UNITS AND MEASUREMENTS

LEARNING OBJECTIVES:

- ♦ Recap of units and measurements
- ♦ How to find area of square,rectangle,circle and triangle etc
- ♦ How to measure the volume of cube,cuboid,cone, and cylinder etc
- ♦ How to measure the area and volume of irregular bodies
- ♦ Vernier calliper
- ♦ Screwgauge

Real time Applications:

- Φ Architects use area to measure out floor areas of houses
- Φ Quantity surveyors use area to cost building materials
- Φ Area is used if a DIY man is fitting carpets or floors or even wall papers
- Φ For measuring liquids to assessing drinking amounts,volume is necessary.
- Φ Vernier callipers is typically used in scientific labs and engineering schools where precise measurements are a must.
- Φ Vernier callipers is a great addition to a woodworker's tools since it comes in handy when working with different projects that require carefull and precise measurement.

♥ **Important Formulae:**

1) Area of square = S^2
2) Area of rectangle = l X b
3) Area of triangle = 1/2 X b X h
4) Area of circle = $\prod r^2$
5) Volume of cube = S^3
6) Volume of cuboid = l x b x h
7) Volume of cone =1/3 $\prod r^2h$
8) Volume of cylinder = $\prod r^2h$
9) Volume of sphere = 4/3 $\prod r^3$
10) N VSD = (N-1) MSD.
11) LC = 1M.S.D. - 1V.S.D. = 0.1mm (or) 1/10 mm (or) 1/100 cm (or) 0.01cm

12) $L.C = \frac{S}{N}$

13) Length = M.S.R + [C.V.S.R. $\times$ LC]
14) Observed length= M.S.R+(V.S.DXL.C)
15) Corrected length=Observed length+correction of error
16) Observed diameter= M.S.R+(V.S.DXL.C)
17) Corrected diameter=Observed diameter+correction of error
18) Corrected radius r=d/2

19) Pitch of the screw, $P = \frac{\text{Distance travelled by the screw}}{\text{No.of complete rotaions made}} = \frac{x}{n}$

20) Least count (L.C) = $\frac{\text{pitch of the screw}}{\text{No.of head scale divisions}}$

21)Thickness = P.S.R+(H.S.R. x L.C)

§§ *Measurement*

¶¶ Physical quantities:

All the quantities which are used to describe the laws of physics are known as physical quantities. OR

The quantities which are measurable are called physical quantities

Eg: length, mass, time, speed etc.

Physical quantities can be classified on the following bases

I. Based on their directional properties

i) **Scalars:** The physical quantities which have only magnitude but not direction are called scalar quantities.

Eg: mass, density, volume, time, etc.

ii) **Vectors :** The physical quantities which have both magnitude and direction and obey laws of vector algebra are called vector quantities.

Eg: Displacement,velocity,force etc

II.Based on their dependency

i) **Fundamental or base quantities** : The quantities which do not depend on other physical quantities for their complete definition are known as fundamental or base quantities.

Eg: length, mass, time, etc

There are seven fundamental quantities in SI system-

i) Mass

ii) Length

iii) Time

iv) Temperature

v) Electric current

vi) Luminous intensity

vii)Amount of substance

ii)**Derived Physical quantities :** The quantities which can be expressed in terms of the fundamental quantities are known as derived quantities.

Eg: Speed (=distance/time), volume, acceleration, force, pressure, etc.

Note: Physical quantities can also be classified as dimensional and dimensionless quantities or constants and variables.

EXAMPLE

√ **Example-1:**

Classify the following quantities into vectors and scalars

displacement, mass, force, time, speed, velocity, acceleration,pressure and work

Sol:i)Fundamental:displacement, force,velocity, acceleration

ii)Derived:mass, time, speed,pressure and work

§§ UNIT:

That fixed and definite quantity which we take as our standard of reference and by which we measure other quantities of same kind, is defined as unit.

¶¶ **Fundamental Units :** The units which are independent and which are not be derived from other units, are defined as fundamental units.

Eg: Meter, Kilogram, Second, etc.

¶¶ **Derived unit:**The units which depend on fundamental units is called derivd units.

Eg : Area (m^2), Volume(m^3), Speed(m/s) etc.

Selection Criteria Of a Unit OR Characteristics of a unit:

1. It's value must not vary with place and time.
2. It should be capable of being reproduced easily.
3. It must be well defined.
4 It should be of proper size i.e neither too large nor too small when compared to the quantities to be measured.

§§ **Measurement of physical quantity:**

The unit of a physical quantity is inversely proportional to its numerical value $n \alpha \frac{1}{U}$

where u and n are the units of physical quantity and its numerical value respectively.

Relation between unit and its numerical value

$n_1u_1 = n_2u_2$

Eg: Mass of the stone is 40 times mass of kilogram stone.

Mass of stone = 40 X kilogram = 40 kg

¶¶ **Measuring system of units:**

The following are some system of units that we use to measure any physical quantity.

S.No	Measuring system	Length	Mass	Time
1	CGS (Gaussian System)	centi meter	gram	second
2	MKS (Metric System	meter	kilo gram	second
3	FPS (British System)	foot	pound	second

At present M.K.S System is accepted world wide as international system of units called as S.I units.

¶¶ **SI system of units :** The general conference of weights and measurements held in 1960 decided a new system of units called " System International" (SI).

This system is an improved and extended version of M.K.S system.

This system defines seven fundamental and two supplementary quantities in it.

Units of the International System (SI)		
Quantity	***Name of Unit***	***Unit Symbol***
length	metre	m
mass	kilogram	kg
time	second	s
temperature	kelvin	K
amount of substance	mole	mol
electric current	ampere	A
luminous intensity	candela	cd
Supplementary quantities		
Plane angle	radian	rad
Solid angle	steradian	sr

♣ ***Rules for writing units and symbols:***

i) The full names of the units do not begin with a capital letter.
For example,The unit of force is newton but not Newton

ii) The symbols of units named after scientists have initial capital letters.
For example,J for joule,N for newton.

iii) Symbols do not have plural forms.
For example,10kg but not 10kgs, 7m but not 7ms.

iv) No full stop, or coma (or) colon is put after the symbol.
For example,16N for sixteen newton, without any fullstop (or) coma at the end.

v) Multiplication of units is shown by leaving a spate or a raised dot.
For example, Nm and not N-m (or) N x m.

vi) Division of units is indicated by solidus (/) sign (or) negative powers.
For example, m/s (or) ms^{-1}.

vii) In front of a decimal number, zero should be placed.For example,0.7kg but not .7kg.

viii) Compound pre fixes should be avoided. For example, pf for pico farad but not $\mu\mu F$

ix) A space must be left between a number and unit. For example, 7 kg but not 7kg.

¶¶ ***Prefixes used in S.I units:***

Multiple	Prefix	Symbol	Common Name
10^{18}	exa	E	quintillion
10^{15}	peta	P	quadrillion
10^{12}	tera	T	trillion
10^{9}	giga	G	billion
10^{6}	mega	M	million
10^{3}	kilo	k	thousand
10^{2}	hecto	h	hundred
10^{1}	deca	da	ten

Multiple	Prefix	Symbol	Common Name
10^{-1}	deci	d	Tenth
10^{-2}	centi	c	Hundredth
10^{-3}	milli	m	Thousandth
10^{-6}	micro	*u* (Greek mu)	Millionth
10^{-9}	nano	n	Billionth
10^{-12}	pico	p	Trillionth
10^{-15}	femto	f	quadrillionth
10^{-18}	atto	a	Quintillionth

§§ ***Measurement of Area:***

The amount of surface occupied by an object (or) a place is called its area.It is a derived physical quantity.

Area = length X breadth

Units:

C.G.S	*S.I*	*F.P.S*
Square centimeter (cm^2)	***Square meter (m^2)***	***Foot^2 (ft^2)***

- The area of a surface, whose each side is equal to one meter is called one square meter.
- The area of a surface, whose each side is equal to one centimeter is called one square centimeter.

$1m^2 = 10{,}000\ cm^2 = 10^4 cm^2$

$1cm^2 = \frac{1}{10{,}000} m^2 = 10^{-4} m^2.$

¶¶ ***Multiples and sub multiples of square meter:***

Multiples

100 sq.mts = 1are

100 acres = 1 hectare

100 hectares = $1km^2$

Sub Multiples

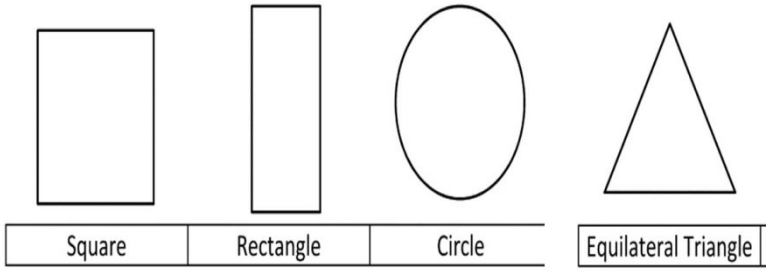
10,000 sq.cm = 1sq.m

10,00,000 sq.mm = 1 sq.m

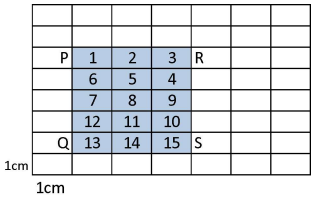
§§ ***Area of regular bodies/surfaces:***

Surfaces that have definite shapes are called regular bodies.

Eg: Black board,ball,house,play ground etc.



- Area of regular bodies can be measured by using scale (or) measuring tape (or) mathematical formulae (or) graph paper(centimeter graph paper).



The area of a regular surface can be found out by counting the number of squares enclosed by its boundary on a graph paper. The area of a regular rectangular surface can also be found by finding the product of its length and breadth. i.e., area=lengthXbreadth.

Area of rectangular surface = length x breadth

Area of square surface = side x side

Area of triangular surface = $\frac{1}{2}$ x base x height

Area of parallelogram surface = product of adjacent sides.

Area of circular surface = Π x square of radius.

§§ ***Area of irregular surfaces:***

Surfaces which doesn't have particular shapes are called irregular surfaces or bodies.

Area of irregular surfaces (A leaf) can be found by counting the number of squares enclosed by its boundary on a graph paper.

- Place the leaf flat on the centimeter graph paper. With the help of a sharp pencil mark the

outline of the leaf. Now count the number of complete squares enclosed by the face of leaf.

- Count the number of squares covered completely in graph paper . Now mark the incomplete squares with a '*' mark and count * mark squares. Assuming area of incomplete squares equal to half ($^1/_2$) of the full square , then approximate area of leaf (in cm^2) = Number of complete squares + ($^1/_2$ number of incomplete squares).

(let us full squares are 20 and * mark squares are 40 then ,

= 20+ ($^1/_2$ X 40) cm^2

= 40 cm^2 is the area of irregular leaf can be calculated by centimeter (cm) graph paper i.e., unit of area is cm^2 here.

√ **Ex 1:** The length and breadth of arectangle are 2 m and 5 m respectively, the area of the rectangle is _____

Sol: Area of rectangle = length x breadth

= 2 x 5 =10 m^2=100000 cm^2

√ **Ex 2:** The whole length of a metre scale is divided into 500 equal parts then the smallest measurement that can be measured by usign the scale is ____

Sol: Total distance = 1m is divided into 500 equal parts then the length of one

$$division = \frac{1}{500} m = 0.002\, m = 2\, mm.$$

√ **Ex 3:** The area of a circle whose radius is 10 cm is _____

Sol: Area of circle = πr^2

$$= \pi \times 10^2 = 314\, cm^2$$

√ **Ex 4:** If the area of a square field is 100 cm^2 then the length of the side is _____

Sol: Area of square = $(side)^2$=100 cm^2

Side = 10 cm=0.1 m

TEACHING TASK

I) Choose the correct answer:

1. The area of a square surface whose each side is equal to 100m is

A) are B) km^2 C) hectare D) cm^2

2. A school measures 20cm in length and 12m in breadth then its area

A) 120m^2 B) 240m^2 C) 2.4m^2 D) 1.3m^2

3. The submultiple of standard international unit of area

A) m^2 B) hectare C) cm^2 D) are

4. The cost for fencing a rectangular field of 30m long 20m wide at 2 rupees per metre

A) Rs 200 B) Rs 1200 C) Rs 100 D) Rs 800

5. Each side of a square measures 3m6dm. Then its area is

A) 64.6dm^2 B) 12.96m^2 C) 64.6m^2 D) 12.9bm^2

6. The length of a school compound is 450m and breadth is 145m. Then its area is

A) 65250 hectares B) 6250 hectares

C) 6.525 hectares D) 6.525 acres.

7. 1km^2 =

A) 1000m^2 B) 1000hm^2

C) 10,000,000m^2 D) 10000000000cm^2

8. The area of a rectangular field is 0.7 hectares. If one side of the field is 60m. Calculate the other side

A) 167.12m B) 127.89m

C) 116.67m D) 115.67m

9. What happens to the area of a square if its side is doubled ?

A) area is doubled B) area increases by three times

C) area increases by four times D) area decreases by four times

10. What happens to the area of a square if its side is halved ?

A) area is halved B) area decreases by 4 times

C) area is doubled D) area increases by 4 times

II) ***Fill in the blanks***

11. The submultiple of m^2 is.....

12. The area of circle is.....

13. The side of a square is 4 m,then its area is.....cm^2.

14. The area of a rectangle is 72 m^2,its length is 9 m,then its breadth is.....

15. The total surface area of a hemi sphere of radius 10 cm using value of π = 3.14 is.....

III) ***Match the following:***

◆ *This section contains Matrix-Match Type questions. Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in* ***Column–I*** *have to be matched with statements (p, q, r, s) in* ***Column–II****. The answers to these questions have to be appropriately bubbled as illustrated in the following example.*

*If the correct matches are A-p,A-s,B-r,B-r,C-p,C-q and D-s,then the correct bubbled 4*4 matrix should be as follows:*

16.

Side of a square	**Area**
a) s = 4 cm	1) A = 16 cm^2
b) s = 8 cm	2) A = 4 cm^2
c) s = 2 cm	3) A = 1 cm^2
d) s = 1 cm	4) A = 64 cm^2

A) a-1,b-2,c-3,d-4 B) a-2,b-4,c-3,d-1

C) a-1,b-4,c-2,d-3 D) a-4,b-3,c-1,d-2

KEY

ΦΦ TEACHING TASK :

1) C, 2) C, 3) C, 4) A, 5) B, 6) C, 7) D, 8) C, 9) C, 10) B, 11) cm^2, 12) πr^2 13) 16×10^4, 14) 8 m, 15) 314 cm^2, 16) C

LEARNER'S TASK

BEGINNERS (Level - I)

I) **Choose the correct option:**

1. 10000 cm^2 = ...m^2

A) 10 B) 1 C) 100 D) 10^{-2}

2. 1km^2 = ... acres.

A) 100 B) 10000 C) 1000 D) $\frac{1}{10,000}$

3. The ratio of C.G.S to S.I units of area is

A) 10^{-4} B) 10^{4} C) 10^{2} D) 10^{-2}

4. The side of a square is 4m. Then its area would be

A) 16m B) $16m^2$ C) $16m^3$ D) $3m^2$

5. A rectangular field area is $100m^2$ and its length is 20m. Its width is

A) 80m B) 5m C) 20m D) 10m

6. $1dm^2$ = ... m^2

A) 10^{-2} B) 10^{-4} C) 1 D) 10^{2}

7. $\frac{1 \text{ km}^2}{100 \text{ ares}}$ =.....

A) 10 B) 1/100 C) 100 D) 10,000

8. The length and breadth of a rectangle are 10cm and 8cm find its area

A) $800m^2$ B) $80m^2$ C) $0.8m^2$ D) $8x10^{-3}m^2$

9. The area of a square whose side is 10dm

A) $1m^2$ B) 1000 dm^2 C) $100cm^2$ D) $10,000dm^2$

10. The area of a rectangular surface of length 20m and breadth 150cm

A) $1800m^2$ B) $30m^2$ C) $12.5m^2$ D) $1800cm^2$

11. The area of triangular surface (A) = ... sq.units

A) $A = \frac{1}{2}$ x base x height B) $A = \frac{1}{2}$ base x base

C) $\frac{1}{2}$ x $(\text{height})^2$ D) length x length

12. The area of irregular body can be measured by using

A) graph paper B) meter scale C) pipette D) litre measure

13. What will be the change in the area of a rectangle it is length is doubled without any change in the breadth

A) area is doubled B) area increases a four times

C) area increases by four times D) area remains same

14. What happens to the area of a rectangle if both length and breadth are doubled ?

A) area remains same B) area is doubled

C) area increases by four times D) area increases by 8 times

ACHIEVERS (Level - II)

Solve the following:

1. In a square plot of area 3600 m^2 a building is constructed, which occupies an area of 2000 m^2.Find the area of remaining part?

2. The area of the triangle, whose base is 8 cm and height is equal to the area of square.Find the side of the square?

3. Around circular park of radius 30 m a foot path is constructed of width 5 m. Now what is the new area of park?

4. A sheet of paper is 180cm long and 90cm wide. How many envelopes of size 10cm by 4cm can be made from that sheet ?

EXPLORERS (Level - III)

I) More than one answer type questions:

- *This section contains multiple choice questions. Each question has 4 choices (A), (B), (C),(D), out of which **ONE or MORE** is correct. Choose the correct options*

1. Units of area

a.m^2 b.cm^2 c.ft^2 d.cm^3

A)a,b and d B)a,b and c C)a and b D)a,c and d

2. Multiples of square metre

a. acre b. hectare c. sq.cm d. sq.mm

A)a and b B)c and d C)a and d D)b and c

3. 1 acre is equal to

a.100 sq.mts b.1000000 sq.cm c.100 km^2 d.1000sq.mts

A)a and c B)a,b and c C)a and b D)b and d

II) Fill in the blanks:

4. The F.P.S unit of area is .....

5. 1 sq.metre =.....sq.cm

6. 100 hectares=.....km^2

7. The amount of surface occupied by an object is called.....

8. 1 cm^2=.....km^2

9. If 1 km^2 = x mm^2,then find the value of x =.....

10. 1 m^2 = ...hectare.

III) Match the following:

- *This section contains Matrix-Match Type questions. Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in **Column–I** have to be matched with statements (p, q, r, s) in **Column–II**. The answers to these questions have to be appropriately bubbled as illustrated in the following example.*

  *If the correct matches are A-p,A-s,B-r,B-r,C-p,C-q and D-s,then the correct bubbled 4*4 matrix should be as follows:*

11.

a) 1acre	1) $10^{-4}m^2$
b) 1hectare	2) 10^6m^2
c) 1km^2	3) 10^4m^2
d) 1cm^2	4) 10^2m^2

A) a - 1, b - 2, c - 3, d - 4 B) a - 4, b - 3, c - 2, d - 1

C) a - 3, b - 4, c - 2, d - 1 D) a - 3, b - 4, c - 1, d - 2

12.

Surface	**Area**
a) Rectangle	1) A = S^2
b) Circle	2) A = l X b
c) Square	3) A = 1/2 X b X h
d) Triangle	4) A = πr^2

A) a - 1, b - 2, c - 3, d - 4 B) a - 2, b - 3, c - 4, d - 1

C) a - 2, b - 4, c - 1, d - 3 D) a - 1, b - 4, c - 3, d - 2

Comprehension type questions:

♦ *This section contains paragraph. Based upon each paragraph multiple choice questions have to be answered. Each question has 4 choices (A) , (B) ,(C) and (D) out of which* ***ONLY ONE i****s correct. Choose the correct option.*

Values of length, breadth and area of different surfaces are given below.

surface	length	breadth	area
i. reading room	5 m	4.5 m	?m^2
ii. reading table	1.5 m	? m	1.5 m^2
iii. physics text book	0.24 m	0.11 m	0.0264m^2
iv. geometry box	0.12 m	0.05 m	? m^2

13. Find the area of reading room?

A. 22.5 m^2 B. 2.25 m^2 C.225 m^2 D.25 m^2

14. What is the breadth of reading table?

A. 1 m B. 2 m C. 1.5 m D. 5 m

15. Find the area of geometry box?

A. 0.6 m^2 B. 0.006 m^2 C. 0.06 m^2 D. 6 m^2

16. What is the length of physics text book?

A. 24 m B. 2.4 m C. 0.24 m D. 240 m

KEY

ΦΦ LEARNER'STASK :

☐ **BEGINNERS :**

1) B, 2) B, 3) A, 4) B, 5) B, 6) A, 7) C, 8) D, 9) A, 10) B, 11) A , 12) A , 13) A, 14) C,

☐ **ACHIEVERS :** 1)1600 m^2 2)6 cm 3)3850 m^2 4)405

☐ **EXPLORERS :** 1) B, 2) A, 3) C, 4) ft^2, 5) 10^4, 6) $1km^2$, 7) area, 8) 10^{-10}, 9) 10^{12}, 10) 10^{-4}, 11) B, 12) C, 13) A, 14) A, 15) B, 16) C

§§ *Measurement of volume*

When we say that a bucket is bigger than a cup , we mean that volume of bucket is more than the cup. Similarly , the volume of air in the drawing room is more than the volume of air in the store room and so on.

The space occupied by a substance (solid, liquid or gas) is called volume.

Volume = length X breadt

Units:

C.G.S	S.I	F.P.S
Cubic centimeter (cm^3 (or) cc)	Cubic meter (m^3)	$Foot^3$(ft^3)

A cube is a solid having same length, breadth and height.

One cubic metre ($1m^3$) is the volume occupied by a cube whose each side is equal to 1m.

One cubic centimetre ($1cm^3$) is the volume occupied by a cube whose each side is equal to 1cm.

$1m^3 = 1000000\ cm^3 = 10^6 cc.$ and $1cc = \frac{1}{1000,000} m^3 = 10^{-6} m^3$

¶¶ ***Volume of regular bodies:***

Volume of regular bodies can be found out using scale (or) measuring tape.

Volume of a cube = $(side)^3 = l^3$ cubic units

Volume of a cuboid = lbh cubic units (where l = length, b = breadth, h = height)

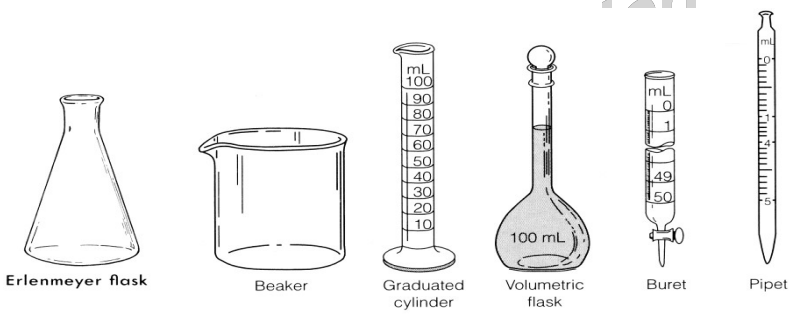
Volume of a cone = $\frac{1}{3}\pi r^2 h$ cubic units

Volume of a sphere = $\frac{4}{3}\pi r^3$ cubic units (where r = radius)

§§ ***Measurement of volume of liquids:*** The volume of liquids is generally measured in liters (l). The smallest unit for measuring volume of liquids is milliliter (ml).

$\therefore$ 1l = 1000 ml = 1000cc = $1000cm^3$, $1m^3$ = 1000 l

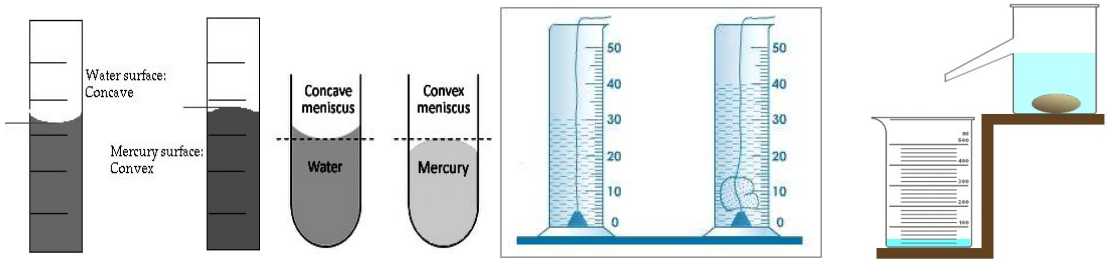
Volume of liquids is measured by using measuring cylinders, measuring flasks, burettes, pipettes etc.



- Measuring jar is used to measure volume of liquids in milli liters.
- Measuring flask and pipette are used to obtain fixed amount of liquids.
- Burette is used to deliver any required volume of liquids. Reading on this instrument should always taken at the bottom level of the meniscus.

In case of liquids which wet the sides of the graduated cylinder, such as water , alchol, etc., the level is **concave** as shown in fig.we have to look at the reading the mark which appears to touch the lowest level of concave surface. we must keep our eye for the reading line with lowest level of **concave surface.**

Some liquids like mercury do not wet the sides of the cylinder. They form a convex surface rather than concave as shown in fig. In such liquids the eye level should coincide with the uppermost point of the convex surface.



§§ **Measuring Cylinder method:**

Take a measuring cylinder and almost half fill it with water. By keeping the eye at the lowest point of **concave surface**, record the volume of water (let x). Now tie the stone with a fine cotton thread. lower the stone gentaly in water, so that it completely immersed in water. The level of water in the measuring cylinder will rise as stone displaces water equal to its own volume(let y). Now volume of stone will be the difference between the second volume to first volume readings. i.e., (y-x)

Volume of stone = (y-x)cc (cc= cubic cm or cm^3)

Note: *If the solid is soluble in water, replace water with a liquid in which the solid is insoluble.*

¶¶ **Over flow jar method:** We can also measure volume of irregular bodies by using overflow jar method. Fill the over flow jar with water till the water is at the pont of overflowing. Under spout of overflow jar , place a measuring cylinder. Now gently lower the solid in the overflow jar.

EXAMPLE

√ **Ex 1:** How cm^3 amd m^3 are related

Sol: 1 cm = 10^{-2} m $\Rightarrow (1\text{ cm})^3 = (10^{-2}\text{ m})$

$\Rightarrow 1^3\ cm^3 = (10^{-2})^3\ m^3 \Rightarrow 1\ cm^3 = 10^{-6}\ m^3$

√ **Ex 2:** When 20 drops of water is added to a graduated cylindrical container filled with water, the level of the liquid rises from 10 ml to 20 ml. Calculate the volume of each water drop.

Sol: Volume of 20 drops=20-10=10 ml

Volume of 1 drop = $\frac{10}{20}$ ml=0.5 ml=0.5 x 10^{-6} m^3.

√ **Ex 3:** Find the volume of cuboid of dimensions 3 cm x 5 cm x 7cm in SI system.

Sol: The volume of cuboid v=1 x b x h

= 3 x 5 x 7=105 cm^3

And in SI system = 105 x 10^{-6} m^3 (since 1 cm^3 = 10^{-6} m^3)

√ **Ex 4:** Radius of a sphere is 2 cm. Find its volume in SI units.

Sol: Volume of sphere = $\frac{4}{3}\pi r^3 = \frac{4}{3}\times\frac{22}{7}\times 2^3 = \frac{4}{3}\times\frac{22}{7}\times 8$

$= \frac{704}{21}$ = 33.52 cm^3 = 33.52 x 10^{-6} m^3.

TEACHING TASK

I) Choose the correct answer:

1. The ratio of C.G.S to S.I units of volume is

A) 10^6 B) 10^3 C) 10^4 D) 10^{-6}

2. Length, breadth and height of a cuboid are 10cm, 8cm and 6cm respectively. Find its volume

A) $80cm^3$ B) $480cm^2$ C) $480cm^3$ D) 480cm

3. The volume of a book of length 25cm, breadth 18cm and height 2cm is

A) $800cm^3$ B) $900cm^3$ C) $1000cm^3$ D) 1200cc

4. The level of water in a measuring cylinder is 12.5ml. When a stone is lowered in it, the volume is 21ml. Then the volume of the stone now is

A) 9ml B) 8.5ml C) 8ml D) 11ml

5. The water level in a measuring cylinder is 23ml. When a stone was dropped into it, water rises to the mark of 60ml. The volume of stone is

A) 23ml B) 58ml C) 37ml D) 35ml

6. The level of water in a measuring cylinder is 'A' ml. When a stone is lowered in it, the volume is 'B' ml. Then the volume of the stone now is

A) (A - B) ml B) (B - A) ml C) (A x B) ml D) (B/A) ml

7. The apparatus used to measure very accurately 10.5 ml of milk is

A) measuring jar B)pipette C)Burette D)Measuring flask

II) More than one answer type questions:

- *This section contains multiple choice questions. Each question has 4 choices (A), (B), (C),(D),out of which **ONE or MORE** is correct. Choose the correct options*

8. For measuring the volume of irregular stone we need

a)measuring cylinder b) pipette c) water d) thread

A) only a B) a and c C) a,c and d D) a,b and c

9. Units of volume are

a) cubic metre b) litre c) cubic centimetre d) square metre

A) a and c B) a,b and c C) b and c D) all

III) Fill in the blanks:

10. We measure the volume of a small irregular solid by using a .....

11. Volume of liquids is measured in litres (or).....

12. The liquids which wet the surface of glass have a .....meniscus.

13. Measuring flask is used for finding the volume of .....

IV) Match the following:

- *This section contains Matrix-Match Type questions. Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in **Column–I** have to be matched with statements (p, q, r, s) in **Column–II**. The answers to these questions have to be appropriately bubbled as illustrated in the following example.*

  *If the correct matches are A-p,A-s,B-r,B-r,C-p,C-q and D-s,then the correct bubbled 4*4 matrix should be as follows:*

14.

Column A	*Column B*
1) A unit used to express the volume of liquids	a) overflow jar
2) Volume a uniform wooden cylinder	b) $\pi r^2 h$
3) Volume of a sphere	c) litre
4) Device used to find the volume of irregular solids	d) $\frac{4}{3}\pi r^3$

A) 1 - c, 2 - b, 3 - d, 4 - a B) 1 -d, 2- a, 3- b, 4 - c

C) 1 - b, 2 - c, 3 - d, 4- a D) 1 -a, 2- d, 3-b, 4-c

V) Comprehension type questions:

♦ *This section contains paragraph. Based upon each paragraph multiple choice questions have to be answered. Each question has 4 choices (A) , (B) ,(C) and (D) out of which* ***ONLY ONE i****s correct. Choose the correct option.*

15. A bottle of tonic contains 240ml of the medicine. David has been told by the doctor that he should take two spoons thrice a day. Each spoon measures 5ml.

i) Tonic used in 1 day is ?

A) 20 ml B) 30 ml C) 240 ml D) 5 ml

ii) For how many days will he take the tonic?

A) 4 days B) 2 days C) 8 days D) 6 days

iii)Convert 5ml into litres?

A) $5x10^{-3}$ litres B) $50x10^{-3}$ litres C) $5x10^{-4}$ litres D)$0.5x10^{-3}$ litres

KEY

ΦΦ TEACHING TASK :

1) D, 2) C, 3) B,4) B, 5) C, 6) B, 7) D, 8) C, 9) B, 10) measuring cylinder, 11)cc, 12) concave, 13) liquids, 14) A, 15) i)B, ii)C, iii)A

LEARNER'S TASK

BEGINNERS (Level - I)

I) Choose the correct answer:

1. The space occupied by an object is called

A) area B) length C) mass D) volume

2. The abbreviation for cubic centimetre

A) cc B) cm C) mm D) cm^2

3. The S.I unit of volume is

A) m^3 B) cm^3 C) mm^3 D) dm^3

4. 1 cubic centimetre = ... m^3.

A) 10^6 B) 10^{-6} C) 10^4 D) 10^{-4}

5. The side of a cube is 3m. Then its volume would be

A) 9m B) $27m^3$ C) $27m^2$ D) $26m^3$

6. Choose the correct equation

A) Area = $\frac{\text{height}}{\text{volume}}$ B) Area = $\frac{\text{voulme}}{\text{height}}$ C) Height = $\frac{\text{area}}{\text{volume}}$ D) volume = $\frac{\text{area}}{\text{height}}$

7. $1km^3$ = ... m^3

A) 10^{12} B) 10^9 C) 10^6 D) 10^3

8. Which of the following is a unit of volume ?

A) meter B) square meter C) cubic meter D) centimetre

9. The submultiple of C.G.S unit of volume

A) mm^3 B) cm^3 C) m^3 D) km^3

10. The volume of an irregular solid can be measured by

A) meter scale B) beam balance C) measuring jar D) common balance

11. The most suitable unit used for measuring volume of an exercise book is

A) cm^3 B) m^3 C) litre D) milliliter

12. 1ml = ... litres

A) 10 B) 1000 C) 10^{-3} D) 10^{-4}.

13. The unit used to measure volume of liquids is

A) litre B) metre C) centimetre D) cm^3

14. 1cubic metre = ... cc

A) 10^4 B) 10^6 C) 10^{-4} D) 10^{-6}

15. 1ml = ... cc

A) 1 B) $\frac{1}{1000}$ C) 100 D) 10^{-2}

16. $1m^3$ = ... litres

A) 1000 B) 100 C) 10 D) 10000

17. Measuring vessel used take a fixed volume of the liquid

A) measuring jar B) burette C) pipette D) all the above

ACHIEVERS (Level - II)

Solve the following:

1. The volume of cube is 27 m^3,then its side is?

2. The volume of cuboid is 4800 m^3.The length of the cuboid is 20 m and breadth is10m,then find the height of the cuboid?

3. The volume of cylinder is equal to the volume of sphere.Find the height of cylinder?

4. The volume of a sphere is 1437.33m^3 then find its radius.

5. While constructing a house engineer constructed a cube shaped room of side 10 m. Due to some reason only the length was increased by 5 m and the room is constructed find the area and volume of room?

EXPLORERS (Level - III)

I) More than one answer type questions

1. 1 litre is equal to

a) 1000 ml b) 1000 cc c) 1000 cm^3 d) 1000 mm^3

A. a and c B. a and b C. a,b and c D. b and c

2. Units of volume

a) cm^3 b) m^3 c) milli litres d) mm^3

A. a,b and d B. a,c and d C.a,b,c and d D.a and c

3. The instruments which are used to measure volume of liquids

a) pipette b) Burette c) measuring mask d) graph paper

A. a,b and c B.a and c C. a,c and d D.a,b,c and d

II) Fill in the blanks:

4. 1cubic metre = ... cc

5. ..... is the amount of surface occupied by an object

6. Volume of a rectangular slab = ...

7. $10000m^3$ = ... cm^3.

8. 1 litre = ... cm^3.

9. The water level in a measuring cylinder is 50.5 ml. When a stone was dipped into it, water rose to the mark of 58ml. Then the volume of the stone is .....

10. The water level in a measuring cylinder is 32.5 ml. When a stone was dipped into it, water rose to the mark of 38ml. Then the volume of the stone is .....

11. The water level in a measuring cylinder is 12 ml. When a stone was dipped into it, water rose to the mark of 16.5ml. Then the volume of the stone is .....

12. The water level in a measuring cylinder is 2.5 ml. When a stone was dipped into it, water rose to the mark of 9.5ml. Then the volume of the stone is .....

13. The water level in a measuring cylinder is 15.25 ml. When a stone was dipped into it, water rose to the mark of 18.5ml. Then the volume of the stone is .....

14. The water level in a measuring cylinder is 55 ml. When a stone was dipped into it, water rose to the mark of 62ml. Then the volume of the stone is .....

15. Measuring jar is used to measure the volume of the liquids in .....

16. The liquids which wet the surface of glass have a ..... meniscus

III) Match the following:

♦ *This section contains Matrix-Match Type questions. Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in* ***Column–I*** *have to be matched with statements (p, q, r, s) in* ***Column–II****. The answers to these questions have to be appropriately bubbled as illustrated in the following example.*

*If the correct matches are A-p,A-s,B-r,B-r,C-p,C-q and D-s,then the correct bubbled 4*4 matrix should be as follows:*

17.

object	**volume**
a) cube	1) $v=1/3r^2h$
b) sphere	2) $v=r^2h$
c) cone	3) $v=(side)^3$
d) cylinder	4) $\frac{4}{3}\pi$ (radius)^3

A) a - 4, b - 2, c - 3, d - 1 B) a - 3, b - 2, c - 1, d - 4
C) a - 3, b - 4, c - 1, d - 2 D) a - 2, b - 1, c - 4, d - 3

18.

column-I	**column-II**
a) 1 litre	1) 1 cc
b) 1 m^3	2) 1000 cc
c) 1 ml	3) ft^3
d) volume	4) 1000 litre

A) a - 3, b - 2, c - 4, d - 1 B) a - 2, b - 4, c - 1, d - 3
C) a - 3, b - 4, c - 2, d - 1 D) a - 2, b - 1, c - 4, d - 3

IV) Comprehension type questions:

◆ *This section contains paragraph. Based upon each paragraph multiple choice questions have to be answered. Each question has 4 choices (A) , (B) ,(C) and (D) out of which* ***ONLY ONE i****s correct. Choose the correct option.*

19. The level of water in a measuring cylinder is 12.5 ml.When a stone is lowered in it,the volume is 21.0 ml.

i) How much level of water increased?
A) 8.5 ml B) 9.5 ml C) 7.5 ml D) 8 ml

ii) Find the volume of stone?
A) 8.5 m^3 B) 9.5 ml C) 7.5 ml D) 8 ml

iii) The level of water in measuring cylinder after lowering the stone?
A) 8.5 ml B) 21 ml C) 7.5 ml D) 12.5 ml

20. Volumes of some objects are given below.

objects	**in S.I system**	**in C.G.S system**
a. A rupee coin	? m^3	24 cm^3
b.A pen	11 X 10^{-6} m^3	11 cm^3
c.A paper cone	? m^3	366 cm^3

i) What is the volume of a rupee coin in S.I units?
A. 24 m^3 B.24 x 10^{-6} m^3 C.24 X 10^6 m^3 D.24 X 10^3 m^3

ii) What is the submultiple of 366 cm^3?
A. 366 m^3 B.366 X 10^3 m^3 C. 366 X 10^3 km^3 D.366 X 10^{-3} m^3

iii) What is the volume of a pen in mm?
A. 11 mm^3 B.11 X 10^6 mm^3 C. 11 X 10^3 mm^3 D. 11 X 10^{-3} m^3

RESEARCHERS (Level - IV)

I) Choose the correct answer:

1. Which of the following has largest volume? (**NSO-2011**)
A.1 litre milk carton B.40 ml sunscreen tube C.10 ml test tube D.60 ml coke bottle

2. How many bottles of 300 ml capacity will be filled from a pot which contains 2.85 m^3 oil? (**JNV-2010**)
A.950 B. 9050 C. 9500 D. 9550

3. In a given system of units,the ratio of the unit of volume to that of area given the unit of (**NSO-2009**)

A. mass B.length C.time D.temperature

4. A cube has sides of length 1.2×10^{-2} m. Calculate its volume. (**IIT-JEE-2003**)

A. $1.7 \times 10^{-6} m^3$ B. $1.73 \times 10^{-6} m^3$ C. $17 \times 10^{-6} m^3$ D. $1.732 \times 10^{-6} m^3$

5. A stone of volume $30cm^3$ is lowered into 60cm3 of water in measuring cylinder. What will be the new reading in the measuring cylinder? (**NSO-2009**)

A. $60cm^3$ B. $30\ cm^3$ C. $90cm^3$ D. $100cm^3$

II) Additional question for practice:

1. 1 hectare = ... km^2

A) 10^2 B) 10^4 C) 10^{-4} D) 10^{-2}

2. Surface of a table corresponds to

A) length B) breadth C) volume D) area

3. 1m x 1m =

A) 1m B) $1m^2$ C) $1m^3$ D) 2m

4. The C.G.S unit of area is

A) cm^2 B) m^2 C) mm^2 D) cm^3

5. The multiple of sq.metre is

A) cm^2 B) mm^2 C) hectare D) none of these

6. Unit of area among the following is

A) light year B) centimetre C) cubic meter D) square meter

7. The submultiple of square centimeter

A) m^2 B) cm^2 C) mm^2 D) cm^3

8. One acre = ...

A) $10m^2$ B) $100m^2$ C) $100m^2$ D) $1000m^2$

9. Area of an object is the

A) total surface possessed by the object B) total volume occupied by the object

C) total amount of matter contained in the body D) total space occupied by the object.

10. Unit of area in standard international system is

A) square millimeter B) square centimetre C) square meter D) square kilometer

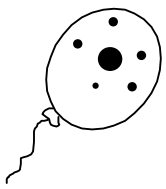
11. $1m^2$ = ... mm^2

A) 10^4 B) 10^6 C) 10^8 D) 10^{10}

12. The unit in which the volume of a match box measured is

A) m^3 B) l C) cm^3 D) ml

13. In which of the following cubes can a balloon filled with air increases in size.



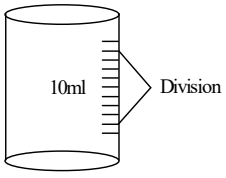
A) When it is kept with ice

B) When it is kept in the sun

C) When it si kept inside water

D) When it is kept in a salt solution

14. Study the figure of a measuring jar given here. Which of the following jars will enabley you to measure the volume of a liquid with the highest accuracy.



A) 50ml jar with a gap of 0.5cm between the divisions.

B) 100ml jar with a gap of 0.25cm between the divisions.

C) 200ml jar with a gap of 1cm between the divisions.

D) 500ml jar with a gap of 1.5cm between the divisions.

15. Study the following table:

Wt.of 10 mangoes	width of a tree	volume of a stone
weighing balance	measuring tape	?

Which of the following can be placed in the box that is blank ?

A) stop watch B) standard scale C) measuring jar D) thread & scale

16. Name the units in which the areas of each of the following objects can be expressed respectively.i) A 50 paise coin ii) A playing card iii) area of your class room iv) area of a district

A) kg^2, m^2, litre and cm^2 B) mm^2, cm^2, m^2 and km^2

C) mm^2, km^2, hectare and acre D) none of the above

KEY

ΦΦ LEARNER'STASK :

☐ **BEGINNERS :**

1) A, 2) A, 3) A, 4) B, 5) B, 6) B, 7) B, 8) C, 9) A, 10) C, 11) A, 12) C, 13) A, 14) B, 15) A, 16) A, 17) C,

☐ **ACHIEVERS :** 1)3m 2)24 m 3)4r/3 4)7m 5)150 m^2, 1500 m^3

☐ **EXPLORERS :** 1) B, 2) C, 3) A, 4) 10^6, 5) volume, 6) l x b, 7)$10^{10}cm^3$, 8)10^3, 9)7.5 ml (or) cc, 10) 5.5 ml, 11) 4.5 ml, 12) 4.7 ml 13) 3.25 ml, 14) 7 ml, 15) ml, 16) concave, 17) C 18) B, 19) i) A, ii) A, iii) B, 20) i) B, ii)B, iii)A.

☐ **RESEARCHERS :** i)1) A, 2) C, 3) B, 4) B, 5)C,

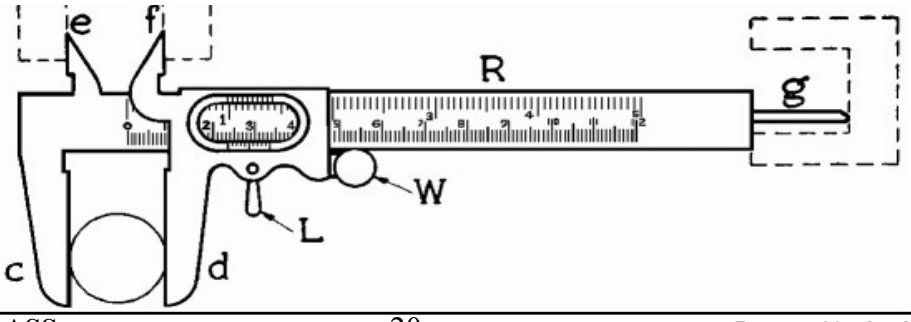
ii) 1) D, 2) D, 3) B, 4) A, 5) C, 6) D, 7) C, 8) B, 9) A, 10) C, 11) B, 12) A, 13) B, 14) B, 15) C, 16) B

Vernier Callipers

§§ ***Least Count :*** The smallest value which can be measured by a given instrument accurately is called its Least Count.

1) LC of ordinary meter scale is 1mm 2) LC of a wall clock is 1sec

Vernier Callipers :



1) It was invented by **Paul Vernier.**

2) A mechanical device which combines a main scale and a vernier scale whose least count is much smaller than that of a main scale is called a Vernier Callipers.

3) It consists of two scales called main scale (graduated in centimeters or inches), vernier scale (contains **10 divisions in 9mm** length).

4)Principle: The principle of Vernier is to make N vernier scale divisions (V.S.D.) equal to (N-1) main scale divisions (M.S.D.) or N . **VSD = (N-1) MSD**

5)Least count : LC = 1M.S.D. - 1V.S.D. = 0.1mm (or) 1/10 mm (or) 1/100 cm (or) 0.01cm

6)Zero Error : When two jaws of Vernier Callipers are in contact, if the zero of the main scale does not coinsides with zero of the vernier scale then the vernier is said to have zero
error.

a) Positive zero error *:* If the zeroth division of the vernier scale is to the 'right' of the zeroth division of the main sacle,then the error is said to be positive and the correction is negative.

Corrected reading = observed reading - error

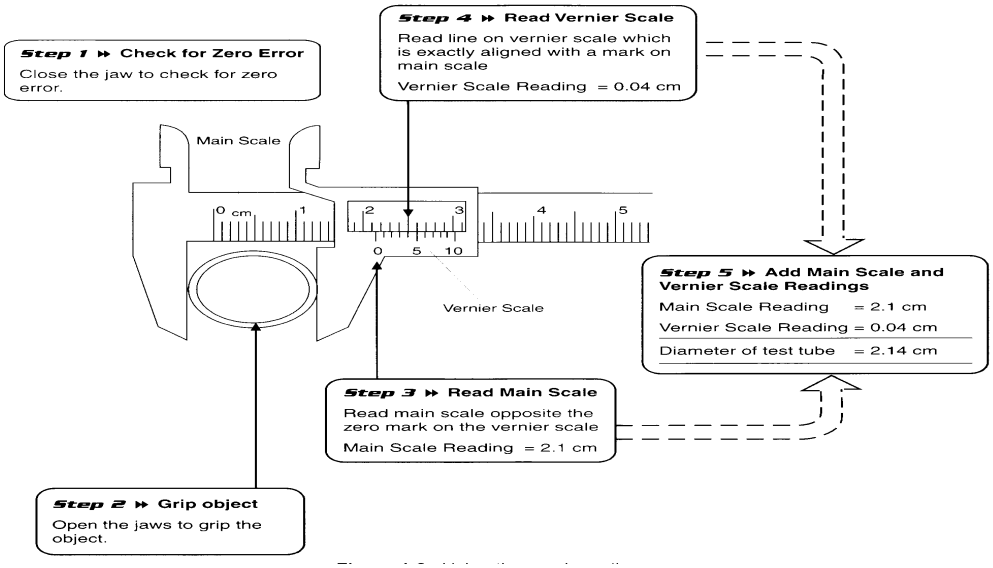
b) Negative error : If the zeroth division of vernier scale is to the 'left' of the zeroth division of the main scale,then the error is said to be negative and correction is positive
.

Corrected reading = observed reading + error.

7) Length of an object = Main scale reading + [Corrected Vernier scale reading $\times$ Least Count]

L= M.S.R + [C.V.S.R. $\times$ LC]

8) Vernier callipers is used to measure length,diameteror inner diameter of an object.



EXAMPLE

√ **Example1:**

A vernier callipers has 10 divisions , it slides over a main scale , whose pitch is 1 mm. if the no.of divisions on the left hand of zero of vernier on main scale are 4 and the 6th vernier scale division coinside with the main scale, the length in cm is?

Solution:

No.of vernier scale divisions (N)=10

Pitch of the vernier scale (s)=1mm

$$\text{Least Count } (L.C)=\frac{S}{N}=\frac{1mm}{10}=0.1mm$$

M.S.R=no.of divisions on the left hand of zero xpitch=4x1mm=4mm

V.S.D=6

length= M.S.R+(V.S.DXL.C)

length = 4mm+(6x0.1mm)=4mm+0.6mm=4.6mm

length=0.46cm

√ **Example 2:**

A vernier callipers has 10 divisions , it slides over a main scale , whose pitch is 1 mm .if the no.of divisions on the left hand of zero of vernier on main scale is 56 and the 8th V.S.D coincides with main scale, if the instrument has a negative error of 0.07cm.calculate the corrected length.

Solution:

No.of vernier scale divisions (N)=10

Pitch of the vernier scale (s)=1mm

$$\text{Least Count } (L.C)=\frac{S}{N}=\frac{1mm}{10}=0.1mm$$

M.S.R=no.of divisions on the left hand of zero xpitch=56x1mm=56mm

V.S.D=8

Observed length= M.S.R+(V.S.DXL.C)

Observed length = 56mm+(8x0.1mm)=56mm+0.8mm=56.8mm

Observed length=5.68cm

Error= -0.07cm correction of error=+0.07cm

Corrected length=Observed length+correction of error

Corrected length=5.68cm+0.07cm=5.75cm

√ **Example 3:**

The least count of a vernier callipers is 0.0025cm and it has an error of 0.0125cm.while measuring the length of a cylinder the reading on main scale is 7.55cm and 12th V.S.D coincides with main scale, calculate the corrected length.

Solution:

Least Count =0.0025 cm

M.S.R=7.55cm

V.S.D=12

Observed length= M.S.R+(V.S.DXL.C)

Observed length = 7.55cm+(12x0.0025cm)=7.55cm+0.03cm=7.58cm

Observed length=7.58cm

Error= 0.0125cm correction of error= - 0.0125cm

Corrected length=Observed length+correction of error

Corrected length=7.58cm - 0.0125cm=7.5675cm

√ **Example 4:**

The least count of a vernier callipers is 0.01cm and it has an error of +0.07cm.while measuring the diameter of the sphere, the reading on main scale is 2.90cm and 5th V.S.D coincides with main scale, calculate the corrected radius.

Solution:

Least Count =0.01 cm

M.S.R=2.90 cm

V.S.D=5

Observed diameter= M.S.R+(V.S.DXL.C)

Observed diameter = 2.90 cm+(5x0.01cm)=2.90 cm+0.05cm=2.95 cm

Observed diameter=2.95 cm

Error= +0.07 cm correction of error= - 0.07 cm

Corrected diameter=Observed diameter+correction of error

Corrected diameter(d)=2.95 cm - 0.07 cm=2.88 cm

Corrected radius r=d/2=2.88cm/2=1.44cm

TEACHING TASK

I) Single correct option questions:

1. A vernier callipers has 20 divisions on the vernier scale which coincides with 19mm on the main scale. Its least count is

1) 0.5mm 2) 1mm 3) 0.05mm 4) $\frac{1}{4}mm$

2. Least count of a vernier callipers is 0.01cm. Using this, the diameter of a sphere is measured as 1.95cm. Radius of the sphere to the correct significant figure will be

1) 0.98cm 2) 0.975 cm 3) 1.0 cm 4) 1 cm

3. The main scale of vernier callipers is divided into 0.5mm and its least count is 0.005cm. Then the number of divisions on vernier scale is

1) 10 2) 20 3) 30 4) 40

4. The side of a cube is measured by a vernier calliper (10 divisions of vernier scale coincide with 9 divisions of main scale, where 1 division of main scale is 1mm). The main scale reads 10mm and first division of vernier scale coincides with the main scale. Mass of the cube is 2.736g. The density of the cube is approximate appropriate significant figures is

1) $1.33gcm^{-3}$ 2) $2.66gcm^{-3}$ 3) $3.667\,gcm^{-3}$ 4) $2.5\,gcm^{-3}$

5. The n^{th} division of main scale coincides with $(n+1)^{th}$ division of vernier scale. Given one main scale division is equal to 'a' units. The least count of vernier is

1) $\frac{n}{a+1}$ 2) $\frac{a}{n+1}$ 3) an 4) $\frac{a}{n}$

6. The vernier scale of a travelling microscope has 50 divisions which coincide with 49 main scale divisions. If each main scale division is 0.5mm, the minimum inaccuracy in the measurement of distance is

1) 0.1mm 2) 0.001 mm 3) 0.01mm 4) 1mm

7. The vernier constant of a vernier callipers is 0.1mm and it has a positive zero error of 0.04cm. While measuring diameter of a rod, the main scale reading is 1.2 cm and 5^{th} vernier division is coinciding with any scale division. The correct diameter of the rod is

1) 1.21cm 2) 1.21 mm 3) 1.29mm 4) 1.29 cm

8. When the two jaws of a vernier callipers are in touch, zero of vernier scale lies to the right of zero of main scale and coinciding with vernier division 3. If vernier constant is 0.1mm, the zero correction is

1) $-0.03cm$ 2) $+0.03cm$ 3) $-0.03mm$ 4) $+0.03mm$

9. You are given two different vernier calipers A and B haiving 10 divisions on vernier scale that coincide with 9 divisions on the main scale each. If 1 cm of main scale A is divided into 10 parts and that of B in 20 parts, then least count of A and B are

1) 0.001 cm and 0.005 cm 2) 0.01 cm and 0.05cm

3) 0.01 cm and 0.005cm 4)0.01 cm and 0.001cm

II) More than one correct option questions :

- *This section contains multiple choice questions. Each question has 4 choices (A), (B), (C),(D), out of which **ONE or MORE** is correct. Choose the correct options*

10. $\frac{1}{100}$ th of a mm is equal to

a) 0.1 mm b) 0.0001 cm c) 0.01 mm d) 0.001 cm

A) a,b correct B) c,d correct C) a,d correct D) only a correct

11. In a vernier callipers 19 M.S.D coincide with 20 V.S.D. If the main scale has 20 divisions in a centimetre.Choose the correct option

a) The pitch of the vernier callipers is 0.5mm

b) L.C of the vernier callipers is 0.25 mm

c) L.C of the vernier callipers is 0.0001mm

d) L.C of the vernier callipers is 0.025 mm

A) a,b B) c,d C) a,d D) only a

12. A) Vernier callipers with 20 divisions on sliding scale, coinciding with 19 main scale divisions

B) A screw gauge of pitch 1mm and 100 divisions on the circular scale

C) An optical instrument that can measure length to within a wavelength of light

Out of A, B and C the most precise device for measuring length is

1) A only 2) B only 3) C only 4) All are equally accurate

III) **Assertion - A and Reason - R:**

- *This section contains certain number of questions. Each question contains Statement – 1 (Assertion) and Statement – 2 (Reason). Each question has 4 choices (A), (B), (C) and (D) out of which* ***ONLY ONE*** *is correct Choose the correct option.*

A) Both A and R are true and R is correct explanation of A.

B) Both A and R are true and R is not correct explanation of A.

C) A is true but R is false.

D) A is false but R is true.

13. A:The difference between one main scale division and one vernier scale division is called its Least count.

R:The least count of a vernier scale is of the order of 1m.

14. A:There are five zero errors in a vernier callipers.

R:If the zeroth division of a vernier scale does not coinside with zeroth division of main scale then it is said to have zero error.

IV) ***Match the following :***

- *This section contains Matrix-Match Type questions. Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in* ***Column–I*** *have to be matched with statements (p, q, r, s) in* ***Column–II****. The answers to these questions have to be appropriately bubbled as illustrated in the following example.*

*If the correct matches are A-p,A-s,B-r,B-r,C-p,C-q and D-s,then the correct bubbled 4*4 matrix should be as follows:*

15.

a) Positive zero error	1) Zero of V.S is on right side to zero of main scale
b) Negative zero error	2) positive
c) correction for Positive Zero error	3) negative
d) correction for negative zero error	4) Zero of V.S is on left side of main scale

A) a-1,b-2,c-3,d-4 B) a-2,b-3,c-4,d-1

C) a-1,b-4,c-3,d-2 D) a-3,b-4,c-2,d-1

V) **Comprehension type questions:**

- *This section contains paragraph. Based upon each paragraph multiple choice questions have to be answered. Each question has 4 choices (A) , (B) ,(C) and (D) out of which* ***ONLY ONE i****s correct. Choose the correct option.*

16. Using vernier callipers the length of the object is found by the formula length = Reading on M.S. + L.C. ×V.S.D $\pm$ correction

i) A vernier scale has 20 divisions. It slides over main scale, whose pitch is 0.5 mm. If the number of divisions on the left hand of the zero of vernier on the main scale is 38 and the 18th vernier scale division coincides with main scale, calculate the observed diameter of the sphere, held in the jaws of vernier callipers.

A) 1.945 cm B) 2.945 cm C) 3.945 cm D) 4.945 cm

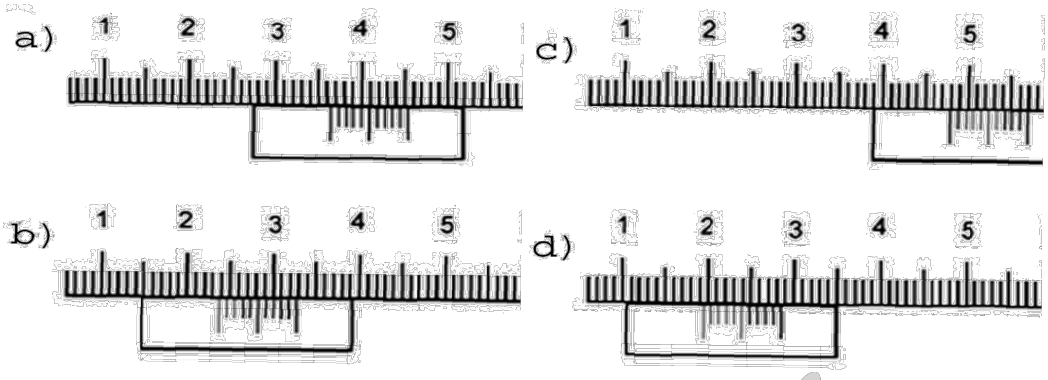
ii) In the above problem If the vernier has a negative error of 0.04 cm, the corrected radius of sphere is

A) 1.945 cm B) 2.945 cm C) 1.985 cm D) 2.985 cm

iii) The least count of a vernier callipers is 0.0025 cm and it has an error of -0.0125 cm. While measuring the length of a cylinder, the reading on main scale is 7.55 cm, and 10th vernier scale division coincides with main scale, the corrected length is

A) 7.5875 cm B) 75.67 cm C) 756.7 cm D) 7567 cm

17. Write the reading shown by Vernier callipers in each case.



KEY

ΦΦ TEACHING TASK :

1) 3, 2) 1, 3) 1, 4) 2, 5) 2, 6) 3, 7) 1, 8) 1, 9)2, 10) B, 11) C, 12)C, 13) C, 14) D, 15) C, 16) i) A, ii) C, iii) A, 17) a) 3.64cm, b) 2.47cm c) 4.79cm d) 1.94cm.

LEARNER'S TASK

BEGINNERS (Level - I)

I) ***Single correct option questions:***

1. The least count of our watch or table clock is

A) one second B) one minute C) one hour D) one day

2. The Vernier Callipers was invented by

A) Paul vernier B) Einstein C) Newton D) Raman

3. The least count of Vernier Callipers in mm is

A) 0.01 B) 0.001 C) 0.1 D) 1

4. The main scale reading for the length of a cylinder is 3 cm and vernier coincidence is 8. Its length is

A) 3.8 cm B) 3.008 cm C) 0.38 cm D) 3.08 cm

5. The formula for measuring thickness of a rod by using vernier callipers is

A) M.S.R. + [V.S.R. X L.C.] B) M.S.R. - [V.S.R. X L.C.]

C) M.S.R. X [V.S.R. + L.C.] D) [M.S.R. X L.C.]+ V.S.R.

6. The main scale of vernier callipers has 10 divisions in a centimeter and 10 vernier scale divisions coincide with 9 main scale divisions. Calculate L.C of vernier callipers.

A) 0.1cm B) 0.0001cm C) 0.001cm D) 0.01cm

7. While measuring the radius of a cylinder, the main scale reading is 3.60 cm and 8th division of vernier scale consides with main scale, calculate the radius (take L.C=0.01 cm)

A) 1.84 cm B) 3.86 cm C) 3.68 mm D) 3.86 mm

8. In a vernier callipers 19 main scale divisions coincide with 20 vernier scale divisions.If the main scale has 20 divisions in a centimeter calculate L.C of vernier .

A) 0.0025cm B) 0.00025cm C) 0.025cm D) 0.25 cm

9. The least count of a vernier callipers is 0.01 cm. It has an error of + 0.02 cm. While measuring the radius of a cylinder, the main scale reading is 3.60 cm and 8th vernier scale division coincides with main scale.Calculate the corrected radius.

A) 1.25 cm B) 0.183 cm C) 1.83 mm D) 1.83 cm

10. The least count of a vernier callipers is 0.0025 cm and it has an error of + 0.0125 cm. While measuring the length of a cylinder,the reading on main scale is 7.55 cm, and 12th vernier scale division coincides with main scale.Calculate the corrected length

A) 7.657 cm B) 7.756 cm C) 7.567 cm D) 7.83 cm

11. The least count of a vernier callipers is 0.01 cm and it has an error of + 0.07 cm. While measuring the radius of a sphere, the main scale reading is 2.90 cm and the 5th vernier scale division coincides with main scale. Calculate the corrected radius.

A) 1.46 cm B) 1.004 cm C) 1.44 cm D) 1.044 cm

12. A vernier scale has 10 divisions. It slides over main scale whose pitch is 1mm. If number of divisions on the left hand of zero of vernier on the main scale is 56 and the 8th vernier scale division coincides with main scale. If the vernier has a negative error of 0.07 cm.Find the corrected length?

A) 5.75cm B) 5.83cm C) 5.92cm D) 5.98cm

13. The least count of a vernier callipers is 0.01 cm and it has an error of + 0.02 cm. While measuring the diameter of a sphere, the main scale reading is 3.60 cm and the 8th vernier scale division coincides with main scale. Calculate the corrected radius ?

A) 1.32cm B) 1.53cm C) 1.83cm D)1.93cm

14. The main scale for the length of cylinder is 5cm and vernier coincidence is 4 when negative error 0.04 then the corrected length is

A) 4.95 B) 4.98 C) 4.99 D) 5.09

ACHIEVERS (Level - II)

Solve the following :

1. While measuring the length of a cylinder reading on main scale is 5.2 mm and the 5th verneir scale division coincides with main scale. What is its length

2. The main scale of a vernier callipers has 10 divisions in a cm and 10 vernier scale divisions coincide with 9 main scale divisions. Calculate the least count of vernier callipers in cm.

3. While measuring the length of a cylinder, the reading on main scale is 7.55 cm, and the 12th vernier scale division coincides with main scales calculate the length ?

4. The main scale of a vernier callipers has 10 divisions in a centimeter and 10 vernier scale divisions coincide with 9 main scale divisions. calculate the least count of vernier callipers in mm.

5. In a vernier callipers 19 main scale divisions coincide with 20 vernier scale divisions. If the main scale has 20 divisions in a centimeter calculate its L.C

EXPLORERS (Level - III)

I) More than one correct option questions :

- *This section contains multiple choice questions. Each question has 4 choices (A), (B), (C),(D), out of which **ONE or MORE** is correct. Choose the correct options*

1. The LC of vernier scale is

a) 1 mm b) 0.1 mm c) 0.01 cm d) 0.1 cm

A) a,b correct B) b,c correct C) c,d correct D) d,a correct

2. The parts of vernier scale

a) main scale b) vernier scale c) clock d) none

A) a,b true B) b,c true C) c,d true D) d,a true

3. The vernier scale is used to measure

a) diameter b) length c) depth of hallow object d) radius

A) a,b,c correct B) b,c,d correct C) c,d,a correct D) all correct

II) Assertion - A and Reason - R:

- *This section contains certain number of questions. Each question contains Statement – 1 (Assertion) and Statement – 2 (Reason). Each question has 4 choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct Choose the correct option.*

A) Both A and R are true and R is correct explanation of A.

B) Both A and R are true and R is not correct explanation of A.

C) A is true but R is false. D) A is false but R is true.

4. **A:** Least count of vernier callipers is 0.1 cm

R: Smallest value which can be measured by instrument accurately is called least count.

5. **A:** Principle of vernier is N vernier scale division coincides N-1 main scale divisions.

R: Vernier callipers consists two scales.

6. **A:** Vernier callipers is used to measure length, diameter, depth of object.

R: Reading = M.S.R+[V.S.RXLC].

7. **A:** If zeroth division of vernier scale is right of the zeroth main scale division is said to be positive error.

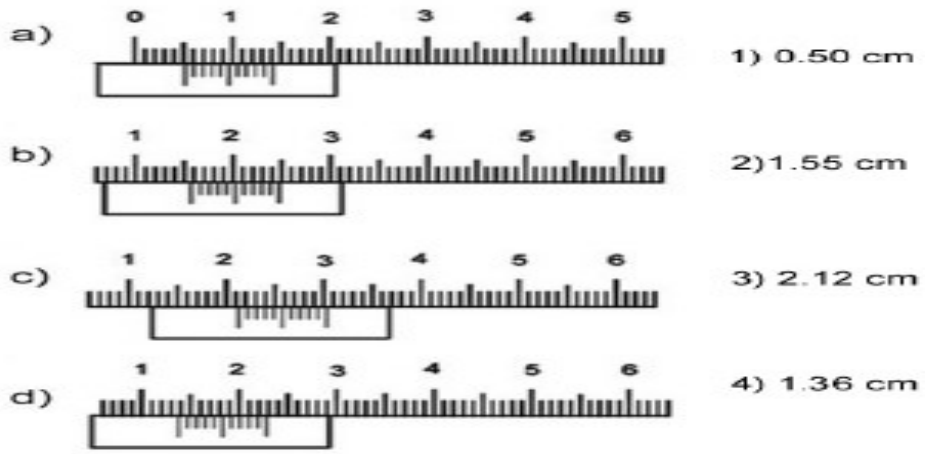
R: Correction for positive error is negative.

III) Match the following:

- *This section contains Matrix-Match Type questions. Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in **Column–I** have to be matched with statements (p, q, r, s) in **Column–II**. The answers to these questions have to be appropriately bubbled as illustrated in the following example.*

*If the correct matches are A-p,A-s,B-r,B-r,C-p,C-q and D-s,then the correct bubbled 4*4 matrix should be as follows:*

8. Observe the following Diagrams and match with correct readings.



A) a-1,b-2,c-3,d-4 B) a-4,b-2,c-1,d-3
C) a-3,b-2,c-1,d-4 D) a-1,b-4,c-3,d-2

9. a) LC of vernier scale 1) negative
b) Length of object 2) 0.1 mm
c) Correction for positive error 3) positive
d) Correction for negative error 4) M.S.R+[V.S.RXLC]
A) a-1,b-2,c-3,d-4 B) a-2,b-4,c-1,d-3
C) a-3,b-2,c-1,d-4 D) a-4,b-1,c-3,d-2

10. a) Inside jaws 1) to measure external diameter
b) Strip 2) to measure depth of bottle
c) Vernier scale 3) to measure length up to 0.1 mm
d) Outside jaws 4) to measure internal diameter
A) a-1,b-2,c-3,d-4 B) a-4,b-3,c-2,d-1
C) a-4,b-2,c-3,d-1 D) a-4,b-1,c-3,d-2

IV) <u>Comprehension type questions:</u>

♦ *This section contains paragraph. Based upon each paragraph multiple choice questions have to be answered. Each question has 4 choices (A) , (B) ,(C) and (D) out of which* ***ONLY ONE i****s correct. Choose the correct option.*

11. A vernier scale has 20 divisions. If slides over main scale which has 20 divisions in one centimeter If number of divisions on the left hand of zero of vernier on the main scale is 38 and the 18th vernier scale division coincides with main scale.When object held in the jaws of vernier callipers. If the vernier has a negative error of 0.04 cm.

i) The LC of vernier scale is
A) 0.25 cm B) 0.025 cm C) 0.0025 cm D) 0.00025 cm

ii) The main scale reading of vernier is
A) 1.9 cm B) 1.9 mm C) 0.19 cm D) 0.19 mm

iii) Correction of error in vernier scale is
A) -0.04 cm B) 0.04 mm C) 0.04 cm D) -0.04 mm

iv) The observed diameter of the object

A) 1.495 cm B) 1.495 mm C) 1.945 cm D) 1.945 mm

v) The corrected diameter of the object

A) 1.859 cm B) 1.859 mm C) 1.985 mm D) 1.985 cm

12. A vernier scale has 10 divisions. It slides over a main scale. Which has 10 divisions in one centimeter. If number of divisions on the left hand of zero of vernier on main scale are 4 and 6th vernier scale division coincide with main scale, If the above instrument has a negative error 0.03 cm.

i) The LC of vernier scale is

A) 0.01 cm B) 0.001 cm C) 0.0001 cm D) 0.00001 cm

ii) The main scale reading of vernier is

A) 0.4 cm B) 0.004 mm C) 0.04 mm D) 0.004 cm

iii) Correction of error in vernier scale is

A) -0.03 cm B) 0.03 mm C) 0.03 cm D) -0.03 mm

iv) The observed diameter of the object

A) 0.460 mm B) 0.460 cm C) 1.460 cm D) 1.460 mm

v) The corrected diameter of the object

A) 0.490 cm B) 0.490 mm C) 0.480 mm D) 0.480 cm

RESEARCHERS (Level - IV)

1. A vernier scale has 1mm marks on the main scale. It has 20 equal divisions on the vernier which match with 16 main scale divisions,for this venier clipers find L.C? **(IIT JEE-2010)**

2. A student measured the length of a rod and wrote it as 3.50 cm. Which instrument did he use to measure it ? **(IIT JEE-2014 Main)**

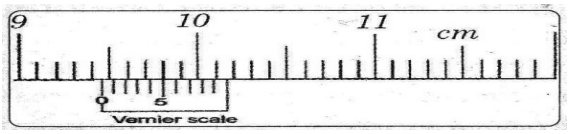
A) A meter scale

B) A vernier calliper where the 10 divisions in vernier scale matches with 9 divisions in main scale and main scale has 10 divisions in 1 cm

C) A screw gauge having 100 divisions in the circular scale and pitch as 1 mm.

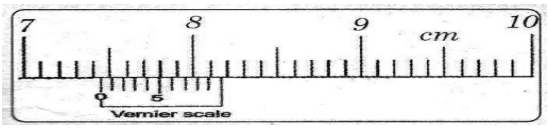
D) A screw gauge having 50 divisions in the circular scale and pitch as 1 mm.

3. The length of a cube is measured with the help of a vernier callipers.The observations are shown in figure below. Find length of the cube with these observations.



(NSEP2004)

4. In the figure for vernier callipers,calculate the length recorded. **(NSEP2005)**



KEY

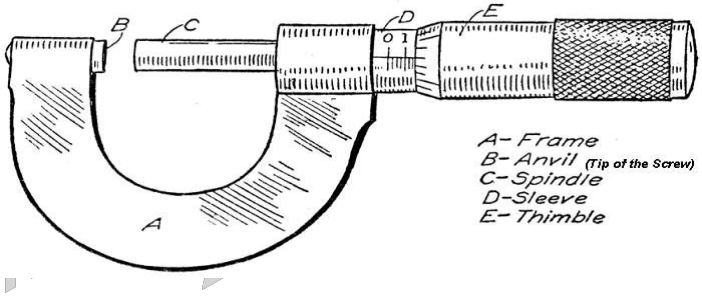
ΦΦ LEARNER'STASK :

- **BEGINNERS :** 1) A, 2) A, 3) C, 4) D, 5) A, 6) D, 7) A , 8) A, 9) D, 10) C, 11) C, 12)A 13)C 14)D
- **ACHIEVERS :** 1)5.25 cm 2)0.05 3)7.67 cm 4)0.1 mm 5)0.0025 cm
- **EXPLORERS :** 1) B, 2) A, 3) D, 4) D, 5) B, 6) B, 7) B, 8) A, 9) B, 10) C, 11) i) C, ii) A, iii) C, iv) C, v) D, 12) i) A, ii) A, iii) C, iv) B, v) A.
- **RESEARCHERS :** 1) 0.2 mm; 2) B; 3) 9.45 cm; 4) 7.45 cm;

§§ *Screw gauge-Micrometer :*

A screw gauge is used to measure the thickness of a thin glass plate and the diameter of a thin wire or a small sphere.

Its accuracy is up to **0.001 cm.**



¶¶ Principle: Screw gauge works on the principle of screw in a nut.

1. Screw gauge consist of two scales

a) *Pitch Scale or main Scale* : It is a fixed scale graduated in millimeters over a base line on a cylinder on the screw.

b) *Head Scale (or) Circular Scale* : It consists of 50 (or) 100 divisions marked on a Circular level edge, which can be movable on main scale.

2. The distance travelled by the tip of a screw for one complete rotation of its screw head is called the "pitch of the screw".

$$\text{Pitch of the screw, } P = \frac{\text{Distance travelled by the screw}}{\text{No.of complete rotaions made}} = \frac{x}{n}$$

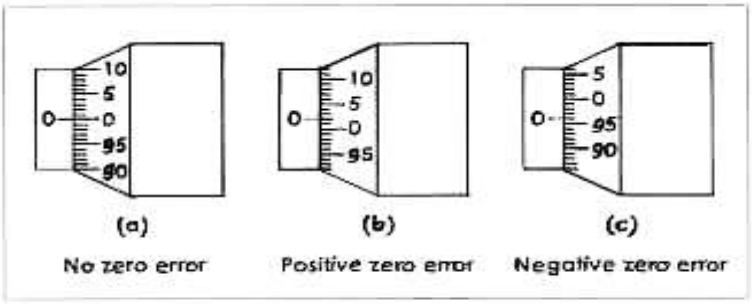
3. The smallest length that can be measured by using a screw is called the least count.

$$\text{Least count (L.C)} = \frac{\text{pitch of the screw}}{\text{No.of head scale divisions}}$$

$$\text{L.C} = \frac{P}{N}$$

4. The thickness of the wire can be measured by using the formula.

Thickness = P.S.R+(H.S.R. x L.C)



5. ***Zero error :*** When the zero of circular scale does not coincide with the reference line perfectly when the screw is completely rotated, then the the screw gauge is said to have Zero error

a) Positive error : When the zero of circular scale is left behind the reference line, then the instrument is said to have positive error and the correction is negative .

Correction = - Coinciding division of C.S x L.C

Corrected diameter = Observed diameter +Correction.

b) Negative zero error : When the zero of circular scale advances beyond the reference line the instrument is said to have negative error and the correction is positive

Correction = +[n - coinciding division of C.S x L.C]

where n is the total number of circular scale divisions.

Corrected diameter = Observed diameter + Correction.

EXAMPLE

√ **EX.1** In Two complete rotations the disatnce travelled by the pitch scale is 2mm, IF therer are 50 divisions on the circular scale The pitch scale is 2 mm I.If there are 50 divisions on the cicular scale ,then calculate pitch and L.C

sol: pitch of the screw= distance travelled by the screw/ no of complete rotations made

P=x/n

P=2/2

P=1mm

least count (L.C) = pitch of the screw/ no of head scale divisions

L.C =0.1/50 = 1/5 = 0.002 cm

√ **EX.2**.A.micrometer screw gauge haveing a postive error of 5 divisions is used to measure diameter of wire, when reading on main scale is 3 rd divisions and 48 th circular divisions coincides with base line .If the micro meter on main scale and 100 divisitions on circular scale ,Finale the corrected diameter.

sol: pitch of the screw = x/n

p =1/1 = 1mm

least count = p/n = 0.1/100 =0.001 cm

observed diameter =(P.S.RX Pitch) + (H.S.RXL.C)

= (3x0.1)+(48x0.001)

=0.3+0.048= 0.348 cm

Corrected diameter = Observed diameter +Correction.

Correction.= - coinciding division of C.S X L.C

=-5x0.001 = -0.005 cm

corrected diameter = 0.348 - 0.05

= 0.343 cm

TEACHING TASK

I) *Single correct option questions:*

1) A screw gauge having 100 equal divisions and a pitch of length 1mm is used to measure the diameter of a wire of length 5.6cm. The main scale reading is 1mm and 47th circular division coincides with the main scale. The curved surface area of the wire to the approximate significant figures is

1) $2.6cm^2$ 2) $2.587cm^2$ 3) $2.58cm^2$ 4) $2.5872cm^2$

2) Two full turns of the circular scale of a screw gauge cover a distance of 1mm on its main scale. The total number of divisions on the circular scale is 50. Further it is found that the screw gauge has a zero error of $-0.03mm$. While measuring the diameter of a thin wire, a student notes the main scale reading of 3mm and the number of circular scale divisions in line with the main scale as 35. The diameter of the wire is

1) 3.32mm 2) 3.73 mm 3) 3.67mm 4) 3.38 mm

3) The density of a solid ball is to be determined in an experiment. The diameter of the ball is measured with a screw gauge, whose pitch is 0.5mm and there are 50 divisions on the circular scale. The reading on the main scale is 2.5mm and that on the circular scale is 20 divisions. If the measured mass of the ball has a relative error of 2%, the relative percentage error in the density is

1) 0.9% 2) 2.4% 3) 3.1% 4) 4.2%

4) A screw gauge gives the following reading when used to measure the diameter of a wire. Main scale reading $= 0mm$, circular scale reading = 52 divisions. Given that 1mm on main scale corresponds to 100 divisions of the circular scale. The diameter of the wire from the above data is

1) 0.052cm 2) 0.026cm 3) 0.005cm 4) 0.52cm

5) The circular scale of a screw gauge has 200 divisions. When it is given 4 complete rotations, it moves through 2mm. The least count of the screw gauge is

1) $0.25\times10^{-2}cm$ 2) $0.25\times10^{-3}cm$ 3) $0.001cm$ 4) $0.001mm$

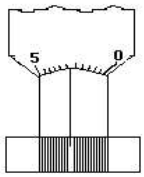
6) While measuring diameter of a wire using a screw gauge the main scale reading is 7mm and zero of circular scale is 35 divisions above the reference line. If the screw gauge has a zero error of $-0.003cm$, the correct diameter of the wire is (given least count = 0.001cm)

1) 0.735cm 2) 0.732cm 3) 0.738 cm 4) 7.38 cm

7) When a screw gauge is completely closed, zero of circular scale is 6 divisions below the reference line of graduation. If least count of screw gauge is 0.001cm, the zero correction is

1) $-0.006cm$ 2) $+0.006cm$ 3) $-0.006mm$ 4) $+0.006mm$

8) For the given figure, calculate zero correction.



1) - 0.02mm
2) + 0.02mm
3) - 0.03mm
4) +0.03mm

9) The pitch of a screw guage is 0.5 mm and there are 50 divisions on circular scale. When there is nothing between the two ends (studs) of screw guage, 45th division of circular scale is coincide with screw guage, and in this situation zero of main scale is not visible. When a wire is placed between the studs, the linear scale reads 2 divisions and 20th division of circular scale coincides with reference line.

For this situation mark the correct statement(s).

1) Least count of the instrument is 0.01mm
2) Zero correction for the instrument is +0.45mm
3) Thickness of wire is 1.65mm 4) All of the above

10) In a screw guage, the value of one division on the linear scale is 1mm, while the circular scale have 100 divisions. Without any object for measurement, while the screw touches the stud, the zero on circular scale advances 27 divisions beyond the reference line. What is the type and amount of zero error?

1) positive, 0.27mm 2) negative, 0.27mm
3) positive, 0.027mm 4) negative, 0.027mm

11) When a screw guage is completely closed, zero of circular scale is 7 division above the reference line of graduation. If LC of screw guage is 10^{-3} cm, the zero error is

1) $-7\times10^{-3}cm$ 2) $+7\times10^{-3}cm$ 3) $-0.007mm$ 4) $+0.007mm$

12) A screw gauge gives the following reading when used to measure the diameter of a wire.Main scale reading: 0 mm Circular scale reading: 52 divisions Given that 1 mm on main scale corresponds to 100 divisions of the circular scale.The diameter of wire from the above data is:

1) 0.052 cm 2) 0.026 cm 3) 0.005 cm 4) 0.52 cm

13) If in a screw gauge, zero mark of the circu lar scale remains on right of reference line and does not cross it and 2nd division on circular scale comes on refernce line. then zero correction is

1) +0.02 mm 2) -0.02 mm 3) +0.002 mm 4) -0.002 mm

14) On measuring diameter of a wire with help f screw gauge, main scale reading is 1 mm and 6th division of circular scale lying over reference line. On measuring zero error,it is found that zero of circular scale has advanced from reference line by 3 divisions on circular scale, then corrected diameter is

1) 1.09 mm 2) 1.06 mm 3) 1.03 mm 4) 1.60 mm

II) More than one correct option questions

- *This section contains multiple choice questions. Each question has 4 choices (A), (B), (C),(D), out of which **ONE or MORE** is correct. Choose the correct options*

1. Main scale of a screw gauge has 10 divisions in a centimeter and its circular scale has 100 divisions. Such that the tip advances by one division on one complete rotation.Then which of the following is correct

a) The pitch of screw is 0.1cm b) The pitch of screw is 0.1mm

c) The L.C is 0.01cm d) The L.C is 0.001cm

A) a,c B) a,d C) b,c D) b,d

2. A screw guage has a positive zero error of 4 divisions and the reading on main scale is 4 divisions and that on circular scale is 78 divisions.If main scale of the screw gauge has 10 divisions to a cm and it's circular scale has 100 divisions such that spindle advances by 1 division on 1 rotationThen choose the correct

a) The observed diameter is 0.478cm b) The observed diameter is 0.0478cm

c) The Corrected diameter is 0.474 cm d) The Corrected diameter is 0.0474 cm

A) a,c B) a,d C) b,c D) b,d

III) Fill in the blanks :

3. _____ is u sed to meausre the thickness of a thin glass plate

4. screw guage consisits of _____ and _____ scale

5. pitch of the secrew ,p =_____

6. The smallest length that can be measure by useing a secrew gauge is called _____

IV) Assertion - A and Reason - R:

- *This section contains certain number of questions. Each question contains Statement – 1 (Assertion) and Statement – 2 (Reason). Each question has 4 choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct Choose the correct option.*

A) Both A and R are true and R is correct explanation of A.

B) Both A and R are true and R is not correct explanation of A.

C) A is true but R is false.

D) A is false but R is true

7. **A:** Least count of screw gauge is 0.001 cm

R: Smallest value which can be measured by instrument accurately is called least count.

8. **A:** Screw gauge works on the principle of screw in nut.

R: Screw gauge consists two scales.

V) Match the following.

- *This section contains Matrix-Match Type questions. Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in **Column–I** have to be matched with statements (p, q, r, s) in **Column–II**. The answers to these questions have to be appropriately bubbled as illustrated in the following example.*

*If the correct matches are A-p,A-s,B-r,B-r,C-p,C-q and D-s,then the correct bubbled 4*4 matrix should be as follows:*

9. a) Pitch of the screw 1) zero line on circular scale is above reference line on main scale

b) least count 2) $\frac{\text{distance travel by screw}}{\text{no.of rotations}}$

c) Thickness 3) P.S.R+(H.S.RXLC)

d) Negative zero error 4) $\frac{\text{pitch of screw}}{\text{no.of head scale division}}$

A) a-3,b-2,c-1,d-4 B) a-2,b-4,c-3,d-1

C) a-4,b-2,c-3,d-1 D) a-2,b-4,c-3,d-1

VI) Comprehensive type questions:

◆ *This section contains paragraph. Based upon each paragraph multiple choice questions have to be answered. Each question has 4 choices (A) , (B) ,(C) and (D) out of which* ***ONLY ONE i****s correct. Choose the correct option.*

10. When the jaws of a micrometer screw gauge are fully closed, the 94th circular scale division coincides with base line.The circular scale of this instrument has 100 divisions and main scale has 10 divisions in a centimeter. While measuring the diameter of a wire, the reading on a main scale is 5mm and 35th circular scale division coincides with main scale base line.

i) From the above information the type of error in instrument is

A) positive B) negative C) positive D) negative

ii) Pitch of the screw gauge is equal to

A) 0.1 cm B) 0.1 mm C) 0.01cm D) 0.01 mm

iii) The LC of screw gauge

A) 0.1 cm B) 0.01 cm C) 0.001cm D) 0.0001 cm

iv) Corrected diameter is

A) 0.541cm B) 0.451cm C) 0.541 mm D) 0.451 mm

KEY

ΦΦ TEACHING TASK :

I)1) 1, 2) 4, 3) 3, 4) 1, 5) 2, 6) 3, 7) 1, 8) 3, 9) 4, 10) 3, 11) 1, 12) 1, 13) 2, 14) 1

II)1) B, 2)A, 3) Screw guage, 4) Pitch scale and circular scale, 5)disatance trvavelled by screw/ no of rotations made, 6) Least count, 7) B, 8) B, 9) B, 10) i) B, ii) A, iii) C, iv) A.

LEARNER'S TASK

BEGINNERS (Level - I)

I) Single correct option questions:

1) In a screw gauge, the main scale has divisions in millimeter and circular scale has 50 divisions. The least count of screw gauge is

1) 2 microns 2) 5 microns 3) 20 microns 4) 50 microns

2) The diameter of a wire is measured with a screw gauge having least count 0.01mm. Out of the following the one which correctly expresses its diameter is

1) 2.00 mm 2) 0.2 mm 3) 0.02 cm 4) 0.002mm

3) A screw gauge has 1.0mm pitch and 200 divisions on the circular scale. The least count of the instrument is

1) $5\times10^{-3}mm$ 2) $5\times10^{-4}mm$ 3) $5\times10^{-2}mm$ 4) $5\times10^{-5}mm$

4) In a screw gauge, keeping pitch of the screw constant, if we increase the number of head scale divisions, then its accuracy of measurement

1) increases 2) decreases

3) does not change 4) cannot be predicted

5) Out of the following three devices, the one which is more accurate to measure length is

(i) a meter rod

(ii) a vernier callipers with least count 0.01cm

(iii) a screw gauge with a pitch 0.5mm having number of divisions on the circular scale as 100

1) (i) 2) (ii) 3) (iii) 4) all the three are equally accurate.

6) Pitch of the screw gauge is 0.5mm. Its head scale contains 50 divisions. The least count of it is

1) 0.01mm 2) 0.1mm 3) 0.25mm 4) 0.02mm

7) Without changing the number of divisions on the circular scale, if the pitch of the screw gauge is halved, then its accuracy of measurement

1) decreases 2) increases 3) remains unaffected

4) increases or decreases depending on the weight.

8) The least count of a screw gauge is 0.005mm and it has 100 equal divisions on its head scale.Then the distance between two consecutive threads on its screw is

1) 0.5mm 2) 0.05mm 3) 0.01mm 4) 0.1mm

9) The diameter of a wire is measured by using a screw gauge having least count 0.01mm. If the diameter is found to be 0.20mm, then the error in the cross-section of the wire will be

1) 5% 2) 10% 3) 1% 4) 2.5%

10) The least count of a screw gauge is $\frac{1}{100}mm$ and the pitch of the screw is $1mm$. The maximum percentage error of the instrument is

1) 5% 2) 2% 3) 1% 4) 10%

11) The radius of a ball bearing measured by a screw gauge is 3.75mm. The pitch of the screw is 1mm and it has 100 division on its head scale. The percentage error in the volume of the ball bearing which is perfectly spherical by shape is

1) 2% 2) 1.5% 3) 0.8% 4) 1%

12) The length, breadth and thickness of a small uniform rectangular glass strip are 4.25cm, 6.25mm and 2.75mm. Its length is measured by vernier callipers of least count 0.01cm and breadth and thickness were measured by screw gauge having least count 0.01mm. The percentage error in the measurement of volume of the strip is

1) 0.76% 2) 1.36% 3) 2.13% 4) 1.76%

13) Length of a thin cylinder as measured by vernier callipers having least count 0.01cm is 3.25cm and its radius of cross-section is measured by a screw gauge having least count 0.01mm as 2.75mm. The percentage error in the measurement of volume of the cylinder will be

1) 2% 2) 3% 3) 1% 4) 1.5

14) When circular scale of a screw gauge carrying 100 divisions is given four complete rotations, the head of the screw moves through 2mm. The pitch and least count of

screw gauge are respectively.

1)1mm and 0.005 mm 2) 0.05 mm and 0.001 mm

3) 0.5mm and 0.005 mm 4) 0.005mm and 0.005 mm

15. A student measured the diameter of a wire using a screw gauge with least count 0.001cm and listed the measurement. The correct measurement is

1) 5.3 cm 2) 5.32 cm 3) 5.320 cm 4) 5.3200 cm

16. Average distance between sun and earth is

A) astronomical unit B) light year C) parallactic second D) none

17. Among the following which is the smallest unit for length

A) centimeter B) milli meter C) Fermi D) kilo meter

18. Which of the following is the largest unit of length

A) light year B) astronomical unit C) parsec D) km

19. The one which is not the unit of length is

A) angstrom B) micron C) par sec D) st radian

20. One quintol = ... kg

A) 100 B) 1000 C) 10 D) 1

21. The sub multiple of kilogram is

A) quintol B) gram C) slug D) none

22. 1 sec = ... shakes

A) 10^8 B) 10^{-8} C) 10^6 D) 1

23. While measuring the length of a cylinder, the reading on main scale is 7.55 cm, and the 12th vernier scale division coincides with main scales calculate the length ?

A) 7.76 cm B) 7.67 cm C) 7.67 mm D) 7.68 mm

24. The main scale of a vernier callipers has 10 divisions in a centimeter and 10 vernier scale divisions coincide with 9 main scale divisions. calculate the least count of vernier callipers in mm.

A) 0.001 mm B) 1 mm C) 0.1 mm D) 0.01 mm

25. In a vernier callipers 19 main scale divisions coincide with 20 vernier scale divisions. If the main scale has 20 divisions in a centimeter calculate its L.C

A) 0.0025 cm B) 0.025 cm C) 0.25 cm D) 2.5 cm

26. The main scale of screw guage has 200 divisions its head advances by 1 mm for 2 complete rotations of its head. Find its pitch and its least count.?

A) 0.5 mm, 0.025 mm B) 0.5 mm, 0.0025 mm

C) 0.5 mm, 0.25 mm D) 0.5 mm, 0.05 mm

27. The thimble of a screw has 100 divisions engraved on it. The thimble advances by 2 mm, when four complete rotations are given. Claculate : (i) pitch (ii) LC

A) 0.05 cm, 0.0005 cm B) 0.05 cm, 0.5 cm

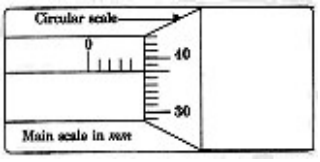
C) 0.5 cm, 0.0005 cm D) 0.05 cm, 0.5 cm

28. Figure shows a screw gauge in which thimble has 100 divisions. calculate L.C and diameter of wire?

(in dia.up 40, down 30 index line at 35)

A) 0.001cm,0.435cm B) 0.01cm,0.45cm

C) 0.1cm,0.5cm D) 0.1cm,0.435cm



29. In four complete revolution of the cap, the distance travelled by the pitch scale is 2mm. If there are 50 divisions on the circular scale, then calculate the least count of screw gauge ?

A) 0.5mm B) 0.01mm C) 0.005mm D) 5mm

ACHIEVERS (Level - II)

Solve the following :

1. If 10 mm is the distance moved by the main scale when 10 complete rotations are made then find the pitch.

2. If the head scale reading is 50 and pitch scale reading is 5 find the diameter of the given sphere. (LC = 0.01mm)

3. The thimble of screw guage has 50 divisions the spindle advances 5cm when the screw is turned 5 rotations then the pitch of the screw and LC in cm

4. The circular head of a screw gauge is divided into 200 divisions and move 1mm ahead in one revolution. If same instrument has a zero error of -0.05mm and the reading on the main scale in measuring diameter of a wire is 6mm and that on circular scale is 45. find the diameter of the wire ?

5. The timble (Head scale) has 50 divisions for one rotation. The tip of the screw advances 1mm when screw is turned through two rotations. What is its pitch and least count. When the screw gauge is used to measure the diameter of the wire the reading on main scale is found to be 0.5 mm and on the circular scale 27 divisions. What is diameter of wire in centimeter.

6. A micrometer screw gauge has a negative error of 8 divisions. While measuring the diameter of a wire the reading on main scale is 3 divisions and 24 m circular scale division coincides with the base line. If the number of divisions on main scale are 20 to a centimeter and circular scale has 50 divisions, calculate its pitch, lest count and corrected diameter.

EXPLORERS (Level - III)

I) More than one correct option questions :

- *This section contains multiple choice questions. Each question has 4 choices (A), (B), (C),(D), out of which **ONE or MORE** is correct. Choose the correct options*

1. Screw gauge is used to measure

a) thickness of glass plate b) diameter of thin wire

c) radius of small sphere d) length of object

A) a,b,c true B) b,c,d true C) c,a,d true D) all true

2. Screw gauge LC is

a) 1 mm b) 0.1 mm c) 0.01mm d) 0.001 cm

A) a,b correct B) b,c correct C) c,d correct D) all correct

II) Fill in the blanks

3. The thickness of wire is given by _____

4. The ZERO line on circular scale is above reference line on main scale than the error is _____

5. _____ works on the principle of screw in a nut

III) **Assertion - A and Reason - R:**

- *This section contains certain number of questions. Each question contains Statement – 1 (Assertion) and Statement – 2 (Reason). Each question has 4 choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct Choose the correct option.*

A) Both A and R are true and R is correct explanation of A.

B) Both A and R are true and R is not correct explanation of A.

C) A is true but R is false. D) A is false but R is true.

6. **A:** Screw gauge is used to measure thickness of glass plate.

R: Reading = P.S.R+[H.S.RXLC].

7. **A:** If zeroth line of screw gauge circular scale is below the reference line on main scale is called negative zero error.

R: Correction for positive error is negative.

IV) **Match the following:**

- *This section contains Matrix-Match Type questions. Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in **Column–I** have to be matched with statements (p, q, r, s) in **Column–II**. The answers to these questions have to be appropriately bubbled as illustrated in the following example.*

*If the correct matches are A-p,A-s,B-r,B-r,C-p,C-q and D-s,then the correct bubbled 4*4 matrix should be as follows:*

8.

a) LC of screw gauge	1) negative
b) Thickness of object	2) 0.01 mm
c) Correction for positive error	3) positive
d) Correction for negative error	4) P.S.R+[H.S.RXLC]

A) a-1,b-2,c-3,d-4 B) a-2,b-4,c-1,d-3

C) a-3,b-2,c-1,d-4 D) a-4,b-1,c-3,d-2

9.

a) Ratcher	1) to read length upto 0.01 mm
b) Thimble	2) to rotate the screw by turning it
c) Main scale	3) to read length upto 1 mm
d) Circular scale	4) to mark circular scale

A) a-1,b-2,c-3,d-4 B) a-1,b-4,c-2,d-3

C) a-4,b-2,c-3,d-1 D) a-2,b-4,c-3,d-1

V) **Comprehension type of questions:**

- *This section contains paragraph. Based upon each paragraph multiple choice questions have to be answered. Each question has 4 choices (A) , (B) ,(C) and (D) out of which **ONLY ONE i**s correct. Choose the correct option.*

10. Main scale of screw guage has 10 divisions to a centimeter and its circularscale has 100 divisions, such that the spindle advances by one division for one

rotation..if this instrument has a positive zero error of 4 divisions and the reading on main scale is 4 divisions and that on circular scale is 74 divisions.

i) LC of screw gauge from the above information is

A) 0.001cm B) 0.01cm C) 0.1cm D) 0.0001cm

ii) Diameter of the wire (corrected)

A) 0.047 cm B) 0.47 cm C) 0.0047 cm D)0.00047 cm

KEY

ΦΦ LEARNER'STASK :

- **BEGINNERS :**

  1) 3, 2) 1, 3) 1, 4) 1, 5) 3, 6) 1, 7) 2, 8) 1, 9) 2, 10) 3, 11) 3,
  12) 1, 13) 3, 14) 3, 15) 3. 16) A, 17) C, 18) C, 19) D, 20) A, 21) B, 22) B,
  23) B, 24) C, 25) A, 26) B, 27) A, 28) A, 29) B

- **ACHIEVERS:** 1) 1 mm 2) 5.5mm 3) 1, 0.02 4) 6.275mm 5) 0.5mm,
  0.001 cm, 0.077cm 6) 0.05cm, 0.001cm, 0.182 cm

- **EXPLORERS :** 1) A, 2) C , 3) P.S.R + (H.S.R X L.C), 4) negative zero error
  5) screw gauge 6) A, 7) D, 8) B, 9) D, 10) i) A, ii) B