width = W = 12.80 cm, Area of rectangular plate = ?

Sol : Area = A = L * W = 15.3cm * 12.8cm = $195.84 \text{ cm}^2 \approx 196 cm^2$

1.4: Add the following masses given in kg upto appropriate precision.2.189, 0.089, 11.8 and 5.32?

Given Data : $m_1 = 2.189$kg, $m_2 = 0.089$kg, $m_3 = 11.8$kg, $m_4 = 5.32$kg, total mass = m = ?

solution : $m = m_1 + m_2 + m_3 + m_4 = 2.189\text{kg} + 0.089\text{kg} + 11.8\text{kg} + 5.32\text{kg} = 19.398 \approx 19.4$ kg

1.5: Find the value of 'g' and its uncertainty using $T = 2\pi\sqrt{\frac{l}{g}}$ form the following measurements made during an experiment, Length of simple pendulum l = 100cm. Time for 20vibrations = 40.2s.

Given data : length = L = 100cm = 1m, time for 20 vib = 40.2 sec, T = 40.2/20 = 2.01 sec, g = ?

$$\text{solution : Using } T = 2\pi\sqrt{\frac{L}{g}} \Rightarrow T^2 = 4\pi^2\frac{L}{g} \Rightarrow g == \frac{4\pi^2 L}{T^2} = \frac{4(3.14)^2 * 1}{(2.01)^2} = 9.76ms^{-2}$$

1.6: What are the dimensions and units of gravitational constant G in the formula $F = G\frac{m_1\ m_2}{r^2}$.

$$\text{Given : } F = G\frac{m_1\ m_2}{r^2}, \text{unit of G = ? Dimension of G = ? As } G = \frac{F * r^2}{m_1\ m_2}$$

$$\text{solution : unit of } G = \frac{F * r^2}{m_1\ m_2} = \frac{N * m^2}{Kg * Kg} = \frac{Nm^2}{Kg^2} = Nm^2Kg^{-2}$$

$$\text{dimension of } G = \frac{F * r^2}{m_1\ m_2} = \frac{[MLT^{-2}][L^2]}{[M][M]} = \frac{[T^{-2}][L^3]}{[M]} = [M^{-1}L^3T^{-2}]$$

1.7: Show that the expression $V_f = V_i + at$ is dimensionally correct, where V_i is the velocity at t =0, a is acceleration and V_f is the velocity at time t.

solution : $[V_f] = [LT^{-1}]$ - - - - - (1) Where $Vi + at = [LT^{-1}] + [LT^{-2}][T] = [LT^{-1}] + [LT^{-1}]$ - - - (2)

from equation (1) and (2) both have same dimensions, so it is dimensionally correct

1.8: The speed v of sound waves through a medium may be assumed to depend on (a) the density ρ of the medium and (b) its modulus of elasticity E which is the ratio of stress to strain. Deduce by the method of dimensions, the formula for the speed of sound.

$v \propto \rho^a E^b$

$v = \text{Constant}\ \rho^a E^b$ − − − − − − − − − −(1)

$[v] = [LT^{-1}]$, $[\rho\rho = [ML^{-3}]$, $[E]$ = stress/strain $= [ML^{-1}T^{-2}]$, puttingin eq (1)

$[LT^{-1}] = \text{Constant}\ [ML^{-3}]^a[ML^{-1}T^{-2}]^b$

$[LT^{-1}] = \text{Constant}\ [M^aL^{-3a}][M^bL^{-b}T^{-2b}]$

$[M^oLT^{-1}] = \text{Constant}\ [M^{a+b}L^{-3a-b}T^{-2b}]$

comparing powers

$T^{-2b} = T^{-1} \Rightarrow -2b = -1 \Rightarrow b = 1/2$

$M^o = M^{a+b} \Rightarrow a + b = 0 \Rightarrow a = -b \Rightarrow a = -1/2$

Putting the value of a and b in equation (1)

$v = \text{Constant}\ \rho^{-1/2}E^{1/2}$

$$v = \text{Constant}\ \frac{E^{1/2}}{\rho^{1/2}} = \text{Constant}\ (\frac{E}{\rho})^{1/2}$$

$$v = \text{Constant}\sqrt{\frac{E}{\rho}}$$

1.9: Show that the famous "Einstein equation" E = mc² is dimensionally consistent.

As work is stored in form of energy so $W = E = Fd = [MLT^{-2}][L]$

$[E] = [ML^2T^{-2}]$----------------------(1)

$mc^2 = [M][LT^{-1}]^2 = [M][L^2T^{-2}] = [ML^2T^{-2}]$------(2)

comparing both equation L.H.S = R.H.S, this proves that equation is dimensionally consistent.

1.10: Suppose, We are told that the acceleration of a particle moving in a circle of radius r with uniform speed v is proportional of r, say **r, and some power of v, say v^m, determine the powers of r and v?**

Let $a \propto r^n v^m$

$a = \text{constant}\, r^n v^m$

$[LT^{-2}] = \text{constant}\,[L]^n [LT^{-1}]^m$

$[LT^{-2}] = \text{constant}\,[L^n[L^mT^{-m}]$

$[LT^{-2}] = \text{constant}\,[L^{n+m}T^{-m}]$

comparing powers of L and T

$T^{-m} = T^{-2}$

$m = 2$

$L^{n+m} = L \Rightarrow n + m = 1 \Rightarrow n + 2 = 1 \Rightarrow$

$n = -1$

Multiple Choice Questions

1) According to Einstein 1kg mass is converted to energy

$9*10^9$ J	**$9*10^{16}$ J**	$9*10^{15}$ J	$9*10^{17}$ J
Sol: $m = 1kg, c = 3*10^8$ m/s as $E = mc^2$ putting values of m and c to get the result			

2) Color printing uses colors

Three	**Four**	Five	Seven

3) Which colors are used in color printing?

Cyan	Magenta	Yellow &black	**All of these**

4) Travel time of light from moon to earth is

1 min 20 sec	8 min 20 sec	5 hour 20 sec	None of these

5) Travel time of light from sun to earth is

1 min 20 sec	**8 min 20 sec**	5 hour 20 sec	None of these

6) Travel time of light from Pluto to earth is

1 min 20 sec	8 min 20 sec	**5 hour 20 sec**	None of these

7) Which of the following primary standard for the unit of time used in Colorado (USA)?

Radio telescope	**Cesium atomic frequency standard**	Technology meter	Hour technology

8) Age of universe is

$5*10^{17}$ sec	$1.4*10^{17}$ sec	$1*10^{-6}$ sec	$8.6*10^4$ sec

9) Age of earth is

$5*10^{17}$ sec	**$1.4*10^{17}$ sec**	$1*10^{-6}$ sec	$8.6*10^4$ sec

10) Period of typical radio waves is

$5*10^{17}$ sec	$1.4*10^{17}$ sec	**$1*10^{-6}$ sec**	$8.6*10^4$ sec

11) One day is equal to

$5*10^{17}$ sec	$1.4*10^{17}$ sec	$1*10^{-6}$ sec	**$8.6*10^{4}$ sec**

12) Light year is the unit of

Distance	Time	Speed	None of these

13) Time between normal heartbeats is

$8*10^{-1}$ sec	$8*10^{-2}$ sec	$8*10^{-3}$ sec	$8*10^{-4}$ sec

14) Period of audible sound waves is

$1*10^{-3}$ sec	$1*10^{-6}$ sec	$1*10^{-9}$ sec	$1*10^{-13}$ sec

15) Period of vibration of an atom in a solid is

$1*10^{-3}$ sec	$1*10^{-6}$ sec	**$1*10^{-13}$ sec**	$1*10^{-16}$ sec

16) Period of visible light waves is

$1*10^{-13}$ sec	$1*10^{-6}$ sec	**$2*10^{-15}$ sec**	$5*10^{17}$ sec

17) Which of the following is not unit of time?

Second	**Light year**	Hour	Minutes

18) One light year is equal to

$9.5*10^{15}$ m	$3.1*10^{7}$m	$1*10^{-6}$ sec	$8.6*10^{4}$ sec
Hint: See solution of numerical no 1.1, by applying formula S=vt, v is speed of light t is 1 year is time			

19) 1 year is equal to One day is equal to

$5*10^{17}$ sec	**$3.1*10^{7}$sec**	$1*10^{-6}$ sec	$8.6*10^{4}$ sec
Hint: 1 year=365 days=365*24 hours=365*24*60 min=365*24*60*60 sec=31536000 sec=$3.1*10^{7}$sec			

20) Force in terms of base units is written as

$Kgms^{1}$	**$Kgms^{-2}$**	kgms	$Kgms^{-3}$

21) The units of E in $E=mc^2$ are

$Kgms^{1}$	**$Kgm^{2}s^{-2}$**	kgms	$Kgms^{-3}$

22) 1 atto is equal to

10^{15}	**10^{-18}**	10^{-12}	10^{-9}

23) 1 femto is equal to

10^{-15}	10^{-18}	10^{-12}	10^{-9}

24) 1 Pico is equal to

10^{15}	10^{18}	**10^{-12}**	10^{-9}

25) 1 nano is equal to

10^{15}	10^{18}	10^{12}	**10^{-9}**

26) 1 micro is equal to

10^{15}	10^{18}	10^{12}	**10^{-6}**

27) 1 milli is equal to

10^{15}	10^{18}	**10^{-3}**	10^{-9}

28) 1 centi is equal to

10^{6}	10^{9}	**10^{-2}**	10^{9}

29) 1 deci is equal to

10^{6}	10^{9}	**10^{-1}**	10^{9}

30) 1 deca is equal to

10^{1}	10^{-9}	10^{-1}	10^{9}

31) 1 killo is equal to

10^{3}	10^{9}	10^{6}	10^{12}

32) 1 mega is equal to

10^3	10^9	**10^6**	10^{12}

33) 1 giga is equal to

10^3	**10^9**	10^6	10^{12}

34) 1 tera is equal to

10^{15}	10^{18}	**10^{12}**	10^6

35) 1 peta is equal to

10^{15}	10^{18}	10^{12}	10^6

36) 1 exa is equal to

10^{15}	**10^{18}**	10^{12}	10^6

PAST PAPERS SOLVED MCQS

	Questions	Option A	Option B	Option C	Option D
1).	The percentage uncertainty in mass and velocity are 2% and 3%, the maximum uncertainty in measurement of K.E	11%	**8%**	6%	1%
2).	The term 134.7 can be written as	$1.347*10^3$	**$1.347*10^2$**	$1.347*10^1$	$1.347*10^4$
Apply formula for power factor, which is= power x % uncertainty and for multiplication % uncertainties are added. As K.E=1/2 mv^2, as power of mass is 1 and velocity is 2 so= % uncertainty in K.E= 1*%uncertainty of mass+2*%uncertainty in velocity=1*2%+2*3%=2%+6%=8%					
3).	Solid angle subtends at the center of sphere	2π	6π	8π	**4π**
4).	Significant figures in "1.00110" are	3	1	7	**6**
5).	In scientific notation number "0.0001" written as	10^{-3}	10^3	**$1*10^{-4}$**	$1*10^4$
6).	The quantities which can be measured accurately are	Base quantities	Derived Quantities	**Physical Quantities**	Supplementary quantities
7).	SI unit of co-efficient of viscosity is	Kgm/s	**$Kgm^{-1}s^{-1}$**	$Kgms^{-2}$	None of these
8).	0.00467 has significant figures	2	**3**	4	5
9).	Absolute uncertainty in a measuring instrument is equal to	Accuracy	**Least count**	Fractional uncertainty	Percentage uncertainty
10).	According to Einstein $E=mc^2$ equation 1kg mass equal to energy	$3x10^8$ J	**$9x10^{16}$J**	$9x10^8$ J	$9x10^{-16}$ J
$m = 1kg, c = 3*10^8$ m/s as $E = mc^2$ $E=1*(3*108)^2=9*10^{16}$ J					
11).	The dimension $[ML^0T^0]$ represents the	Length	**Mass**	Time	Force
12).	Name the quantity which can be measured by using base unit 'kgm^2s^{-3}'	Weight	**Power**	Pressure	Work
13).	Absolute uncertainty in measuring instrument is equal to	**Least count**	Fractional uncertainty	Accuracy	% uncertainty
14).	The dimension of density are	**$[ML^{-3}]$**	$[ML^2T^{-2}]$	$[MLT^{-1}]$	$[ML^2T^{-1}]$
15).	The number of significant figures in "$8.100x10^3$" Kg are	2	3	**4**	7
16).	The dimension of quantity light year is	**[L]**	[T]	[M]	None of these
17).	What is the correct record for the diameter of wire when measured	2.3cm	2.31cm	**2.312cm**	2.3124cm

	by screw gauge of least count of 0.001cm				
	As least count =0.001 cm According to rule correct readings will upto three decimal places				
18).	A light year is the unit for	**Distance**	Time	Speed	Velocity
19).	The formula for electric field strength is E = F/Q', where E is electric field strength and F is force and Q is charge. Which one of the following options gives the correct base units for electric field strength?	**$kgms^{-3}A^{-1}$**	$kg^2m^{-2}s^{-3}A$	$kgs^{-2}A^{-3}$	$ms^{-1}A^{-3}$
Unit of force is $kgms^{-2}$ and charge As, put in formula $E=kgms^{-2}/As= kgms^{-3}A^{-1}$					
20).	Which is not base unit in these?	Kilogram	**Joule**	Ampere	Kelvin
21).	The principle of homogeneity of dimensions determines	Only variable in the equation	**Correctness of an equation**	Only constant in the equation	Constant and variable in the equation
22).	Force in terms of base units is written as	Kgm/s	**$Kgms^{-2}$**	Kgm^2s^{-2}	Js
23).	When the dimensions of both sides of an equation are equal, then the equation is said to be	Simultaneous	Instantaneous	**Homologous**	Quadratic
24).	The wavelength 'λ' of a wave depends on the speed 'v' of the wave and its frequency 'f'. Decide which of the following is correct?	$f = v\lambda$	**$f = v/\lambda$**	$f = \lambda/v$	$f = v\lambda$-2
25).	The dimension power are	$[ML^3T^{-2}]$	$[ML^2T^{-2}]$	**$[ML^2T^{-3}]$**	$[ML^2T^{-1}]$
26).	SI unit of pressure in terms of base units is	**$Kgm^{-1}s^{-2}$**	Kgm/s	Kgm^2s^{-2}	Pacal
27).	Dimension of moment arm is	**[L]**	[M]	[LT]	[T]
28).	An observer notes reading of scale from different angles (parallax) while measuring the length of wire, what type of error is possible	Systematic error	Precised error	**Random error**	Zero error
29).	Which of the following is least multiple?	Pico	Femto	**Atto**	Nano
30).	Which one is the highest power multiple?	Giga	**Tera**	Mega	Deca
31).	Which set of the prefixes gives values in increasing der?	Pico, Mega, Kilo, Tera	Tera, Pico, Micro, Kilo	**Pico, Micro, Mega, Giga**	Giga, Kilo, Milli, Nano
Pico=10^{-12}, micro=10^{-6}, mega=10^6, giga=10^9					
32).	The sum of three number 2.7543, 4.10, 1.273 upto correct decimal places	8.12	**8.13**	8.1273	8.127
According to rule of significant figures in addition or subtraction answer should be written upto least significant figures which are multiply or divided. So in this least significant term of 3 digits so ans will be correct upto 3 digits					
33).	Dimension of force is	$[ML^{-3}]$	**$[MLT^{-2}]$**	$[MLT^{-1}]$	$[ML^2T^{-1}]$
34).	The dimensional ratio of work to power is	Joule	Killo watt hour	**T**	L
35).	A student is calculating the area of rectangular sheet whose length and	$602.64cm^2$	$602.6\ cm^2$	$602\ cm^2$	**$603cm^2$** A=l*W 27.9*21.6=602.64=603

	width are 27.9cm and 21.6cm, find correct value?				
According to rule of significant figures in multiplication or division answer should be written upto least significant figures which are multiply or divided. So in this least significant term of 3 digits so ans will be correct upto 3 digits					
36).	Which of the following pair have same dimension	Work and power	**Work and torque**	Momentum and energy	Power and pressure
37)..	For a student measured the length of needle whose least count is 1mm, what is correct reading?	0.2145m	0.21m	**0.214m**	0.2m
As least count 1mm=1/1000=0.001 m According to rule correct readings will upto three decimal places					
38).	The ratio of dimension of K.E and power is	1:1	**T:1**	$1:T^{-1}$	M:T
As dimension of K.E=$[ML^2T^{-2}]$ and power=$[ML^2T^{-3}]$ taking ratio of these dimensions					
39).	Which of the following is dimensionless quantity?	Stress	**Strain**	Surface tension	Pressure
40).	In 5.47*19.89=108.7983 answer should be written as	0.18.8	108.9	**109**	108.79
According to rule of significant figures in multiplication or division answer should be written upto least significant figures which are multiply or divided. So in this least significant term of 3 digits so ans will be correct upto 3 digits					
41).	How many seconds are there in one year	$3.156*10^6$ s	$3.1536*10^8$ s	$3.1536*10^{10}$ s	**$3.1536*10^7$s**
Time=1year=365 days=365*24hour=365*24*60min=365*24*60*60=31536000 s=$3.1536*10^7$ s					
42).	Zero error belongs to	Personal error	Random error	**Systematic error**	Collective error
43).	Light year is a measure of	Force	Light intensity	**Distance**	Speed
44).	The units of E in E=mc^2 are	$Kgms^1$	**Kgm^2s^{-2}**	kgms	$Kgms^{-3}$
As E is energy the unit of energy is above given in ans					