UNITS AND MEASUREMENTS

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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

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 and synopsis:

1) Area of square = S^2 5) Volume of cube = S^3 2) Area of rectangle = I X b6) Volume of cuboid = I x b x h3) Area of triangle = 1/2 X b X h7) Volume of cone = $1/3 \prod r^2 h$ 4) Area of circle = $\prod r^2$ 8) Volume of cylinder = $\prod r^2 h$ 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

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

§§ 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.

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Physical guantities 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

Foundation 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 guantities or constants and variables.

Solved problems:

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

<u>§§</u> 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.
- <u>§§</u> Derived unit: The units which depend on fundamental units is called derivd units. **Eg** : Area (m²), Volume(m³), Speed(m/s) etc.

Selection Criteria Of a Unit OR Characteristics of a unit: PP

1. It's value must not vary with place and time.

2. It should be capable of being reproduced easily.

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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 $\ln \alpha \frac{1}{U}$ where u and n are the units of physical quantity and its numerical value respectively.

Relation between unit and its numerical value

 $n_1 u_1 = n_2 u_2$

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.

Quantity	Name of Unit	Unit Symbol
length	metre	m
mass	kilogram	kg
time	second	S
temperature	kelvin	К
amount of substance	mole	mol
electric current	ampere	А
luminous intensity	candela	cd
Suppleme	entary quantitie	S
Plane angle	radian	rad
Solid angle	steradian	sr

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UNITS AND MEASUREMENTS

PHYSICS

- 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	Multiple	Prefix	Symbol	Common Name
10 ¹⁸	exa	E	quintillion	10-1	deci	d	Tenth
10 ¹⁵	peta	Р	quadrillion	10 ⁻²	centi	с	Hundredth
10 ¹²	tera	T	trillion	10-3	milli	m	Thousandth
10 ⁹	giga	G	billion	10-6	micro	u (Greek mu)	Millionth
10 ⁶	mega	М	million	10 ⁻⁹	nano	n	Billionth
10 ³	kilo	k	thousand	10 ⁻¹²	pico	р	Trillionth
10 ²	hecto	h	hundred	10 ⁻¹⁵	femto	f	quadrillionth
10 ¹	deca	da	ten	10 ⁻¹⁸	atto	а	Quintillionth

<u>§§</u> <u>Measurement of Area:</u>

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

Units:

Area = length X breadth

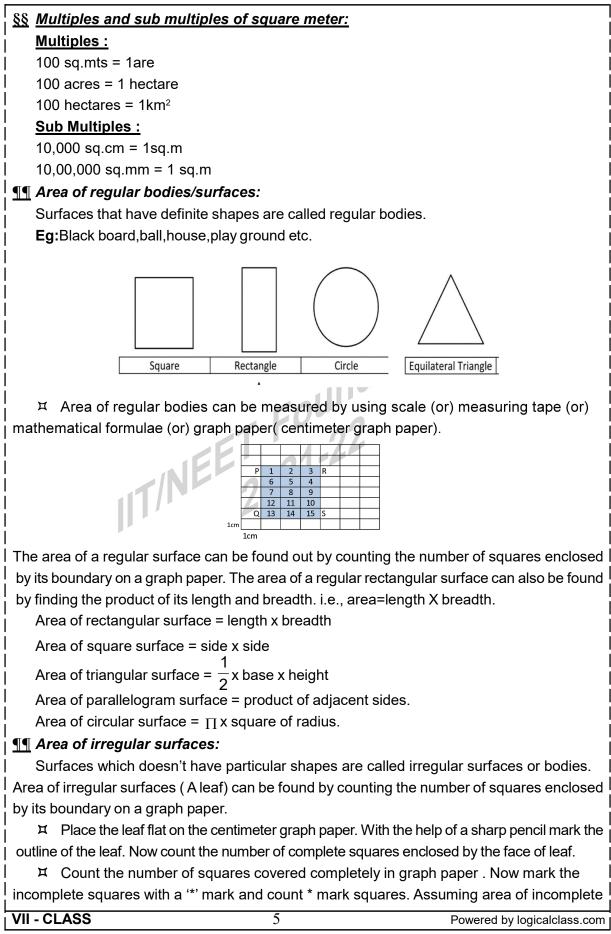
C.G.S	S.I	F.P.S
Square centimeter (cm ²)	Square meter (m ²)	Foot ² (ft ²)

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

XThe area of a surface, whose each side is equal to one centimeter is called one squarecentimeter.

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

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	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 ,							
	$= 20 + (1/2 \times 40) \text{ cm}^2$							
	= 40 cm^2 is the area of irregular leaf can be calculated							
рр	by centimeter (cm) graph paper i.e., unit of area is cm ² here.							
	EXAMPLE							
√	Ex 1: The length and breadth of arectangle are 2 m and 5 m respectively, the area of the rectangle is							
∣ ∣ So								
00	$= 2 \times 5 = 10 \text{ m}^2 = 100000 \text{ cm}^2$							
1	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							
So	I: Total distance = 1m is divided into 500 equal parts then the length of one							
	$division = \frac{1}{500}m = 0.002m = 2mm.$							
√	Ex 3: The area of a circle whose radius is 10 cm is							
So	ol: Area of circle = πr^2							
ĺ	$=\pi \times 10^2 = 314 cm^2$							
\checkmark	Ex 4: If the area of a square field is 100 cm ² then the length of the side is							
So								
	Side = 10 cm=0.1 m							
	TEACHING TASK							
)	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.							
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7.	1km ² =						
 	A) 1000m ²	B) 1000hm²					
1	C) 10,000,000m ²	D) 100000000cm ²					
8.	The area of a rectangular fiel	d is 0.7 hectares. If one side of the field is 60m. Calculate the $ $					
	other side						
	A) 167.12m	B) 127.89m					
1	C) 116.67m	D) 115.67m					
9.	What happens to the area of	a square if its side is doubled ?					
ļ	A) area is doubled	B) area increases by three times					
	C) area increases by four tin	nes D) area decreases by four times					
¦ 10	. What happens to the area of	a square if its side is halved ?					
İ	A) area is halved	B) area decreases by 4 times					
	C) area is doubled	D) area increases by 4 times					
<i>II</i>)	Fill in the blanks						
¦ 11.	. The submultiple of m ² is						
<mark> </mark> 12	. The area of circle is	A10					
13	. The side of a square is 4 m,t	hen its area iscm². m²,its length is 9 m,then its breadth is					
14	. The area of a rectangle is 72	m²,its length is 9 m,then its breadth is					
15	. The total surface area of a he	emi sphere of radius 10 cm using value of π = 3.14 is					
¦ <i>IIII)</i>	Match the following:	1 07					
◆ 	 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 matrix should be as follows	-p,A-s,B-r,B-r,C-p,C-q and D-s,then the correct bubbled 4*4 s:					
16	. Side of a square	e Area					
	a) s = 4 cm	1) A = 16 cm ²					
İ	b) s = 8 cm	2) A = 4 cm ²					
ļ	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						
İ	C) a-1,b-4,c-2,d-3	3 D) a-4,b-3,c-1,d-2					
 		KEY					
Φ	Φ teaching task :						
<u> </u>	$\frac{\Phi\Phi}{11000000000000000000000000000000000$						
- 							
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 	LEARNER'S TASK
 	◆ ₩₩ ◆ BEGINNERS (Level - I) ◆ ₩₩ ◆
│ │ I) <u>C</u> │ │ 1.	hoose the correct option : $10000 \text{ cm}^2 = \dots \text{m}^2$
	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.	A) 100 B) 10000 C) 1000 D) 10,000 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
 6.	A) 80m B) 5m C) 20m D) 10m 1dm ² = m ²
0.	
	A) 10^{-2} B) 10^{-4} C) 1 D) 10^{2}
7. 	100 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 areaA) 800m²B) 80m²C) 0.8m²D) 8x10-3m²
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
ļ	A) 1800m ² B) 30m ² C) 12.5m ² D) 1800cm ²
11. 	The area of triangular surface (A) = sq.units
ļ	A) $A = \frac{1}{2}x$ base x height B) $A = \frac{1}{2}$ base x base
	C) $\frac{1}{2}$ x (height) ² D) length x length
12.	Z 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
ļ	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 sameB) area is doubledC) area increases by four timesD) area increases by 8 times
İ	
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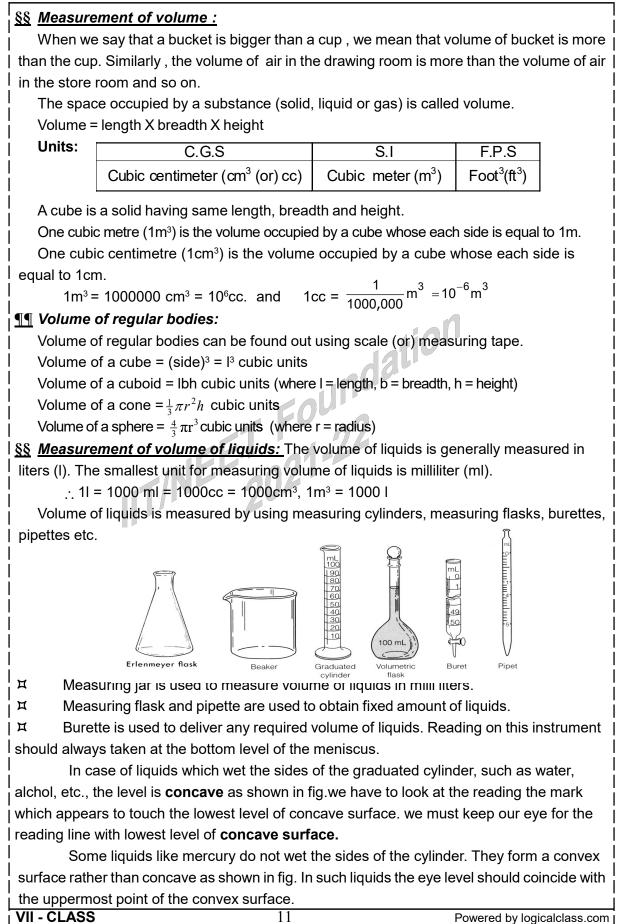
I I

Solve the following :

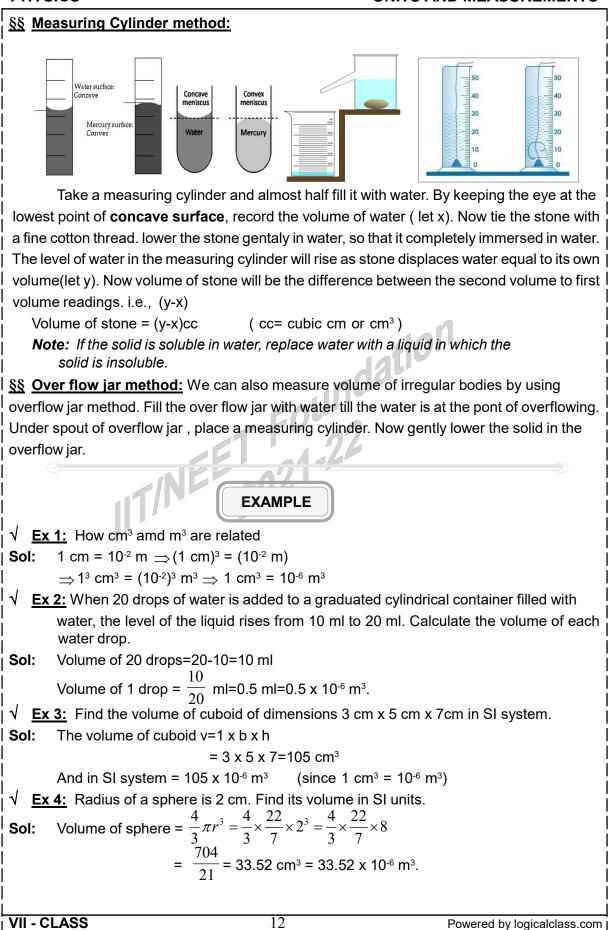
	the tonowing .					
1 . 	In a square plot of area 3600 m ² a building is constructed, which occupies an area of 2000 m ² .Find the area of remaining part?					
2.	The area of the triangle, whose base is 8 cm and height is equal to the area of square.Find the side of the square?					
3 .	Around circular 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 ?					
ĺ						
	★ ■ ■ ■ ■ EXPLORERS (Level - III) < ■ ■ ■ ■					
 1)	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 cB.a,b and cC.a and bD.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. \	$1 \text{ m}^2 = \dots$ hectare.					
·)	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:					
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11. a) 1acre	1) 10 ⁻⁴ m ²	
b) 1hectare	2) 10 ⁶ m ²	
c) 1km²	3) 10⁴m²	
d) 1cm ²	4) 10 ² m ²	I
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	l
b) Circle	2) A = I X b	
c) Square	3) A = 1/2 X b X h	
d) Triangle	4) A = π r 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	
IV) <u>Comprehension type question</u>	<u>ns :</u>	
have to be answered. Each qu ONE i s correct. Choose the co	oh. Based upon each paragraph mult estion has 4 choices (A) , (B) ,(C) and (rrect option. Id area of different surfaces are giver	D) out of which ONLY
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	l
iv. geometry box	0.12 m 0.05 m ? m ²	
13. Find the area of reading roo	m?	
A. 22.5 m ² B. 2.2	25 m ² C.225 m ²	D.25 m²
14. What is the breadth of readi	ng table?	
A.1m B.2m	C. 1.5 m D. 5	m l
15. Find the area of geometry b		
A. 0.6 m ² B. 0.0	006 m ² C. 0.06 m ²	D. 6 m ²
16. What is the length of physic		ĺ
A. 24 m B. 2.4	4 m C. 0.24 m	D. 240 m
	KEY	
Ι <u>ΦΦ_LEARNER'S_TASK_</u> :		
BEGINNERS : 1) B, 2) B,	3) A, 4) B, 5) B, 6) A, 7) C, , 12) A, 13) A,	, 8) D, 9) A,
ACHIEVERS : <i>1</i> .1600 m ²	2.6 cm 3.3850 m ² 4.40	5
	3) A, 4) C, 5) ft ² , 6) 10 ⁴ , 7) 0 ¹² , 11) 10 ⁻⁴ , 12) B, 17) C	
	10 5	
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UNITS AND MEASUREMENTS



İ	TEACHING TASK							
	TEACHING TASK							
)	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							
<u>3</u> .	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,							
1	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,							
ļ	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							
i	volume is 'B' ml. Then the volume of the stone now is							
ļ	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							
1	A) measuring jar B)pipette C)Burette D)Measuring flask							
¦ <i>II</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							
8. 	For measuring the volume of irregular stone we need							
i	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							
1	a) cubic metre b) litre c) cubic centimetre d) square metre							
İ	A) a and c B) a,b and c C) b and c D) all							
1 '	Fill in the blanks:							
10 .	с , с							
11. 12								
	. Measuring flask is used for finding the volume of							
<i>™)</i> ∡	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							
i	to be matched with statements (p , q , r , s) in Column–II . The answers to these questions							
ļ	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							
1	matrix should be as follows:							
ļ Ļ								
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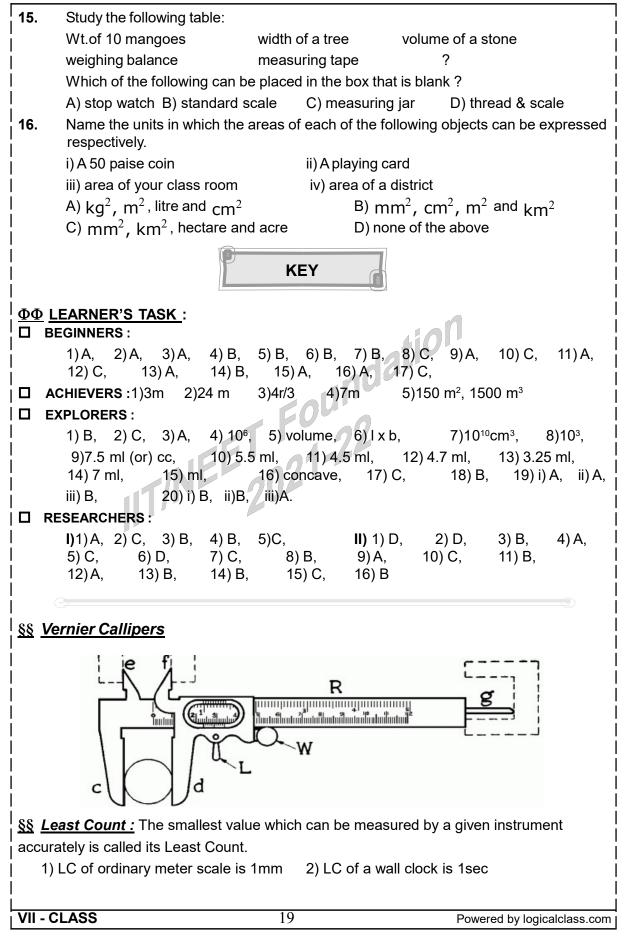
PHYSICS UNITS AND MEASUREMENTS					
14.	Column A	Colu	mn B		
 	1) A unit used to express the volume of liquids a) over		overflow jar		
1	2) Volume a uniform wooden cylinder	b) <i>πr</i>	² h		
ĺ	3) Volume of a sphere	c) litre	e l		
	4) Device used to find the volume of irregular solids d) $\frac{4}{3}\pi r^3$				
	A) 1 - c, 2 - b, 3 - d, 4 - a	B) 1 -d, 2-a, 3-b, 4	4-c		
	C) 1 - b, 2 - c, 3 - d, 4- a	D) 1 -a, 2- d, 3-b, 4	4-c I		
V) <u>C</u>	omprehension type questions:		ļ		
↓ 	This section contains paragraph. Based upo have to be answered. Each question has 4 ch 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 ?				
ĺ	A) 20 ml B) 30 ml C) 24	40 ml D) 5 ml	Ĭ		
	ii) For how many days will he take the toni	c?	l		
 	A) 4 days B) 2 days C) 8	days D) 6 days	l		
1	iii)Convert 5ml into litres?	ada			
İ	A) 5x10 ⁻³ litres B) 50x10 ⁻³ litres	C) 5x10 ^{-₄} litres	D)0.5x10 ⁻³ litres		
 <u>ΦΦ</u> 		, 6) B, 7) D, 8) C, cc, 12) concave			
 	LEARNER'S T				
,) c	hoose the correct answer:		i		
1.	The space occupied by an object is called				
 	A) area B) length	C) mass	D) volume		
 2 .	The abbreviation for cubic centimetre	,	, 		
İ	A) cc B) cm	C) mm	D) cm ²		
3.	The S.I unit of volume is	,	, í		
	A) m ³ B) cm ³	C) mm ³	D) dm ³		
 4 .	1 cubic centimetre = m ³ .		·		
l	A) 10 ⁶ B) 10 ⁻⁶	C) 10 ⁴	D) 10 ⁻⁴		
5.	The side of a cube is 3m. Then its volume	,	, I		
	A) 9m B) 27m ³	C) 27m ²	D) 26m ³		
6.	Choose the correct equation	,	, 		
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			· · · ·		

 A)	Area = $\frac{\text{height}}{\text{volume}}$ B) Area	$= \frac{\text{voulme}}{\text{height}} C_{2}$) Height =	area volume	D) vo	lume = area height
7.	1km³ = m³					
	A) 10 ¹² B) 10 ⁹		C) 10 ⁶	D) 10	3	
 8.	Which of the following i	s a unit of volu	,	D) 10		
	•) cubic met	er	D) centimetre
9.	The submultiple of C.G	, ·		,		_)
	•	3) cm ³		c) m³	D) kn	1 ³
10.	The volume of an irregu	ular solid can	be measu	ired by		
l	A) meter scale B) bea	am balance	C) measu	uring jar	D) c	ommon balance
11.	The most suitable unit	used for meas	suring vol	ume of an e	xercise	book is
	A) cm ³ B) m ³		C) litre	D) mi	lliliter	
12.	1ml = litres					
	,	3) 1000	,	D) 10) ⁻⁴ .	
13. 	The unit used to measu					
		e C) cen	timetre D)) cm ³		
14.	1cubic metre =	сс С) 10 ⁻⁴		0) 10 ⁻⁶		
 15.	A) 10 ⁴ B) 10 ⁶ 1ml = cc	C) 10 ·	<u> 1715</u>) 10°		
13.		$\frac{1}{1000}$;) 100	D) 10	-2
16.	1m ³ = litres	1000		100	0)10	
	A) 1000	B) 100		C) 10		D) 10000
 17.	Measuring vessel used		olume of	,		_)
i I	A) measuring jar	B) bure		•	pette	D) all the above
 	•H• 4	ACHIEVERS	(Level	<u>-)</u> •∎	1.+	
 Solve	the following:					
<u>00110</u> 1.	The volume of cube is :	27 m³.then its	side is?			
2.	The volume of cuboid	-		of the cubo	oid is 20) m and breadth is
	10m,then find the heigh		-			
3.	The volume of cylinder is	equal to the vo	olume of s	phere.Find t	ne heigh	t of cylinder?
4.	The volume of a sphere					
5.	While constructing a ho	•			•	
	Due to some reason or constructed find the are			-	n and tr	
			; 01100111	:		
VII - C	LASS	15			Power	red by logicalclass.com

 	← ₿₩₩≯	<u>EXPLORERS(Lev</u>	<u>el - III)</u>	•
)	More than one answ	er type questions :		
		nultiple choice questions. IORE is correct. Choose i		toices (A), (B), (C),(D),
¦1. 	1 litre is equal to a) 1000 ml A. a and c	b) 1000 cc B. a and b	c) 1000 cm³ C. a,b and c	,
2.	Units of volume a) cm ³	b) m ³	c) milli litres	d) mm³
 3. 	a) pipette	B. a,c and d which are used to measu b) Burette	c) measuring mask	,
 <i>11</i>) 4.	A. a,b and c <u>Fill in the blanks:</u> 1cubic metre =	B.a and c cc	C. a,c and d	D.a,b,c and d
5. 6. 7.	Volume of a rectar 10000m ³ =	cm ³ .	no	
8. 9. 10.	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			
 11.	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 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.	rose to the mark of	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. 14.	rose to the mark of 18.5ml. Then the volume of the stone is			
 15.	rose to the mark of	62ml. Then the volume of sed to measure the volu	the stone is	
16.	The liquids which	wet the surface of glass	have a menis	cus
III) <u>Match the following:</u>				
◆ 	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 matche matrix should be as	s are A-p,A-s,B-r,B-r,C-p, follows:	C-q and D-s,then the co	rrect bubbled 4*4
17.	object	volume		
 . 	a) cube b) sphere	1) v=1/3r²h 2) v=r²h		
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3) v=(side)³ c) cone 4) $\frac{4}{3}\pi$ (radius)³ d) cylinder B) a - 3, b - 2, c - 1, d - 4 A) a - 4, b - 2, c - 3, d - 1 C) a - 3, b - 4, c - 1, d - 2 D) a - 2, b - 1, c - 4, d - 3 18. column-l column-ll a) 1 litre 1) 1 cc b) 1 m³ 2) 1000 cc c) 1 ml 3) ft³ 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: 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? D) 8 ml A) 8.5 ml B) 9.5 ml C) 7.5 ml ii) Find the volume of stone? C) 7.5 ml D) 8 ml A) 8.5 m³ B) 9.5 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 coir 24 cm³ ? m³ b.A pen 11 X 10⁻⁶ m³ 11 cm³ ? m³ 366 cm³ c.A paper cone i) What is the volume of a rupee coin in S.I units? A. 24 m³ B.24 x 10⁻⁶ m³ C.24 X 10⁶ m³ D.24 X 10³ m³ ii) What is the submultiple of 366 cm³? 366 m³ B.366 X 10³ m³ A. C. 366 X 10³ km³ D.366 X 10⁻³ m³ iii) What is the volume of a pen in mm? C. 11 X 10³ mm³ A. 11 mm³ B.11 X 10⁶ mm³ D. 11 X 10⁻³ m³ **RESEARCHERS (Level - IV)** 4 B B B A > *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 m³ 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) C.time A. mass B.length D.temperature VII - CLASS 17 Powered by logicalclass.com

4.	A cube has sides of length 1.2 x 10 ⁻² m. Calculate its volume. (IIT-JEE-2003)
 	A. 1.7 x 10 ⁻⁶ m ³ B.1.73 x 10 ⁻⁶ m ³ C 17 x 10 ⁻⁶ m ³ D 1.732 x 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
l	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
l	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
40	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
 	A) square millimeterB) square centimetreC) square meterD) square kilometer
, 11.	$1m^2 = \dots mm^2$
	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) I C) cm^3 D) mI
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. $10ml \equiv 2$ Division
 	B) 100ml jar with a gap of 0.25cm between the divisions. \blacksquare
	C) 200ml jar with a gap of 1cm between the divisions.
	D) 500ml jar with a gap of 1.5cm between the divisions.
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§§ Vernier Callipers :

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

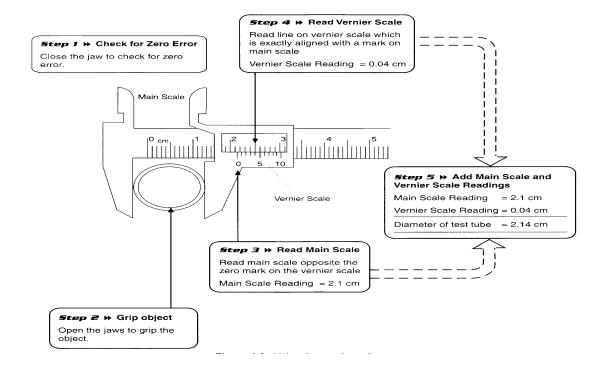
2) A mechanical device which combines a main scale and a vernier scale whose least count is much smaller than that of a main scale is called a Vernier Callipers.

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) <u>Positive zero error :</u> 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) <u>Negative error :</u> 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 is= 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			
Example 1:			
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 6 th 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			
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	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	ļ		
length=0.46cm √ Example 2:	ļ		
√ Example 2:			
A vernier callipers has 10 divisions , it slides over a main scale , whose pitch is			
if the no.of divisions on the left hand of zero of vernier on main scale is 56 and V.S.D coincides with main scale, if the instrument has a negative er 0.07cm.calculate the corrected length.			
Solution:	İ		
No.of vernier scale divisions (N)=10			
Pitch of the vernier scale (s)=1mm			
Least Count (L.C)= $\frac{S}{N} = \frac{1mm}{10} = 0.1mm$			
M TO 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 = 56 mm+(8x0.1mm)= 56 mm+0.8mm= 56.8 mm			
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	İ		
$\sqrt{\text{Example 3:}}$			
The least count of a vernier callipers is 0.0025cm and it has an error of 0.0125cm			
measuring the length of a cylinder the reading on main scale is 7.55cm ar V.S.D coincides with main scale, calculate the corrected length.	' Id 12 th ا ا		
Solution:			
Least Count =0.0025 cm	l		
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 VII - CLASS 21 Powered by logicalc			
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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

$\sqrt{\text{Example 4}}$:

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 5^{th} 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) 0.5mm1) 10.5mm2) 1mm3) 0.05mm4) $\frac{1}{4}mm$
- 1) 0.5mm2) 1mm3) 0.05mm4) $\frac{-}{4}mm$ 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) 0.98cm2) 0.975 cm3) 1.0 cm4) 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

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) $\frac{a}{n}$

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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) <u>I</u>	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 toa) 0.1 mmb) 0.0001 cmc) 0.01 mmd) 0.001 cmA) a,b correctB) c,d correctC) a,d correctD) 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 only2) B only3) C only4) 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.		
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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

4) Zero of V.S is on left side of main

b) Negative zero error

c) correction for Positive Zero error

2) positive
 3) negative

scale

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

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

d) correction for negative zero error

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

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

V) <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 is 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. \times 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

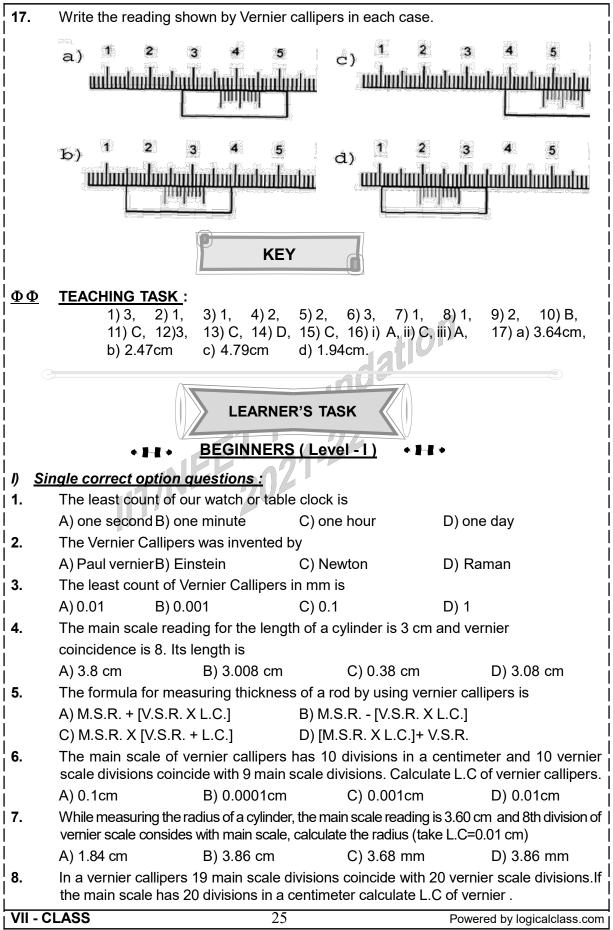
ii) In the above problem If the vernier has a negative error of 0.04 cm, the corrected radius of sphere is

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

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	/SICS	UNITS AND MEASUREMENTS			
	A) 0.0025cm B) 0.00025cm C)	C) 0.025cm D) 0.25 cm			
9.	•	is 0.01 cm. It has an error of + 0.02 cm. While main scale reading is 3.60 cm and 8th vernie ale.Calculate the corrected radius.			
	A) 1.25 cm B) 0.183 cm	C) 1.83 mm D) 1.83 cm			
10.	While measuring the length of a cylinde	0.0025 cm and it has an error of + 0.0125 cm der,the reading on main scale is 7.55 cm, and vith main scale.Calculate the corrected length			
	A) 7.657 cm B) 7.756 cm C)	C) 7.567 cm D) 7.83 cm			
11.	While measuring the radius of a spher	is 0.01 cm and it has an error of + 0.07 cm ere, the main scale reading is 2.90 cm and the ith main scale. Calculate the corrected radius			
	A) 1.46 cm B) 1.004 cm	C) 1.44 cm D) 1.044 cm			
12.	number of divisions on the left hand of z 8th vernier scale division coincides with of 0.07 cm.Find the corrected length?				
13.	A) 5.75cm B) 5.83cm	C) 5.92cm D) 5.98cm is 0.01 cm and it has an error of + 0.02 cm			
13.	While measuring the diameter of a sphe 8th vernier scale division coincides with	here, the main scale reading is 3.60 cm and the th main scale. Calculate the corrected radius '			
	A) 1.32cm B) 1.53cm	C) 1.83cm D)1.93cm			
14.	negative error 0.04 then the corrected le	der is 5cm and vernier coincidence is 4 when l length is			
		C) 4.99 D) 5.09			
	◆ ■ ◆ ACHIEVERS	<u>S (Level - II)</u>			
II) Se	olve the following :				
1.		ler reading on main scale is 5.2 mm and the 5			
	verneir scale division coincides with ma	nain scale. What is its length			
2.	The main scale of a vernier callipers ha	nas 10 divisions in a cm and 10 vernier scale			
divisions coincide with 9 main scale divisions. Calculate the least count of vern					
	callipers in cm.				
3.	While measuring the length of a cylinde the 12th vernier scale division coincides	der, the reading on main scale is 7.55 cm, and es with main scales calculate the length ?			
3. 4.	While measuring the length of a cylinder the 12th vernier scale division coincides The main scale of a vernier callipers ha scale divisions coincide with 9 main sca	der, the reading on main scale is 7.55 cm, and			
4.	While measuring the length of a cylinder the 12th vernier scale division coincides The main scale of a vernier callipers ha scale divisions coincide with 9 main sca vernier callipers in mm.	der, the reading on main scale is 7.55 cm, and es with main scales calculate the length ? has 10 divisions in a centimeter and 10 vernie cale divisions. calculate the least count of			
	While measuring the length of a cylinder the 12th vernier scale division coincides The main scale of a vernier callipers ha scale divisions coincide with 9 main sca vernier callipers in mm.	der, the reading on main scale is 7.55 cm, and es with main scales calculate the length ? has 10 divisions in a centimeter and 10 vernie cale divisions. calculate the least count of <i>r</i> isions coincide with 20 vernier scale divisions			
4.	While measuring the length of a cylinder the 12th vernier scale division coincides The main scale of a vernier callipers ha scale divisions coincide with 9 main scale vernier callipers in mm. In a vernier callipers 19 main scale divis	der, the reading on main scale is 7.55 cm, and es with main scales calculate the length ? has 10 divisions in a centimeter and 10 vernie cale divisions. calculate the least count of <i>r</i> isions coincide with 20 vernier scale divisions			
4.	While measuring the length of a cylinder the 12th vernier scale division coincides The main scale of a vernier callipers ha scale divisions coincide with 9 main scale vernier callipers in mm. In a vernier callipers 19 main scale divis	der, the reading on main scale is 7.55 cm, and es with main scales calculate the length ? has 10 divisions in a centimeter and 10 vernie cale divisions. calculate the least count of <i>r</i> isions coincide with 20 vernier scale divisions			

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j)	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			
1	a) 1 mm b) 0.1 mm c) 0.01 cm d) 0.1 cm			
i	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			
1	A) a,b true B) b,c true C) c,d true D) d,a true			
3.	The vernier scale is used to measure			
ļ	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.			
1	A) Both A and R are true and R is correct explanation of A.			
i	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 leas count.			
5 .	A: Principle of vernier is N vernier scale division coincides N-1 main scale divisions.			
i	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.			
1	R: Correction for positive error is negative.			
i 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.			
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ļ	If the correct matches	are A-p,A-s,B-r,B-r,C-j	p,C-q and D-s,then th	e correct bubbled 4*4
 8. 			4 5 minimum 1)	0.50 cm
 	ы түтү		5 6)1.55 cm
 	c) 1 шшшш		5 6 3) 2.12 cm
 	a) Linin		s e 4) 1.36 cm
	A) a-1,b-2,c	-3 d-4 B) a	a-4,b-2,c-1,d-3	
	C) a-3,b-2,c	,	a-1,b-4,c-3,d-2	
 9.	a) LC of vernier sca	,	1) negative	
	b) Length of object		2) 0.1 mm	ļ
	c) Correction for po	sitive error	3) positive	l
	d) Correction for negative error 4) M.S.R+[V.S.RXLC]			XLC1
1	Á) a-1,b-2,c-3,d-4		a-2,b-4,c-1,d-3	-
İ	C) a-3,b-2,c-1,d-4		a-4,b-1,c-3,d-2	ļ
10.	a) Inside jaws		1) to measure ex	ternal diameter
	b) Strip		2) to measure de	
1	c) Vernier scale		3) to measure le	ہ ا ngth up to 0.1 mm
	d) Outside jaws		4) to measure in	
	A) a-1,b-2,c-3,d-4	B) a	a-4,b-3,c-2,d-1	l
	C) a-4,b-2,c-3,d-1	D) a	a-4,b-1,c-3,d-2	
¦IV) <u>C</u>	omprehension type	questions:		l
	 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 is correct. Choose the correct option. 			
11. 	centimeter If numb is 38 and the 18th in the jaws of verni	er of divisions on the I n vernier scale division er callipers. If the vern	eft hand of zero of ve coincides with main	has 20 divisions in one ernier on the main scale scale.When object held ror of 0.04 cm.
1	i) The LC of vernie			_,
İ	A) 0.25 cm	B) 0.025 cm	C) 0.0025 cm	D) 0.00025 cm
	,	eading of vernier is		
	A) 1.9 cm	B) 1.9 mm	C) 0.19 cm	D) 0.19 mm
İ	iii) Correction of eri	or in vernier scale is		
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	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. I		
	one centimeter. If number of division		
	are 4 and 6th vernier scale division has a negative error 0.03 cm.		
	i) The LC of vernier scale is		
	A) 0.01 cm B) 0.001 c	m C) 0.000	1 cm D) 0.00001 cm
	ii) The main scale reading of verr	,	
	A) 0.4 cm B) 0.004 m		nm D) 0.004 cm
	iii) Correction of error in vernier s	,	_,
	A) -0.03 cm B) 0.03 mm	C) 0.03 cm	D) -0.03 mm
	iv) The observed diameter of the	,	
	Á) 0.460 mm B) 0.460 cm	-	D) 1.460 mm
	v) The corrected diameter of the	· · · · · · · · · · · · · · · · · · ·	,
	A) 0.490 cm B) 0.490 mm	C) 0.480 mm	D) 0.480 cm
		CUM.	·
		07	
	ATTA RESEAR	CHERS(Level - IV) <∦∦∦≈
Solve	e the following :	Z	
í 1.	A vernier scale has 1mm marks		-
	vernier which match with 16 main	n scale divisions,for t	-
 2.	A student measured the length of	f a rad and wrata it a	(IIT JEE-2010)
2.	A student measured the length or instrument did he use to measure		(IIT JEE-2014 Main)
İ	A) A meter scale	511 !	(III JEE-2014 Wall)
	B) A vernier calliper where the 10	divisions in vernier so	cale matches with 9 divisions in
 	main scale and main scale has 1		
	C) A screw gauge having 100 div	isions in the circular	scale and pitch as 1 mm.
l	D) A screw gauge having 50 divis	sions in the circular s	cale and pitch as 1 mm.
3.	The length of a cube is measured	with the help of a ver	nier callipers. The observations
 	are shown in figure below. Find le	ength of the cube with	
			(NSEP2004)
4.	In the figure for vernier callipers, c	alculate the length re	corded. (NSEP2005)
 ¹⁰	<u> </u>	10	
	$\begin{bmatrix} 7 & 8 & 9 \\ 0 & 0 & 0 \end{bmatrix}$		$\begin{array}{cccc} 10 & 11 & cm \\ 1 & 1 & 1 & 1 \end{array}$
	Vernier scale		r scale
1			
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