



Science

IX - Standard

Based on the Updated New Textbook

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- Answers for **Slow Learning Students**.
- Quarterly Exam 2019 & 2023 [QY-'19 & '23], Half Yearly Exam - 2019 & 2023 [HY-'19 & '23] and Common Annual Exam April 2023, 2024 & 2025 [April-'23, '24 & '25] questions are incorporated in the appropriate sections.
- Half Yearly Exam - December 2025 Question Paper is given with answers.

Slow
Learner's
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NOTE FROM PUBLISHER

It gives me great pride and pleasure in bringing to you **Sura's Science Guide** for **9th Standard**. It is prepared as per the Latest New Textbook.

This guide encompasses all the requirements of the students to comprehend the text and the evaluation of the textbook.

Additional questions have been provided exhaustively for clear understanding of the units under study.

In order to learn effectively, I advise students to learn the subject section-wise and practice the exercises given. It will be a teaching companion to teachers and a learning companion to students.

Though these salient features are available in this Guide, I cannot negate the indispensable role of the teachers in assisting the student to understand the subject thoroughly.

I sincerely believe this guide satisfies the needs of the students and bolsters the teaching methodologies of the teachers.

I pray the almighty to bless the students for consummate success in their examinations.

Subash Raj, B.E., M.S.

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CONTENTS

Unit	Name	Page No.	Month
1.	Measurement	1 - 16	June
2.	Motion	17 - 34	July
3.	Fluids	35 - 52	August
4.	Electric charge and Electric current	53 - 67	October
5.	Magnetism and Electromagnetism	68 - 82	November
6.	Light	83 - 102	December
7.	Heat	103 - 118	January
8.	Sound	119 - 132	February
9.	Universe	133 - 148	March
10.	Matter Around Us	149 - 162	June
11.	Atomic Structure	163 - 178	July
12.	Periodic Classification of Elements	179 - 186	August
13.	Chemical Bonding	187 - 202	October
14.	Acids, Bases and Salts	203 - 216	November
15.	Carbon and its Compounds	217 - 230	January
16.	Applied Chemistry	231 - 242	February
17.	Animal Kingdom	243 - 255	June
18.	Organisation of Tissues	256 - 274	July
19.	Plant Physiology	275 - 290	August
20.	Organ Systems in Animals	291 - 308	October
21.	Nutrition and Health	309 - 320	November
22.	World of Microbes	321 - 338	November
23.	Economic Biology	339 - 354	January
24.	Environmental Science	355 - 368	February
25.	LibreOffice Impress	369 - 372	September
Half Yearly Exam December 2025 Question Paper with answers		373 - 380	

SYLLABUS

I MID TERM TEST	June & July	III MID TERM TEST	January & February
QUARTERLY EXAMINATION	June to September	ANNUAL EXAM	Full portions
II MID TERM TEST	October & November		
HALF YEARLY EXAMINATION	June to December		

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MEASUREMENT

TEXT BOOK EXERCISES

I. Choose the correct answer.

1. Choose the correct one.

[QY-'19 & '23]

(a) $\text{mm} < \text{cm} < \text{m} < \text{km}$

(b) $\text{mm} > \text{cm} > \text{m} > \text{km}$

(c) $\text{km} < \text{m} < \text{cm} < \text{mm}$

(d) $\text{mm} > \text{m} > \text{cm} > \text{km}$

[Ans : (a) $\text{mm} < \text{cm} < \text{m} < \text{km}$]

2. Rulers, measuring tapes and metre scales are used to measure

[April-'23]

(a) mass

(b) weight

(c) time

(d) length

[Ans : (d) length]

3. 1 metric ton is equal to

(a) 100 quintals

(b) 10 quintals

(c) 1/10 quintals

(d) 1/100 quintals

[Ans : (b) 10 quintals]

4. Which among the following is not a device to measure mass?

(a) Spring balance

(b) Beam balance

(c) Physical balance

(d) Digital balance

[Ans : (a) Spring balance]

II. Fill in the blanks.

1. Metre is the unit of _____.

[Ans : length]

2. 1 kg of rice is weighed by _____.

[Ans : beam balance]

3. Thickness of a cricket ball is measured by _____.

[Ans : Vernier caliper]

4. Radius of a thin wire is measured by _____.

[Ans : screw gauge]

5. A physical balance measures small differences in mass up to _____. [Ans : 1mg or less]

III. State whether true or false. If false, correct the statement.

1. The SI unit of electric current is kilogram.

[Ans. False]

Correct statement : The SI unit of electric current is **ampere**.

2. Kilometre is one of the SI units of measurement.

[Ans. False]

Correct statement : **Metre** is one of the SI units of measurement.

3. In everyday life, we use the term weight instead of mass.

[Ans. True]

4. A physical balance is more sensitive than a beam balance.

[Ans. True]



5. One Celsius degree is an interval of 1K and zero degree Celsius is 273.15 K.

[Ans. True]

6. With the help of Vernier caliper we can have an accuracy of 0.1 mm and with screw gauge we can have an accuracy of 0.01 mm.

[Ans. True]

IV. Match the following.

1. [QY-'23]

Column I	Column II	Answers
Length	kelvin	metre
Mass	metre	kilogram
Time	kilogram	second
Temperature	second	kelvin

- 2.

Column I	Column II	Answers
Screw gauge	Vegetables	Coins
Vernier caliper	Coins	Cricket ball
Beam balance	Gold ornaments	Vegetables
Digital balance	Cricket ball	Gold ornaments

V. Assertion and reason type questions.

Mark the correct answer as :

- (a) Both A and R are true but R is not the correct reason.
- (b) Both A and R are true and R is the correct reason.
- (c) A is true but R is false.
- (d) A is false but R is true.

1. **Assertion (A) :** The scientifically correct expression is “The mass of the bag is 10 kg”.

Reason (R) : In everyday life, we use the term weight instead of mass.

[Ans : (b) Both A and R are true and R is the correct reason]

2. **Assertion (A) :** $0^{\circ}\text{C} = 273.16\text{ K}$. For our convenience we take it as 273 K after rounding off the decimal.

Reason (R) : To convert a temperature on the Celsius scale we have to add 273 to the given temperature.

[Ans : (b) Both A and R are true and R is the correct reason]

3. **Assertion (A) :** Distance between two celestial bodies is measured in terms of light year.

Reason (R) : The distance travelled by the light in one year is one light year.

[Ans : (b) Both A and R are true and R is the correct reason]

VI. Answer very briefly.**1. Define measurement.**

Ans. Measurement is defined as the determination of the size or magnitude of a quantity. It is the process of comparison of the given physical quantity with the known standard quantity of the same nature.

2. Define standard unit.

[QY-'19]

Ans. A unit is a standard quantity with which the unknown quantities are compared. Unit is the quantity of a constant magnitude which is used to measure the magnitudes of other quantities of the same nature.

3. What is the full form of SI system?

Ans. International System of Units.

4. Define least count of any device.

[HY-'19; QY-'23]

Ans. (i) The smallest length which can be measured by metre scale is called least count.

$$(ii) \text{ Least count of the instrument (LC)} = \frac{\text{Value of one main scale division}}{\text{Total number of vernier scale division}}$$

5. What do you know about pitch of screw gauge?

Ans. The pitch of the screw is the distance moved by the tip of the screw for one complete rotation of the head. It is equal to 1 mm in typical screw gauges.

$$\text{Pitch of the screw} = \frac{\text{Distance moved by the pitch}}{\text{No. of rotations by Head scale}}$$

6. Can you find the diameter of a thin wire of length 2 m using the ruler from your instrument box?

Ans. Yes, first you have to wind the wire around the scale for 10 cm and count the number of turns in it. Then if you divide 10 cm by number of turns which gives the thickness of the wire.

VII. Answer briefly.**(Slow Learners' Answers given at the end of the Unit)****1. Write the rules that are followed in writing the symbols of units in SI system.**

[QY-'19; HY-'23; April-'25]

- Ans.** (i) Units named after scientists are written in lower case. **Eg.** joule, kelvin and newton.
(ii) Symbols of units are always written in lower case. **Eg.** m, kg and s.
(iii) The symbols of units are derived from the names of scientists are to be written in capital letters. **Eg.** A (ampere), N (newton) and J (joule).
(iv) Symbols are not followed by a full stop. **Eg.** 75 cm and not as 75 cm.
(v) Symbols are never written in plural. **Eg.** 100 kg not as 100 kgs.
(vi) When temperature is expressed in kelvin, the degree sign is omitted. **Eg.** 283 K not as 283° K
(vii) Use of solidus (/) is recommended for indicating a division of one unit symbol by another unit symbol. Not more than one solidus is used. **Eg.** ms⁻¹ or m/s.



- (viii) The number and units should be separated by a space. **Eg.** 15 kgms^{-1} not as 15 kgms^{-1} .
- (ix) Accepted symbols alone should be used. **Eg.** ampere should not be written as amp and second should not be written as sec.
- (x) The numerical values of physical quantities should be written in scientific form. **Eg.** The density of mercury should be written as $1.36 \times 10^4 \text{ kgm}^{-3}$ not as 13600 kgm^{-3} .

2. Write the need of a standard unit.

Ans. A Standard Unit is needed to maintain uniformity in measurements like length, weight, size and distance. **Eg:** Standard Unit of length is metre.

3. Differentiate mass and weight.

⊗ [HY-'19 & '23; QY & April-'23 & '24]

Ans.	No.	Mass	Weight
	1.	Fundamental quantity.	Derived quantity.
	2.	Has magnitude alone – scalar quantity.	Has magnitude and direction – vector quantity.
	3.	It is the amount of matter contained in a body.	It is the normal force exerted by the surface on the object against gravitational pull.
	4.	Remains the same everywhere.	Varies from place to place.
	5.	It is measured using physical balance.	It is measured using spring balance.
	6.	Its unit is kilogram.	Its unit is newton.

4. How will you measure the least count of vernier caliper?

Ans. Least count of the instrument (LC) = $\frac{\text{Value of one main scale division}}{\text{Total number of vernier scale division}}$

The main scale division will be in centimeter, further divided into millimetre. The value of the smallest main scale division is 1 mm. In the Vernier scale there will be 10 divisions.

$$(LC) = \frac{1\text{mm}}{10} = 0.1\text{mm} = 0.01\text{cm}$$

VIII. Answer in detail.

(Slow Learners' Answers given at the end of the Unit)

1. Explain a method to find the thickness of a hollow tea cup.

Ans. The thickness of a hollow tea cup can be determined using a screw gauge.

Step 1 : The Pitch, Least count and the type of zero error of the screw gauge are determined.

Step 2 : The given cup is placed in between two studs.

Step 3 : The head screw using the ratchet arrangement is freely rotated until the given cup is held firmly, but not tightly.

Step 4 : Pitch scale reading (PSR) by the head scale and head scale coincidence (HSC) with the axis of the pitch scale, are found.

Step 5 : The readings are recorded and the experiment for different positions of the given cup is repeated.

Step 6 : The thickness of the cup is calculated using the formula $PSR + (HSC \times LC) \pm$ zero error.

Step 7 : Then the average of the last column of the table gives the thickness of the hollow tea cup.

S. No.	PSR (mm)	HSC (division)	CHSC = HSC $\pm$ ZC (Division)	CHSR = CHSC $\times$ LC (mm)	Total reading = PSR + CHSR (mm)
1.					
2.					
3.					

2. How will you find the thickness of a one rupee coin? ⊗ [QY-'23]

Ans. The thickness of a one rupee coin can be determined using screw gauge.

Step 1 : The Pitch, Least count and the type of zero error of the screw gauge are determined.

Step 2 : The given coin is placed in between two studs.

Step 3 : The head screw using the ratchet arrangement is freely rotated until given one rupee coin is held firmly, but not tightly.

Step 4 : Pitch scale reading (PSR) by the head scale and head scale coincidence (HSC) with the axis of the pitch scale are found.

Step 5 : The reading are recorded and the experiment for different positions of the given coin is repeated.

Step 6 : The thickness of the coin is computed using the formula $PSR + (HSC \times LC) \pm$ zero error

Step 7 : Then the average of the last column of the table is found.

S. No.	PSR (mm)	HSC (division)	CHSC = HSC $\pm$ ZC (Division)	CHSR = CHSC $\times$ LC (mm)	Total reading = PSR + CHSR (mm)
1.					
2.					
3.					
				Average = _____ mm	

IX. Numerical Problems

1. Inian and Ezhilan argue about the light year. Inian tells that it is 9.46×10^{15} m and Ezhilan argues that it is 9.46×10^{12} km. Who is right? Justify your answer.

Solution : Both are correct. The values given are expressed in different units. (m & km)
In one year we have 365 days.

The total number of seconds in one year is equal to $365 \times 24 \times 60 \times 60$



$$\begin{aligned}\text{Distance travelled by light in 1 year} &= (3.153 \times 10^7) \times (3 \times 10^8) \\ &= 9.46 \times 10^{15} \text{ m.}\end{aligned}$$

$$1 \text{ km} = 1000 \text{ m} = 10^3 \text{ m}$$

$$\therefore 9.46 \times 10^{15} \text{ m} = 9.46 \times 10^{15} \times 10^{-3} \text{ Km} = 9.46 \times 10^{12} \text{ km}$$

2. The main scale reading while measuring the thickness of a rubber ball using Vernier caliper is 7 cm and the Vernier scale coincidence is 6. Find the radius of the ball.

Solution : MSR = 7 cm; VC = 6

$$\text{LC} = 0.1 \text{ mm} = 0.01 \text{ cm}$$

$$\text{Diameter} = D = \text{MSR} + (\text{VC} \times \text{LC}) = 7 + 0.06 \text{ cm}$$

$$\text{Diameter } D = 7.06 \text{ cm}$$

$$\text{Radius } R = \frac{D}{2} = \frac{7.06}{2} = 3.53 \text{ cm}$$

$$\text{The radius of the ball} = 3.53 \text{ cm (or) } 0.0353 \text{ m.}$$

3. Find the thickness of a five rupee coin with the screw gauge, if the pitch scale reading is 1 mm and its head scale coincidence is 68.

Solution : PSR = 1 mm = 1×10^{-3} m

$$\text{HSC} = 68$$

$$\text{LC} = 0.01 \text{ mm} = 0.01 \times 10^{-3} \text{ m}$$

$$\text{Total reading} = \text{PSR} + (\text{HSC} \times \text{LC})$$

$$\therefore \text{Thickness of the five rupee coin} = 1 \times 10^{-3} + (68 \times 0.01 \times 10^{-3}) \text{ m}$$

$$\therefore \text{Thickness of the five rupee coin} = 1.68 \times 10^{-3} \text{ m} = 1.68 \text{ mm}$$

4. Find the mass of an object weighing 98 N.

Solution : W = mg

$$W = 98 \text{ N}$$

$$g = 9.8 \text{ m/s}^2$$

$$m = \frac{W}{g} = \frac{98}{9.8} = 10 \text{ kg.}$$

Intext Activities

ACTIVITY - 1

Using Vernier caliper find the outer diameter of your pen cap.

Aim : To find the outer diameter of the pen cap.

Materials required : Vernier caliper, pen cap.

Solution :

S. No.	MSR (cm)	VSR (division)	VSR = (VSC × LC)	Diameter (cm) = MSR + VSR
1.	9	34	$34 \times 0.01 = 0.34$	$9 + 0.34 = 9.34$
2.	9	36	$36 \times 0.01 = 0.36$	$9 + 0.36 = 9.36$
3.	9	35	$35 \times 0.01 = 0.35$	$9 + 0.35 = 9.35$
				Mean D = 9.35 cm

Result : The outer diameter of the pen cap = 9.35 cm

[End of the activity]



ACTIVITY - 2

Determine the thickness of a single sheet of your science textbook with the help of a Screw gauge.

S. No.	PSR (mm)	HSC (division)	HSR (mm) HSR = HSC × LC	Total thickness t (mm) = PSR + HSR mm
1.	0	29	0.29	0.29
2.	0	30	0.30	0.30
3.	0	31	0.31	0.31
Mean thickness 't' of the sheet = 0.30				

Result : The thickness of the single sheet is = **0.30 mm.**

[End of the activity]

Government Exam Questions

1 Mark

1. 1 Angstrom ($\text{\AA}$) = _____

[HY-'23]

- a) 10^{-8} m b) 10^{-4} m c) 10^{-10} m d) 10^4 m

[Ans : 10^{-10} m]

2 Marks

1. Match the following.



Column I	Column II	Answers
Electric Current	kg	ampere
Luminous intensity	ampere	candela
Temperature	candela	K
Mass	K	kg

7 Marks

1. Explain a method to find the diameter of spherical body.

[QY-'19]

Ans. Procedure :

- (i) Find the least count (LC) of the Vernier caliper.
- (ii) Find the zero correction (ZC) of the Vernier caliper.
- (iii) Fix the object firmly in between the two lower jaws of the Vernier.
- (iv) Measure the main scale reading (MSR) and the Vernier scale coincidence (VC).
- (v) Repeat the experiment by placing the jaws of the Vernier at different position of the object.
- (vi) The formula to find the diameter of the object (d), is
Diameter of object (d) = $\text{MSR} + (\text{VC} \times \text{LC}) \pm \text{ZC (cm)}$.

II. Fill in the blanks :

- The precision of vernier calipers is _____ mm. [Ans : (a) 0.1mm]
- The gravity accelerates any object, the distance fallen is proportional to _____. [Ans : time squared ($s \propto t^2$)]
- SI unit of electric current is _____. [Ans : ampere]
- Larger unit for measuring time is _____. [Ans : millennium]
- The value of an astronomical unit is _____. [Ans : 1.496×10^{11} m]
- Mass is a _____ quantity. [Ans : scalar]

III. State whether true or false. If false, correct the statement :

- The precision of screw gauge is 0.001cm.

Ans. True.

- The unit of amount of substance is candela.

Ans. False.

Correct statement : The unit of amount of substance is **mole**.

- The symbol for the units derived from the names of scientists are written in capital letter.

Ans. True.

- Yard was used as the unit of length.

Ans. True.

- Micron is also known as micro-metre.

Ans. True.

- Weight has both magnitude and direction.

Ans. True.

IV. Match the following :

- | Column I | Column II | Answer |
|-----------|-----------------------------|-----------------------------|
| FPS | Metre, kilogram and second | Foot, pound and second |
| CGS | Foot, pound and second | centimetre, gram and second |
| MKS or SI | centimetre, gram and second | Metre, kilogram and second |

- | Column I | Column II | Answer |
|--------------|-----------------------|-----------------------|
| 10 years | 1 year | 1 decade |
| 10 centuries | 1 century (100 years) | 1 millennium |
| 10 decades | 1 millennium | 1 century (100 years) |
| 365.24 days | 1 decade | 1 year |

- | Column I | Column II | Answer |
|-------------|-----------|-----------|
| Angle | m | radian |
| Solid angle | radian | steradian |
| Length | s | m |
| Time | steradian | s |



4.	Column I	Column II	Answer
	Millimeter	10^{-15}m	10^{-3}m
	Nanometer	10^{-3}m	10^{-9}m
	Angstrom	10^{-9}m	10^{-10}m
	Fermi	10^{-10}m	10^{-15}m

V. Assertion and reason type :

1. **Assertion (A) :** Light year and wave length both measure distance

Reason (R) : Both have dimensions of time.

- (a) Both A and R are true but R is not the correct explanation of A.
 (b) Both A and R are true and R is the correct explanation of A.
 (c) A is true but R is false.
 (d) A is false but R is true.

[Ans : (c) A is true but R is false]

2. **Assertion (A) :** Density is a derived physical quantity

Reason (R) : Density cannot be derived from the fundamental physical quantities.

- (a) Both A and R are true but R is not the correct explanation of A.
 (b) Both A and R are true and R is the correct explanation of A.
 (c) A is true but R is false.
 (d) A is false but R is true.

[Ans : (c) A is true but R is false]

Correct statement : Density can be derived from mass and volume.

3. **Assertion (A) :** Mass, Length and Time are fundamental physical quantities.

Reason (R) : They are independent of each other.

- (a) Both A and R are true but R is not the correct explanation of A.
 (b) Both A and R are true and R is the correct explanation of A.
 (c) A is true but R is false. (d) A is false but R is true.

[Ans : (b) Both A and R are true and R is the correct explanation of A]

VI. Comprehensive type :

- (a) The speed of a body gives us an idea of how slow or fast that a body is moving.

Speed of a body is the distance travelled by it per unit time. The SI unit of speed is metre per second. It is a scalar quantity. The speed of a running cab at any instant of time is shown by an instrument called, 'speedometer' and the distance travelled by a car is measured by another instrument called, 'odometer'.

1. Which of the following is not correct unit of speed?

- (a) cm/s (b) m/s (c) km/h (d) km/s. [Ans : (d) km/s]

2. If the distance travelled by the cab in 3 hours is 120 km, then its speed will be

- (a) 40 m/s (b) 40 km/s (c) 40 km/h (d) 40 km/min

[Ans : (c) 40 km/h]

3. The formula for finding the speed of the cab is

- (a) Distance = speed $\times$ time (b) velocity = distance $\times$ time
 (c) time = distance $\times$ velocity (d) None of these.

[Ans : (a) Distance = speed $\times$ time]

- (b) Read the passage and answer the questions given below.

Mass is the amount of matter contained in an object. Measurement of mass helps us to distinguish between lighter and a heavier body. Beam balance, spring balance and electronic balance are used to measure mass of different objects. The SI unit of mass is kilogram (kg). But different units are used to measure the mass of different objects depending upon their weight. e.g. weight (mass) of a tablet is measured in milligrams

(mg), weight of a student is measured in kilogram (kg), and weight of a truck with goods is measured in metric tons. 1 metric ton is equal to 10 quintals and 1 quintal is equal to 100 kg. 1 gram is equal to 1000 mg.

1. The value of 1 metric ton is equal to

- (a) 1000 kg (b) 10 quintals (c) 1000,000 g (d) 100 kg

[Ans : (a) 1000 kg (or) (b) 10 quintals]

2. How will you measure weight of a tablet?

- (a) kg (b) g (c) mg (d) none of these.

[Ans : (c) mg]

VII. Answer very briefly :

1. Write the units which are used to measure long distances.

Ans. km, AU, light year, parsec.

2. Define Astronomical unit.

Ans. AU is defined as the average distance between the earth and the sun.

$$1 \text{ AU} = 1.496 \times 10^{11} \text{ m.}$$

3. Define light year.

Ans. The distance travelled by light in one year in vacuum. $1 \text{ light year} = 9.46 \times 10^{15} \text{ m.}$

4. Convert the temperature from Fahrenheit into Celsius & Kelvin.

Ans.

°F to °C	°F to K
$\frac{(F - 32)}{1.8}$	$\left[\frac{(F - 32)}{1.8} + 273 \right]$

5. Convert 100°C into Kelvin.

Ans. $100 + 273 = 373 \text{ K.}$ ie. $^{\circ}\text{C} + 273$

6. Convert 112° F into K.

$$\text{Ans. } \frac{(F - 32)}{1.8} + 273 = \frac{(112 - 32)}{1.8} + 273 = \frac{80}{1.8} + 273 = 44.44 + 273 = 317.44 \text{ K}$$

7. Write the principle of screw gauge.

Ans. The screw gauge works on the principal that when a screw rotates in a nut, the distance moved by the tip of the screw is directly proportional to the number of rotations.

8. What are the kinds of units?

Ans. Fundamental or basic units. Derived units.

9. Give some examples of fundamental units.

Ans. The examples of fundamental units are kg for mass, m for length, s for time.

10. Give some examples of derived units.

Ans. The units of area, volume, density.

11. Define Mass.

Ans. Mass is the amount of matter contained in a body. Unit - Kilogram.

12. Define Weight.

Ans. The force with which the earth attracts a body towards its center is called weight.
Unit - Newton.



13. What is the SI unit of temperature?

Ans. Kelvin is the SI unit of temperature.

14. What is the measuring unit of the thickness of a plastic carry bag?

Ans. 1 micron = 10^{-6} m (or) μm .

VIII. Answer briefly :

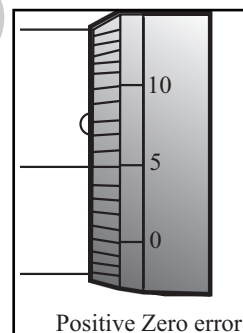
1. Write temperature conversion.

Ans. Temperature Conversion (Exact)

From	To Fahrenheit	To Celsius	To Kelvin
Fahrenheit ($^{\circ}\text{F}$)	$^{\circ}\text{F}$	$\left(\frac{\text{F} - 32}{1.8} \right)$	$\left[\frac{\text{F} - 32}{1.8} + 273 \right]$
Celsius ($^{\circ}\text{C}$)	$(\text{C} \times 1.8) + 32$	$^{\circ}\text{C}$	$^{\circ}\text{C} + 273$
Kelvin (K)	$[(\text{K} - 273) \times 1.8] + 32$	$\text{K} - 273$	K

2. Write about the positive zero error in screw gauge instrument.

Ans. When the plane surface of the screw and the opposite plane stud on the frame are brought into contact, if the zero of the head scale lies below the pitch scale axis, the zero error is positive. For example, the 5th division of the head scale coincides with the pitch scale axis, then the zero error is positive and is given by
 $\text{Z.E} = + (n \times \text{LC})$ where 'n' is the head scale coincidence. In this case, Zero error = $+(5 \times 0.01) = 0.05$ mm. So the zero correction is -0.05 mm.



3. Write SI units for the fundamental quantity.

Ans.

Basic Quantity	Unit
Length	metre
Mass	kilogram
Time	second
Electric current	ampere
Temperature	kelvin
Amount of substance	mole
Luminous intensity	candela

4. Convert the following units in metre.

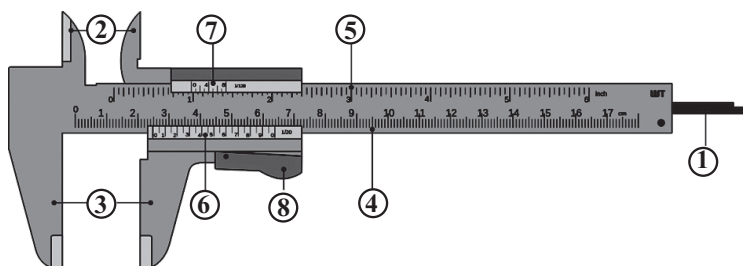
Ans.

Smaller units	Value in metre
centimetre (cm)	10^{-2} m
millimetre (mm)	10^{-3} m
micron or μm	10^{-6} m
nanometre (nm)	10^{-9} m
angstrom ($\text{\AA}$)	10^{-10} m
fermi (f)	10^{-15} m

5. Draw and mark the parts of vernier caliper

Ans. PARTS Marked in the Vernier caliper

1. Lower fixed jaw
2. Upper fixed jaw
3. Lower movable jaw
4. Vernier scale
5. Retainer
6. Main scale
7. Depth probe.

**IX. Numerical Problems :**

1. A piece of iron of volume 40cm^3 whose density is 6.8g/cm^3 . Find the mass of iron.

Solution :

Given, density of iron, $D = 6.8\text{g/cm}^3$

volume of iron, $V = 40\text{ cm}^3$

mass of iron, $M = V \times D$ [$\therefore \text{mass} = \text{volume} \times \text{density}$]

$$= 40\text{ cm}^3 \times \frac{6.8\text{g}}{\text{cm}^3}$$

$$m = 272.0\text{g.}$$

2. Solve : The mass of 40 apples in a box is 5 kg.

(i) Find the mass of a dozen of them.

(ii) Express the mass of one apple in gram.

Solution :

(i) 40 apple = 5 kg = 5000 g

$$1\text{ apple} = \frac{5000}{40}$$

$$1\text{ apple} = 125\text{ g}$$

$$\therefore 1\text{ dozen} = 12\text{ apples}$$

$$12\text{ apples} = 125 \times 12\text{ g}$$

$$12\text{ apples} = 1500\text{ g.}$$

(ii) 40 apples = 5000 g

$$1\text{ apple} = \frac{5000}{40}\text{ g} = 125\text{g}$$

$$\text{The mass of 1 apple} = 125\text{ g.}$$

X. Answer in detail :

1. How will you find Zero Error of the screw gauge?

Ans. i. **Zero error** occurs when the screw gauge shows a reading other than zero when its jaws are fully closed.

ii. **Finding Zero Error:**

- Close the screw so that the fixed and movable studs touch.

• **Check the head scale:**

- If zero of head scale coincides with pitch scale axis $\rightarrow$ No zero error.



- If zero lies below → Positive zero error.

$$ZE = + (n \times LC)$$

Example: 5th division coincides, $LC = 0.01 \text{ mm} \rightarrow Z.E = +0.05 \text{ mm}$; So the zero correction is -0.05 mm .

- If zero lies above → Negative zero error.

$$ZE = - (100 - n) \times LC$$

Example: 95th division coincides, $LC = 0.01 \text{ mm} \rightarrow Z.E = -0.05 \text{ mm}$; So the zero correction is $+0.05 \text{ mm}$.

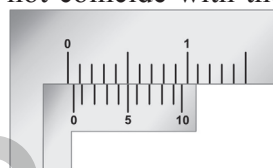
2. How will you find Zero Error of Vernier Caliper? Explain.

Ans. i. Zero error occurs when the zero of the Vernier scale does not coincide with the zero of the main scale when the jaws are fully closed.

- ii. Finding Zero Error :** Close the jaws and check the zero marks.

Positive Zero Error :

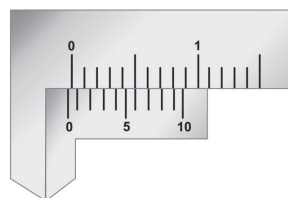
- Vernier zero is to the right of main scale zero;
- Obtained reading is more than the actual reading.
- Example: If 5th vernier division coincides, $LC = 0.01 \text{ cm}$.
- Therefore, positive zero error $= +5 \times LC$
 $= +5 \times 0.01 = 0.05 \text{ cm}$.



Positive zero error

Negative Zero Error:

- Vernier zero is to the left of main scale zero
- Obtained reading is less the actual reading.
- **Example:** If 4th division coincides; negative zero error $= -4 \times LC = -4 \times 0.01 = -0.04 \text{ cm}$.



Negative zero error

3. Write short note on the following :

- (i) Common balance (ii) Physical balance
(iii) Digital balance (iv) Spring balance

Ans. Common (beam) balance :

A beam balance compares the sample mass with a standard reference mass (Standard reference masses are 5g, 10g, 20g, 50g, 100g, 200g, 500g, 1kg, 2kg, 5kg). This balance can measure mass accurately up to 5g

Physical balance :

This balance is used in labs and is similar to the beam balance but it is a lot more sensitive and can measure mass of an object correct to a milligram. The standard reference masses used in this physical balance are 10 mg, 20 mg, 50 mg, 100 mg, 200 mg, 500 mg, 1 g, 2g, 5 g, 10 g, 20 g, 50 g, 100g, and 200 g.



Common beam balance



Physical balance

Digital balance :

Nowadays, for accurate measurements digital balances are used, which measure mass accurately even up to a few milligrams, the least value being 10 mg (Figure 1.11). This electrical device is easy to handle and commonly used in jewellery shops and labs.

**Digital balance****Spring balance :**

This balance helps us to find the weight of an object. It consists of a spring fixed at one end and a hook attached to a rod at the other end. It works by 'Hooke's law' which states that the addition of weight produces a proportional increase in the length of the spring. A pointer is attached to the rod which slides over a graduated scale on the right.

**Spring balance**

The spring extends according to the weight attached to the hook and the pointer reads the weight of the object on the scale.

Slow Learners' Answers - Text book Exercises

VII. Answer briefly :

1. Write the rules that are followed in writing the symbols of units in SI system.

[QY-'19; HY-'23; April-'25]

- Ans. (i) Units named after scientists are written in lower case. **Eg.** joule, kelvin and newton.
 (ii) Symbols of units are always written in lower case. **Eg.** m, kg and s.
 (iii) Symbols are never written in plural. **Eg.** 100 kg not as 100 kgs.

3. Differentiate mass and weight.

⊗ [HY-'19 & '23; QY & April-'23 & '24]

Mass	Weight
Amount of matter in a body; fundamental and scalar quantity	Force of gravity acting on a body; derived and vector quantity
Remains the same everywhere.	Varies from place to place.
SI unit: kilogram (kg)	SI unit: newton (N)

VIII. Answer in detail :

1. Explain a method to find the thickness of a hollow tea cup.

Ans. To find the thickness of a hollow tea cup using a screw gauge:

- Step 1 :** Find the pitch, least count and zero error of the screw gauge.
Step 2 : Place the tea cup between the two studs of the screw gauge.
Step 3 : Rotate the ratchet gently until the cup is held firmly.
Step 4 : Note the pitch scale reading (PSR) and head scale coincidence (HSC).
Step 5 : Calculate the thickness using.



Thickness = $PSR + (HSC \times LC) \pm \text{zero error}$ and take the average value.

S. No.	PSR (mm)	HSC (division)	CHSC = HSC $\pm$ ZC (Division)	CHSR = CHSC $\times$ LC (mm)	Total reading = PSR + CHSR (mm)
1.					
2.					
3.					

2. How will you find the thickness of a one rupee coin?

⊗ [QY-'23]

Ans. To find the thickness of a one-rupee coin using a screw gauge:

Step 1 : Find the pitch, least count and zero error of the screw gauge.

Step 2 : Place the one-rupee coin between the two studs of the screw gauge.

Step 3 : Rotate the ratchet gently until the coin is held firmly.

Step 4 : Note the pitch scale reading (PSR) and head scale coincidence (HSC).

Step 5 : Calculate the thickness using

Thickness = $PSR + (HSC \times \text{Least Count}) \pm \text{zero error}$ and take the average value.

S. No.	PSR (mm)	HSC (division)	CHSC = HSC $\pm$ ZC (Division)	CHSR = CHSC $\times$ LC (mm)	Total reading = PSR + CHSR (mm)
1.					
2.					
3.					
				Average = _____ mm	

