UNIT # 1

PHYSICAL QUANTITIES

AND MEASUREMENT

ClassNotes

Q1. Define Science?

Ans: Science:

The knowledge gained through observations and experimentations is called Science. The word science is derived from the Latin word scientia, which means knowledge. Not until eighteenth century, various aspect of material objects were studied under a single subject called natural philosophy.

Q2. Describe the division of science into two main streams?

Ans: Division of science:

As the knowledge increased, it was divided into two main streams.

i. Physical sciences:

Physical sciences - which deal with the study of non-living things.

ii. Biological: sciences:

Biological sciences - which are concerned with the study of living things.

Q3. Define Physics?

Ans: Physics:

Physics is that branch of science which deals with the study of properties of matter energy and their mutual relationship.

Q4. Describe the different branches of physics?

Ans: Branches of physics:

i. Mechanics:

It is the study of motion of objects, its causes and effects.

ii. Heat:

Deals with the nature of heat modes of transfer and effects of heat.

iii. Sound:

It deals with, the physical aspects of sound waves, their production, properties and applications.

iv. Light (Optics):

It is the study of physical aspects of light, its properties, working and use of optical instruments.

v. Electricity and Magnetism:

It is the study of the charges at rest and in motion, their effects and their relationship with magnetism.

vi. Atomic Physics:

It is the study of the structure and properties of atoms.

vii. Nuclear Physics:

It deals with the properties and behavior of nuclei and the particles within the nuclei.

viii. Plasma Physics:

It is the study of production, properties of the ionic state of matter - the fourth state of matter.

ix. Geophysics:

It is the study of the internal structure of the Earth.

Q5. Describe the Lord Kelvin statement?

Ans: Kelvin statement:

When you can measure what you are speaking about and express it in numbers, you know something about it. When you cannot measure what you are speaking

about or you cannot express it in numbers, your knowledge is of a meager and of unsatisfactory kind.

FOR YOUR INFORMATION



Andromeda:

Andromeda is one of the billions of galaxies of known universe.

Q6. Describe the crucial role of physics in science, technology and society?

Ans: Crucial role of physics in science, technology and society:

The rapid progress in science during the recent years has become possible due to the discoveries and inventions in the field of Physics. The technologies are the applications of scientific principles. Most of the technologies of our modern ° society throughout the world are related to Physics.

Examples:

1. A car is made on the principles of mechanics and a refrigerator is based on the principles of thermodynamics.

2. Consider pulleys that make it easy to lift heavy loads.

3. Electricity is used not only to get light and heat but also mechanical energy that drives fans and electric motors etc.

4. Consider the means of transportation such as car and aero planes; domestic appliances such as air-conditioners, refrigerators, vacuum-cleaners, washing, machines, and microwave ovens etc.

5. Similarly, the means of communication such as radio, TV, telephone and computer are the result of applications of Physics. These devices have made out lives much easier, faster and more comfortable than the past.

6. Mobile phone allows us to contact people anywhere in the world and to get latest worldwide information. We can take and save pictures, send and receive messages of our friends. We can also receive radio transmission and can use it as e calculator as well.

Q7. List the harmful effects of the scientific inventions on nature?

Ans: The scientific inventions have also caused harms and destruction of serious nature. One of which is the environmental pollution and the other is the deadly weapons.

DO YOU KNOW?

Wind turbines are used to produce pollution free electricity.



Quick Quiz

1. Why do we study physics?

Ans: We study physics because Physics is the branch of science which deals with the matter, energy and their interaction. Most of the technologies of our modern society throughout the world are related to physics.

2. Name any five branches of physics?

Ans: i. Mechanics

ii. Thermodynamics

iii. Electromagnetism

iv. Atomic Physics

v. Plasma Physics

Q8. Explain with examples that science is based on physical quantities which consist of numerical magnitude and a unit.

Ans: Physical Quantities:

All measurable quantities are called physical quantities such as length, mass, time and temperature.

A physical quantity possesses at least two characteristics in common. One is its numerical magnitude and the other is the unit in which it is measured.

Examples:

For example, if the length of a student is 104 cm then 104 is its numerical magnitude and centimeter is the unit of measurement.

Similarly, when a grocer says that each bag contains 5 kg sugar, he is describing its numerical magnitude as well as the unit of measurement. It would be meaningless to state 5 or kg only.

Physical quantities are divided into base quantities and derived quantities.



Q9. What is the difference between base quantities and derived quantities? Give three examples in each case.

Ans: See Q # 1.2 from Exercise.

Q10. Define unit?

Ans: Unit:

Once a. standard is set for a quantity then it can be expressed in terms of that standard quantity. This standard quantity is called a unit.

Q11. List the seven units of System international (SI) along with their symbols and physical quantities?

Ans: International system of units:

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 is commonly referred as SI.

Base units:

The units that describe base quantities are called base units. Each base quantity has its SI unit. Table shows seven base quantities, their SI units and their symbols.

Base quantities, their SI units with symbols quantity Unit Name Symbols

Quantity		Unit	
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

Q12. What are the main advantages of system international (SI units)?

OR

Why do we prefer SI units?

Ans: i. SI system is in use all over the world.

ii. Manipulation in this system is quite easy i.e. the multiple and sub multiple of different units are obtain simply by multiplying or dividing with ten or powers of tens.

Q13. Explain with examples the derived units?

Ans: Derived units:

The units used to measure derived quantities are called derived units.

Derived units are defined in terms of base units and are obtained by multiplying or dividing one, or more base units with each other.

Examples:

i. The unit of area $(meter)^2$ and the unit of volume $(meter)^3$ are based on the unit of length, which is meter. Thus, the unit of length is the base unit while the unit of area and volume are derived units.

ii. Speed is defined as distance covered in unit time; therefore, its unit is meter per second. In the same way the unit of density, force, pressure, power etc. can be derived using one or more base units.

Derived quantities and their SI units with symbols

Quantity		Unit	
Name	**Symbol**	**Name**	**Symbol**
Speed	V	meter per second	ms^{-1}
Acceleration	A	meter per second per second	ms^{-2}
Volume	V	cubic meter	m3
Force	F	newton	N or (kg m s^2)
Pressure	P	pascal	Pa or (N m^{-2})
Density	P	kilogram per cubic meter	Kgm^{-3}
Charge	Q	coulomb	C or (As)

Quick Quiz

1. How can you differentiate between base and derived quantities?

Ans: Difference between base and derived quantities:

Base Quantities	Derived Quantities
i. Base quantities are the quantities on the basis of which other quantities are expressed.	**i.** The quantities that are expressed in terms of base quantities are called derived quantities
ii. Length, mass, time, electric current, temperature, intensity of light | and the amount of a substance.	**ii.** Area, volume, speed, force, work, energy, power, electric charge, electric potential, etc.

2. Identify the base quantity is the following:

(i) Speed (ii) Area (iii) Force (iv) Distance

Ans: i. Distance can be considered as base quantity, because distance is equal to length and its unit is meter.

ii. Speed, area and force are derived quantities because these quantities are express in terms of base quantities.

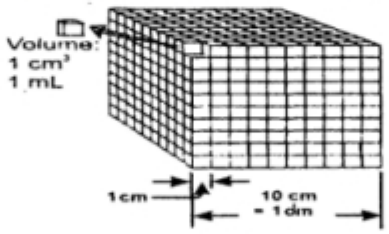
3. Identify the following as base or derived quantity: density, force, mass, speed, time, length, temperature and volume.

Ans:

Base Quantities	Derived Quantities
Length, mass, time, temperature.	Density, volume, speed, force,

ClassNotes

Mini Exercise



Volume is a derived quantity

1L = 1000mL

1L = 1 dm^3

= $(10cm)^3$

= 1000 cm^3

1mL = 1 cm^3

Express 1 m^3 in liters L

Solution: -1m^3 in liters=1000L

Q14. Define prefixes. Interconvert the prefixes and their symbols to indicate multiples and sub-multiples for both base and derived units?

Ans: Prefixes:

Prefixes are the words or letters added before Si units such as kilo, mega, giga and milli.

SI units have the advantage that their multiples and sub-multiples can be expressed in terms of prefixes. These prefixes are given in Table.

Some Prefixes

Prefix	Symbol	Multiplier
exa	E	10^{18}
peta	P	10^{15}
tera	T	10^{12}
giga	G	10^{9}
mega	M	10^{6}
Kilo	K	10^{3}
hecto	h	10^{2}
deca	da	10^{1}
deci	d	10^{-1}
centi	c	10^{-2}
milli	m	10^{-3}
micro	M	10^{-6}
nano	n	10^{-9}

Pico	P	10^{-12}
femto	f	10^{-15}
atto	a	10^{-18}

Advantages of prefixes:

The prefixes are useful to express very large or small quantities. For example, divide 20,000 g by 1000 to express it into kilogram, since kilo represents 10^3 or 1000.

Thus 20,000g = 20,000 ÷ 1,000Kg = 20kg

or 20,000 g = 20 x 10g = 20kg

Note:

Double prefixes are not used. For example, no prefix is used with kilogram since it already contains the prefix kilo.

Prefixes given in Table are used with both types base and derived units.

Multiples and sub-multiples of length:

1km	10^3m
1cm	10^2m
1mm	10^{-3}m
1μm	10^{-6}m
1nm	10^{-9}m

Q15. What do you understand by scientific notation?

Ans: Scientific notation/Standard form:

In scientific notation a number is expressed as some power of ten multiplied by a number between 1 and 10.

Examples:

i. The Moon is 384000000 meters away from the Earth. Distance of the moon from the Earth can also be expressed as 3.84×10^8 m. This save writing down or interpreting large numbers of zeros.

ii. A number 62750 can be expressed as 6.275×10^4. Similarly, the standard form of 0.00045 sis 4.5×10^{-4}s.

Quick Quiz

1. Name five prefixes most commonly used.

Ans: (1) kilo (k) = 10^3 (2) centi(c)10^{-2} (3) milli(m) = 10^{-3}

(4) micro (u) = 10^{-6} (5) mega (M) = 10^6

2. The Sun is one hundred and fifty million kilometers away from the Earth. Write this.

(a) as an ordinary whole number

(b) in scientific notation.

Ans: The distance of Sun from the Earth = 150 million km

(A) as an ordinary whole number:

$= 150 \times 10^6$km$= 150 \times 10^6 \times 10^3$m 1 million 10^6 1 kilo = 10^3

$= 150000000000$ m

(c) In scientific notation.

$= 150 \times 10^6 \times 10^3$

$= 150 \times 10^9$

$= 15 \times 10 \times 10^9$

$= 15 \times 10^{10}$

$= 15 \div 10 \times 10 \times 10^{10}$

$=1.5 \times 10^{11}$

$=1.5 \times 10^{11}$ m

3. Write the numbers given below in scientific notation.

a) 3000000000 ms^{-1} (c) 6400000 m

b) 0.0000000016 g (d) 0.0000548 s

Ans:

(a) 3000000000 ms-1

$= 3 \times 1000000000\ ms^{-1}$

$= 3x\ 10^{9}\ ms^{-1}$

ClassNotes

(b) 6400000 m

$= 64 \times 10^{5}m$

$= 6.4 \times 10 \times 10^{5}$

$= 6.4 \times 10^{6}m$

(c) 0.0000000016 g

$= 0.0000000016 \div 10000000000$ g

$= 16 \times 10^{-10}g$

$=1.6x\ 10x\ 10^{-10}g$

$=1.6x10^{-9}g$

(d) 0.0000548 s

= 0.0000548

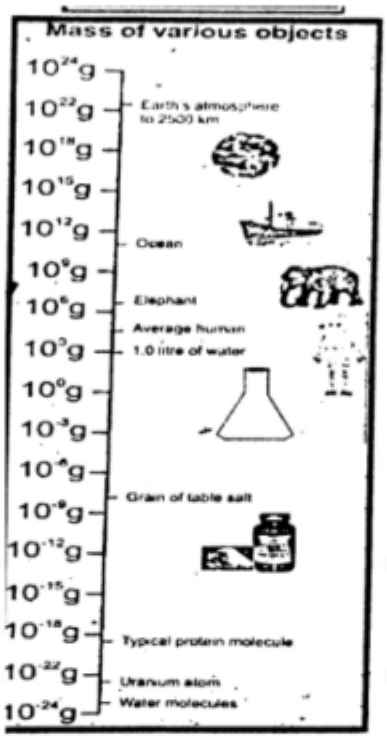
= 0.0000548 ÷10000000

= 548 x 10^{-7}

= 5.48 x 10^{2} x 10^{-7}

=5.48x 10^{-5} s

Tidbits



FOR YOUR INFORMATION

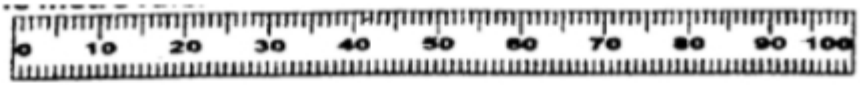
Hubble Space Telescope:

Hubble Space Telescope orbits around the Earth. It provides information about stars.



Q16. What is a meter rule? What is the least count of a meter rule used in the laboratories?

Ans: The meter rule:



A meter rule is a length measuring instrument as shown in figure. It is commonly used in the laboratories to measure length of an object or distance between two points. It is one meter long which is equal to 100 centimeters. Each centimeter (cm) is divided into 10 small divisions called millimeter (mm). Thus, one millimeter is the smallest reading that can be taken using a meter rule and is called its least count.

Least count of meter rule = 0.1 cm or 1mm

Q17. What is a measuring tape? What is the least count of a measuring tape?

Ans: The measuring tape:

Measuring tapes are used to measure length in meters and centimeters. A measuring tape used by blacksmith and carpenters. A measuring tape consists of a thin and long strip of cotton, metal or plastic generally 10 m, 20 m, 50 m or 100 m long. Measuring tapes are marked in centimeters as well as in inches.

Least count of measuring tape = 0.1 cm or 1 mm

ClassNotes

Mini Exercise

Cut a strip of paper sheet. Fold it along its length. Now mark centimeters and half centimeter along its length using a ruler. Answer the following questions:

1. **What is the range of your paper scale?**

Ans: The range of paper scale is 20 cm.

2. **What is its least count?**

Ans: The least count of paper scale is 1 cm.

3. **Measure the length of a pencil using you. Paper scale and with a meter ruler. Which one is more accurate and why?**

Ans: The measurement of pencil measured by the meter ruler is 4.2 cm. The measurement of pencil measured by the ruler is more accurate because it even can measure the length in millimeters.

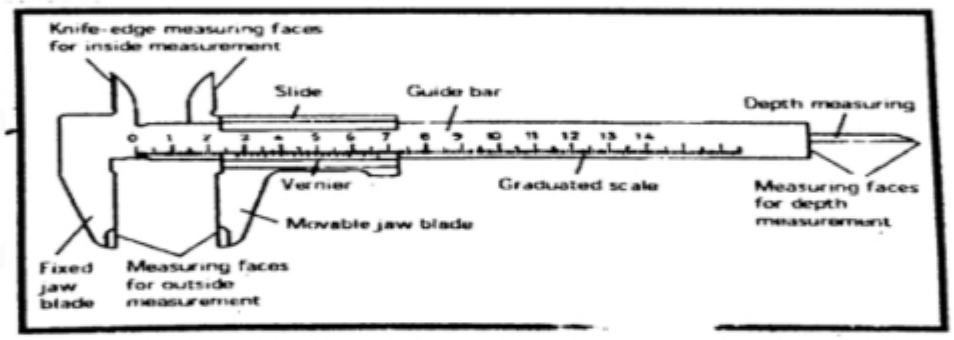
Q18. Describe the construction and working of Vernier calipers?

Ans: Vernier calipers:

An instrument used to measure small lengths such as internal or external diameter or Length of a cylinder etc. is called as Vernier Calipers.

Construction:

A Vernier Calipers consists of two jaws. One is a fixed jaw with main scale attached to it.



Main scale:

Main scale has centimeter and millimeter marks on it. The other jaw is a moveable jaw.

Vernier scale:

It has Vernier scale having 10 divisions over it such that each of its division is 0.9 mm.

Least count (LC)/Vernier constant:

The difference between one small division on main scale division and one Vernier scale division is 0.1 mm. It is called least count (LC) of the Vernier Calipers. Least count of the Vernier Calipers can also be found as given below:

Least count of Vernier Calipers = smallest reading on main scale ÷number of divisions on Vernier scale

= 1mm ÷ 10 divisions

Hence LC=0.1mm= 0.01 cm

Working of a Vernier Calipers:

First of all, find the error, if any, in the measuring instrument. It is called the zero error of the instrument. Knowing the zero error, necessary correction can be made to find the correct measurement. Such a correction is called zero correction of the instrument. Zero correction is the negative of zero error.

Taking a Reading on Vernier Calipers:

Let us find the diameter of a solid cylinder using Vernier Calipers. Place the solid cylinder between jaws of the Vernier Calipers. Close the jaws till they press the opposite sides of the object gently.

Note the complete divisions of main scale past the Vernier scale zero in a tabular form. Next find the Vernier scale division that is coinciding with any division on the main scale. Multiply it by feast count of Vernier Calipers and add it in the main scale reading. This is equal to the diameter of the solid cylinder. Add zero correction (Z.C) to get correct measurement. Repeat the above procedure and record at least three observations with the solid cylinder displaced or rotated each time.

Q19. What is zero error? How zero error is corrected?

OR

What do you understand by the zero error of a measuring instrument? Why is the use of zero error necessary in a measuring instrument?

Ans: Zero Error and Zero Correction:

To find the zero error, close the jaws of Vernier Calipers gently. If zero line of the Vernier scale coincides with the zero of the main scale then the zero error is zero. Zero error will exist if zero line of the Vernier scale is not coinciding with the zero of main scale.

Positive zero error:

Zero error will be positive if zero line of Vernier scale is on the right side of the zero of the main scale. | To get the correct value zero error must be recorded and subtracted from each reading.

Negative zero error:

Zero error will be negative if zero line of Vernier scale is on the left side of zero of the main scale.

To get the correct value zero error must be recorded and add to each reading.

Quick Quiz

1. What is the least count of the Vernier Calipers?

Ans: The least count of the Vernier Caliper is 0.1 mm or 0.01 cm.

2. What is the range of the Vernier Calipers used in your Physics laboratory?

Ans: Range of the Vernier Calipers used in your Physics laboratory is 12 cm.

3. How many divisions are there on its Vernier scale?

Ans: Vernier scale has 10 divisions over it such that each of its division is 0.9 mm.

4. Why do we use zero correction?

Ans: Zero correction is used to get correct and exact measurement.

DIGITAL VERNIER CALLIPERS

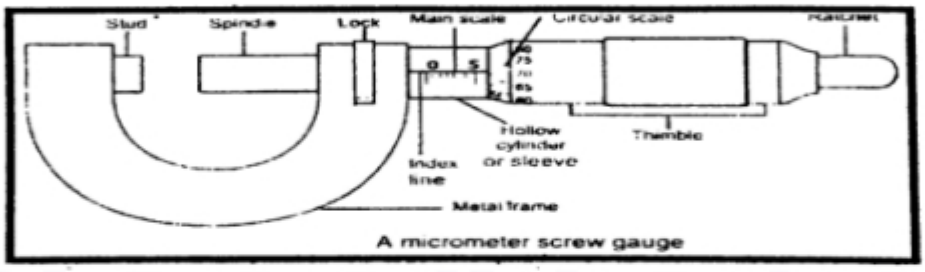
Digital Vernier Calipers has greater precision than mechanical Vernier Calipers. Least count of Digital Vernier Calipers is 0.01 mm.



Q20. Describe the construction and working of screw gauge?

Ans: Screw gauge:

A screw gauge is an instrument that is used to measure small lengths with accuracy greater than a Vernier Caliper. It is also called as micrometer screw gauge.



A micrometer screw gauge

Construction:

A simple screw gauge consists of a U-shaped metal frame with a metal stud at its one end. A hollow cylinder (or sleeve) has a millimeter scale over it along a line called index line parallel to its axis. The hollow cylinder acts as a nut. It is fixed at the end of U-shaped frame opposite to the stud. A Thimble has a threaded spindle inside it. As the thimble completes one rotation, the spindle moves 1 mm along the index line. It is because the distance between consecutive threads on the spindle is 1 mm. This distance is called the pitch of screw on the spindle.

Least count of screw gauge:

Least count = pitch of the screw gauge Least count ÷ no. of division on circular scale

= 1mm ÷ 100 => 0.01 mm = 0.001 cm

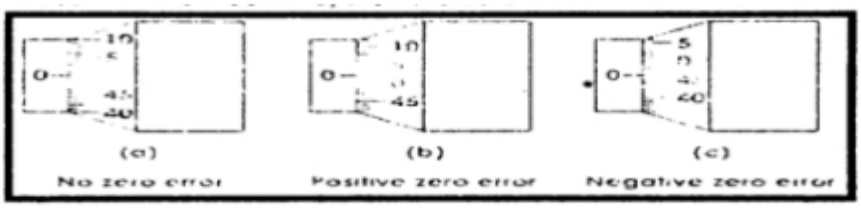
Thus, least count of the screw gauge is 0.01 mm or 0.001 cm.

Working of a screw gauge:

The first step is to find the zero error of the screw gauge.

Zero error:

To find the zero error, close the gap between the spindle and the stud of the screw gauge by rotating the ratchet in the clockwise direction. If zero of circular scale coincides with the index line, then the zero error will be zero.



Positive zero error:

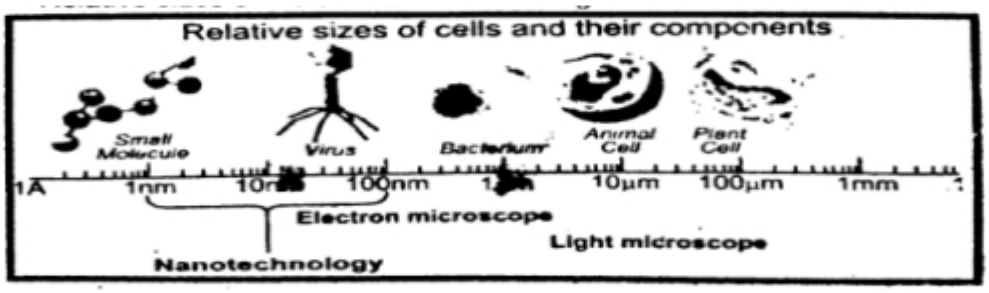
Zero error will be positive if zero of circular scale is behind the index line. In this case. Multiply the number of divisions of the circular scale that has not crossed the index line with the least count of screw gauge to find zero error.

Negative zero error:

Zero error will be negative if zero of circular scale has crossed the index line. In this case, multiply the number of divisions of the circular scale that has crossed the index line with the least count of screw gauge to find the negative zero error.

Tidbits

Relative sizes of molecules and micro-organisms.



MINI EXERCISE

1. What is the least count of a screw gauge?

Ans: The least count of the screw gauge is 0.01 mm or 0.001 cm.

2. What is the pitch of your laboratory screw gauge?

Ans: The pitch of our laboratory screw gauge is 1mm.

3. What is the range of your laboratory screw gauge?

a) Vernier Calipers b) Screw Gauge

Ans: The range of our laboratory screw gauge is 100 mm.

4. Which one of the two instruments is more precise and why?

a) Vernier Calipers b) Screw Gauge

Ans: The least count of Vernier calipers is 0.01cm while the least count of screw gauge is 0.001 cm. The Vernier calipers measure the length with an accuracy of 0.01 cm. The screw gauge measures the length with an accuracy of 0.001 cm. therefore screw gauge is more precise instrument.

USEFUL INFORMATION

Least count of ruler is 1mm. It is 0.1mm for Vernier Calipers and 0.01mm for micrometer screw gauge. Thus, measurements taken by micrometer screw gauge are the most precise than the other two.

Q21. Describe the construction and working of beam balance?

Ans: Beam balance:

Pots were used to measure grain in various part of the world in the ancient times. However, balances were also in use by Greeks and Romans. Beam balances are still in use at many places. In a beam balance, the unknown mass is placed in one pan. It is balanced by putting known masses in the other pan. Today people use many types of mechanical and electronic balances.



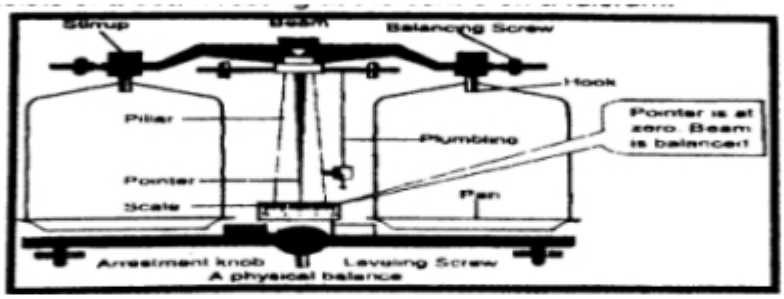
Q22. Describe the construction and working of physical balance?

Ans: Physical balance:

A physical balance is used in the laboratory to measure the mass of various objects by comparison.

Construction and working:

It consists of a beam resting at the Centre on a fulcrum.



The beam carries scale pans over the hooks on either side. Unknown mass is placed on the left pan. Find some suitable standard masses that cause the pointer to remain at zero on raising the beam.

MINI EXERCISE

1. What is the function of balancing screws in a physical balance?

Ans: We use the balancing screws to remove the zero error of the physical balance. Balancing screws in a physical balance is used to bring the pointer at zero position.

OR (Second answer)

There are two screws on the physical balance. One is on the left side and other is on the right side of the physical balance. If pointer is not in middle of the scale, we move these screws forwards or backwards to bring the pointer in the middle of the scale. This is done before we put any mass or weight in either of the pan.

In other words, we use the screws to remove the zero error of the physical balance.

2. On what pan we place the object and why?

Ans: We Place the object into left pan. In case of physical balance, there the body is fixed and the weights have to be added in denominations. So only for convenience we put the weights on the right pan after keeping body on the left pan. If suppose a left-handed person weighs in a physical balance then no harm in placing the body in the right pan and putting the denominations of the weights on the left pan.

Q23. Describe the construction and working of lever balance?

Ans: Lever balance:

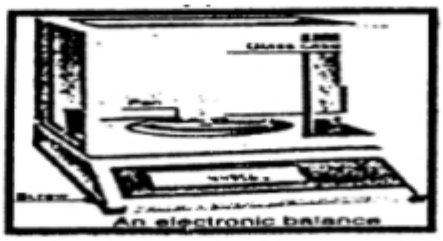
A lever balance consists of a system of levers. When lever is lifted placing the object in one pan and standard masses on the other pan, the pointer of the lever system moves. The pointer is brought to zero by varying standard masses.


A lever balance

Q24. Describe the construction and working of electronic balance?

Ans: Electronic balance:

Electronic balances come in various ranges; milligram ranges, gram ranges and kilogram ranges. Before measuring the mass of a body, it is switched ON and its reading is set to zero. Next place the object to be weighed. The reading on the balance gives you the mass of the body placed over it.


An electronic balance

Q25. Which type of balance is more precise to measure the mass of an object?

Ans: The most Accurate Balance:

The mass of one-rupee coin is done using different balances as given below:

(a) Beam Balance:

Let the balance measures coin's mass = 3.29 A sensitive beam balance may be able to detect a change as small as of 0.1 g or 100 mg.

(b) Physical Balance:

Let the balance measures coin's mass = 3.24 g

Least count of the physical balance may be as small as 0.01 g of 10 mg. Therefore, its measurement would be more precise than a sensitive beam -balance.

(c) Electronic Balance:

Let the balance measures coin's mass = 3.247 g Least count of an electronic balance is 0.001 g or 1mg. Therefore, its measurement would be more precise than a sensitive physical balance.

Conclusion:

Thus, electronic balance is the most sensitive balance in the above balances.

USEFUL INFORMATION

The precision of a balance in measuring mass of an. object is different for different balances. A sensitive balance cannot measure large masses. Similarly, a balance that measures large masses cannot be sensitive.

Some digital balances measure even smaller difference of the order of 0.0001 g or 0.1 mg. Such balances are considered the most precise balance.

Q26. What is a stopwatch? What is the least count of a mechanical stopwatch you have used in the laboratories?

Ans: See Q # 1.10 from Exercise.

LABORATORY SAFETY EQUIPMENTS

A school laboratory must have safety equipment's such as:

- Waste-disposal basket
- Fire extinguisher. S
- Fire alarm.
- First Aid Box.
- Sand and water buckets.
- Fire blanket to put off fire.
- Substances and equipment's that need extra care must bear proper warning signs such as given below:

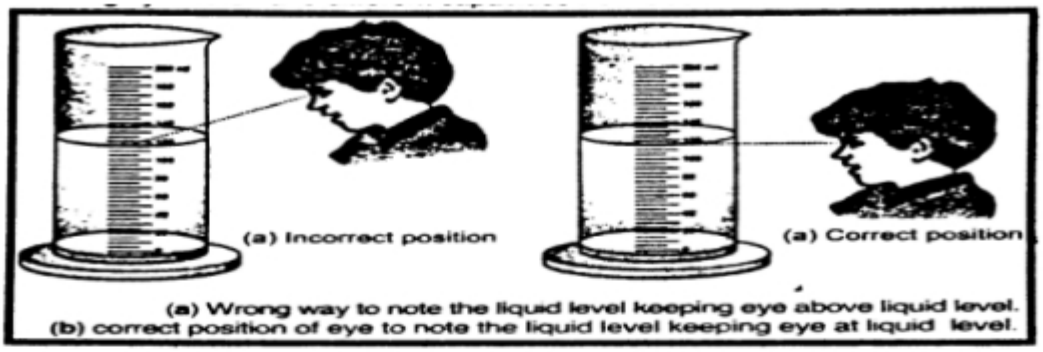


Q27. What is a measuring cylinder? Write the method to use the measuring cylinder?

Ans: Measuring cylinder:

A measuring cylinder is a graduated glass cylinder marked in milliliters. It is used to measure the volume of a liquid and also to find the volume of an irregular shaped solid object. It has a scale along its length that indicates the volume in milliliter (mL).

Measuring cylinders have different capacities from 100 mL to 2500 ml.



(a) Wrong way to note the liquid level keeping eye above liquid level.
(b) correct position of eye to note the liquid level keeping eye at liquid level.

How to use a measuring cylinder:

While using a measuring cylinder, it must be kept vertical on a plane surface. Take a measuring cylinder. Place it vertically on the table. Pour some water into it. Note that the surface of water is curved. The meniscus of the most liquids curve downwards while the meniscus of mercury curves upwards.

Correct method to note the level of a liquid:

The correct method to note the level of a liquid in the cylinder is to keep the eye at the same level as the meniscus of the liquid. It is incorrect to note the liquid level keeping the eye above the level of liquid.

When the eye is above the liquid level, the meniscus appears higher on the scale. Similarly, when the eye is below the liquid level, the meniscus appears lower than actual height of-the liquid.

Q28. How can we measure the volume of small irregular shape objects which floats (piece of cork) on the water by using a measuring cylinder?

Ans: Measuring volume of an irregular shaped solid:

Measuring cylinder can be used to find the volume of a small irregular shaped solid that sinks in water. Let us find the volume of a small stone. Take some water in. a graduated measuring cylinder. Note the volume V, of water in the cylinder. Tie the solid with a thread. Lower the solid into the cylinder till it is fully immersed in water. Note the volume V_i of water and the solid. Volume of the solid will be V_f — V_i

LABORATORY SAFETY RULES

The students should know what to do in case of an accident. The charts or posters are to be displayed in the laboratory to handle situations arising from any mishap or accident. For your own safety and for the safety of others in the laboratory, follow safety rules given below:

1. Do not carry out any experiment without the permission of your teacher.
2. Do not eat, drink, play or run in the laboratory.
3. Read the instructions carefully to familiarize yourself with the possible hazards before handling equipment and materials.
4. Handle equipment's and materials with care.
5. Do not hesitate to consult your teacher in case of any doubt.
6. Do not temper with the electrical appliances and other fittings in the laboratory.
7. Report any accident or injuries immediately to your teacher.

ClassNotes

Q29. What is meant by the significant figures of a measurement? What are the main points to be kept in mind while determining the significant figures of a measurement?

Ans: See Q # 1.12 from Exercise.

RULES TO FIND THE SIGNIFICANT DIGITS INA MEASUREMENT

(i) Digits other than zero are always significant.

27 has 2 significant digits.

275 has 3 significant digits.

(ii) Zeros between significant digits are also significant.

2705 has 4 significant digits.

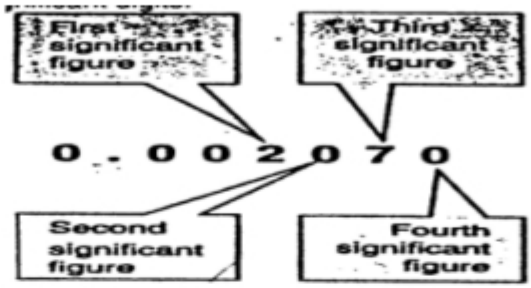
(iii) Final zero or zeros after decimal are significant

275.00 has 5 significant digits.

(iv) Zeros used for spacing the decimal point are not significant here zeros are placeholders only.

0.03 has 1 significant digit.

0.027 has 2 significant digits.



ROUNDING THE NUMBERS

(i) If the last digit is less than 5 then it is simply dropped. This decreases the number of significant digits in the figure.

For example,

1.943 is rounded to 1.94 (3 significant figure)

(ii) If the last digit is greater than 5, then the digit on its left is increased by one. This also decreases the number of significant digits in the figure.

For example,

1.47 is rounded to two significant digits 1.5

(iii). If the last digit is 5, then it is rounded to get nearest even number.

For example,

1.35 is rounded to 1.4 and 1.45 is also rounded to 1.4

SUMMARY

1. **Physics:** Physics is a branch of Science that deals with matter, energy and their relationship.

2. **Branches of Physics:** Some main branches of Physics are mechanics, heat, sound, light (optics), electricity and magnetism, nuclear physics and quantum physics.

3. **Role of physics in daily life:** Physics plays an important role -in our 'daily life. For example, electricity is widely used everywhere, domestic appliances, office equipment, machines used in industry, means of transport and communication etc. work on the basic laws and principles of Physics.

4. **Physical quantity:** A measurable quantity is called a physical quantity.

5. **Base quantities:** Base quantities are defined independently. Seven quantities are selected as base quantities. These are length, time, mass, electric current, temperature, intensity of light and the amount of a substance.

6. **Derived quantities:** The quantities which are expressed in terms of base - quantities are called derived quantities. For example, speed, area, density, force, pressure, energy, etc.

7. **International system of units (SI):** -A world-wide system of measurements is known as international system of units (SI). In SI, the units of seven base quantities are meter, kilogram, second, ampere, kelvin, candela and mole.

8. **Prefixes:** The words or letters added before a unit and stand for the multiples or sub-multiples of that unit are known as prefixes. For example, kilo, mega, milli, micro, etc.

9. **Scientific notation or standard form:** A way to express a given number as a number between 1 and 10 multiplied by 10 having an appropriate power is called scientific notation or standard form.

10. **Vernier Calipers:** An instrument used to measure small lengths such as internal or external diameter or length of a cylinder etc. is called as Vernier Calipers.

11. **Screw gauge:** A Screw gauge is used to measure small lengths such as diameter of a wire, thickness of a metal sheet, etc.

12. **Physical balance:** Physical balance is a modified type of beam balance used to measure small masses by comparison with greater accuracy.

13. **Stopwatch:** A stopwatch is used to measure the time interval of an event. Mechanical stopwatches have least count up to 0.1 seconds. Digital stopwatch of least count 0.01s is common.

14. **Measuring cylinder:** A measuring cylinder is a graduated glass cylinder marked in milliliters. It is used to measure the volume of a liquid and also to find the volume of an irregular shaped solid object.

15. **Significant figures**: All the accurately known digits and the first doubtful digit in an expression are called significant figures. It reflects the precision of a measured value of a physical quantity.

ClassNotes