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NOTE FROM PUBLISHER

It gives me great pride and pleasure in bringing to you **Sura's Science Full Year Guide for 8th 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

SYLLABUS	
I MID TERM TEST	June & July
QUARTERLY EXAMINATION	June to September
II MID TERM TEST	October & November
HALF YEARLY EXAMINATION	All Portions

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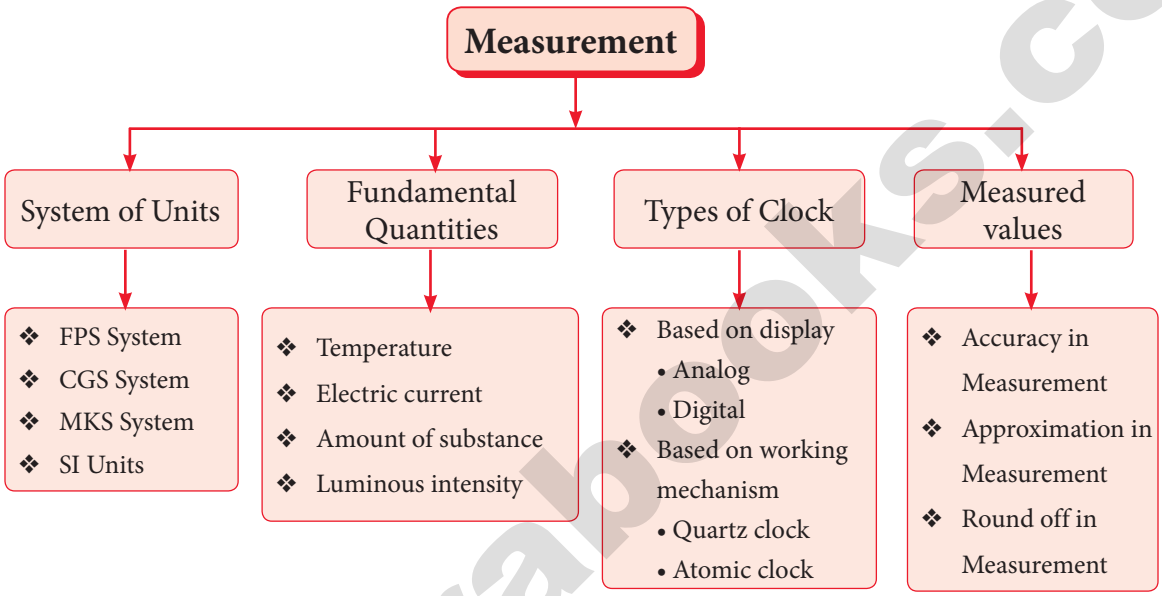
Unit 1

MEASUREMENT

Concept Map



Definitions

Measurement	:	**Measurement** is the process of finding an unknown physical quantity by using a standard quantity.
Temperature	:	**Temperature** is a measure of the average kinetic energy of the particles in a system.
Electric Current	:	The magnitude of an **electric current** is the amount of electric charges flowing through a conductor in one second.
One ampere	:	**One ampere** is defined as one 'coulomb' of charge moving in a conductor in one second.
Amount of substance	:	**Amount of substance** is a measure of the number of entities (particles) present in a substance.
Mole	:	The SI unit of amount of substance is **mole** and it is denoted as **'mol'**.

Luminous intensity	:	The measure of the power of the emitted light, by a light source in a particular direction, per unit solid angle is called as **luminous intensity**.
One candela	:	The light emitted from a common wax candle is approximately equal to **one candela**.
Luminous flux or luminous power	:	**Luminous flux** or **luminous power** is the measure of the perceived power of light. Its SI unit is '**lumen**'.
One lumen	:	**One lumen** is defined as the luminous flux of the light produced by the light source that emits one candela of luminous intensity over a solid angle of one steradian.
Plane angle	:	It is the angle between the intersection of two straight lines or intersection of two planes.
Radian	:	**Radian** is the angle subtended at the centre of a circle by an arc whose length is equal to the radius of the circle.
Solid angle	:	It is the angle formed by three or more planes intersecting at a common point.
Steradian	:	**Steradian** is the solid angle at the centre of a sphere subtended by a portion whose surface area is equal to the square of its radius of the sphere.
Digital clock	:	A **digital clock** displays the time directly. It shows the time in numerals or other symbols. It may have 12 hours or 24 hours display.
Analog clock	:	Clock which shows time with 3 moving motion and the clock face is marked from 1 to 12.
Quartz clock	:	These clocks are activated by 'electronic oscillations', which are controlled by a 'quartz crystal'.
Atomic clock	:	These clocks are making use of periodic vibrations occurring within the atom.
Accuracy	:	**Accuracy** is the closeness of a measured value to the actual value or true value.
Precision	:	**Precision** is the closeness of two or more measurements to each other.
Approximation	:	**Approximation** is the process of finding a number, which is acceptably close to the exact value of the measurement of a physical quantity.

Formulae to Remember

1.	Electric Current	=	$I = \frac{Q}{t}$ Electric Current $I = \frac{\text{Amount of electric charge (Q)}}{\text{time (t)}}$
2.	π radian	=	180^o 1 radian $= \frac{180^o}{\pi}$ (or) $1^o = \frac{\pi}{180^o}$

TEXT BOOK EXERCISES

I. Choose the best answer :

1. **Which one the following systems of units is the British System of unit?** *(QY-2023)*
(a) CGS (b) MKS (c) FPS (d) SI **[Ans. (c) FPS]**

2. **Electric current is a _____ quantity.** *(QY-2024; April-2025)*
(a) base (b) supplementary (c) derived (d) professional **[Ans. (a) base]**

3. **SI unit of temperature is _____ .** *(April, QY-2023; HY-2024)*
(a) celsius (b) fahrenheit (c) kelvin (d) ampere **[Ans. (c) kelvin]**

4. **Luminous intensity is the intensity of _____ .** *(QY-2024)*
(a) laser light (b) UV light
(c) visible light (d) IR light **[Ans. (c) visible light]**

5. **Closeness of two or more measured values is called as _____ .** *(HY-2023)*
(a) accuracy (b) precision
(c) error (d) approximation **[Ans. (b) precision]**

6. **Which one of the following statement is wrong?**
(a) Approximation gives accurate value.
(b) Approximation simplifies the calculation.
(c) Approximation is very useful when little information is available.
(d) Approximation gives the nearest value only.
[Ans. (a) Approximation gives accurate value.]

II. Fill in the blanks :

1. The solid angle is measured in _____. **[Ans. steradian]**

2. The coldness or hotness of a substance is expressed by ____. **[Ans. temperature]**

3. _____ is used to measure electric current. **[Ans. Ammeter]** *(QY-'23; HY-'24 & April-'24 & '25)*

4. One mole of a substance contains _____ atoms or molecules. **[Ans. 6.023×10^{23}]**

5. The uncertainty in measurement is called as _____. **[Ans. error]**

6. The closeness of the measured value to the original value is _____. **[Ans. Accuracy]**

7. The intersection of two straight lines gives us_____. **[Ans. plane angle]**

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

1. Temperature is a measure of total kinetic energy of the particles in a system. **[Ans. False]**

   Correct statement : Temperature is a measure of **average** kinetic energy of the particles in a system.

2. If one coulomb of charge is flowing in one minute, it is called 'ampere'. **[Ans. False]**

   Correct statement : If one coulomb of charge is flowing in one **second**, it is called 'ampere'.

3. Amount of substance gives the number of particles present in a substance. **[Ans. True]**
4. Intensity of light coming from a candle is approximately equal to one 'candela'. **[Ans. True]**
5. Quartz clocks are used in GPS devices. **[Ans. False]** *(HY-2023)*

   Correct statement : **Atomic** clocks are used in GPS devices.

6. Angle formed at the top of a cone is an example for 'plane angle'. **[Ans. False]**

   Correct statement : Angle formed at the top of a cone is an example for 'solid angle'

7. The number 4.582 can be rounded off as 4.58. **[Ans. True]**

IV. Match the following :

Temperature	Closeness to the actual value
Plane angle	Measure of hotness or coldness
Solid angle	Closeness to two or more measurements
Accuracy	Angle formed by the intersection of three or more planes
Precision	Angle formed by the intersection of two planes

Ans.

Temperature	Measure of hotness or coldness
Plane angle	Angle formed by the intersection of two planes
Solid angle	Angle formed by the intersection of three or more planes
Accuracy	Closeness to the actual value
Precision	Closeness to two or more measurements

V. Consider the statements given below and choose the correct option :

(a) Both assertion and reason are true and reason is the correct explanation of the assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of the assertion.
(c) Assertion is true, but reason is false.
(d) Both the assertion and the reason are false.

1. **Assertion : The SI system of units is the suitable system for measurements.**
   Reason : The SI unit of temperature is kelvin.
   [Ans. (b) Both assertion and reason are true but reason is not the correct explanation of the assertion]

   Correct explanation : In SI system the units are precisely defined and have the same value everywhere.

2. **Assertion : Electric current, amount of substance, luminous intensity are the fundamental physical quantities.**
   Reason : They are independent of each other.
   [Ans. (a) both assertion and reason are true and reason is the correct explanation of the assertion]

3. **Assertion** : **Radian is the unit of solid angle.**
Reason : **One radian is the angle subtended at the centre of a circle by an arc of length equal to its radius.**

[Ans. ★ Assertion is false, but reason is true]

Correct explanation : Radian is the unit of plane angle.

VI. Answer very briefly :

1. **How many base quantities are included in SI system?**

Ans. Seven.

2. **Give the name of the instrument used for the measurement of temperature.**

Ans. Thermometer.

3. **What is the SI unit of luminous intensity?**

Ans. Candela (cd).

4. **What type of oscillations are used in atomic clocks?**

Ans. Periodic vibrations.

5. **Mention the types of clocks based on their display.**

Ans. Analog clock and digital clock.

6. **How many times will the 'minute hand' rotate in one hour?**

Ans. One time.

7. **How many hours are there in a minute?**

Ans. 60 minutes = 1 hr

1 minute = $\frac{1}{60}$ = **0.0167** hour.

VII. Answer briefly :

1. **What is measurement?** *(QY-2023 & 2024)*

Ans. Measurement is the process of finding an unknown physical quantity by using a standard quantity.

2. **Name the three scales of temperature.** *(April- '23, '24 & '25, QY-2023; HY-'24)*

Ans. Celsius, Fahrenheit, Kelvin are the most commonly used scales to measure temperature.

3. **Define - Ampere.** *(QY-2024; April-'25)*

Ans. One ampere is defined as one 'coulomb' of charge moving in a conductor in one second.

4. **What is electric current?** *(HY-2023)*

Ans. The magnitude of an electric current is the amount of electric charges flowing through a conductor in one second.

5. **What do you mean by luminous intensity?**

Ans. The measure of the power of the emitted light, by a light source in a particular direction, per unit solid angle is called as luminous intensity.

6. **Define - Mole.**

Ans. Mole is defined as the amount of substance, which contains 6.023×10^{23} entities.

7. What are the differences between plane angle and solid angle?

Ans. Differences between Plane Angle and Solid Angle :

Plane Angle	Solid Angle
It is the angle made at the point of intersection of two lines or planes.	It is the angle by the intersection of three or more planes at a common point.
It is two dimensional.	It is three dimensional.
Its unit is radian.	Its unit is steradian.

VIII. Answer in detail :

1. List out the base quantities with their units. *(QY-2023; QY & HY-'24 & April-'24 & '25)*

Ans. Base Quantities and Units :

Quantity	Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Temperature	kelvin	K
Electric Current	ampere	A
Amount of Substance	mole	mol
Luminous Intensity	candela	cd

2. Write a short note on different types of clocks.

Ans. Types of clocks based on display :

(i) Analog clocks

(ii) Digital clocks

Analog Clock

(i) Analog clocks : It looks like a classic clock. It has three hands to show the time.

(1) Hours hand : It is short and thick. It shows 'hour'.

(2) Minutes hand : It is long and thin. It shows 'minute'.

(3) Seconds hand : It is long and very thin. It shows 'second'. It makes one rotation in one minute and 60 rotations in one hour.

Analog clocks can be driven either mechanically or electronically.

(ii) Digital clocks :

(1) A digital clock displays the time directly. It shows the time in numerals or other symbols. It may have 12 hours or 24 hours display.

(2) Recent clocks are showing date, day, month, year, temperature etc.

(3) Digital clocks are often called as Electronic clocks.

Types of clocks based on working mechanism :

Quartz Clock

(i) Quartz Clock :

(1) These clocks are activated by 'electronic oscillations', which are controlled by a 'quartz crystal'.

(2) The frequency of a vibrating crystal is very precise. So, quartz clock is more accurate than mechanical clock.

(3) These clocks have an accuracy of one second in every 10^9 seconds.

(ii) **Atomic Clock :**

(1) These clocks make use of periodic vibrations occurring within the atom.

(2) These clocks have an accuracy of one second in every 10^{13} seconds.

(3) Atomic clocks are used in Global Positioning System (GPS), Global Navigation Satellite System (GLONASS) and International Time Distribution Services.

Atomic Clock

IX. Higher Order Thinking Question :

1. Your friend was absent to school yesterday. You are enquiring about his absence. He told that he had fever and it was measured to be 100°C. Is it possible to have 100°C fever? If he is wrong, try to make him understand.

Ans. (i) No. It is not possible to have 100ºC fever. The normal temperature of human body is between 98.4ºF and 98.6ºF.

(ii) So, he should have told that, he had fever which was measured to be 100ºF and not 100ºC.

Intext Activities

➝ ACTIVITY - 1

Measure the length and breadth of your science book using a ruler (scale) and compare your value with those of your friends.

Ans. Aim : To determine the length and breadth of science book and to understand magnitude and unit.

Apparatus required : Science book and ruler (scale)

Tabular column :

Name of the object	Length (cm)	Breadth (cm)
Science textbook	25	21

Inference :

The length of science book $l = 25$ cm

The breath of science book $b = 21$ cm

Here, 25, 21 are the magnitudes (number values) and the unit is cm.

➝ ACTIVITY - 2

From the news paper or television, collect the highest and lowest temperature experienced in your nearest town or city for a week and record the values in a tabular column. Does this data remain same throughout the year?

Ans.

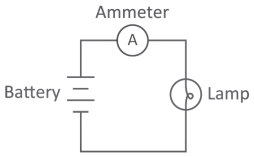
Name of the city or town	Day	Highest temperature (ºC)	Lowest temperature (ºC)
	Day - 1		
	Day - 2		
	Day - 3		
	Day - 4		
	Day - 5		
	Day - 6		
	Day - 7		

(Activity to be done by the students)

Inference : The data (temperature) does not remain same throughout the week.

ACTIVITY - 3

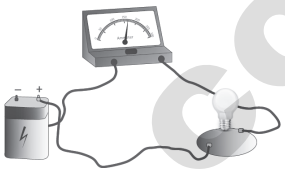
Connect a battery, an ammeter and a lamp in series as shown in the figure. Note the ammeter reading. It is the amount of current flowing in the circuit.



Ans. **Aim :** To measure the current in an electric circuit.

Components required : Battery, Ammeter and Lamp (Bulb).

Procedure :



(i) Connect the battery, ammeter and the lamp in series as shown in the figure.

(ii) Note the ammeter reading.

(iii) It is the current in the circuit.

Inference : Current is measured by using ammeter in an electric circuit.

ACTIVITY - 7

Calculate the approximate 'heart beat' of a man in a day. (Hint: Take number of heart beats per minute as 75, approximately)

Ans. **Solution :** Number of heart beats per minute = 75 (approx.)

$\therefore$ Approximate heart beat of a man in a day = ?

1 hour = 60 minutes

1 day = 24 hours

= $75 \times 24 \times 60$

$\therefore$ Approximate heart beats of a man in a day = **1,08,000**

★★★★★

GOVERNMENT EXAM QUESTION

I. Answer the question given below (Short Answer) :

1. **Name some common systems of measurement.** ***(Govt. MQP-2019)***

Ans. **Some common systems of units are :**

(i) FPS - System (Foot for length, Pound for mass and Second for time)

(ii) CGS -System (Centimetre for length, Gram for mass and Second for time)

(iii) MKS - System (Metre for length, Kilogram for mass and Second for time)

Additional Questions

I. Choose the correct answer :

1. **The SI unit of length is the _____.**
(a) millimetre (b) centimetre (c) metre (d) kilometre **[Ans. (c) metre]**

2. **The magnitude of a physical quantity consists of _____.**
(a) a unit (b) a number and a unit
(c) a number (d) a unit and its symbol
[Ans. (b) a number and a unit]

3. **The SI unit of mass is _____.**
(a) milligram (b) gram (c) quintal (d) kilogram **[Ans. (d) kilogram]**

4. **Among the following, which is not a metric system?**
(a) CGS (b) MKS (c) FPS (d) SI **[Ans. (c) FPS]**

5. **_____ is a physical quantity that expresses the degree of hotness or coldness of a substance.**
(a) Electric current (b) Luminous intensity
(c) Temperature (d) none of the above **[Ans. (c) Temperature]**

6. **Luminous intensity is measured by a _____ which gives the luminous intensity in terms of candela.**
(a) ammeter (b) photometer
(c) voltmeter (d) analog clock **[Ans. (b) photometer]**

7. **Scientists modified the clock's mechanism to obtain _____.**
(a) estimation (b) approximation
(c) accuracy (d) none of the above **[Ans. (c) accuracy]**

8. **Atomic clocks have an accuracy of one second in every _____ seconds.**
(a) 10^9 (b) 10^3 (c) 10^{10} (d) 10^{13} **[Ans. (d) 10^{13}]**

9. **Time difference between two adjacent time zones is _____.**
(a) 2 hours (b) 5:30 hours (c) 1 hour (d) 24 hours **[Ans. (c) 1 hour]**

10. **GMT is measured at the longitude of _____ degree.**
(a) 20 (b) 0 (c) 10 (d) 5 **[Ans. (b) 0]**

II. Fill in the Blanks :

1. _____ is the process of finding an unknown physical quantity by using a standard quantity. **[Ans. Measurement]**
2. The CGS, MKS and SI units are _____ system of units. **[Ans. metric]**
3. FPS is a _____ system of units. **[Ans. British]**
4. Temperature is a measure of the average _____ of the particles in a system. **[Ans. kinetic energy]**
5. Flow of electric charges (eleectrons) in a unit time is _____. **[Ans. Electric current]**

III. True or False - if false give the correct statement :

1. The unit of length in FPS system is foot. **[Ans. True]**
2. The unit of mass in CGS system is kilogram. **[Ans. False]**
Correct statement: The unit of mass in CGS system is **gram**.

3. Heat is a physical quantity that expresses the degree of hotness or coldness of a substance. **[Ans. False]**

Correct statement: Temperature is a physical quantity that expresses the degree of hotness or coldness of a substance.

4. Heat energy removed from a substance will lower its temperature. **[Ans. True]**

5. Voltmeter is a device used to measure electric current. **[Ans. False]**

Correct statement: Ammeter is a device used to measure electric current.

IV. Match the following.

1.

1.	π radian	(a)	Mars climate orbiter
2.	Base quantities	(b)	mol
3.	Amount of substance	(c)	7
4.	Martian climate	(e)	180º

[Ans. (1 - d. 2 - c, 3 - b, 4 - a)]

2.

1.	$\frac{Q}{t}$	(a)	Plane angle
2.	GMT	(b)	Royal observatory
3.	Two dimensional	(c)	Solid angle
4.	Three dimensional	(d)	I

[Ans. (1 - d. 2 - c, 3 - a, 4 - c)]

V. Consider the statements given below and choose the correct option:

(a) Both assertion and reason are true and reason is the correct explanation of the assertion.
(b) Both assertion and reason are true, but reason is not the correct explanation of the assertion.
(c) Assertion is true, but reason is false.
(d) Assertion is false, but reason is true.

1. **Assertion** : **The SI unit of temperature is kelvin.**

Reason : **Thermometers are calibrated with some standard scales like celsius, fahrenheit and kelvin.**

[Ans. (b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion]

2. **Assertion** : **Temperature is a physical quantity.**

Reason : **Temperature is expresses degree of hotness or coldness of a body.**

[Ans. (a) Both assertion and reason are true and reason is the correct explanation of the assertion]

3. **Assertion** : **Radian is the angle subtended at the centre of a circle by an arc whose length is equal to the radius of the circle.**

Reason : **1 radian** $= \frac{180^\circ}{\pi}$

[Ans. (a) Both assertion and reason are true and the reason is the correct explanation of the assertion]

VI. Answer very briefly :

1. What is Physics?

Ans. Physics is the study of nature and natural phenomena.

2. Name the British system of units.

Ans. FPS system.

3. Which city's location is taken as the 'reference longitude' of the 1st?

Ans. The location of Mirzapur in U.P.

4. What is the symbol for unit of electric current?

Ans. A (ampere).

5. Mention the SI unit of luminous flux.

Ans. Lumen.

VII. Answer briefly :

1. Mention the SI unit & symbol of temperature.

Ans. **(i)** The SI unit of Temperature is kelvin.

(ii) Its symbol is 'K'.

2. Define electric current. Write its formula and unit.

Ans. **(i)** The magnitude of an electric current is the amount of electric charges flowing through a conductor in one second.

$$\text{Electric current} = \frac{\text{Amount of electric charge (Q)}}{\text{time (t)}}$$

$$I = \frac{Q}{t}$$

(ii) SI unit of electric current is 'ampere' and it is denoted as A.

3. Define amount of substance. Mention its SI unit and symbol.

Ans. **(i)** Amount of substance is a measure of the number of entities (particles) present in a substance.

(ii) The SI unit of amount of substance is mole and it is denoted as 'mol'.

4. What is luminous intensity? Mention its SI unit and symbol.

Ans. **(i)** The measure of the power of the emitted light, by a light source in a particular direction, per unit solid angle is called as luminous intensity.

(ii) The SI unit of luminous intensity is candela and is denoted as 'cd'.

5. What are the rules for rounding off a number?

Ans. **Rules for rounding off :**

(i) Decide which is the last digit to keep.

(ii) Leave it the same, if the next digit is less than 5.

(iii) Increase it by one, if the next digit is 5 or greater than 5.

VIII. Answer in detail :

1. Write a note on accuracy and precision.

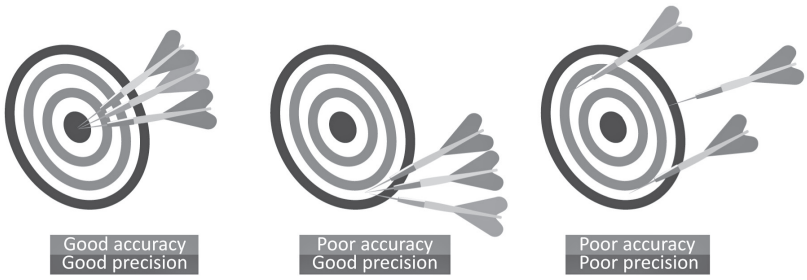
Ans. **Accuracy in Measurements :**

(i) Measurement is the base of all experiments in science and technology. The value of every measurement contains some uncertainty. These uncertainties are called as 'Errors'.

(ii) The difference between the real value and the observed value is called an error.

Accuracy : Accuracy is the closeness of a measured value to the actual value or true value.

Precision : Precision is the closeness of two or more measurements to each other.



Accuracy and Precision

2. Explain the Greenwich Mean Time.

Ans. (i) Greenwich Mean Time (GMT) is the mean solar time at the Royal Observatory, located at Greenwich in London.

(ii) It is measured at the longitude of zero degree.

(iii) The Earth is divided into 24 zones, each of a width of 15 degree longitude.

(iv) These regions are called as 'Time Zones'. Time difference between two adjacent time zones is 1 hour.

3. Write a note on approximation.

Ans. (i) Approximation is the process of finding a number, which is acceptably close to the exact value of the measurement of a physical quantity.

(ii) It is an estimation of a number obtained by rounding off a number to its nearest place value.

(iii) When the data are inadequate, physicists are in need of an approximation to find the solution for problems.

(iv) Approximations are usually based on certain assumptions having a scientific background and they can be modified whenever accuracy is needed.

IX. Problems for practice:

1. When 5 coulomb of charge, flows through a circuit for 20 seconds. calculate the current.

Ans. **Given:** Charge, Q = 5 C

Time, t = 20 s

Solution: Cureent $I = \frac{Q}{t} = \frac{5}{20} = 0.25$ A

$I = 0.25$ A

2. Convert 90º into radian.

Ans. **Given:** $1^\circ = \frac{\pi}{180^\circ}$

$90^\circ = \frac{\pi}{\cancel{180}_{2}} \times \cancel{90} = \frac{\pi}{2}$ **radian.**

3. Round off the number 5.323 to two decimal places.

Ans. **Step : 1** Identify the last digit to be kept. 2 is the last digit to be kept.

Step : 2 The following digit, (i.e.) 3 is less than 5. So retain 2 as 2.

∴ The answer is 5.32.

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UNIT TEST

Time : 60 min. Marks : 25

I. Choose the correct answer : (3×1 = 3)

1. **SI unit of temperature is**
   (a) celsius (b) fahrenheit (c) kelvin (d) ampere
2. **Closeness of two or more measured values is called as_____.**
   (a) accuracy (b) precision (c) error (d) approximation
3. **Heat energy given to a substance will _____ its temperature.**
   (a) increase (b) decrease (c) remains same (d) none

II. Fill in the blanks. (3 × 1 = 3)

4. _____ is used to measure electric current.
5. The SI unit of plane angle is _____.
6. _____ clocks are used in Global Positioning System.

III. Match the following : (4 × 1 = 4)

7.	Quartz clock	(a)	periodic vibrations
8.	Atomic clock	(b)	ampere
9.	Electric current	(c)	coulomb
10.	Charge	(d)	10^9 seconds

IV. Very briefly : (4 × 1 = 4)

11. What is the SI unit of luminous intensity?
12. What type of oscillations are used in atomic clocks?
13. How many base quantities are there?
14. Round off the number 1.862 to two decimal places.

V. Answer briefly : (any 3) (3 × 2=6)

15. What is measurement?
16. What are the differences between plane angle and solid angle?
17. What are the rules for rounding off a number?
18. Mention the SI unit & symbol of temperature.
19. Define amount of substance. Mention its SI unit and symbol.

VI. Answer the following in detail : (1 × 5 = 5)

20. (a) Write a short note on different types of clocks.

(or)

(b) Write a note on accuracy and precision.

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Answer Key

I. 1. (c) kelvin 2. (b) precision 3. (a) increase

II. 4. Ammeter 5. radian 6. Atomic

III. 7 - d, 8 - a, 9 - b, 10 - c.

IV. 11. Candela (cd) 12. Periodic vibrations 13. Seven 14. 1.86

V. 15. Refer Sura's Guide, Textual Q. No. VII - 1.

16. Refer Sura's Guide, Textual Q. No. VII - 7.

17. Refer Sura's Guide, Additional Q. No. VII - 5.

18. Refer Sura's Guide, Additional Q. No. VII - 1.

19. Refer Sura's Guide, Additional Q. No. VII - 3.

VI. 20. a) Refer Sura's Guide, Textual Q. No. VIII - 2. (or)

b) Refer Sura's Guide, Additional Q. No. VIII - 1.

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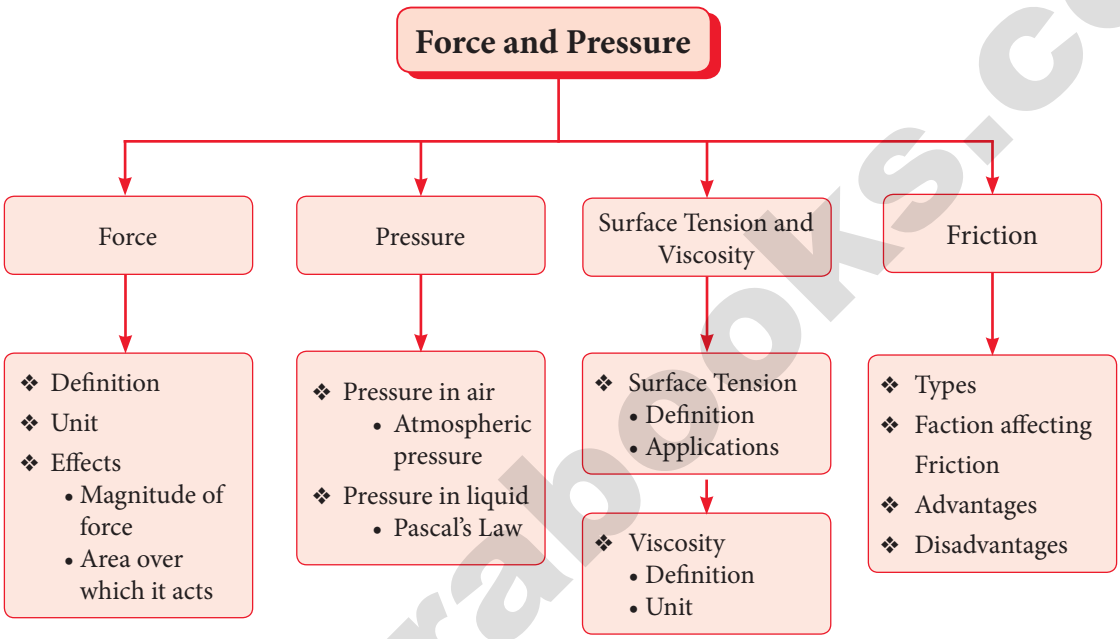
Unit 2

FORCE AND PRESSURE

Concept Map



Definitions

Force	:	**Force** is an external agency which changes or tends to change the state of rest or the state of uniform motion of a body or the direction of a moving body or the shape of the body.
Thrust	:	The force acting perpendicularly on any given surface area of a body. It is measured by the unit newton.
Pressure	:	The amount of force or thrust acting perpendicularly on a surface of area of one square meter of a body.
Atmospheric pressure	:	The amount of force or weight of the atmospheric air that acts downward on unit surface area of the surface of the Earth.
Buoyant force	:	**Buoyant force** is the upward force exerted by water on a floating or a partly submerged body. The phenomenon is known as buoyancy.

Pascal's law	:	The pressure applied at any point of a liquid at rest, in a closed system, will be distributed equally through all directions of the liquid.
Surface tension	:	**Surface tension** is the property of a liquid. The molecules of a liquid experience a force, which contracts the extent of their surface area as much as possible, so as to have the minimum value. Thus, the amount of force acting per unit length, on the surface of a liquid is defined as surface tension.
Viscosity	:	The frictional force acting between the successive layers of the liquid which acts in order to oppose the relative motion of the layer is known as viscous force. Such a property of a liquid is called **viscosity**.
Friction	:	It is the force which opposes the relative motion between two surfaces in contact.
Static friction	:	The friction experienced by the bodies, which are at rest is called **static friction**.
Kinetic friction	:	Friction existing during the motion of bodies is called **kinetic friction**.
Sliding friction	:	When a body slides over the surface of another body, the friction acting between the surfaces in contact is called **sliding friction.**
Rolling friction	:	When a body rolls over another surface, the friction acting between the surfaces in contact is called **rolling friction**.

Formulae to Remember

1.	Pressure P	=	$\frac{\text{Thrust (or) Force (F)}}{\text{Area (A)}}$ $P = \frac{F}{A}$
2.	Force F	=	Pressure × Area
3.	Area A	=	$\frac{\text{Force}}{\text{Pressure}}$

TEXT BOOK EXERCISES

I. Choose the correct answer for each of the following :

1. If we apply force against the direction of motion of the body, then the body will

(a) stop moving
(b) move with an increased speed
(c) move with a decreased speed
(d) move in a different direction

[Ans. (a) stop moving]

2. Pressure exerted by a liquid is increased by

(a) the density of the liquid (b) the height of the liquid column
(c) Both a and b (d) None of the above **[Ans. (c) Both a and b]**

3. Unit of pressure is *(April-2023, '24 & '25; QY, HY-2023)*

(a) Pascal (b) $N\ m^{-2}$
(c) Poise (d) Both a and b **[Ans. (d) Both a and b]**

4. The value of the atmospheric pressure at sea level is *(Govt. MQP-2019)*

(a) 76 cm of mercury column
(b) 760 cm of mercury column
(c) 176 cm of mercury column
(d) 7.6 cm of mercury column **[Ans. (a) 76 cm of mercury column]**

5. Pascal's law is used in *(HY-2024)*

(a) hydraulic lift (b) brake system
(c) pressing heavy bundles (d) All the above **[Ans. (d) All the above]**

6. Which of the following liquids has more viscosity?

(a) Grease (b) Water
(c) Coconut oil (d) Ghee **[Ans. (a) Grease]**

7. The unit of viscosity is *(QY-2023 & 2024)*

(a) $N\ m^2$ (b) poise (c) $kg\ m\ s^{-1}$ (d) No unit **[Ans. (b) poise]**

II. Fill in the blanks :

1. The pressure of a liquid column _____ with the depth of the column. **[Ans. increases]**

2. Hydraulic lift works under the principle of _____. *(HY-2023)* **[Ans. Pascal's Law]**

3. The property of _____ of a liquid surface enables the water droplets to move upward in plants. **[Ans. surface tension]**

4. A simple barometer was first constructed by _____. *(QY- 2024)* **[Ans. Torricelli]**

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

1. Force acting on a given area is called pressure. *(April-2023; QY-2024)* **[Ans. True]**

2. A moving body comes to rest due to friction alone. *(QY-2023; April-'24)* **[Ans. True]**

3. A body will sink if the weight of the body is greater than the buoyant force. **[Ans. True]**

4. One atmosphere is equivalent to 1,00,000 newton force acting on one square metre. **[Ans. True]**

5. Rolling friction is slightly greater than the sliding friction. *(April -2025)* **[Ans. False]**
Correct statement: Rolling friction is **slightly lesser** than the sliding friction.

6. Friction is the only reason for the loss of energy. **[Ans. True]**

7. Liquid pressure decreases with the decrease of depth. *(HY-2024)* **[Ans. True]**

8. Viscosity depends on the pressure of a liquid. **[Ans. True]**

IV. Match the following : *(HY-2023)*

a.

Static friction	Viscosity
Kinetic friction	Least friction
Rolling friction	Objects are in motion
Friction between the liquid layers	Objects are sliding
Sliding friction	Objects are at rest

Ans.

Static friction	Objects are at rest
Kinetic friction	Objects are in motion
Rolling friction	Least friction
Friction between the liquid layers	Viscosity
Sliding friction	Objects are sliding

b.

Barometer	reduce friction
Increasing area of contact	Atmospheric pressure
Decreasing area of contact	cause of friction
Lubricants	increases friction
Irregular surface	decreases friction

Ans.

Barometer	Atmospheric pressure
Increasing area of contact	increases friction
Decreasing area of contact	decreases friction
Lubricants	reduce friction
Irregular surface	cause of friction

V. Complete the analogy :

1. Knot in a thread : _____ friction ::Ball bearing : _____ friction *(April-'23 & '25)*
Ans. Static, rolling.

2. Downward force : Weight :: Upward force offered by liquid : ___ *(April-'23 & '25)*
Ans. Buoyant force.

VI. Numerical Problem :

1. A stone weighs 500 N. Calculate the pressure exerted by it, if it makes contact with a surface of area 25 cm^2. *(QY-2023; April-2025)*

Ans. Given : Weight of a stone F = 500 N

Area A = 25 cm^2 = 25×10^{-4} m^2

To find : Pressure P = ?

Formula : Pressure $P = \frac{F}{A}$

$$= \frac{\overset{20}{\cancel{500}}}{\underset{1}{\cancel{25} \times 10^{-4}}}$$

Solution : Pressure P = **20×10^4 Nm^{-2} (or) 20×10^4 Pa**

VII. Consider the statements given below and choose the correct option.

(a) Both assertion and reason are true and reason is the correct explanation of assertion.

(b) Both assertion and reason are true, but reason is not the correct explanation of assertion.

(c) Assertion is true, but reason is false.

(d) Both assertion and reason are false.

1. Assertion : Sharp knives are used to cut the vegetables.

Reason : Sharp edges exert more pressure.

[Ans. (a) Both assertion and reason are true and reason is the correct explanation of assertion]

2. Assertion : Broad straps are used in bags.

Reason : Broad straps last for long.

[Ans. (b) Both assertion and reason are true, but reason is not the correct explanation of assertion]

Correct explanation: The weight of the bags falls on larger area of shoulder. So lesser pressure is produced.

3. Assertion : Water strider slides easily on the surface of water.

Reason : Water strider experiences less buoyant force.

[Ans. (b) Both assertion and reason are true, but reason is not the correct explanation of assertion]

Correct explanation : It is due to the surface tension of water.

VIII. Answer very briefly:

1. Give two examples to verify that a force changes the shape of a body.

Ans. Force can change the static condition of a body.

(i) If you squeeze a sponge, its shape changes.

(ii) If you pull a rubber band, it becomes longer.

2. Give two examples to verify that a force tends to change the static condition of a body.

Ans. Force can change the static condition of a body.

(i) A rest rubber ball begins to move, when a force applied on it.

(ii) Player applies a force on the stationary football while taking a penalty kick in football match. The force applied by player makes the football move towards the goal.

3. How do you feel when you touch a nail immediately after it is hammered into a wooden plank? Why?

Ans. The nail becomes hot due to friction. Friction changes kinetic energy to heat.

4. How does the friction arise between the surfaces of two bodies in relative motion?

Ans. The force of friction is arised by the interlocking of the irregularities of the two surfaces.

5. Name two instruments which help to measure the pressure of a fluid. *(April-2023)*

Ans. **(i)** Manometer

(ii) Pressure gauge.

6. Define one atmosphere. *(QY-2023)*

Ans. The pressure exerted by the mercury column is considered as the pressure of magnitude 'one atmosphere' (1 atm).

7. Why are heavy bags provided with broad straps? *(HY-2023; April-'24)*

Ans. Broader straps are provided on a back-pack for giving less pressure on the shoulders by providing a larger area of contact with the shoulder.

8. How does surface tension help a plant? *(Govt. MQP-2019)*

Ans. Water molecules rise up due to surface tension. Xylem tissues are very narrow vessels present in plants. Water molecules are absorbed by the roots and these vessels help the water to rise upward due to "capillarity action" which is caused by the surface tension of water.

9. Which has greater viscosity, oil or honey? Why? *(QY-2024)*

Ans. Honey has greater viscosity.

Reason : Thicker liquids are more viscous than thinner liquids. As honey has greater viscosity, more frictional force will be acting on it.

IX. Answer briefly :

1. Define friction. Give two examples of the utility of friction in day to day life.

Ans. **Friction :** Friction is a force that slows down moving objects or prevents stationary objects from moving.

Examples of the utility of friction in day to day life.

(i) Cars and buses are able to move safely on the road because of friction between the treaded tyres and the surface of the road.

(ii) We are able to write on paper only with the help of friction between the pencil or pen and paper.

2. Mention any three ways of minimising friction. *(HY-2023)*

Ans. **(i) By using lubricants :** These are applied to surfaces to reduce the friction between the surfaces.

Ex : Grease, coconut oil, graphite, castor oil, etc.

(ii) By polishing the surface :

We sprinkle fine powder on the carrom board and then we polish its surface to make smooth so that the striker slides easily on the surface.

(iii) By using ball bearing :

We use lead shots in bearing of a cycle hub because rolling friction is smaller than sliding friction.

3. State Pascal's law and mention its applications. *(HY & QY-2024)*

Ans. Pascal's law states that the pressure applied at any point of a liquid at rest, in a closed system, will be distributed equally through all directions of the liquid.

Applications:-

(i) In automobile service stations, the vehicles are lifted upward using the hydraulic lift, which works as per Pascal's law.

(ii) Automobile brake system works according to Pascal's law.

(iii) The hydraulic press is used to compress the bundles of cotton or cloth so as to occupy less space.

4. Why is a ball bearing used in a cycle hub?

Ans. The rolling friction is smaller than sliding friction, sliding is replaced by rolling with the usage of ball bearings. So lead shots are used in the bearing of a cycle hub to reduce the friction.

X. Answer in detail :

1. Friction is a necessary evil - explain.

Ans. Friction is a necessary for our day to day activities. It is desirable in most of the situations of our daily life.

(i) We can hold objects in our hand due to friction.

(ii) We can walk on the road because of friction. The friction between footwear and the ground help us to walk without slipping.

(iii) Writing on the paper with a pen is easy due to friction.

(iv) Automobiles can move safely due to friction between the tyres and the road. Brakes can be applied due to frictional resistance on brake shoes.

(v) We are able to light a matchstick, sew clothes, tie a knot or fix a nail on the wall because of friction.

Though friction makes our life easy, it has some negative effects also. So, it is called as "necessary evil".

Disadvantages of friction :

(i) Friction wears out the surfaces rubbing with each other, like screws and gears in machines or soles of shoes.

(ii) An excess amount of effort has to be given to overcome the friction while operating a machine. This leads to wastage of energy.

(iii) Friction produces heat, which causes physical damage to the machines.

2. Give the different types of friction and explain each with an example.

Ans. Friction can be classified into two basic types:

(i) Static friction
(ii) Kinetic friction.

(i) Static friction : The friction experienced by the bodies, which are at rest is called static friction. (**E.g :** All the objects are rigidly placed to be at rest on the Earth.)

(ii) Kinetic friction : Friction existing during the motion of bodies is called kinetic friction.

Kinetic friction can be further classified into two:

(i) Sliding friction
(ii) Rolling friction.

(i) Sliding friction : When a body slides over the surface of another body, the friction acting between the surfaces in contact is called sliding friction.

(ii) Rolling friction : When a body rolls over another surface, the friction acting between the surfaces in contact is called rolling friction.

Rolling friction is less than sliding friction. That is why wheels are provided in vehicles, trolleys, suitcases etc.

3. Describe an experiment to prove that friction depends on the nature of a surface.

Ans. Arrange some notebooks one over the other to form a platform, on a table. Keep a wide scale, as slide, such that one of its ends rests on the pile of books. Take different kinds of materials like cotton cloth, plastic paper, newspaper, writing pad etc. Place some glass marbles in a bowl placed on the table.

First, keep a rectangular piece of paper near the end of the scale, which is in contact with the table.Now, release a glass marble from the top end of the scale such that it rolls down the scale. Allow the marble to roll over the piece of paper and finally, come to rest. Measure the distance travelled by the marble over the paper, using the meter scale. Replace the 'rolling surface' by placing Glass plate, Cotton cloth, Wooden plank, etc. In each trial measure the distance travelled by the glass marble. Tabulate the distance covered by the marble over each surface.

S.No.	Rolling surface placed on the table	Distance covered by the glass marble after sliding down (in centimetre)
1.	Paper	60
2.	Glass	80
3.	Cotton cloth	40
4.	Wood	45

Inference: The marble covers a lesser distance over the cotton cloth in comparison with the distance it covers over the glass plate.

Reason: A rough surface like the cotton cloth, offers more frictional force. So, the marble moves slowly and covers a minimum distace. The smooth surface of glass,offers lesser friction.So, the glass marble travels a greater distance over it.

The above activity reveals the 'effect of the force of friction', which increases as the roughness of the surface increases.

It is easy to walk or ride a vehicle on a road, but it is difficult to do the same on sand due to its greater friction (roughness).

4. Explain how friction can be minimised.

Ans. (i) Using lubricants :

(1) A substance, which reduces the frictional force, is called a lubricant.
E.g : Grease, coconut oil, graphite, castor oil, etc.

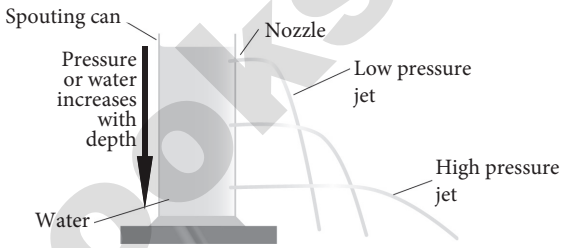
(2) The lubricants fill up the gaps in the irregular surfaces between the bodies in contact. This provides a smooth layer thus preventing a direct contact between their rough surfaces.

(ii) Using ball bearing :

Since, rolling friction is smaller than sliding friction, sliding is replaced by rolling with the usage of ball bearings.For the same reason, lead shots are used in the bearing of a cycle hub.

5. Describe an experiment to prove that the pressure in a liquid increases with depth. *(Govt. MQP-2019)*

Ans. Take a plastic bottle. Punch three holes on its side in the same direction, but at different heights. Now pour some water into it and let it flow through the holes. Observe the flow of water.



Inference : The water comes out from all the holes with different forces and falls on the table at points that are at variable distances from the bottle. Water from the lowest hole comes out with the greatest force and falls at a point that is at the maximum distance from the bottle. Water from the topmost hole comes out with the least force and falls at the point that is at the minimum distance from the bottle.

Reason : This activity confirms that the pressure in a liquid varies with the depth of the point of observation in it.

XI. Higher Order Thinking Questions. :

1. Why is it not advisable to use a fountain pen while travelling in an aeroplane?

Ans. Fountain pens are built in such a way that the pressure inside them balances the atmospheric pressure at sea level. Since atmospheric pressure decreases with an increase in height above sea level, the pressure inside the pen turns out to be much greater than the air pressure in an aeroplane and the pen starts leaking.

2. Is there any possibility of making a special device to measure the magnitude of friction directly?

Ans. Yes. Tribometer is a special device to measure the magnitude of friction directly.

3. Vidhya feels that mercury is costly. So, instead of mercury she wants to use water as a barometric liquid. Explain the difficulty of constructing a water barometer.

Ans. (i) Mercury is commonly used in barometers because of its high density means the height of the column can be a reasonable size to measure atmospheric pressure.

(ii) A barometer using water, for instance, would need to be 13.6 times taller than a mercury barometer to obtain the same pressure difference.

(iii) This is because mercury is 13.6 times more dense than water.

Intext Activities

ACTIVITY - 1

Fix a matrix of sharp pins on a wooden board in rows and columns. Take a big blown up balloon. Place it gently over the pins and place a small book on the top of the balloon. Will the balloon burst? Will the pins prick the balloon?

Ans. **Aim :** To understand the effect of a force depends on the magnitude of the force and the area over which it acts.

Materials required : Sharp pins, wooden board, balloon.

Procedure :

(i) Fix a matrix of sharp pins on a wooden board in rows and columns.
(ii) Take a big blown up balloon.
(iii) Place it gently over the pins.
(iv) Place a small book on the top of the balloon.
(v) Observe what happens.
(vi) Will the balloon burst? Will the pins prick the balloon?

Inference :

(i) The balloon will not burst. If you prick the balloon with a single pin it will burst. But this did not happen even though many more pins were pricking the balloon.
(ii) A single pin produces a large pressure over a small area. But, when a large number of pins prick a body, each pin exerts very little pressure on the balloon, as the applied force gets distributed over a large surface of the body. So, the balloon will not burst.

Conclusion : We conclude that the effect of a force depends on the magnitude of the force and the area over which it acts.

ACTIVITY - 2

Take a conical flask and a well boiled egg, after removing its shell. Place the egg on the mouth of the flask. It will not enter the flask. Now take a piece of paper. Burn it and drop it inside the flask. Wait for a few seconds to burn fully. Now, keep the egg on the mouth of the flask. Wait for a few minutes. What do you observe?

Ans. **Aim :** To realise the atmospheric pressure.

Materials required : Conical flask, boiled egg, piece of paper.

Procedure :

(i) Take a conical flask.
(ii) Take a well boiled egg, after removing its shell.
(iii) Place the egg on the mouth of the flask.
(iv) It will not enter the flask.
(v) Take a piece of paper.
(vi) Burn it and drop it inside the flask.
(vii) Wait for a few seconds, let it burnt fully.
(viii) Now keep the egg on the mouth of the flask.
(ix) Wait for a few minutes.

Observation : The egg placed at the mouth of the flask gets compressed and it falls into the flask, due to the atmospheric pressure.

Inference :

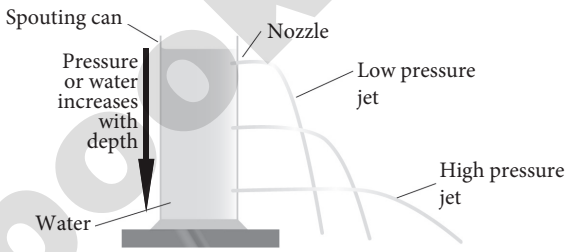
(i) When the paper is burning in the flask, the oxygen present in the air inside the conical flask is used up for its combustion. This reduces the pressure of the air in the flask. The air in the atmosphere tends to occupy the low pressure region in the flask.

(ii) So, it rushes through the mouth of the flask, thus pushing the egg into the flask.

➞ ACTIVITY - 3

Take a plastic bottle. Punch three holes on its side in the same direction, but at different heights. Now pour some water into it and let it flow through the holes. Observe the flow of water.

Ans. **Aim :** To understand that the pressure in a liquid varies with the depth of the point of observation in it.



Materials required :

(i) Plastic bottle

(ii) Water

Procedure :

(i) Take a plastic bottle.

(ii) Punch three holes on its sides in the same direction but at different heights.

(iii) Now pour some water into it and let it flow through the holes.

(iv) Observe the flow of water.

Observation :

(i) The water comes out from all the holes with different forces and falls on the table at points that are at variable distances from the bottle.

(ii) Water from the lowest hole comes out with the greatest force and falls at a point that is at the maximum distance from the bottle.

(iii) Water from the top most hole comes out with the least force and falls at the point that is at the minimum distance from the bottle.

Inference : This activity confirms that the pressure in a liquid varies with the depth of the point of observation in it.

➞ ACTIVITY - 4

Take a glass tube that is open at both ends. Fix a rubber balloon at the lower end of the tube. Pour some water into the tube and observe the balloon. Now, pour some more water into the balloon and again observe the balloon.

Ans. **Aim :** To demonstrate that liquid exerts pressure at the bottom of its container depends on the height of the liquid column in it.

Materials required : Transparent glass tube, balloon, water.

Procedure :

(i) Take a glass tube that is open at both ends.
(ii) Fix a rubber balloon at the lower end of the tube.
(iii) Put some water into the tube and observe the balloon.
(iv) Now, pour some more water into the balloon and again observe the balloon.

Observation : The balloon starts bulging outwards. The bulge increase with an increase in the height of the water column.

Inference : The pressure exerted by a liquid at the bottom of a containers depends on the height of the liquid column in it.

➝ ACTIVITY - 5

Take a plastic bottle. Punch three holes on its sides at the same height from its base. Now, pour some water into it and let it flow through the holes. Observe the flow of the water.

Ans. **Aim :** To demonstrate that liquid exerts equal pressure at same depth.

Material required : Plastic bottle, water.

Procedure :

(i) Take a plastic bottle.
(ii) Punch three holes on its sides at the same height from its base.
(iii) Now, pour some water into it and let it flow through the holes.
(iv) Observe the flow of the water.

Observation : The water comes out from all the holes with the same force and falls on the ground / table, at the same distance from the bottle.

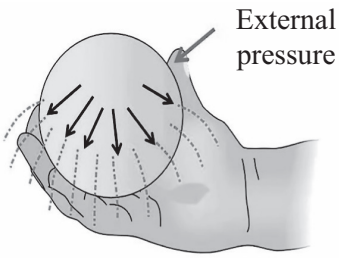
Inference : This activity confirms that liquids exert the same pressure in all directions at a given depth in their container.

➝ ACTIVITY - 6

Take a rubber ball and fill it with water. Make tiny holes on its surface with a pin at different points. Press anywhere on the ball. What do you observe?

Ans. **Aim :** To demonstrate pressure applied on one point of liquid transmits equally in all directions.

Materials required : Rubber ball, water, pin.



Procedure :

(i) Take a rubber ball. Fill it with water.
(ii) Then make tiny holes on its surface with a pin at different points.
(iii) Press anywhere on the ball.
(iv) What do you observe?

Observation : There are identical streams of water flowing in all directions from the holes.

Inference : This is due to the phenomenon that the pressure, which is applied on the liquid, is equally transmitted in all directions.

ACTIVITY - 7

Take some water in a beaker and spread a tissue paper on the surface of the water. Gently place the paper clip on the tissue paper. Observe what happens to the paper pin after some time.

Ans. **Aim :** To understand about surface tension property of liquid.

Materials required : Glass beaker, water, paper clip, tissue paper.

Procedure :

(i) Take some water in a beaker.

(ii) Take a tissue paper and spread it on the surface of the water.

(iii) Gently, place the paper clip on the tissue paper.

(iv) Observe what happens to the paper pin after some time.

Observation : After a few moments, the tissue paper will submerge and the paper clip will make a small depression on the surface of the water. It will instantly begin to float on the surface, even though it is denser than water.

Inference : This is due to the water molecules on the surface, which tend to contract themselves like the molecules of an elastic membrane. A force exists on them, which tends to minimize the surface area of water. The paper clip is balanced by the molecules on the water surface that is now behaving like a stretched elastic membrane. So, it does not submerge.

ACTIVITY - 8

Take a small quantity of different kinds of liquid like coconut oil, honey, water and ghee etc., Place one drop of each liquid on a separate glass plate. Now gently raise one end of the glass plate, so as to allow the liquid to slide down the smooth surface of the plate. Observe the speed of each liquid.

Ans. **Aim :** To understand about the frictional force between the layers of liquid in motion.

Materials required : Different kinds of liquid (coconut oil, honey, water, ghee), glass plates - 4 nos.

Procedure :

(i) Take a small quantity of different kinds of liquid like coconut oil, honey, water and ghee etc., in a cup.

(ii) Place one drop of each liquid on a separate glass plate.

(iii) Next, gently raise one end of the glass plate, one by one, so as to allow the liquid to slide down the smooth surface of the plate.

(iv) Observe the speed of each liquid.

Observation : Each liquid moves with a different speed. Water flows faster than other liquids. Coconut oil flows with a moderate speed. Ghee flows very slowly.

Inference : Between the layers of each liquid, in motion, there is a frictional force parallel to the layers of the liquid. This frictional force opposes the motion of the liquid layers while they are in motion.

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Additional Questions

I. Choose the correct answer :

1. **The SI unit of pressure is _____.**

(a) $\frac{kg}{m^3}$ (b) $\frac{kg}{m^2}$ (c) Pascal (d) Newton **[Ans. (c) Pascal]**

2. **The wear and tear in the machine part is due to _____.**

(a) electrostatic force (b) frictional force
(c) muscular force (d) gravitational force **[Ans. (b) frictional force]**

3. **Which of the following increases friction?**

(a) Lubricant (b) Treads on a tyre
(c) Streamlining (d) Polishing **[Ans. (b) Treads on a tyre]**

4. **The total force exerted by a body normal to the surface is called _____.**

(a) pressure (b) thrust
(c) force of gravity (d) none of these **[Ans. (b) thrust]**

5. **The atmospheric pressure on the surface of the earth is about _____.**

(a) 10^{-5} Nm^{-2} (b) 10^{4} Nm^{-2} (c) 10^{5} Nm^{-2} (d) 10^{3} Nm^{-2} **[Ans. (c) 10^5 Nm^{-2}]**

6. **The SI unit of force is _____.**

(a) dyne (b) newton (c) pascal (d) newton second
[Ans. (b) newton]

7. **The SI unit of surface tension is _____.**

(a) Nm^{-2} (b) Nm^{-1} (c) pascal (d) dyne **[Ans. (b) Nm^{-1}]**

8. **The amount of force acting per unit length on the surface of a liquid is called ____.**

(a) friction (b) buoyant force
(c) surface tension (d) atmospheric pressure
[Ans. (c) surface tension]

9. **At sea level, the height of the mercury column is around _____ mm.**

(a) 760 (b) 76 (c) 67 (d) 670 **[Ans. (a) 760]**

10. **Friction existing during the motion of bodies is called _____ friction.**

(a) sliding (b) static (c) rolling (d) kinetic **[Ans. (d) kinetic]**

II. Fill in the Blanks :

1. If the same force is made to act on a larger area, the pressure _____.
[Ans. decreases]

2. At the given depth, a liquid exerts _____ pressure in all directions. **[Ans. equal]**

3. The pressure exerted by the air around us is called _____ pressure.
[Ans. atmospheric]

4. At higher altitudes, atmospheric pressure is _____. **[Ans. less]**

5. Friction depends on the _____ of two surfaces in contact. **[Ans. nature]**

6. Water strider insect slides on the water surface easily due to the _____ of water.
[Ans. surface tension]

7. The force which acts in order to oppose the relative motion of the layer is known as _____ force. **[Ans. viscous]**

8. The automobile brake system works according to _____. [Ans. Pascal's law]
9. The _____ is used to compress the bundles of cotton or cloth so as to occupy less space. [Ans. hydraulic press]
10. In the SI system 1 atm = _____ pascal. [Ans. 1,00,000]

III. True or False - if false give the correct statement :

1. A push or pull on an object is called force.

Ans. True.

2. Pressure can be increased by decreasing the thrust.

Ans. False. **Correct statement:** Pressure can be increased by **increasing** the thrust.

3. Cooking is difficult at higher altitude.

Ans. True.

4. The pressure exerted by air is called atmospheric pressure.

Ans. True.

5. Pressure is directly proportional to the area of contact.

Ans. False. **Correct statement:** Pressure is **inversely** proportional to the area of contact.

6. The pressure in a liquid is the same at all depths.

Ans. False. **Correct statement:** The pressure in a liquid **increases** with depth.

IV. Match the following :

1.

i	Friction produces	(a)	Ceiling fan
ii	Lubricants	(b)	Heat
iii	Soapy floor	(c)	Oil and grease
iv	Ball bearing	(d)	Rolling friction
v	Wheels	(e)	Less the friction

[Ans. (i - b, ii - c, iii - e, iv - a, v - d)]

2.

i	Force	(a)	one atmosphere
ii	1 atm	(b)	Reduce friction
iii	viscosity	(c)	vector quantiy
iv	Lubricants	(d)	barometer
v	Torricelli	(e)	poise

[Ans. (i - c, ii - a, iii - e, iv- b, v - d)]

V. Analogy :

1. Liquid pressure : _____:: Atmospheric Pressure : _____.

Ans. Manometer, Barometer.

2. Broader straps : _____ :: Thin needles : _____.

Ans. Less pressure, High pressure.

3. Pascal's law : _____ :: Surface tension : _____.

Ans. Hydraulic brake, Capillary action.

4. Viscous force : _____ :: Buoyant force : _____.

Ans. Viscosity, Buoyancy.

5. Objects placed at rest on earth : _____ :: Bodies slide over the surface on other body : _____.

Ans. Static friction, Sliding friction.

VI. Assertion and Reason.

Mark the correct choice as :

(a) Both assertion and reason are true and the reason is the correct explanation of the assertion.
(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.
(c) The assertion is true, but the reason is false.
(d) The assertion is false, but the reason is true.

1. **Assertion :** **Force is defined as a push or pull acting on a body.**
Reason : **CGS unit of force is newton.**
[Ans. (c) The assertion is true, but the reason is false]

2. **Assertion :** **Friction always opposes the motion.**
Reason : **Whenever one surface moves or tries to move over another surface, the force of friction starts acting on the surfaces.**
[Ans. (d) The assertion is false, but the reason is true]

3. **Assertion :** **The pressure at the bottom of the sea is lesser than that near the surface.**
Reason : **The pressure exerted by a liquid depends upon the depth of the liquid and density of the liquid.**
[Ans. (d) The assertion is false, but the reason is true]

4. **Assertion :** **We can live very happily if friction is not present in nature.**
Reason : **Aeroplane shape is streamlined to reduce the effort of frictional force.** **[Ans. (d) The assertion is false, but the reason is true]**

5. **Assertion :** **There is danger of a vehicle skidding on a wet road.**
Reason : **The tyres of the vehicle lose their grip on the road due to increase in friction due to presence of water on the road.**
[Ans. (c) The assertion is true, but the reason is false]

VII. Answer very briefly.

1. **Write the SI unit of force.**

Ans. newton (N).

2. **Write the SI unit of pressure.**

Ans. pascal (Pa).

3. **Mention the factors that the effect of a force depend.**

Ans. **(i)** Magnitude of the force
(ii) The area over which it acts.

4. **Name the material which is used to reduce friction.**

Ans. Lubricant.

5. What is lateral pressure?

Ans. Liquid exerts pressure on the walls of the container also. This is called lateral pressure.

6. What is thrust?

Ans. The force acting normally on a surface is called thrust.

7. Mention the two types of forces.

Ans. **(i)** Contact force
(ii) Non - contact force.

8. State whether the liquids and gases also exerts pressure.

Ans. Yes, both the liquids and gases also exerts pressure.

VIII. Answer briefly.

1. Define force. Mention its SI unit.

Ans. Force is an external agnecy which changes or tends to change:
(i) the state of rest or
(ii) the state of uniform motion of a body or
(iii) the direction of a moving body or
(iv) the shape of a body.
(v) its unit is 'newton'(N)

2. Does the palm apply any force on the ball, when we place our palm in front of a moving ball?

Ans. Yes, when we place our palm in front of a moving ball, then the palm apply a force on the moving ball and stop it.

3. Briefly explain how do we experience force in our daily life.

Ans. Since, there are many actions which give us the feeling of force like we hit or catch many objects in our regular routine. Most of the times, we see that the moving ball stops after sometime and it changes the direction of motion when it is hit by a bat also, when we compress a spring, its shape and size changes.

4. Can you lift or push a book lying on a table without touching it?

Ans. No, we cannot lift or push a book lying on a table without touching it, because it is a type of contact force.

5. Explain the effect on the pressure when area on which it is applied, decreases.

Ans. As, we know that pressure is defined as the force acting on a unit area of a surface, then,

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}} \quad P = \frac{F}{A}$$

$$P \propto \frac{1}{A}$$

So, pressure is inversely proportional to the area on which force is applied. Therefore with the decrease in area the pressure increases.

6. Explain the variation of the pressure exerted by liquid with respect to following factors. (i) Amount of liquid (ii) Depth (iii) Shape and size of container

Ans. The variation of pressure exerted by liquid with respect to the above factors can be given by,

(i) Pressure in a liquid increases with the amount of liquid.
(ii) Pressure in a liquid increases with depth.
(iii) Pressure of liquid is independent of shape and size of container.

7. Give two examples to reduce friction.

Ans. (i) Drops of oil are poured on the hinges of a door to move the door smoothly.
(ii) Fine powder are sprinkled on the carrom board to reduce friction.

8. Explain why the cutting instruments are sharpened.

Ans. Cutting instruments have very small area of cross-section, which lead to the increase in pressure. So they can easily penetrate the surface (pressure is inversely proportional to area). That's why cutting instruments are usually very much sharpened.

9. Cooking in a place located at a higher attitude is difficult. Why?

Ans. At a higher altitude, due to the lack of atmospheric pressure the boiling point of a substance reduces. So, the water boils even at 80° C. At this temperature, the thermal energy that is produced is not sufficient enough for baking or cooking. So, cooking is difficult at higher altitude.

10. Write about buoyant force.

Ans. (i) An upward force is exerted by water on a floating or a partly submerged body. This upward force is called buoyant force. This phenomenon is known as "buoyancy".
(ii) This force is not only exerted by liquids, but also by gases. Liquids and gases together are called fluids.
(iii) This upward force decides whether an object will sink or float. If the weight of the object is less than the upward force, then the object will float. If not, it will sink.

IX. Answer in detail.

1. Explain the advantages and disadvantages of friction.

Ans. Advantages of friction :

Friction is necessary for our day to day activities. It is desirable in most of the situations of our daily life.

(i) We can hold any object in our hand due to friction.
(ii) We can walk on the road because of friction. The friction between footwear and the ground help us to walk without slipping.
(iii) Writing on the paper with a pen is easy due to friction.
(iv) Automobiles can move safely due to friction between the tyres and the road. Brakes can be applied due to frictional resistance on brake shoes.
(v) We are able to light a matchstick, sew clothes, tie a knot or fix a nail on the wall because of friction.

Though friction makes our life easy, it has some negative effects alos. So, it is called as "necessary evil".

Disadvantages of friction :

(i) Friction wears out the surfaces rubbing with each other, like screws and gears in machines or soles of shoes.

(ii) An excess amount of effort has to be given To overcome the friction while operating a machine. This leads to wastage of energy.

(iii) Friction produces heat, which causes physical damage to the machines.

2. Define Pascal's law. Explain the applications of Pascal's law in our daily life.

Ans. Pascal's law :

The pressure applied at any point of a liquid at rest, in a closed system, will be distributed equally through all directions of the liquid.

Applications of Pascal's law :

(i) In automobile service stations, the vehicles are lifted upward using the hydraulic lift, which works as per Pascal's law.

(ii) Automobile brake system works according to Pascal's law.

(iii) The hydraulic press is used to compress the bundles of cotton or cloth so as to occupy less space.

3. What is surface tension? Explain the applications of surface tension.

Ans. Surface tension is the property of a liquid. The molecules of a liquid experience a force, which contracts the extent of their surface area as much as possible, so as to have the minimum value. The amount of force acting per unit length, on the surface of a liquid is defined as surface tension.

Applications of surface tension :

(i) In plants, water molecules rise up due to surface tension. Xylem tissues are very narrow vessels present in plants. Water molecules are absorbed by the roots and these vessels help the water to rise upward due to "capillarity action" which is caused by the surface tension of water.

(ii) During heavy storm, ships are damaged due surface tension of water. By pouring oil or soap powder into the sea, sailors reduce its impact.

(iii) Water strider insect slides on the water surface easily due to the surface tension of water.

X. Thinking Corner : HOTS

1. Why dams are made stronger and thicker at the bottom that at the top?

Ans. This is because the pressure of the water is much greater at the bottom and the dam needs to be thick at the bottom so that it is strong enough to withstand this larger pressure.

2. Why do scuba divers wear a special suit while they go into deep sea levels?

Ans. Pressure deep under the sea is so high that if the divers don't wear specially designed suits, the water pressure will crush their body.

3. Why are rain drop spherical in nature?

Ans. (i) Surface tension is responsible for the shape of liquid droplets. Although easily deformed, droplets of water tend to be pulled into a spherical shape by the cohesive force of the surface layer.

(ii) In the absence of other force including gravity, drops of all liquids would be approximately spherical.

4. A liquid flowing out of a very small opening of a tube or tap comes out in the form of fine drops and not as a continuous stream. Why?

Ans. For a given volume, the surface area of a sphere is the minimum. This is the reason for the liquid drops to acquire a spherical shape.

5. Trees are greenish. They are greenish at the tip too. How does the water rise upward in a tree or plant against the force of gravity?

Ans. In plants, water molecules rise up due to surface tension. Xylem tissues are very narrow vessels present in plants. Water molecules are absorbed by the roots and these vessels help the water to rise upward due to 'capillarity action', which is caused by the surface tension of water.

XI. Problems for practice :

1. Determine the pressure when a force of 200 N acts on area

(i) 20 m^2

(ii) 8 m^2

Ans. (i) Pressure $P = \frac{F}{A}$

$F = 200\ N,\ A = 20\ m^2$

$P = \frac{200}{20} = 10\ N/m^2$ or 10 Pa

(ii) $A = 8\ m^2$

$P = \frac{200}{8} = \mathbf{25\ N/m^2\ or\ 25\ Pa}$

2. A force of 20 N acts over an area of 4 cm^2. Find the value of pressure? (in Nm^{-2})

Ans. Given : Pressure $= \frac{F}{A}$

$F = 20\ N$

$A = 4\ cm^2 = 4 \times 10^{-4}\ m^2$

Solution : $P = \frac{F}{A} = \frac{20}{4 \times 10^{-4}} = \frac{20 \times 10^4}{4} = 5 \times 10^4\ Nm^{-2}$

$= \mathbf{5 \times 10^4\ Nm^{-2}\ (or)\ 5 \times 10^4\ Pa}$

3. What will be the force required to exert a pressure of 20,000 Pa on an area of 1 cm^2.

Ans. Given : P = 20,000 Pa

A = 1 $cm^2 = 1 \times 10^{-4}\ m^2$

Formula : $P = \frac{F}{A}$

$F = P \times A$

Solution : $= 20{,}000 \times 10^{-4}$

$= 2 \times 10^4 \times 10^{-4}$

$=$ **2 N**.

4. Calculate the area of a 1500 N object that exerts a pressure of 500 Pa.

Ans. Given : P = 500 Pa

F = 1500 N

Formula : $P = \frac{F}{A}$

$A = \frac{F}{P}$

Solution : $A = \frac{1500}{500} =$ **$3m^2$**

XII. Cross word puzzle :

Across :

1. The mixture of gases that surrounds the Earth or some other celestial body.
3. A force acting normal to a surface.
5. The pressure exerted by air.
7. Something that causes a body to move, change its speed or direction, or distorts its shape.
9. The upward force that fluids exert on all matter.

Down :

2. A unit used to measure pressure.
4. A unit used to measure force.
6. Amount of force applied per unit area.
8. An instrument for measuring atmospheric pressure.
10. The pressure exerted at any point on a enclosed liquid is transmitted equally and undiminished in all directions.

Ans. Across :

1. ATMOSPHERE
3. THRUST
5. ATMOSPHERIC PRESSURE
7. FORCE
9. UPTHRUST

Down :

2. PASCAL
4. NEWTON
6. PRESSURE
8. BAROMETER
10. PASCALS LAW

A (1)	T	M	O	S	P (2) (10)	H	E	R	E										
					A														
	A (5)	T	M	O	S	P	H	E	R	I	C	P (6)	R	E	S	S	U	R	E
					C							R							
					A							E							N (4)
					L							S							E
					S				B (8)			S							W
					L				A			U (9)	P	T (3)	H	R	U	S	T
					A				R			R							O
					W			F (7)	O	R	C	E							N
									M										
									E										
									T										
									E										
									R										

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UNIT TEST

Time : 60 min. **Marks : 25**

I. Choose the correct answer: (3×1 = 3)

1. Unit of pressure is

(a) pascal (b) $N\ m^{-2}$ (c) poise (d) Both (a) & (b)

2. Which of the following liquids has more viscosity?

(a) Grease (b) Water (c) Coconut oil (d) Ghee

3. At sea level, the height of the mercury column is around _____ mm.

(a) 760 (b) 76 (c) 67 (d) 670

II. Fill in the blanks: (3 × 1 = 3)

4. The barometer was invented by _____.
5. Friction is called a _____ evil.
6. A drinking straw works on the existence of _____ pressure.

III. Match the following: (4 × 1 = 4)

7.	Barometer	(a)	Upward force
8.	Buoyant force	(b)	Atmospheric pressure
9.	Force	(c)	A substance that can flow
10.	Fluid	(d)	Action of push and pull

IV. Answer in one word: (4 × 1 = 4)

11. Name the two basic types of friction.
12. Write the SI unit of force.
13. Name the material which is used to reduce friction.
14. Which is working due to liquid pressure.

V. Answer the following in one or two sentences: (any 3) (3 × 2=6)

15. Define friction. Give two examples of the utility of friction in day to day life.
16. Cooking in a place located at a higher attitude is difficult. Why?
17. Define force. Mention its SI unit.
18. Give two examples to reduce friction.
19. Explain why the cutting instruments are sharpened.

VI. Answer the following in detail: (1 × 5 = 5)

20. (a) What is surface tension? Explain the applications of surface tension.

(or)

(b) Explain how friction can be minimised.

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Answer Key

I. 1. (d) Both (a) & (b) 2. (a) Grease 3. (a) 760

II. 4. Torricelli 5. necessary 6. atmospheric

III. 7 - b, 8 - a, 9 - d, 10 - c.

IV. 11. Static friction, Kinetic friction

12. newton (N).

13. Lubricant.

14. Hydraulic lift

V. 15. Refer Sura's Guide, Textbook Q. No. IX - 1.

16. Refer Sura's Guide, Additional Q. No. VIII - 9.

17. Refer Sura's Guide, Additional Q. No. VIII - 1.

18. Refer Sura's Guide, Additional Q. No. VIII - 7.

19. Refer Sura's Guide, Additional Q. No. VIII - 8.

VI. 20. a) Refer Sura's Guide, Additional Q. No. IX - 3. (or)

b) Refer Sura's Guide, Textbook Q. No. X - 4.

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