

Loyola

EC SCIENCE



This special guide is prepared
on the basis of New Syllabus
and Govt. Key

Loyola

Publications

Vivek Illam, No. 19, Raj Nagar, N.G.O. 'A' Colony,
Palayamkottai, Tirunelveli - 627 007.

Ph: 0462 - 2553186, 2552405

Cell : 94433 81701, 94422 69810, 90474 74696

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நூலினுள் புகுமுன்

அன்பு நிறை தம்பியரே ! தங்கையரே !

வாழ்த்துக்கள்,

- 9-ஆம் வகுப்பு Science பாடம் சற்று கடினமானது. இதை எளிமையாக்கும் பொருட்டு அரசு பொதுத்தேர்வில் விடைத்தாள்கள் திருத்தப்படும் (key) முறை, பாடத்தை எளிமையாக படிக்கும் முறை, வினாக்களுக்கு மிகச் சரியான விடை அளிக்கும் முறையில், விடைகள் அனைத்தும் மிக எளிமையாக மாணவ, மாணவிகள் எளிதில் புரியும் வண்ணம் Point by point அடிப்படையில் தயாரிக்கப்பட்டுள்ளது.
- படங்களை எளிதில் புரிந்துகொண்டு தேர்வில் வரைய எளிமைப்படுத்தப்பட்டுள்ளது.
- கூடுதல் 2 மற்றும் 5 மதிப்பெண் வினா-விடைகள் கொடுக்கப்பட்டுள்ளது.
- 9-ஆம் வகுப்பு EC Science புத்தகத்தை நன்கு புரிந்து முழுமையாக படித்தால், அரசுத்தேர்வை எவ்வித அச்சமின்றி எதிர்க்கொண்டு உயர் மதிப்பெண் பெறலாம்.

நன்றியுடன்...

லொயோலா பள்ளிகேவூன்

குறிப்பு : Loyola EC புத்தகங்களை வாங்கிப் பயிலும் மாணவ, மாணவிகள் 10, 11 மற்றும் 12ம் வகுப்புகளில் நடைபெறும் அரசுத் தேர்வுகளில் அதிக மதிப்பெண்கள் பெற்று உச்சத்தை தொட உங்களுக்கு உறுதுணையாக இருக்கும் என்பதை மகிழ்ச்சியுடன் தெரிவித்துக் கொள்கிறோம்.



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UNIT 1

PHYSICS

Measurement

Part - I. (Text Book Exercises)

I. Choose the correct answer

- Choose the correct one
 - $\text{mm} < \text{cm} < \text{m} < \text{km}$
 - $\text{mm} > \text{cm} > \text{m} > \text{km}$
 - $\text{km} < \text{m} < \text{cm} < \text{mm}$
 - $\text{mm} > \text{m} > \text{cm} > \text{km}$

Ans : a) $\text{mm} < \text{cm} < \text{m} < \text{km}$
- Rulers, measuring tapes and metre scales are used to measure
 - mass
 - weight
 - time
 - length

Ans : d) Length
- 1 metric ton is equal to
 - 100 quintals
 - 10 quintals
 - 1/10 quintals
 - 1/100 quintals

Ans: b) 10 quintals
- Which among the following is not a device to measure mass?
 - Spring balance
 - Beam balance
 - Physical balance
 - Digital balance

Ans: a) Spring Balance

II. Fill in the blanks.

	Answer
1. Metre is the unit of _____.	Length
2. 1 kg of rice is weighed by _____.	Common Beam balance
3. Thickness of a cricket ball is measured by _____.	Vernier caliper
4. Radius of a thin wire is measured by _____.	Screw gauge
5. A physical balance measures small differences in mass up to _____.	10 Milligram

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

- The SI unit of electric current is **kilogram**
The SI unit of electric current is **ampere**

Ans : False
- Kilometre** is one of the SI units of measurement
Metre is one of the SI units of measurement

Ans : False
- In everyday life, we use the term weight instead of mass.

Ans : True
- A physical balance is more sensitive than a beam balance

Ans : True
- One Celsius degree is an interval of 1K and zero degree Celsius is 273.15k.

Ans : True
- 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.		Column I	Column II	Answer
i	Length	a	kelvin	b metre
ii	Mass	b	metre	c kilogram
iii	Time	c	kilogram	d second
iv	Temperature	d	second	a kelvin

2.		Column I	Column II	Answer
i	Screw gauge	a	Vegetables	b Coins
ii	Vernier caliper	b	Coins	d Cricket ball
iii	Beam balance	c	Gold ornaments	a Vegetables
iv	Digital balance	d	Cricket ball	c 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 10kg”
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.**

Measurement is defined as the determination of the size or magnitude of something.

2. **Define standard unit.**

- SI system of units is the modified and improved form of the previous system of units.
- It is accepted in almost all the countries of the world.

3. **What is the full form of SI system?**

SI System : International System of units.

4. **Define least count of any device.**

The smallest length which can be measured by any device is called least count.

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

The pitch of the screw is the distance between two successive screw threads.

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

- No, a ruler cannot measure diameter it can only measure length.
- The diameter of a thin wire can be measured using a **screw gauge**.

VII. Answer briefly.

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

1. The units named after scientists are not written with a capital initial letter. E.g. newton, henry.
2. The symbols of the units are not expressed in plural form. E.g. 10 kg not as kgs.
3. Small letters are used as symbols for units not derived from a proper noun. Eg. m for metre Kg for kilogram.

2. Write the need of a standard unit

- Different unit systems were used by people from different countries.
- There was a necessity to use worldwide system of measurement at the end of the second world war.
- SI of units were developed and recommended by **General Conference on weights and Measures** at Paris for International usage in 1960.

3. Differentiate mass and weight.

MASS		WEIGHT
1.	Fundamental quantity	Derived quantity
2.	Has magnitude alone – scalar quantity	Has magnitude and direction vector quantity
3.	It is measured using physical balance.	It is measured using spring balance.
4.	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
5.	Remains the same	Varies from place to place.

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

- The smallest length which can be measured by a vernier caliper is called its least count value of one main scale division
- $\text{Least count} = \frac{\text{value of one main scale division}}{\text{Total number of vernier scale division}}$

VIII. Answer in detail

1. How do you find the thickness of a hollow teacup?

The thickness of a hollow teacup can be determined with a vernier caliper.

- First we need to calculate the residual capacity (LC) and the circularity of the vernier caliper.
- The hollow teacup whose thickness to be measured should be firmly held between the upper jaws of the vernier.
- The scale of the main line (MSR) before the vernier caliper should be noted.
- Vernier union (VC) is to find the segment of the vernier scale that is united with a segment of the primary line.

- Thickness of tea cup without inlet = MSR + (VCXLC) ± ZC
- Thus in this method we can find out the thickness of the hollow teacup.

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

- The thickness of a one rupee coin can be determined using a screw gauge.
- Determine the pitch, the least count and the zero error of the screw gauge.
- Place the coin between the two studs. Rotate the head until coin held firmly
- Note the reading of the pitch scale crossed by the head scale (PSR) and the head scale division that coincides with the pitch scale axis(HSC)
- The width of the coin is given by
PSR + CHSR [corrected HSR]
Where CHSR = (HSC ± ZC) LC
- Repeat the experiment for different positions of the coin and tabulate the reading's.
The average of the last column readings gives the width of the coin

S.No	P.S.R. (m.m)	H.S.C. (division)	(HSR) = (HSC × LC)	CHSR = HSC ± ZC (mm)	Total reading CHSR = HSC ± ZC
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.

Inian Statement is true.

Light year is the distance travelled by light in one year in vacuum and it is equal to 9.46×10^{15} m

$$1 \text{ light year} = (3.153 \times 10^7) \times (3 \times 10^8) \\ = 9.46 \times 10^{15} \text{ m}$$

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 :

$$\text{MSR} = 7 \text{ cm} = 70 \text{ mm}$$

$$\text{Coincidence (VC)} = 6$$

$$\text{Radius} = ?$$

Thickness (Diameter of the ball)

$$= \text{MSR} + (\text{VC} \times \text{LC}) - \text{ZE}$$

$$= 70 \text{ CM} + (6 \times 0.01) - 0$$

$$= 70 + 0.6 = 70.6 \text{ mm}$$

$$\text{Radius of the ball} = \frac{\text{Thickness}}{2}$$

$$= \frac{70.6}{2} = 35.3 \text{ mm}$$

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.
- Pitch Scale reading = 1 mm
 Head scale Coincidence = 68
 Zero correction = NIL
 Least Count = 0.01mm
 \therefore Thickness of a five rupee coin
 $= \text{PSR} + (\text{HSC} \times \text{LC}) \pm \text{zc}$
 $= 1\text{mm} + (68 \times 0.01\text{mm}) + 0$
 $= 1\text{mm} + 0.68 \text{ mm} = 1.68 \text{ mm}$
4. Find the mass of an object weighing 98 N.
- Weight = 98 N
 Acceleration due to gravity $g = 9.8\text{ms}^{-2}$
 Mass = ?
 Weight = Mass \times acceleration
 Weight = Mass \times 9.8
 $\text{Mass}(m) = \frac{\text{Weight}}{\text{acceleration}}$
 $\text{Mass} = \frac{98}{9.8} = 10\text{Kg}$
 Mass (m) = 10 k.g

Part - II. (Additional Exercises)

I. One Mark Questions	Answer
1. Physical quantities can be classified into ____ and ____.	Fundamental quantities derived quantities
2. International system of units are called as ____.	SI units
3. ____ is the standard quantity with which unknown quantities are compared.	A unit
4. SI Unit of Luminous intensity is ____.	Candela
5. Number of fundamental quantities are ____.	Seven
6. Distance travelled by light in one year in vaccum is called ____.	light year
7. Distance of the centre of the sun from the centre of the earth is ____.	Astronomical unit (AU)
8. 1 per sec is ____.	3.26 light year
9. The nearest star is ____.	alpha centauri
10. One Angstrom (1\AA) = ____ m	10^{-10}
11. The total length of all the blood vessels in human body is ____km	96000 km
12. A chameleons tongue is ____ the length of its body	twice
13. 1 TMC = ____	2.83×10^{10} litre
14. 1 solar mass = ____.	2×10^{30} kg
15. The least count of vernier caliper is ____.	0.01 cm
16. ____ is used to find the thickness of the coin	Screw Gauge
17. Least count of screw gauge is ____.	0.01 mm
18. ____ designed vernier calliper	Pierre varnier
19. Number of division in pitch scale ____.	100

- | | |
|---|--|
| <p>20. In screw gauge, the zero of the head scale lies below the pitch scale axis, that is called ____.</p> <p>21. In screw gauge, zero of the head scale lies above the pitch scale axis that error is called ____.</p> <p>22. Spring balance helps to find the ____ of an object</p> <p>23. Nowadays ____ balance is used to find the accurate measurements.</p> <p>24. ____ balance is used in Labs.</p> <p>25. $1/273$ 16th of the thermodynamic temperature of the triple point of water is ____.</p> <p>26. The basic unit of electric current is known as ____.</p> <p>27. The SI unit of resistance is ____.</p> <p>28. The rate of doing work is called ____ and it's unit is ____</p> | <p>Positive zero error</p> <p>negative zero error</p> <p>weight</p> <p>digital balance</p> <p>Physical balance</p> <p>kelvin</p> <p>ampere (A)</p> <p>ohm (Ω)</p> <p>power, watt</p> |
|---|--|

II. True or False, If false correct the Statement.

- Light year is the unit of **time**.
Ans : False - Light year is the unit of **distance**.
- Mass of a proton, neutron and electron can be determined using atomic mass unit. **Ans : True**
- 27°C temperature is equal to 300 K. **Ans : True**
- Physical balance is used to find the **weight** of an object.
Ans : False - Physical balance is used to find the **mass** of an object.

III. Match the following.

1.	Unit of length	Value	Answer
i	Light year	a 100 cm	b $9.46 \times 10^{15}m$
ii	Astronomical unit	b 9.46×10^{15}	c $1.496 \times 10^{11}m$
iii	Per sec	c $1.496 \times 10^{11}m$	d 3.26 light year
iv	Metre	d 3.2 LY	a 100 cm

IV. Assertion and reason type Questions

- Assertion(A)** : Quantities which cannot be expressed in terms of any other physical quantities are called fundamental quantities

Reason(R) : Area, volume and density are fundamental quantities.

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

Ans: c) A is true but R is false
- Assertion(A)** : Many of the ancient system of measurement were based on the dimensions of human body.

Reason(R) : As a result, unit of measurement varied from person to person.

- 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

Ans: a) Both A and R are true but R is not the correct reason

V. Short Answer - 2 Marks

- What is light year?**
Light year is the distance travelled by light in one year in vacuum.
- What is astronomical unit?**
Astronomical unit is the mean distance of the centre of the sun from the centre of the earth.
- What are fundamental quantities?**
Quantities which cannot be expressed in terms of any other physical quantities are called fundamental quantities.
- What are atoms?**
The smallest amount of matter imaginable to us in a twinkling of the eye. This is called atoms.
- What is weight?**
Weight is normal force exerted by the surface on the body to balance against gravitational pull on the object.

VI. Answer in Detail - 5 Marks

- Tabulate the fundamental quantities with units followed in SI system.**

Fundamental quantities	Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Temperature	kelvin	K
Electric current	ampere	A
Luminous intensity	candela	cd
Amount of substance	mole	mol

- Write a note on 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 10mg, 20mg, 50 mg, 100mg, 200mg, 500mg, 1g, 2g, 5g, 10g, 20g, 50g, 100g, and 200g.
 - It is used to measure the mass of the body.

UNIT 2

PHYSICS

Motion

Part - I. (Text Book Exercises)

I. Choose the correct answer.

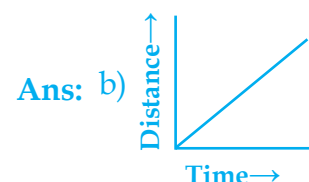
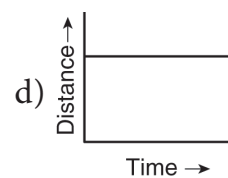
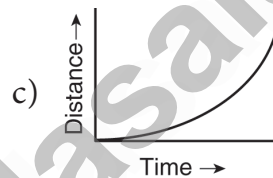
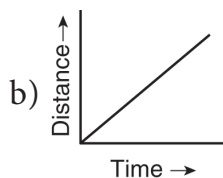
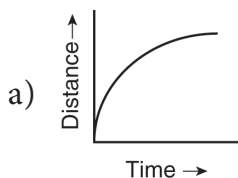
1. The area under velocity - time graph represents the
- velocity of the moving object
 - displacement covered by the moving object
 - speed of the moving object
 - acceleration of the moving object

Ans: b) displacement covered by the moving object

2. Which one of the following is most likely not a case of uniform circular motion?
- Motion of the Earth around the sun
 - Motion of a toy train on a circular track.
 - Motion of a racing car on a circular track.
 - Motion of hours hand on the dial of the clock

Ans: c) Motion of a racing car on a circular track.

3. Which of the following graph represents uniform motion of a moving particle?



4. The centrifugal force is
- a real force
 - the force of reaction of centripetal force
 - a virtual force
 - directed towards the centre of the circular path

Ans: b. the force of reaction of centripetal force.

II. Fill in the blanks.

- | | Answer |
|---|----------------|
| 1. Speed is a _____ quantity whereas velocity is a _____ quantity. | Scalar, Vector |
| 2. The slope of the distance - time graph at any point gives _____. | Speed |
| 3. Negative acceleration is called _____. | retardation |
| 4. Area under velocity - time graph shows _____. | displacement. |

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

1. The motion of a city bus in a heavy traffic road is an example for **uniform motion**.

Ans: False - The motion of a city bus in a heavy traffic road is an example for **non - uniform motion**.

2. Acceleration can get negative value also. **Ans: True**
3. Distance covered by a particle never becomes zero but displacement becomes zero. **Ans: True**
4. The velocity – time graph of a particle falling freely under gravity would be a straight line **parallel to the x axis**.
Ans: False - The velocity - time graph of a particle falling freely under gravity would be straight line **inclined to the X axis**.
5. If the velocity – time graph of a particle is a straight line inclined to x - axis then its displacement – time graph will be a straight line. **Ans: True**

IV. Assertion and reason type questions.

Mark the correct choice as :

- a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If assertion is false but reason is true.

1. **Assertion** : The accelerated motion of an object may be due to change in magnitude of velocity or direction or both of them.
Reason : Acceleration can be produced only by change in magnitude of the velocity. It does not depend the direction.

Ans: d) If assertion is false but reason is true.

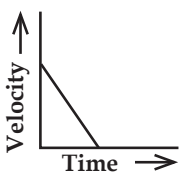
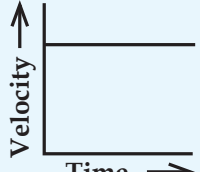
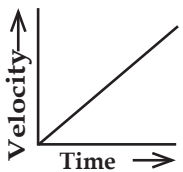
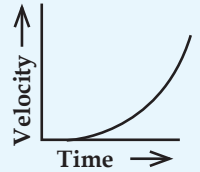
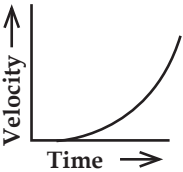
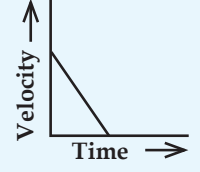
2. **Assertion** : The speedometer of a car or a motor-cycle measures its average speed.
Reason : Average velocity is equal to total displacement divided by total time taken.

Ans: (b) If both assertion and reason are true but reason is not the correct explanation of assertion.

3. **Assertion** : Displacement of a body may be zero when distance travelled by it is not zero.
Reason : The displacement is the shortest distance between initial and final position.

Ans: (a) If both assertion and reason are true and reason is the correct explanation of assertion.

V. Match the following.

	List I		List II		Answer
1	Motion of a body covering equal distances in equal interval of time	a.		d.	
2	Motion with non uniform acceleration	b.		c.	
3	Constant retardation	c.		a.	

4	Uniform acceleration	d		b.	
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VI. Answer briefly.

1. **Define velocity.**

Velocity is the rate of change of displacement. It is the displacement in unit time.

$$\text{Velocity} = \frac{\text{Displacement}}{\text{Time taken}}$$

2. **Distinguish distance and displacement.**

	Distance	Displacement
1.	The actual length of the path travelled by a moving body irrespective of the direction	The change in position of a moving body in a particular direction
2.	It is a scalar quantity	It is vector quantity
3.	It has magnitude only	It has both magnitude and direction

3. **What do you mean by uniform motion?**

An object is said to be in uniform motion if it covers equal distance in equal intervals of time.

4. **Compare speed and velocity.**

	Speed	Velocity
1.	The rate of change of distance in unit time.	The rate of change of displacement in unit time.
2.	It is a scalar quantity	It is vector quantity

5. **What do you understand about negative acceleration?**

- If final velocity is less than initial velocity, the velocity decreases with time and the value of acceleration is negative. It is called negative acceleration.
- Negative acceleration is called retardation (or) deceleration

6. **Is the uniform circular motion accelerated? Give reasons for your answer.**

- Yes, the uniform circular motion is accelerated.
- Reason : An object moving with a constant speed along a circular path, the change in velocity is due to the change in direction

7. **What is meant by uniform circular motion? Give two examples of uniform circular motion.**
When an object moves with constant speed along a circular path, the motion is called uniform circular motion.

- Examples :**
- 1) The earth moves around the sun.
 - 2) The moon moves around the earth
 - 3) In an atom, an electron moves around the nucleus in a circular path.

VII. Answer in detail.

1. Derive the equations of motion by graphical method.

- The graph shows the change in velocity with time of a uniformly accelerated object.
- The object starts from the point D in the graph with velocity u .
- Its velocity keeps increasing and after time t it reaches the point B on the graph

The initial velocity of the object

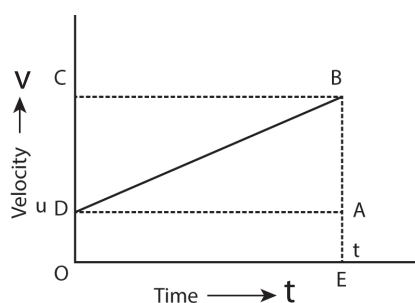
$$= u = OD = EA$$

The final velocity of the object

$$= v = OC = EB$$

Time = $t = OE = DA$

Also, we know that $AB = DC$



First equation of motion

$$\text{Acceleration} = \frac{\text{change in velocity}}{\text{time}}$$

$$= \frac{(\text{final velocity} - \text{initial velocity})}{\text{time}}$$

$$= \frac{(OC - OD)}{OE} = \frac{DC}{OE}$$

$$a = \frac{DC}{t}$$

$$DC = AB = at$$

From the graph $EB = EA + AB$

$$v = u + at$$

Second Equation of motion

From the graph distance covered by the object during time t is given by the area of quadrangle DOEB

$$S = \text{area of the quadrangle DOEB}$$

$$= \text{area of the rectangle DOEA} + \text{area of the triangle DAB}$$

$$= (AE \times OE) + \left(\frac{1}{2} \times AB \times DA \right)$$

$$S = ut + \frac{1}{2}at^2$$

Third equation of motion

From the graph the distance covered by the object during time t is given by the area of the quadrangle DOEB. Here DOEB is a trapezium. Then

$$S = \text{area of trapezium DOEB}$$

$$= \frac{1}{2} \times \text{sum of length of parallel side} \times \text{distance between parallel sides}$$

$$= \frac{1}{2} \times (OD + BE) \times OE$$

$$S = \frac{1}{2} \times (u + v) \times t$$

$$\frac{1}{2} \times \frac{(v+u) \times (v-u)}{a} \left(\because a = \frac{v-u}{t} \therefore t = \frac{v-u}{a} \right)$$

$$2as = v^2 - u^2$$

$$v^2 = u^2 + 2as$$

2. Explain different types of motion.

- **Linear motion** : The object moves along a straight line.
- **Circular motion** : Where the object moves along circular path.
- **Oscillatory motion** : Where an object describes a respective to and fro movement retracing its original path.
- **Uniform motion** : Where an object travels equal distance in equal intervals of time.
- **Random motion** : Where the motion of the object does not fall in any of the above categories.

VIII. Exercise problems.

1. A ball is gently dropped from a height of 20m. If its velocity increases uniformly at the rate of 10ms^{-2} , with what velocity

will it strike the ground? After what time will it strike the ground?

Solution:

Given Data:

initial velocity $u = 0$
 $g = 10\text{ms}^{-2}$
 $h = 20\text{m}$
 $v = ?$ time $t = ?$

$$(i) h = ut + \frac{1}{2}gt^2$$

$$20 = \frac{1}{2} \times 10 \times t^2$$

$$t^2 = 4$$

$$\text{time } \boxed{t = 2\text{s}}$$

$$(ii) v = u + gt$$

$$v = 0 + 10 \times 2$$

$$\boxed{v = 20 \text{ m/s}}$$

2. An athlete completes one round of a circular track of diameter 200 m in 40 s. What will be the distance covered and the displacement at the end of 2 m and 20 s?

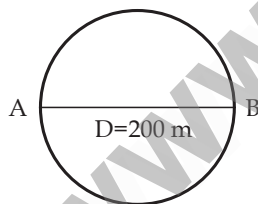
Solution:

Diameter of circular track (D) = 200m

Radius of circular track (r) = $\frac{200}{2} = 100 \text{ m}$

Time taken by the athlete for one round (t) = 40 s

Distance covered by athlete in one round (s) = $2\pi r$



3. A racing car has a uniform acceleration of 4ms^{-2} . What distance it covers in 10 s after the start?

Acceleration (a) = 4 ms^{-2}

Time(t) = 10 s

Initial velocity $u = 0$

S = ?

Solution:

$$S = ut + \frac{1}{2}at^2$$

$$0 \times 10 + \frac{1}{2} \times 4 \times 10^2$$

$$S = 0 + \frac{1}{2} \times 4 \times 100$$

$$\boxed{S = 200\text{m}}$$

Speed of the athlete (v)

$$= 2 \times \frac{22}{7} \times 100$$

$$= \frac{4400}{7}$$

$$= \frac{\text{Distance}}{\text{Time}}$$

$$= \frac{4400}{7} \times \frac{1}{40}$$

$$= \frac{4400}{7 \times 40}$$

\therefore Distance covered in 140s = Speed \times Time

$$= \frac{4400}{7 \times 40} \times (2 \times 60 + 20)$$

(\because 2 minute 20 second = $2 \times 60 + 20$)

$$= \frac{4400}{7 \times 40} \times 140$$

$$= \frac{4400 \times 140}{7 \times 40}$$

$$= \frac{4400 \times 20}{40}$$

$$= \frac{4400}{2}$$

Distance covered = 2200 m

No of round in 40s = 1 round

No of round in 140s = $140 / 40$

= $3 \frac{1}{2}$ rounds

Hence displacement of the athlete =

Diameter of the circular track = 200 m

Part - II. (Additional Exercises)

I. One Mark Questions	Answer
1. Object which do not change their positions are said to be at ____.	rest
2. An object covers equal distance in equal interval of time that motion is called _____.	Uniform motion
3. Distance is a ____ quantity.	Scalar
4. SI unit of distance is _____.	metre (m)
5. An object covers unequal distance in equal intervals of time is called _____.	Non uniform motion
6. Rate of change of distance is known as ____.	speed
7. SI unit of velocity is _____.	m/s
8. SI unit of acceleration is _____.	m/s ²
9. If decrease the velocity with increasing time is called as ____	negative acceleration
10. The area under the velocity - time graph gives ____.	distance
11. In distance - time graph if slope increases ____ will increase	speed
12. Initial velocity of free falling body is _____.	Zero
13. When a particle is moving in circular orbit of radius R, the distance covered after completing full circular path is _____.	2πR
14. When an object is moving with a constant speed along a circular path, that motion is called _____.	uniform circular motion
15. Uniform circular motion is a _____ motion.	accelerated
16. Revolution of moon around the earth is _____ motion	Uniform circular
17. The centripetal acceleration is directed _____ the centre of the circle.	towards
18. _____ must act on the object radially towards the centre.	Centripetal force
19. Force acting on a body away from the centre of circular path is called _____.	Centrifugal force.
20. A spin dryer in washing machine work under the _____ force.	Centripetal force
21. The motion of seconds needle in a clock is in _____ motion	uniform circular
22. Merry -go-round is an example for _____.	centrifugal force
23. Unit of centrifugal force is ____	newton (N)
24. When an object is thrown upwards, the g value will be _____.	-9.8 m/s ²
25. Revolution of earth around the sun is an example for ____.	uniform circular motion
26. If an object moves in uniform motion, its acceleration will be _____.	Zero
27. _____ has both positive and negative values.	Velocity
28. Motion of bus is an example for _____.	Non-uniform motion
29. The value of acceleration due to gravity is _____.	9.8 m/s ²

II. True or False If false Correct the Statement.

1. The objects which change their position are said to be in motion. Ans: True

2. The actual length of the path travelled by a moving body irrespective of the direction is called **displacement**.
Ans: False. The actual length of the path travelled by a moving body irrespective of the direction is called **distance**.
3. Velocity is the rate of change of **distance**.
Ans: False. Velocity is the rate of change of **displacement**
4. Vector quantity having both magnitude and direction. **Ans: True**

III. Match the following.

1.	Physical Quantity	Unit	Answer
1	Displacement	a Newton	c metre
2	Velocity	b m/s ²	d m/s
3	Acceleration	c metre	b m/s ²
4	Centripetal force	d m/s	a Newton

2.	Physical Quantity	Unit	Answer
1	Slope of distance-time graph	a Distance covered	d Speed
2	Slope of displacement-time graph	b Acceleration	c Velocity
3	Slope of velocity -time graph	c Velocity	b Acceleration
4	Area under the speed-time graph	d Speed	a Distance covered

IV. Assertion and reason type Questions.

1. **Assertion (A)** : An object describes a repetitive to and fro movement retracing its original path is called oscillatory motion.
Reason (R) : Time period is constant.
 (a) Both assertion and reason are true and reason is the correct explanation of assertion.
 (b) Both assertion and reason are true and reason is not the correct explanation of assertion.
 (c) Assertion is true but reason is false.
 (d) Assertion is false but reason is true.
Ans: b) Both assertion and reason are true and reason is not the correct explanation of assertion.
-
2. **Assertion (A)** : velocity can have both positive and negative values.
Reason (R) : Velocity is a vector quantity having both magnitude and direction.
 (a) Both assertion and reason are true and reason is the correct explanation of assertion.
 (b) Both assertion and reason are true and reason is not the correct explanation of assertion.
 (c) Assertion is true but reason is false.
 (d) Assertion is false but reason is true.
Ans: a) Both assertion and reason are true but reason is the correct explanation of assertion.
-
3. **Assertion(A)** : The variation in velocity of an object with time can be represented by velocity - time graph.
Reason(R) : Graphical Representation is only uniform motion.
 (a) Both assertion and reason are true and reason is the correct explanation of assertion.
 (b) Both assertion and reason are true and reason is not the correct explanation of assertion.
 (c) Assertion is true but reason is false.
 (d) Assertion is false but reason is true. **Ans: c) Assertion is true but reason is False**

V. Short Answer - 2 Marks

1. **What is displacement?**

It is defined as the change in position of a moving body in a particular direction.

2. **Distinguish scalars from vectors.**

Scalars	vectors
It has magnitude only.	It has both magnitude and direction
Example : Distance, Speed	Example : velocity, displacement.

3. **What is non uniform motion?**

An object is said to be in non uniform motion if it covers unequal distances in equal intervals of time.

4. **Define centripetal force.**

Centripetal force is a constant force that should act on the body, along the radius towards the centre and perpendicular to the velocity of the body.

5. **Define acceleration.**

Acceleration is the rate of change of velocity (or) it is the change of velocity in unit time.

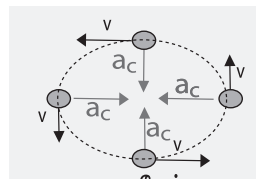
VI. Answer in Details - 5 Marks

1. **Compare speed and velocity.**

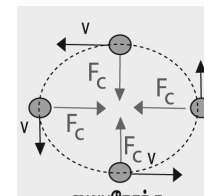
	Speed	Velocity
1.	It is the rate of change of distance	It is the rate of change of displacement
2.	It is a scalar quantity having magnitude only.	It is a vector quantity having both magnitude and direction
3.	It is measured in ms^{-1} in SI system.	It is also measured in ms^{-1} in SI system.
4.	Speed in any direction would be a positive quantity, since the distance in any direction is a positive quantity.	Velocity can have both positive and negative values. If velocity in one direction is assumed to be positive then the velocity, in opposite direction would be negative quantity.

2. **Explain the centripetal acceleration and centripetal force.**

- A body is said to be accelerated, if the velocity of the body changes either in magnitude or in direction.
- Hence the motion of the object in circular path with constant speed and continuous changes of direction is an accelerated motion.
- There must be an acceleration acting along the string directed inwards, which makes the object to move in circular path. This acceleration is known as centripetal acceleration and the force is known as centripetal force.
- Since the centripetal acceleration is directed radially towards the centre of the circle.
- Centripetal acceleration is given by $a = \frac{v^2}{r}$
- Centripetal force is given by $F = \frac{mv^2}{r}$



Centripetal Acceleration



Centripetal Force

UNIT 3

PHYSICS

Fluids

Part - I. (Text Book Exercises)

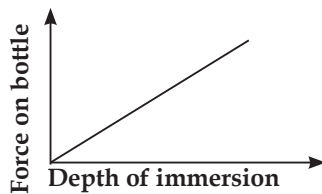
I. Choose the correct answer.

- The size of an air bubble rising up in water
 - decreases
 - increases
 - remains same
 - may increase or decrease

Ans: b) increases
- Clouds float in atmosphere because of their low
 - density
 - pressure
 - velocity
 - mass

Ans: a) density
- In a pressure cooker, the food is cooked faster because
 - increased pressure lowers the boiling point
 - increased pressure raises the boiling point
 - decreased pressure raises the boiling point
 - increased pressure lowers the melting point

Ans: (b) increased pressure raises the boiling point
- An empty plastic bottle closed with an airtight stopper is pushed down into a bucket filled with water. As the bottle is pushed down, there is an increasing force on the bottom. This is because,



- more volume of liquid is displaced
- more weight of liquid is displaced
- pressure increases with depth
- all the above

Ans: (c) pressure increases with depth

II. Fill in the blanks.

- | | Answer |
|--|------------------|
| 1. The weight of the body immersed in a liquid appears to be _____ than its actual weight. | less |
| 2. The instrument used to measure atmospheric pressure is _____. | barometer |
| 3. The magnitude of buoyant force acting on an object immersed in a liquid depends on _____ of the liquid. | density |
| 4. A drinking straw works on the existence of _____. | pressure |

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

- The weight of fluid displaced determines the buoyant force on an object **Ans: True**
- The **shape** of an object helps to determine whether the object will float or not.
Ans: False - The **density** of an object helps to determine whether the object will float or not
- The foundations of high-rise buildings are kept wide so that they may exert **more** pressure on the ground.
Ans: False - The foundations of high - rise buildings are kept wide so that they may exert **less** pressure on the ground.

4. Archimedes' principle can also be applied to gases. Ans: True
5. Hydraulic press is used in the extraction of oil from oil seeds. Ans: True

IV. Match the following.

Column - I		Column - II		Answer
1.	Density	a.	$h\rho g$	c. $\frac{\text{Mass}}{\text{Volume}}$
2.	Pascal's law	b.	Milk	d. Pressure
3.	Pressure exerted by a fluid	c.	$\frac{\text{Mass}}{\text{Volume}}$	a. $h\rho g$
4.	Lactometer	d.	Pressure	b. Milk

V. Answer in brief.

- On what factors the pressure exerted by the liquid depends on?**
Pressure exerted by a liquid at a point is determined by,
i) depth (h), ii) density of the liquid (ρ), iii) acceleration due to gravity (g).

- Why does a helium balloon float in air?**
Helium balloon floats in air because helium gas is less dense than air.

- Why it is easy to swim in river water than in sea water? (The question itself is wrong)**
 - It is easier to swim in sea water than in the river water.
 - The density of sea water is greater than river water due to its high salt content.
 - More over, salt water provides more buoyant force than fresh water.
 - Hence, it is easy to swim in sea water than in river water.

- What is meant by atmospheric pressure?**
 - Earth is surrounded by a layer of air up to certain height and this layer of air around the Earth is called atmosphere of the Earth.
 - Air occupies space and has weight, so it also exerts pressure.
 - This pressure is called atmospheric pressure.
 - The atmospheric pressure normally referred is the air pressure at sea level.

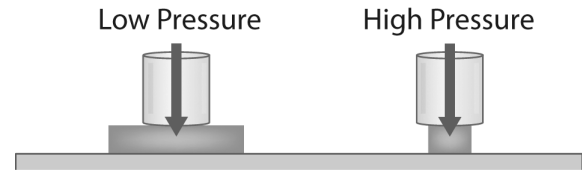
- State Pascal's law.**
The law states that, the external pressure applied on an incompressible liquid is transmitted uniformly throughout the liquid.

VI. Answer in detail.

- With an appropriate illustration prove that the force acting on a smaller area exerts a greater pressure.**
 - Stand on loose sand. Your feet go deep into the sand. Now, lie down on the sand, you will find that your body will not go that deep into the sand
 - In both the cases of the above activity the force exerted on the sand is the weight of your body which is the same. This force acting perpendicular to the surface is called "Thrust"
 - When you stand on loose sand, the force is acting on an area equal to the area of your feet. When you lie down, the same force acts on an area of your whole body, which is larger than the area of your feet.

- Therefore the effect of thrust, that is pressure depends on the area on which it acts. The effect of thrust on sand is larger while standing than lying.
- The net force in a particular direction is called thrust. The force per unit area acting on an object concerned is called pressure. Thus we can say thrust on an unit area is pressure.

$$\text{Pressure} = \frac{\text{Thrust}}{\text{Area of contact}}$$



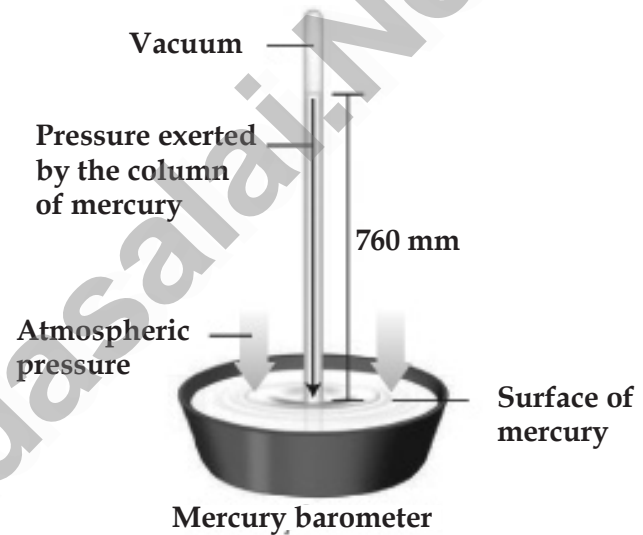
- For the same given force, if the area is large pressure is low and vice versa. (This is shown in figure)

2. Describe the construction and working of mercury barometer.

- The instrument used to measure atmospheric pressure is called barometer.

Construction :

- A mercury barometer, first designed by an Italian Physicist Torricelli, consists of a long glass tube (closed at one end, open at the other) filled with mercury and turned upside down into a container of mercury.
- This is done by closing the open end of the mercury filled tube with the thumb and then opening it after immersing it in to a trough of mercury.



Working :

- The barometer works by balancing the mercury in the glass tube against the outside air pressure
- If the air pressure increases, it pushes more of the mercury up into the tube and if the air pressure decreases, more of the mercury drains from the tube.
- As there is no air trapped in the space between mercury and the closed end, there is vacuum in that space.
- Vacuum cannot exert any pressure. So the level of mercury in the tube provides a precise measure of air pressure which is called atmospheric pressure.
- This type of instrument can be used in a lab or weather station.

3. How does an object's density determine whether the object will sink or float in water?

- Whether an object will sink or float in a liquid is determined by the density of the object compared to the density of the liquid.
- If the density of a substance is less than the density of the liquid it will float.

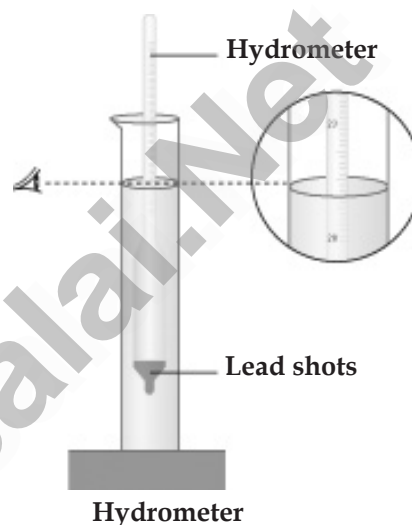
- For example:
 - (i) A piece of wood which is less dense than water will float on it.
 - (ii) Any substance having more density than water (for example: a stone) will sink into water.

4. Explain the construction and working of a hydrometer with diagram.

Principle : Hydrometer is based on the principle of flotation, i.e., the weight of the liquid displaced by the immersed portion of the hydrometer is equal to the weight of the hydrometer.

Construction - Hydrometer :

- A direct-reading instrument used for measuring the density or relative density of the liquid is called hydrometer.
- Hydrometer consists of a cylindrical stem having a spherical bulb at its lower end and a narrow tube at its upper end.
- The lower spherical bulb is partially filled with lead shots or mercury. This helps hydrometer to float or stand vertically in liquids.
- The narrow tube has markings so that relative density of a liquid can be read directly.



Working :

- The liquid to be tested is poured into the glass jar. The hydrometer is gently lowered in to the liquid until it floats freely. The reading against the level of liquid touching the tube gives the relative density of the liquid.

5. State the laws of flotation.

Laws of flotation:

- The weight of a floating body in a fluid is equal to the weight of the fluid displaced by the body.
- The centre of gravity of the floating body and the centre of buoyancy are in the same vertical line.

VII. Assertion and reason type Questions

Mark the correct answer as :

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true but reason is not the correct explanation of assertion.
- (c) If assertion is true but reason is false.
- (d) If assertion is false but reason is true.

1. **Assertion** : To float, body must displace liquid whose weight is equal to the actual weight.

Reason : The body will experience no net downward force in that case.

Ans: (a) If both assertion and reason are true and reason is the correct explanation of assertion.

2. **Assertion** : Pascal's law is the working principle of a hydraulic lift.

Reason : Pressure is thrust per unit area.

Ans : (a) If both assertion and reason are true and reason is the correct explanation of assertion.

VIII. Numerical Problems.

1. A block of wood of weight 200 g floats on the surface of water. If the volume of block is 300 cm^3 . Calculate the upthrust due to water.

Soln :

$$\begin{aligned} 1 \text{ kg} &= 9.8 \text{ N} \\ \text{Weight of wood} &= 200 \text{ g} = 0.2 \text{ kg} \\ &= 0.2 \times 9.8 \\ &= 1.96 \text{ N} \end{aligned}$$

Upthrust due to water = 1.96 N

2. Density of mercury is 13600 kg m^{-3} . Calculate the relative density.

Soln :

$$\begin{aligned} \text{Density of Mercury} &= 13600 \text{ kg m}^{-3} \\ \text{Density of water at } 4^\circ\text{C} &= 1000 \text{ kg m}^{-3} \\ \text{Relative Density} &= \frac{\text{Density of the substance}}{\text{Density of water at } 4^\circ\text{C}} \end{aligned}$$

$$\begin{aligned} \text{Relative Density} &= \frac{13600 \text{ kgm}^{-2}}{1000 \text{ kgm}^{-3}} \\ &= 13.6 \text{ (No unit)} \end{aligned}$$

3. The density of water is 1 g cm^{-3} . What is its density in S.I. units?

Soln :

Water as reference with its highest density at 4°C is $(\rho) = 1 \text{ g / cm}^3$
The correct SI unit is $\rho = 1000 \text{ kg / m}^3$.

4. Calculate the apparent weight of wood floating on water if it weighs 100g in air.

Soln :

Apparent weight of an object =
The weight of the body in air - Upthrust
 $= 100\text{g} - 100\text{g}$
 $= 0$

(Upthrust = The weight of water displaced)
Apparent weight of an object = 0

IX. Higher order Thinking Skills

1. How high does the mercury barometer stand on a day when atmospheric pressure is 98.6 kPa?

$$\begin{aligned} \text{Pressure (P)} &= - h\rho g \\ 98600 \text{ Pa} &= - h \times 13600 \times 9.8 \\ h &= \frac{-P}{\rho g} = \frac{98.6}{13600 \times 9.8} = \frac{98600}{133280} \\ &= -0.7397 \text{ m} \end{aligned}$$

$$\boxed{h = -0.74 \text{ m} = 740 \text{ mm}}$$

2. How does a fish manage to rise up and move down in water?

- To reduce its overall density, a fish fills the bladder with oxygen collected from the surrounding water via the gills.
- In this case, the forces of buoyancy and gravity cancel each other out, and the fish stays at that level.
- Most fish rise and sink using this method, but not all do.

3. If you put one ice cube in a glass of water and another in a glass of alcohol, what would you observe? Explain your observations.

- Ice cube in water : As the density of ice cube is less than water, the ice cube floats in water.
- Ice cube in alcohol : As the density of ice cube is greater than alcohol, the ice cube will sink in alcohol.

(Note : Density : Water = 1.00, Ice cube = 0.917, Alcohol = 0.78)

4. Why does a boat with a hole in the bottom would eventually sink?

A boat with a hole in the bottom eventually sinks due to:

- The water entered through a hole will increase the weight of boat.
- The boat becomes heavier so it cannot displace more water.
- As the water keeps entering into the hole the hydrostatic pressure is higher than the atmospheric pressure which pushes the boat down to the surface of the water causing it to sink.

Part - II. (Additional Exercises)

I. One Mark Questions :	Answers
1. One Pascal = _____	one newton per square metre
2. The pressure exerted by the fluid acts in an object from _____.	all directions.
3. When the volume of the fluid increases, its _____ also increases.	Pressure
4. _____ device is for measuring atmospheric pressure without the use of liquids.	Aneroid barometer
5. _____ barometer that records the atmospheric pressure variations over time.	Barograph
6. Relative density can be measured using _____	Pycnometer
7. The graduation ranging of lactometer from _____ at the top to _____ at the bottom.	15, 45
8. The correct lactometer reading is obtained only at the temperature of _____.	60°C
9. A lactometer measures the _____ of milk	Cream content
10. The point through which the force of buoyancy is supposed to act is known as _____	centre of buoyancy
11. _____ is a device used to measure the relative density of liquids.	Hydrometer
12. Hydrometer based on the _____ principle.	Archimedes' principle
13. The atmospheric pressure _____ as we go up in mountains.	decreases
14. Pycnometer is also called _____	density bottle
15. The buoyant force phenomenon is called _____	buoyancy
16. An _____ is a confined aquifer containing ground water that flow upwards out of a well without the need for pumping.	artesian aquifer
17. Pressure is _____ proportional to the area in which it is acting.	inversely
18. In CGS system force is measured in _____ and area in _____.	Dyne, square Cm
19. Pressure on blood pressure and tires in vehicles is _____ than atmospheric pressure	higher

20. Most buoyant objects are those with a relatively high _____ and low _____. **volume, density**
21. Petroleum-based products typically float on the surface of water, because their _____ is low. **Specific gravity.**
22. Animals jaws can exert a pressure of more than _____ pounds per square inch as they are very sharp. **750**
23. For pressure lower than atmospheric pressure, absolute Pressure = _____. **atmospheric pressure - gauge pressure**
24. Cartesian diver is an experiment that demonstrates the principle of _____. **buoyancy**
25. Human lung is well adapted to breathe at a pressure of sea level _____. **101.3 K Pa**
26. _____ is a device for measuring atmospheric pressure without the use of liquids. **Aneroid barometer**
27. _____ Records the atmospheric variations over time **Barograph**
28. The Global mean pressure at the surface of the earth is _____. **984 hPa**
29. The correct lactometer reading is obtained only at the temperature of _____. **60°F**
30. Salt water provides more _____ than fresh water **Buoyant force**
31. Fish has an Internal swim bladder which is filled with _____. **gas**
32. _____ is Equal to the weight of the fluid displaced. **upthrust**
33. The tyre pressure of vehicles is measured in a unit called _____. **Psi**

II. Match the following

1)	A	B	Answer
1	Hydraulic press	a lactometer	e Pascal's Law
2	Relative Density	b Cartesian diver	d Pycnometer
3	Principle of floating	c Hydrostatic balance	a lactometer
4	buoyancy	d Pycnometer	b Cartesian diver
5	Archimede's Principle	e Pascal's Law	c Hydrostatic balance

III. True or False, If false Correct the Statement

1. Gauge pressure is Zero - referenced against a **perfect vaccum**.
Ans : False - Gauge pressure is zero - referenced against **atmospheric pressure**.
2. The Effect of thrust that is pressure depends **in the object** on which it acts.
Ans : False - The Effect of thrust that is pressure depends **on the area** on which it acts.
3. Mercury barometer can be used in weather station. **Ans: True**

4. All the flowing substances, both liquids and gases are called fluids **Ans : True**
5. Pressure does not depend on shape and size of the containers **Ans : True**

IV.Assertion & Reason type Questions

1. **Assertion (A)** : Some people do not have any damage to the body, even if they are nailed to bed.
Reason (R) : Stress works in large area.
 a. If both assertion and reason are true and reason is the correct explanation of assertion.
 b. If assertion is true, but reason is false
Ans : a) If both assertion and reason are true and reason is the correct explanation of assertion.
2. **Assertion (A)** : Air get 'thinner' with increasing altitude.
Reason (R) : The atmospheric pressure 'increases' as we go up in mountains.
 a. If both assertion and reason are true and reason is the correct explanation of assertion.
 b. If assertion is true, but reason is false **Ans: b) If assertion is true, but reason is false**
3. **Assertion (A)** : The global mean pressure at the surface of the earth is slightly less than mean sea-level pressure.
Reason (R) : Because of the elevation of land.
 a. If both assertion and reason are true and reason is the correct explanation of assertion.
 b. If assertion is true, but reason is false
Ans : a) If both assertion and reason are true and reason is the correct explanation of assertion

V.Analogy

1. Large : Low pressure
 :: Small Area : _____ **Ans : high pressure**
2. Above sea level : low pressure (lesser)
 :: Below sea level : _____ **Ans : high pressure on (greater)**
3. Less dense than water : Float on water
 :: more dense than water : _____ **Ans : Sink into water**
4. Density of milk : Lactometer
 :: Density of sugar in liquid : _____ **Ans : Pycnometer**

VI. Short Answers – 2 Marks

1. **Define thrust & Pressure**
 ➤ The Force which produces compression is called thrust
 ➤ Its S.I Unit is newton.
 ➤ Thrust acting normally to a unit area of a surface is called pressure
 ➤ Its S.I Unit is Pascal. or N/m^2
2. **What is buoyant Force?**
 The upward force experienced by a body when partly or fully immersed in a fluid is called Upthrust or buoyant force.

3. What is explained by Cartesian diver?

Cartesian diver is an experiment which demonstrates the Principle of buoyancy and the ideal gas law.

4. State-Archimedes' Principle.

- Archimedes' Principle state that when a body is partially or wholly immersed in a fluid,
- It experiences an up thrust or apparent loss of weight.
- Which is equal to the weight of the fluid displaced by the immersed part of the body.

5. What is relative density?

- Relative density is the ratio between the density of a substance and density of water.
- Relative density of a body is a pure number and has no unit.

6. What are the types of barometer?

There are three types:

- Fortin's barometer
- Aneroid barometer
- Barograph

7. Write about Absolute pressure and Gauge pressure?

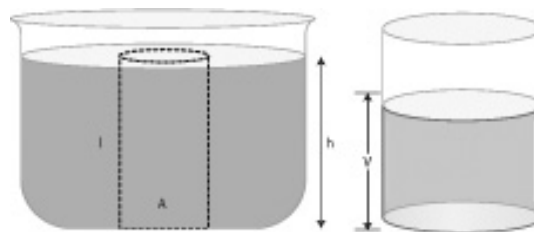
- **Absolute pressure**- is Zero referenced against a perfect vacuum.
- **Gauge pressure**- is Zero referenced against atmospheric pressure.

8. Where is the lactometer used?

The lactometer is used highly at milk processing units and at dairies.

VII. Answer in Detail - 5 Marks**1. Explain pressure due to a liquid column**

- A tall beaker is filled with liquid so that it forms a liquid column.
- The area of cross section at the bottom is A .The density of the liquid is ρ
- The height of the liquid column is h, In other words the depth of the water from the top level surface is 'h'

**Pressure due to a liquid column**

- We know that thrust at the bottom of the column (F) = weight of the liquid Therefore,

$$F = mg \text{ _____ (1)}$$

- We can get the mass of the liquid by multiplying the volume of the liquid and its density.

$$\text{Mass } M = \rho V \text{ _____ (2)}$$

- Volume of the liquid column,

$$V = \text{Area of cross section (A) } \times \text{Height (h)}$$

$$V = Ah \text{ _____ (3)}$$

Substituting (3) in (2)

$$\text{Hence, mass, } m = \rho Ah \text{ _____ (4)}$$

Substituting (4) in (1)

$$\text{Force} = mg = \rho Ahg$$

- Pressure, $p = \frac{\text{Thrust (F)}}{\text{Area (A)}} = \frac{mg}{A}$
 $= \frac{\rho(Ah) g}{A} = \rho hg$

- This expression shows that pressure in a liquid column is determined by depth, density of liquid (or) the amount of liquid and the acceleration due to gravity.

- Thus pressure at given depth does not depend upon the shape of the vessels containing the liquid (or) the amount of liquid in the vessel. It only depends on the depth.

- The pressure is the same even though the containers have different amount of liquid in them, and are of different shapes.



PRACTICAL

PHYSICS

I. TO FIND THE DIAMETER OF A SPHERICAL BODY

Aim:

To determine the diameter of a spherical body using Vernier Caliper

Apparatus required:

Vernier Caliper, given spherical body (cricket ball)

Formula: (i) Least count (LC) = 1 Main scale division - 1 Vernier scale division

$$LC = 1 \text{ mm} - 0.9 \text{ mm}$$

$$LC = 0.1 \text{ mm (or) } 0.01 \text{ cm}$$

(ii) Diameter the spherical object (d) = M.S.R + (VC X LC) ± ZC cm

Where, MSR - Main Scale Reading

VC = Vernier Coincide

LC - Least Count (0.01cm)

ZC - Zero Correction.

Procedure:

- Find the least count of the Vernier caliper.
- Find the zero correction of the Vernier caliper.
- Fix the object firmly in between the two lower jaws of the Vernier.
- Measure the main scale reading and the Vernier scale Coincidence.
- Repeat the experiment by placing the jaws of the Vernier at different position of the object.
- Using the formula find the diameter of the object.

Least count (LC) : 0.01cm

Zero correction (ZC) : _____

SI. No	Main Scale Reading (MSR) cm	Vernier coincidence (VC)	Diameter of object d = MSR + (VC X LC) ± ZC (cm)
1	7.2	5	7.25
2	7.2	8	7.28
3	7.2	7	7.27

Average: 7.267 cm

Result: The diameter of the given spherical object (Cricket ball) is 7.267 cm.

2. TO FIND THE THICKNESS OF GIVEN IRON NAIL

Aim:

To find the thickness of the given iron nail.

Apparatus required:

Screw gauge and iron nail

Formula:

$$(i) \text{ Least Count (LC)} = \frac{\text{Pitch scale Reading}}{\text{No of divisions in the Head scale}}$$

$$(ii) \text{ Thickness (t)} = \text{Pitch Scale Reading (PSR)} + [\text{Head Scale Coincidence (HSC)} \times \text{Least Count (LC)}] \pm \text{Zero correction}$$

$$t = \text{PSR} + (\text{HSC} \times \text{LC}) \pm \text{ZC}$$

Error:

(i) If positive error is 5 points, for zero correction, subtract 5 points.

$$t = \text{PSR} + (\text{HSC} \times \text{LC}) - \text{ZC}$$

$$t = \text{PSR} + (\text{HSC} \times \text{LC}) - 5$$

ii) If negative error is 95 points, for zero correction add 5 points ($100 - 95 = 5$)

$$t = \text{PSR} + (\text{HSC} \times \text{LC}) + \text{ZC}$$

$$t = \text{PSR} + (\text{HSC} \times \text{LC}) + 5$$

iii) If no correction is needed, $t = \text{PSR} + (\text{HSC} \times 0.01) \pm 0$

Procedure:

- The least count of screw gauge is 0.01 mm
- The zero error is to be found when the two faces of the screw gauge touch each other.
- Then place the iron nail between the two faces of the screw gauge. The Pitch Scale reading (PSR) and head scale coincidence (HSC) are to be noted.
- Repeat the process by placing other parts of the iron nail in the screw gauge .
- Tabulate the readings.

Zero correction: Nil

Least count: 0.01 mm

SI.NO.	Pitch Scale Reading PSR (mm)	Head Scale Co- incidence (HSC)	Thickness of the iron nail $t = \text{PSR} + (\text{HSC} \times \text{LC}) \pm \text{ZC}$ (mm)
1	4	60	4.60
2	4	75	4.75
3	4	80	4.80

Average: = 4.63 cm

Result: The diameter (Thickness) of the iron nail is 4.63 mm

3. MELTING POINT OF WAX

Aim :

To determine the melting point of wax using cooling curve.

Principle :

The determination of melting point is based on latent heat which is the amount of heat required to change a unit mass (1gm) of a substance from one state to another state without changing its temperature.

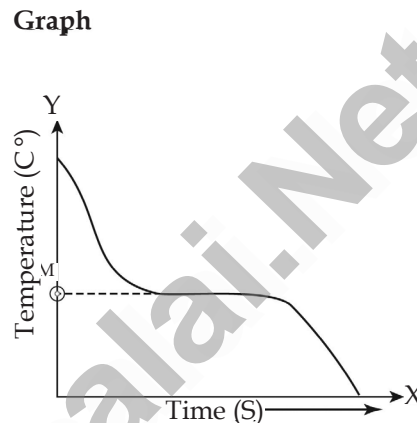
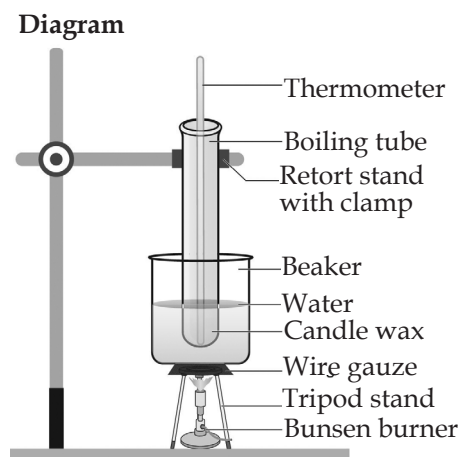
Materials Required :

Beaker, burner, thermometer, boiling tube, retort stand and clamp, wire gauze, tripod stand, candle wax, stop watch, bowl of sand.

Procedure :

- Melt the wax in a warm water bath.
- When the wax is melted entirely, remove it from the bath, dry it and then bury it in sand.
- Record the temperature each 30 seconds while the liquid is being converted to solid.
- At the same time watch for constant temperature at which liquid and solid are present.

Melting point of wax = Constant Temperature over a period of time

**Observation and Tabulation :**

S.No.	Time (Second)	Temperature
1	30	82
2	60	58
3	90	56.7
4	120	56

The temperature at the point M denotes the melting point of wax.

Result : Melting point of wax = 56.7°C

CHEMISTRY

4. MEASUREMENT OF VOLUME OF LIQUIDS

Aim:

To measure the volume of given colourless and coloured liquids.

Materials required :

Pipette (20ml), sample liquids and beakers.

Procedure:

- Take a 20 ml pipette. Wash it thoroughly with water and then rinse it with the given liquid. Insert the lower end of the pipette into the given liquid and suck the solution slowly till the solution rises well above the circular mark on the stem.
- Take the pipette out of the mouth and quickly close it with the fore finger. Take the pipette out the liquid and keep it in such a way that the circular mark on the stem is at the level of the eyes.
- Now slowly release the fore finger to let the liquid drop out until the lower meniscus touches the circular mark on the stem.
- Now the liquid in the pipette is exactly 20 ml. This can be transferred to an empty beaker by removing the fore finger.

Tabulation:

Sl. No.	Name of the liquid	Colour of the liquid	Nature of the meniscus	Volume of the liquid
1.	water	colourless	lower	20 ml
2.	Hcl	colourless	lower	20 ml
3.	Pottassium permanganate	pink	upper	20 ml
4.	Pottassium di-chromate	red orange	upper	20 ml

Report:

Exactly 20ml of various liquids are measured using a standard 20ml pipette.

Note:

1. Keeping the circular mark on the stem of the pipette above or below the level of the eyes will lead to error.
2. When coloured liquids are measured, the upper meniscus should be taken into account
3. Never suck strong acids or strong alkalis using a pipette

- | | | |
|----------------------------|---|-----------------------|
| a. Biofertilizer | - | Rhizobium. |
| b. Medicinal plants | - | Nilavembu, Alovera |
| c. Mushroom | - | Agaricus bisporus |
| d. Indigenous cattle breed | - | Umblachery |
| e. Indian major carp | - | Catla catla |
| f. Type of Honey bees | - | Queen bee, Worker bee |

ANSWER THE FOLLOWING

A. Draw a neat labelled sketch.

BIO FERTILIZER - Eg. Rhizobium - Eg. for symbiosis

Rhizobium is a nitrogen fixing bacteria common in soil.

- Rhizobium colonize in the cells of the root and reside in the nodules.
- They fix the gaseous form of atmospheric nitrogen into soluble form of nitrates.



B. Write its economic importance.

MEDICINAL PLANTS

- 1) Nilavembu, 2) Aloe vera.

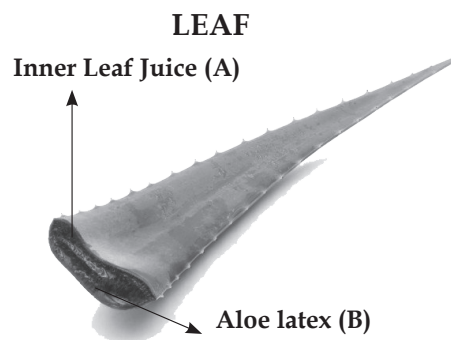
1) Nilavembu :

Andrographis paniculata is the botanical name -

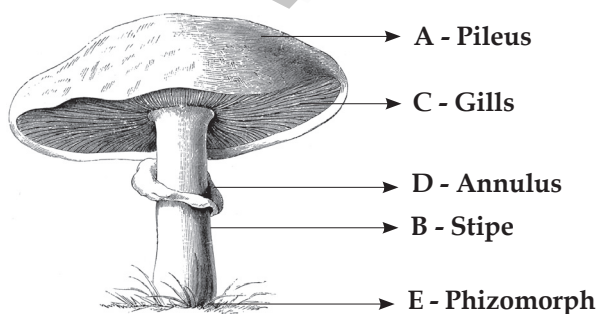
Nilavembu Kudineer is widely used in Siddha medicine to combat, prevent and manage all types of viral infections and fevers.

2) Aloe Vera :

- **A** - The clear, inner fleshy portion of the leaf, packed with nutrients and very healthy for both internal and external consumption.
- **B** - The bitter yellowish sap, with strong odour flow between leaf rind and inner fleshy part is not good for consumption.



C. Mushroom - Agaricus bisporus



Agaricus Basidiocarp has 3 distinct parts

- Pileus
- Stipe
- Rhizomorph

- **Pileus :**
Umbrella shaped structure and many **gills** seen on the underside of the **pileus**, responsible for the production of **basidiospores**.
- **Stipe :**
It is the fleshy stalk made up of parenchymatous mass of hyphae. It gives support to the pileus.
- **Rhizomorph :**
The basal underground mycelial portion, from where develop the fruit body (basidio carp).

D. Indigenous cattle breed - umblachery.

- Umblachery is indigenous breed of domestic cattle of India - It is also known as **Jathemadu** or **Therkuthimadu**.
- It is native to the coastal places of Nagapattinam and Thiruvarur district.
- Male is used for agricultural purposes, carting & ploughing
- Cows yield milk for consumption.



E. Indian major carp - Carp - Catla catla

- It is an economically important fresh water fish in the carp family.
- It has large and broad head, a large protruding lower jaw and upturned mouth.
- It has large greyish scales on it's dorsal side and whitish on it's belly.
- They lay eggs after heavy rain.
- They eat Zoo plankton and grow upto 1.5 metre length and upto 45 kilo weight.
- It is a common south Asian fresh water fish, such as Pakistan, Bangladesh etc.



Carp - Catla catla

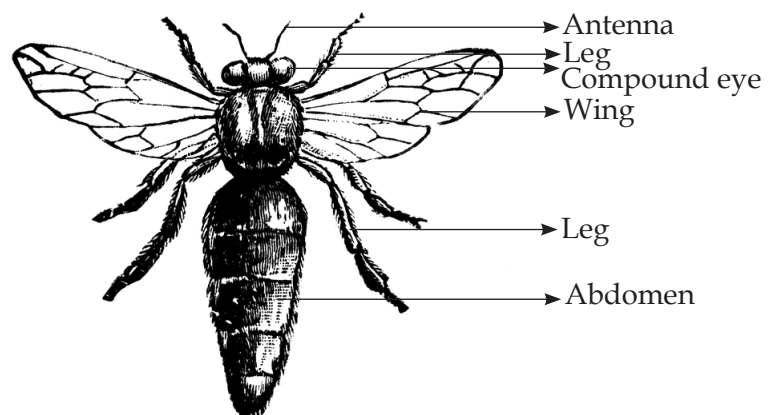
F. Type of Honey bees - Queen bee, Worker bee.

QUEEN BEE :

There is only one Queen bee in a hive, these are the largest fertile female developed sexually from fertilized eggs.

The egg to develop into Queen bee is laid in special big cells of the hive.

- Young Queen bees are fed exclusively by royal jelly.
- The Queen bees are reproduced by haploid drones.
- A Queen bee lay up to 2000 eggs / day inside the cells of a hive.



- Fertilized eggs hatch into female worker bees and unfertilized eggs hatch and become drones or male bees.
- The life span of a Queen bee is upto 3 to 4 years.

WORKER BEES :

- In a hive there are upto 10,000 to 30,000 workers.
- They are female and sterile bees.
- They work tirelessly and so named as worker bees.
- They do cleaning works, building new comb, taking care of larvae, (baby bees or brood), production of royal jelly, and do collection and storage of nectar and pollen etc.

10. IDENTIFICATION OF ADAPTATIONS IN PLANTS

Aim:

To identify the given plant specimen and lists out its adaptations.

1. Mesophytic Plant – Tomato or Brinjal Plant
2. Xerophytic Plant – Opuntia
3. Aquatic Plant – Eichhornia Sp
4. Insectivorous plant – Nepenthes

Observation:

The given plants are identified and the following adaptations are noted.

Sl. no	Name of the Plant	Habitat	Morphological Structure	Anatomical Structure	Physiological Structure
1.	Tomato	Mesophyte	Small Herb		Land Plant Need Water For Growth
2.	Opuntia	Xerophyte	Succulent Stem Leaves- Modified into Spines	-	Tide Over Unfavourable Season
3.	Eichhornia Sp	Floating Hydrophyte	Leaf Petiole, Spongy, Balancing Roots With Root, Pockets	Aerenchyma Present	Adapted To Keep Buoyancy
4.	Nepenthes	Insectivorous Plant	Leaf Modification Lamina-Pitcher Petiole-Phyllode	-	Adapted To Rectify Nitrogen Deficiency Secrete Digestive Enzymes

