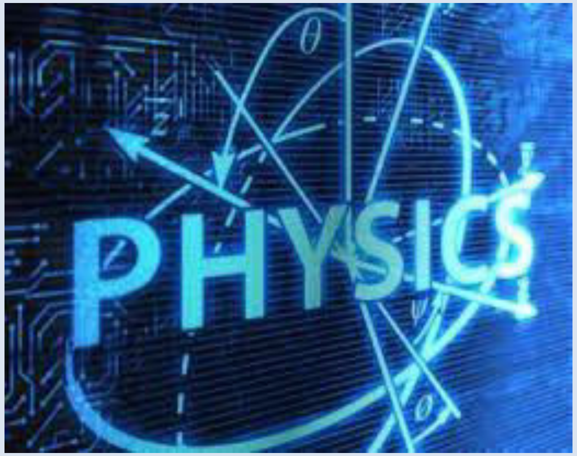
V.V.VANNIAPERUMAL COLLEGE FOR WOMEN
(Belonging to Virudhunagar Hindu Nadars)
An Autonomous Institution Affiliated to Madurai Kamaraj University
Re-accredited with 'A' Grade (3rd cycle) by NAAC
VIRUDHUNAGAR – 626 001 (TAMIL NADU)

GENERAL PHYSICS I LAB MANUAL



Under

DBT STAR COLLEGE SCHEME
DEPARTMENT OF BIOTECHNOLOGY
MINISTRY OF SCIENCE AND TECHNOLOGY
NEW DELHI

Prepared by
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DEPARTMENT OF PHYSICS

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V.V.Vanniaperumal College for Women, Virudhunagar,Tamilnadu
No HRD-11011/163/2020-HRD-DBT/Physics/Lab Manual – General Physics I

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DBT STAR COLLEGE SCHEME

Department of Biotechnology, Ministry of Science and Technology
Government of India, New Delhi

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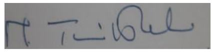
FOREWORD

The Lab Manual on **"GENERAL PHYSICS"** is prepared in accordance with the updated syllabus under DBT Star College Scheme sponsored by the Department of Biotechnology, Ministry of Science and Technology, MHRD, New Delhi to fulfil the needs of students. The handling of instruments and performing the experiments will enhance the practical knowledge of learnt concepts.

We thank the **Department of Biotechnology, The Ministry of Science and Technology, MHRD, New Delhi** for providing a good opportunity under Star College Scheme (No HRD11011/163/2020-HRD-DBT Dt. 24.08.2020). Under this scheme, we have purchased Muffle Furnace, Planck's constant by photoelectric effect apparatus, Spectrometer, Distillation Unit, Polarimeter, Dielectric Constant apparatus for solids and liquids, Solar Cell Characteristics kit, Calender and Barne's apparatus and Optical Fibre Communication Kit. This kind of support motivates the students for better understanding of physics concepts and creates interest on their core subject.

We hope this manual will definitely satisfy our student's need for knowledge to enhance their research attitude and motivate them to become a good physicist in future.



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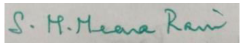

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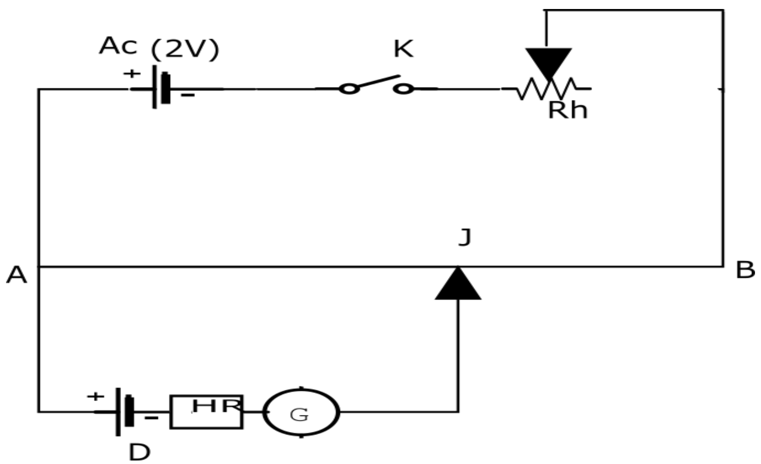
1. CALIBRATION OF AMMETER USING POTENTIOMETER

CIRCUIT DIAGRAM

PRIMARY CIRCUIT



Ac	→	Accumulator
K	→	Key
Rh	→	Rheostat
AB	→	Length of the Potentiometer wire between A and B end
D	→	Daniel Cell
HR	→	High Resistance
G	→	Galvanometer
J	→	Jockey
R	→	Standard resistance (1 Ω)

1. CALIBRATION OF AMMETER USING POTENTIOMETER

AIM

To calibrate the given ammeter using potentiometer and to draw the calibration curve.

REQUIREMENTS

Potentiometer, Ammeter, Accumulators (2 V, 6 V), 2 Plug keys, 2 Rheostats, Daniel cell, High resistance, Galvanometer, Connecting wires etc.,

FORMULAE USED

The current I' will be calculated by,

$$I' = \frac{E_0\ l}{R\ l_0}\ \text{ampere}$$

Correction for the ammeter reading = I' - I

E_0 → emf of standard cell (volt) = 1.08 volt

R → Standard resistance (1 Ω)

l_0 → Balancing length of standard cell (m)

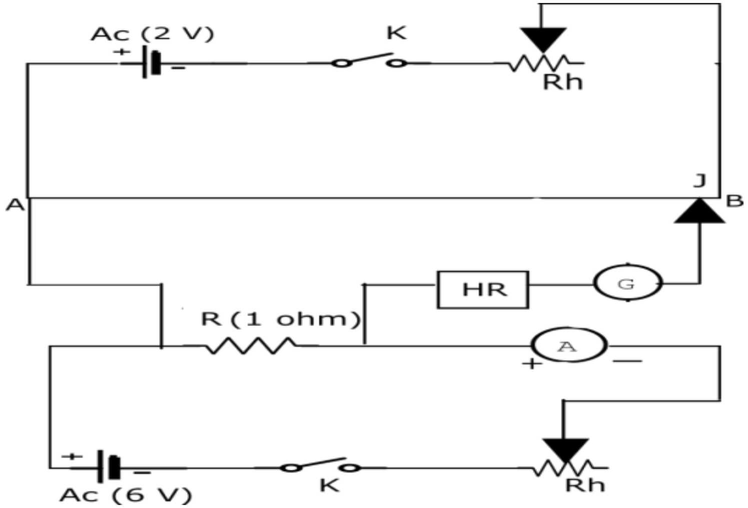
l → Balancing length of the standardized potentiometer wire will correspond to the current(m)

I → Ammeter reading (ampere)

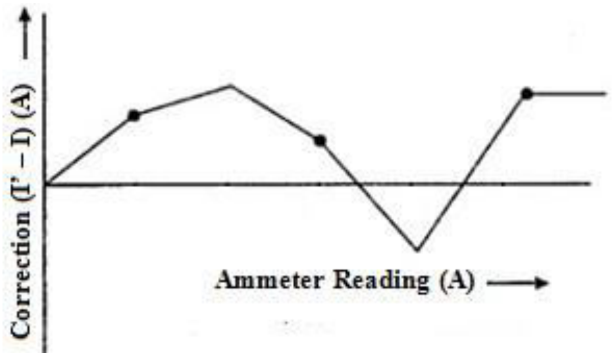
PROCEDURE

1. Make connections as in primary circuit. Connect positive terminal of accumulator with potentiometer end A. Connect the negative terminal of accumulator in series with key, rheostat and potentiometer end B. End A of potentiometer is connected in series with daniel cell, high resistance, galvanometer and jockey.
2. Switch on the accumulator (2 V) and daniel cell.
3. Slide the jockey on the potentiometer till the galvanometer shows null deflection. Measure this balancing length for daniel cell (l_0).
4. Make connections as shown in secondary circuit. Connect positive terminal of accumulator to end A of the potentiometer. Connect negative terminal of accumulator in series with key, rheostat and potentiometer end B. Connect the standard resistance in series with ammeter, rheostat, key and accumulator (6 V). Connect the same end of standard resistance in series with high resistance and jockey. Connect the other end of standard resistance with potentiometer end A.

SECONDARY CIRCUIT



MODEL GRAPH



5 Switch on the two accumulators (2 V and 6 V).

6 Set some current value in the ammeter by adjusting the rheostat. Slide the jockey on the potentiometer till the galvanometer shows null deflection and note down the balancing length (l). Repeat the experiment with different values of current and note down the corresponding balancing lengths.

7 Calculate I' by using the formula given and record the correction value.

8 Plot a graph by taking ammeter reading (I) along X axis and correction I' along Y axis.

RESULT

The given ammeter was calibrated using potentiometer and the calibration curve was drawn.

OUTCOME

Students are able to

- make connections with potentiometer with other electrical components and also to calibrate ammeter using potentiometer.
- gain knowledge to measure an unknown current by comparing it with a known current with a high degree of accuracy.

OBSERVATIONS

EMF of the Daniel cell E_0 = --- volt

Balancing length of the Daniel cell l_0 =----- × 10^{-2} m

S.No.	Ammeter reading I (Ampere)	Balancing length (l) (m) X 10^{-2}	Calculated current (I') (ampere)	Correction (I' – I)
1.	0			
2.	0.1			
3.	0.2			
4.	0.3			
5.	0.4			
6.	0.5			
7.	0.6			
8.	0.7			
9.	0.8			
10.	0.9			
11.	1.0			

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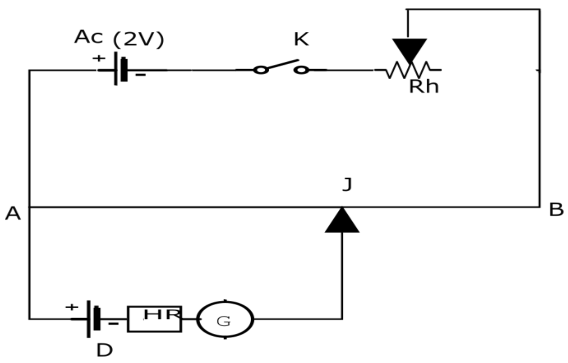
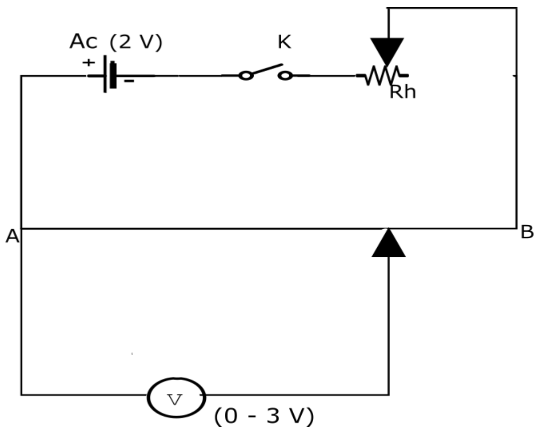
2. CALIBRATION OF LOW RANGE VOLTMETER USING POTENTIOMETER

CIRCUIT DIAGRAM

PRIMARY CIRCUIT



SECONDARY CIRCUIT



AB → Length of the Potentiometer wire between A and B end

K → Key

HR → High Resistance

D → Daniel cell

G → Galvanometer

2. CALIBRATION OF LOW RANGE VOLTMETER USING POTENTIOMETER

AIM

To calibrate the given low range voltmeter using potentiometer and to draw the calibration curve.

REQUIREMENTS

Potentiometer, Low range voltmeter (0-3V), Accumulator, Plug key, rheostat, Daniel cell, High resistance, Galvanometer, Jockey and Connecting wires etc.,

FORMULAE USED

The voltage V' will be calculated by,

$$V' = E_0 \frac{l}{l_0} \text{ volt}$$

Correction for the voltmeter reading = V' - V

E_0 → emf of standard cell (volt) = 1.08 volt

l_0 → Balancing length of standard cell (m)

l → Balancing length of the standardized potentiometer wire will correspond to the voltage V (m)

V → Voltmeter reading (volt)

PROCEDURE

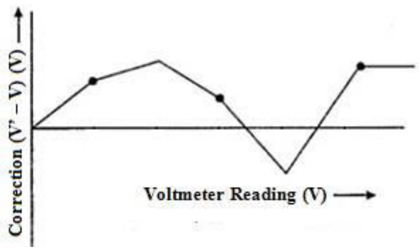
Make connections as in primary circuit. Connect positive terminal of accumulator with potentiometer end A. Connect the negative terminal of accumulator in series with key, rheostat and potentiometer end B. End A of potentiometer is connected in series with daniel cell, high resistance, galvanometer and jockey.

Switch on the accumulator (2 V) and daniel cell.

Slide the jockey on the potentiometer till the galvanometer shows null deflection. Measure this balancing length of daniell cell (l_0).

Make connections as shown in secondary circuit. Connect positive terminal of accumulator with potentiometer end A. Negative terminal of accumulator is connected in series with key, rheostat and potentiometer end B. Connect the voltmeter and jockey in series with potentiometer end A. Switch on the accumulator (2 V).

MODEL GRAPH



OBSERVATIONS

EMF of the Daniel cell E_0 = --- volt

Balancing length of the Daniel cell l_0 =------ × 10^{-2} m

S.No.	Voltmeter reading (volt)	Balancing length (l) (m) X 10^{-2}	Calculated voltage (V') (volt)	Correction (V' – V)
1.	0			
2.	0.1			
3.	0.2			
4.	0.3			
5.	0.4			
6.	0.5			
7.	0.6			
8.	0.7			
9.	0.8			
10.	0.9			
11.	1.0			

5 Set 0.1 V in the voltmeter by sliding the jockey on the potentiometer and note the balancing length (l). Repeat the experiment for different values of voltages and note down the corresponding balancing lengths.

6 Calculate V' by using the formula given and record the correction value.

7 Plot a graph by taking voltmeter reading (V) along X axis and correction along Y axis.

RESULT

The given voltmeter was calibrated using potentiometer and the calibration curve was drawn.

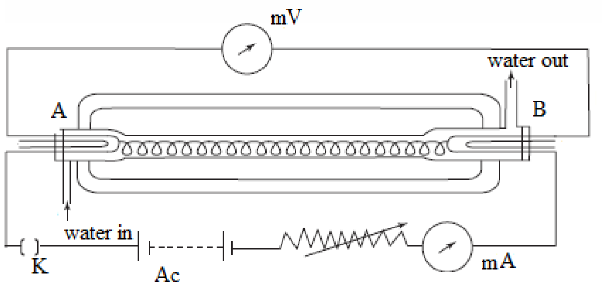
OUTCOME

Students are able to

- make connections with potentiometer with other electrical components.
- check the accuracy of the result by comparing it with the standard value using potentiometer.

3. SPECIFIC HEAT CAPACITY OF WATER BY CALLENDAR AND BARNE'S CONTINUOUS FLOW METHOD

CIRCUIT DIAGRAM



AB	→	Glass tube
Ac	→	Accumulator
mV	→	milli voltmeter
mA	→	milli ammeter

3. SPECIFIC HEAT CAPACITY OF WATER BY CALLENDAR AND BARNE'S CONTINUOUS FLOW METHOD

AIM

To measure specific heat capacity of water by Callendar and Barne's continuous flow method

REQUIREMENTS

Callendar and Barne set up, battery, rheostat, plug key, ammeter, two platinum resistance thermometers.

FORMULAE USED

The specific heat capacity 'C' will be calculated by,

$$C=\frac{(E_1I_1-E_2I_2)t}{(m_1-m_2)(\theta_2-\theta_1)}$$

C	→	Specific heat capacity of water
θ_1	→	Temperature of incoming water (°C)
θ_2	→	Temperature of outgoing water (°C)
T	→	Time of water flow (second)
$E_1$and E_2	→	Two different voltages (volt)
I_1 and I_2	→	Two different currents (ampere)
m_1 and m_2	→	Mass of water at two different time (Kg)

PROCEDURE

1. AB is the cylindrical glass tube with inlet and outlet for the flow of water in the tube.
2. Connect the platinum wire which is stretched across the tube along its axis in series with a battery, a plug key, rheostat and an ammeter. Connect voltmeter parallel to the platinum wire.
3. Circulate the water through the tube at a uniform rate (t sec.).
4. Measure the steady temperatures of incoming and outgoing water ($\theta_1$and θ_2) and mass of the water (m_1).
5. Measure the voltage (E_1) and current (I_1) from voltmeter and ammeter.
6. Repeat the experiment by varying the voltage and current.

OBSERVATIONS

θ_1 = ---°C ; θ_2 = ---°C ; t = -- second

S.No.	Current I (ampere)	Voltage E (volt)	Mass of the liquid (Kg)
1.			
2.			
3.			
4.			
5.			

7. Measure the mass of the liquid (m_2), voltage (E_2) and current (I_2).

RESULT

Thus the specific heat capacity of water measured by Callendar and Barne's continuous flow method is ---.

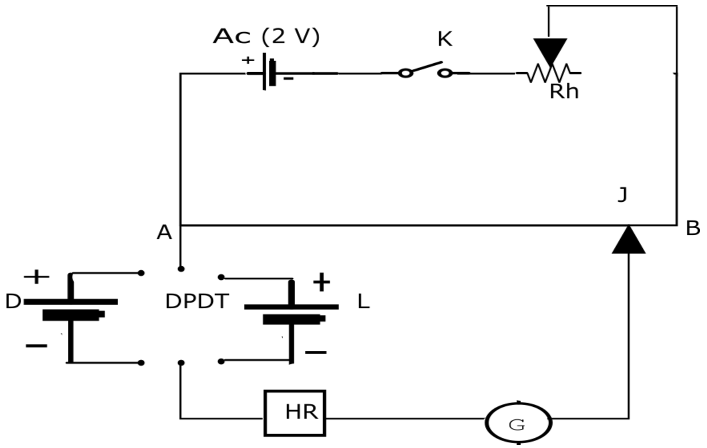
OUTCOME

Students are able to

- gain knowledge to measure the specific heat capacity of water by Callendar and Barne's continuous flow method.
- to measure the specific heat capacity of various liquids like benzene, ethanol, kerosene etc.

4. COMPARISON OF EMF OF TWO CELLS USING POTENTIOMETER

CIRCUIT DIAGRAM



AB	→	Potentiometer
K	→	Key
Rh	→	Rheostat
HR	→	High Resistance
D	→	Daniel cell
L	→	Lechlanche cell
DPDT	→	Double Pole Double Throw Switch
G	→	Galvanometer

4. COMPARISON OF EMF OF TWO CELLS USING POTENTIOMETER

AIM

To compare the emf of two given primary cells using potentiometer.

REQUIREMENTS

Potentiometer, Daniel cell, Lechlanche cell, Accumulator (2V), Plug key, Rheostat, High resistance, Galvanometer, DPDT switch, Connecting wires etc.,

FORMULAE USED

The ratio of emf of two given cells is calculated by,

$$\frac{E_1}{E_2} = \frac{l_1}{l_2} \text{ (no unit)}$$

E_1	→	Voltage of Lechlanche cell (volt) = 1.5 volt
E_2	→	Voltage of Daniel cell (volt) = 1.08 volt
l_1	→	Balancing length of Lechlanche cell (m)
l_2	→	Balancing length of Daniel cell (m)

PROCEDURE

1. Connect the apparatus as shown in circuit diagram. Connect positive terminal of accumulator in series with potentiometer end A, DPDT center terminal, high resistance, galvanometer and jockey. Connect the negative terminal of accumulator in series with key, rheostat and potentiometer end B. Connect daniel cell and lechlanche cell with DPDT key.
2. Include E_1 by using DPDT key.
3. Slide the jockey gently over the potentiometer wires till to obtain a point where the galvanometer shows no deflection.
4. Measure the balancing length and record it as l_1.
5. Repeat the same by including by using E_2 and measure the balancing lengthl_2.
6. Repeat the observations alternately for each cell again for the same value of current.
7. Increase the current by adjusting the rheostat and obtain at least seven sets of observations in a similar way.

OBSERVATIONS

EMF of the Lechlanche cell E_1 = --- volt

EMF of the Daniel cell E_2 = --- volt

S.No.	Balancing length for the Lechlanche cell of emf E_1 is (l_1) (m) X 10^{-2}	Balancing length for the Daniel cell of emf E_2 is (l_2) (m) X 10^{-2}	$\frac{E_1}{E_2} = \frac{l_1}{l_2}$
1.			
2.			
3.			
4.			
5.			

RESULT

The ratio of emf of the two given cells by using potentiometer is ---.

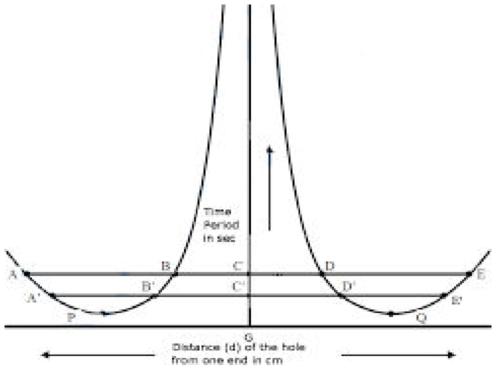
OUTCOME

Students are able to

- gain knowledge to compare the emf of two given cells using potentiometer.
- draw the circuit diagram and to make connections to compare the resistances of the given resistors.

5. DETERMINATION OF 'G' USING COMPOUND PENDULUM

MODEL GRAPH



OBSERVATION

(i). To find T:

S.No	Distance of Knife edges from the end A (cm)	Time for 10 Oscillations (sec)			Period (T) (sec)
		Trial 1	Trial 2	Mean	
1.					
2.					
3.					
4.					
5.					
6.					

5. DETERMINATION OF 'G' USING COMPOUND PENDULUM

AIM

(i) To determine the acceleration due to gravity (g) at the place of pendulum
(ii) To determine the radius of gyration of the pendulum about its centre of gravity

APPARATUS REQUIRED

Compound Bar Pendulum, Stop Watch and Meter Scale.

FORMULA USED

(i).Acceleration due to gravity (g),

—

where,

g = Acceleration due to gravity

l = Length of the equivalent simple pendulum

$= \frac{AD+BE}{2}$

T = Period of oscillation for length 'l'

(ii). Radius of Gyration of the pendulum about its center of gravity,

—

Where,

k = Radius of Gyration of the pendulum about its center of gravity

P,Q = Points corresponding to minimum periods

PROCEDURE

1. The bar pendulum (compound) consists of a metallic bar of about one meter long.
2. The bar is suspended from a horizontal knife-edge passing through any of the holes.

(ii) To find $\frac{l}{T^2}$:

S.No	Period T (sec)	T^2 (sec)	Length of the equivalent simple pendulum (cm)			$\frac{l}{T^2} * 10^{-2}$ (m/s^2)
1.						
2.						
3.						
						Mean =……. (m/s^2)

3. Suspend the pendulum from the knife-edge through the first hole (say A) so that the knife-edge is perpendicular to the edge of the slot and the pendulum is hanging parallel to the wall.
4. Make a small oscillation of the pendulum.
5. Start the stopwatch and count zero.
6. Count one when the pendulum is passing through the same position in the same direction and so on. Note the time taken for 10 oscillations. Repeat again and time taken the mean.
7. Measure the distance between the C.G. and the point A.
8. Now suspend it in the knife-edge through the 2nd hole (now it is A) and repeat the same observations as above.
9. Invert the bar and repeat the operations.

RESULT

(i) The acceleration due to gravity at the place of suspension =............. (m/s^2)

(ii) The radius of gyration of the pendulum about its centre of gravity =.........(m)

OUTCOMES

Able to gain knowledge about determination of gravity using compound pendulum.

Able to understand the radius of gyration calculation.

6. DETERMINATION OF AC FREQUENCY BY SONOMETER

OBSERVATIONS

To find AC frequency by sonometer

S.No	Mass × 10^{-3} Kg	Length of the vibrating segment × 10^{-2} m			$\frac{\sqrt{T}}{l} = \frac{\sqrt{mg}}{l}$
		Trial I	Trial II	Mean	
1.	500				
2.	600				
3.	700				
4.	800				
5.	900				

To find the thickness of the wire using screw gauge

Least Count of screw gauge $= \frac{\text{Value of one pitch scale reading}}{\text{Number of head scale divisions}}$

$= \frac{1}{100}$

= 0.01 mm

Zero Error = ; Zero Correction =

S.No.	PSR (mm)	HSC (div)	CHSC = HSC ± ZC	Corrected HSR = CHSC X LC	TR = PSR + CHSR (mm)
1.					
2.					
3.					
4.					
5.					

6.DETERMINATION OF AC FREQUENCY BY SONOMETER

AIM

To determine the frequency of AC main by using sonometer.

REQUIREMENTS

Sonometer, Steel wire, Electromagnet, Weight hanger with slotted weight, Low voltage AC source (Transformer), Wooden bridges, Meter scale, Screw gauge etc.,

FORMULAE USED

The frequency 'n' of AC main is given by

$$n = \frac{1}{2l}\sqrt{\frac{T}{m}}\ \text{Hz}$$

l	→ Length of the vibrating string (m)
T	→ (= mg) The tension applied to the string
M	→ Mass per unit length of the string (Kg/m) (= π $r^2\rho$)
ρ	→ Density of the steel wire

PROCEDURE

1. Connect the primary of the step down transformer to A.C mains, while the secondary to the two ends of the sonometer wire.
2. The horse shoe electromagnet is placed in the middle of the wire such that the magnetic field is applied in a horizontal plane and at right angles to the length of the wire.
3. Hang a mass m (say ½ kg) from one end of the wire and adjust the distance l between two bridges symmetrically with respect to magnet till the wire appears to be vibrating with the maximum amplitude. Note the distance l between the two bridges.
4. Repeat the experiment by increasing the tension on the wire.

RESULT

Frequency of AC main using sonometer = Hz

OUTCOME

Students are able to

- determine the frequency of alternating current using sonometer.
- relate the tension of the wire, density of the wire and the resonating length of the wire.

7. COMPARISON OF MAGNETIC MOMENTS OF TWO BAR MAGNETS USING DEFLECTION MAGNETOMETER BY NULL METHOD

CIRCUIT DIAGRAM

FIGURE 1. TAN A POSITION

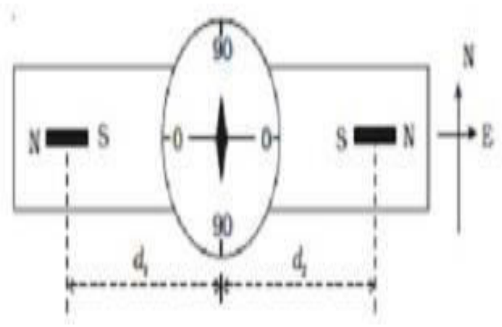
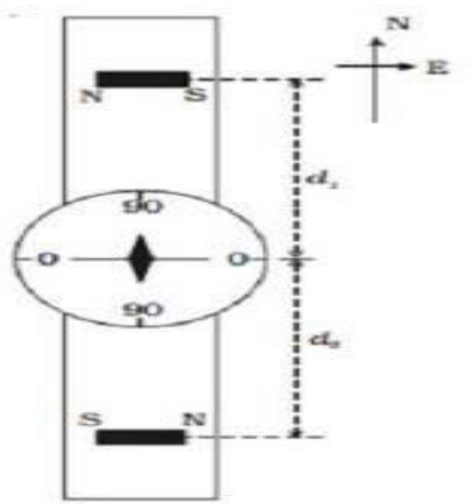


Figure 2. Tan B Position



7. COMPARISON OF MAGNETIC MOMENTS OF TWO BAR MAGNETS USING DEFLECTION MAGNETOMETER BY NULL METHOD

AIM To compare the magnetic moments of two bar magnets using deflection magnetometer by null method

REQUIREMENTS

Two bar magnets, deflection magnetometer and a scale.

FORMULAE USED

where,

Tan A Position

$$\frac{M_1}{M_2} = \frac{(d_1^2 - l_1^2)^2}{(d_2^2 - l_2^2)^2} \frac{d_2}{d_1}$$

Tan B Position

$$\frac{M_1}{M_2} = \frac{(d_1^2 + l_1^2)^{\frac{3}{2}}}{(d_2^2 + l_2^2)^{\frac{3}{2}}}$$

M_1	→	Magnetic moment of first magnet
M_1	→	Magnetic moment of second magnet
$2l_1$	→	Length of first magnet
$2l_1$	→	Length of second magnet
d_1	→	Distance of the first magnet from the center of the magnetic needle
d_2	→	Distance of the second magnet from the center of the magnetic needle

PROCEDURE

1 Place the deflection magnetometer in Tan A position (Figure 1).

2 Place a bar magnet of magnetic moment M_1 and length $2l_1$ at a distance d_1 from the center of the magnetic needle, on one side of the compass box.

3 Since the sensitivity of the magnetometer is more at 45°, the distance of the bar magnet should be chosen such that the deflection lies between 30° and 60°.

4 Place the second bar magnet of magnetic moment M_2 and length $2l_2$ on the other side of the compass box such that like poles of the magnets face each other. Adjust the second to nullify the deflection due to the first magnet and the aluminum pointer reads 0° - 0°. Note down the distance of the second magnet as x_1.

OBSERVATIONS

TAN A POSITION

S.No.	Distance of the first magnet (d_1) × 10^{-2} m	Distance of the second magnet by null method × 10^{-2} m					$\frac{M_1}{M_2}$
		x_1	x_2	x_3	x_4	Mean (d_2)	
1.							
2.							
3.							
4.							
5.							

Tan B Position

S.No.	Distance of the first magnet (d_1) × 10^{-2} m	Distance of the second magnet by null method × 10^{-2} m					$\frac{M_1}{M_2}$
		x_1	x_2	x_3	x_4	Mean (d_2)	
1.							
2.							
3.							
4.							
5.							

5 Reverse the first magnet pole to pole and place at the same distance d_1. Reverse the second magnet also and adjust it such that the aluminium pointer reads 0^o - 0^o. Note down the distance of the second magnet as x_2.

6 Interchange the two magnets. Place the magnet of magnetic moment M_1 on the other side of the compass box at the same distance, note down two more readings $x_3$and $x_4$as above. The mean of the four readings (x_1, x_2, x_3 *and* x_4) gives a value d_2.

7 Next, place the deflection magnetometer in Tan B position (Figure 2) ie the bar magnet is placed horizontally, perpendicular to the arm of the deflection magnetometer and parallel to the magnetic needle of the deflection magnetometer. Repeat the above procedure in Tan B position.

RESULT

Mean ratio of magnetic moments of the two given bar magnets by the null method is.......

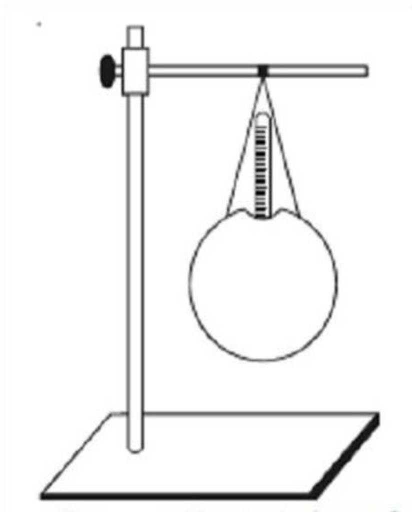
OUTCOME

Students are able to

- Gain knowledge on the principle of tangent law.
- To compare magnetic moments of two bar magnets by null method.

8. NEWTON'S LAW OF COOLING

DIAGRAM



MODEL GRAPH

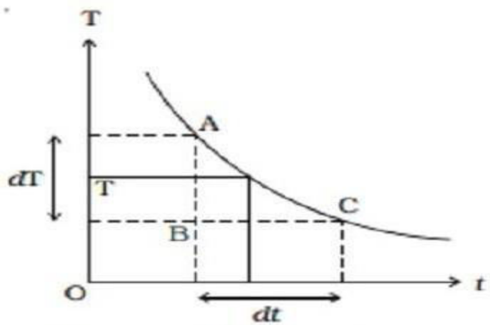


Fig. Cooling curve

8. NEWTON'S LAW OF COOLING

AIM

To verify Newton's law of cooling by cooling curve for water and liquid.

APPARATUS REQUIRED

Copper calorimeter, Stirrer, Wooden box, Thermometer, Stop watch, Hot water, physical balance.

FORMULA USED

Newton's law of cooling for water and liquid is,

Where,

$$\frac{\theta_2-\theta_1}{t\left(\frac{\theta_1+\theta_2}{2}-\theta\right)} = \text{a constant}$$

θ	→ Room Temperature
θ_1, θ_2	→ Temperature Range
t	→ Time of cooling in sec

PROCEDURE

- The given spherical calorimeter is weighed first.
- The calorie meter containing stirrer with hot water of about 90 °C.
- Place the calorimeter inside the wooden box.
- Suspend the thermometer inside the hot water in the calorimeter from the clamp and stand.
- Stir water continuously to make it cool uniformly.
- When the temperature of hot water falls to 80°C, start the stop watch.
- Note the temperature reading at every five minutes.
- Continue the time temperature observation till the temperature becomes constant.
- The readings are tabulated.
- Plot a graph between time along X-axis and temperature along Y-axis. This graph is called the cooling curve.
- Hence Newton's law of cooling is verified.

OBSERVATION

(i) **Time of cooling for Water**

Temperature (deg.Celcius)	Time (sec)

(ii) **Time of cooling for Liquid**

Temperature (deg.celcius)	Time (sec)

(iii) Verification of Newton's law of cooling

Room Temperature $\theta = \ldots\ldots$

From Tabular Column…..

S.No	Water			$\frac{\theta_2-\theta_1}{t(\frac{\theta_1+\theta_2}{2}-\theta)}$	Liquid			$\frac{\theta_2-\theta_1}{t(\frac{\theta_1+\theta_2}{2}-\theta)}$
	θ_1	θ_2	t		θ_1	θ_2	t	
1.								
2.								
3.								
4.								
5.								

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RESULT

Newton's law of cooling is verified for both water and liquid.

OUTCOMES

Able to verify Newton's Law of Cooling.

Able to understand the relationship between temperature and time of cooling of objects.

From Graph

S.No	Water			$\frac{\theta_2-\theta_1}{t(\frac{\theta_1+\theta_2}{2}-\theta)}$	Liquid			$\frac{\theta_2-\theta_1}{t(\frac{\theta_1+\theta_2}{2}-\theta)}$
	θ_1	θ_2	t		θ_1	θ_2	t	
1.								
2.								
3.								
4.								
5.								

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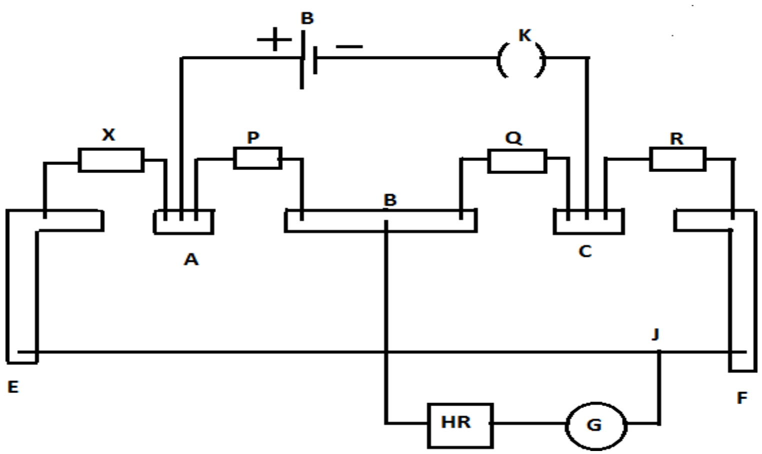
9. RESISTANCE AND RESISTIVITY USING CAREY FOSTER'S BRIDGE

CIRCUIT DIAGRAM



X- Coil; P, Q, R – Resistance boxes; B- Battery; K-key; EF-potentiometer wire; G-galvanometer; HR- High Resistance; J-Jacky

OBSERVATION

(i) **To find the resistance per meter length (ρ)**

S.No	R (ohm)	Balancing length when R is in the left gap and copper strip in the right gap L_1 (cm)	Balancing length when R and copper strip are interchanged L_2 (cm)	$\rho = \frac{R}{L_2 - L_1}$ (ohm/meter)
1.				
2.				
3.				
4.				
				Mean=……..

9. RESISTANCE AND RESISTIVITY USING CAREY FOSTER'S BRIDGE

AIM

To determine the resistance of the coil of wire using Carey Foster's Bridge.

APPARATUS REQUIRED

The given coil, Carey Foster's Bridge, A fractional resistance box [(0.1-1) ohms, (1-10) ohms], Two equal standard resistances, Lechlanche Cell, Plug key, Table Galvanometer, copper strip, High resistance, Jockey.

FORMULA USED

[illegible]

Where,

ρ = The resistance per unit length of the bridge wire

L_1 = Balancing length with a resistance R in the left gap and the thicker copper strip in the right gab

L_2 = Balancing Length after interchanging R and the copper strip.

(ii) X = R + $(L_2 - L_1)\rho$ (Ohm)

Where,

X = Unknown Resistance

R = Resistance introduced in the resistance box R in the left extreme gap

L_1 = Balancing length when R in the left gap and X in the right gab

L_2 = Balancing Length When R and X are interchanged

[illegible]

(ii). To find the Unknown Resistance (X):

S.No	R (ohm)	Balancing length when R is in the left gap and X in the right gap L_1 (cm)	Balancing length when R and X are interchanged L_2 (cm)	X = R + $(L_2 - L_1)\rho$ (Ohm)
1.				
2.				
3.				
4.				
5.				
				Mean=……….

(iii) To find the thickness of the wire using Screw Gauge:

Least Count of Screw gauge $= \frac{\textit{Value of one pitch scale reading}}{\textit{Number of head scale divisions}} = \frac{1}{100}$ **= 0.01 mm**

Zero error = ……… div

Zero Correction = …….div

S.No	PSR (mm)	HSC (div)	CHSC (mm)	CHSR= CHSCXLC (mm)	Total = =PSR+CHSR (mm) (mm)
1.					
2.					
3.					
4.					
5.					
					Mean =……..

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Where,

S = Resistivity of the material of the wire

X = Resistance of the wire

r = Radius of the wire

L = Length of the wire

PROCEDURE

- First construct the circuit as shown in figure.
- Try to find the Galvanometer shows zero deflection.
- Keep R in the left gap, unknown resistance (X) coil in the right gap.
- Note the length at that point. Now, reverse the position of the variable (R) and unknown resistance (X) and again take readings. Thus, we get two sets of readings
- Remove the coil and use a copper strip by making the assumption that copper has infinite resistance.
- Try to find the Galvanometer shows no deflection. Note the length at that point.
- A standard resistance of 0.1 Ω is connected in left gap, and thick copper strip is connected in right gap. The balancing length l_1 is determined.
- The standard resistance and the thick copper strip are interchanged again to take readings.
  The balancing length l_2 is determined.
- Thus, we get two sets of readings. Using this values, we can determine the value of X

RESULT

(i). Resistance of the given coil of wire = ... ohm

(ii). Resistivity of the material of wire = ... ohm

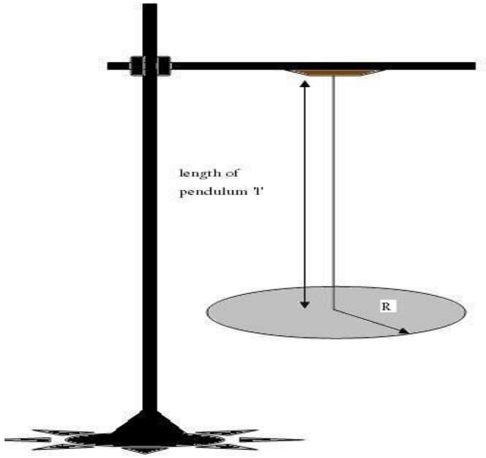
OUTCOMES

Able to understand the construction of circuits.

Able to gain the knowledge about measurement of unknown resistance.

10. RIGIDITY MODULUS BY TORSION PENDULUM

CIRCUIT DIAGRAM



OBSERVATION

Position of symmetrical weights	Time for 20 oscillations			Period (Sec)
	Trial 1	Trial 2	Trial 3	
Without weight				
With weight at distance d1				
With weight at distance d2				

Find the Thickness of the wire using screw gauge

Least Count of Screw gauge $= \frac{\text{Value of one pitch scale readin g}}{\text{Number of head scale divisions}} = \frac{1}{100}$ **= 0.01 mm**

Zero Error =----- div

Zero Correction =-----mm

10. RIGIDITY MODULUS BY TORSION PENDULUM

AIM

To determine

(i) The rigidity modulus of the material of the wire using torsion pendulum.

(ii) The moment of inertia of the disc by torsional oscillations.

APPARATUS REQUIRED

Torsion pendulum, two identical cylindrical masses, stop watch, meter scale, the given circular disc, Screw gauge.

FORMULA USED

Rigidity Modulus of the material of the wire G = $\frac{16\pi LM(d2^2-d1^2)}{a4(T2^2-T1^2)}$

Moment of inertia of the disc I = $\frac{2M(d2^2-d1^2)T0^2}{(T2^2-T1^2)}$

G	=	Rigidity Modulus of the material of the wire (cm)
L	=	Length of the wire (cm)
d1	=	distance at which the masses are first placed (cm)
d2	=	distance at which the masses are next placed (cm)
T1	=	time period of oscillation with the weight at distance d1 (sec)
T2	=	time period of oscillation with the weight at distance d1 (sec)
T0	=	time period of oscillation without weight (sec)
I	=	Moment of inertia of the disc
M	=	Mass of the two symmetrical weights (kg)
A	=	radius of the wire (cm)

S.No	PSR (mm)	HSC (div)	CHSC (mm)	CHSR= CHSCXLC (mm)	Total reading =PSR+CHSR (mm)
1					
2					
3					
4					
5					

PROCEDURE

- The radius of the suspension wire is measured using a screw gauge in various positions
- The length of the suspension wire is measured.
- The disc is set in oscillation without mass.
- Find the time for 20 oscillations thrice and determine the mean period of oscillation' T0 '.
- The two identical masses are placed symmetrically on either side of the suspension wire as close as possible to the centre of the disc, and measure d1 which is the distance between the centers of the disc and one of the identical masses.
- Find the time for 20 oscillations thrice and determine the mean period of oscillation ' T1 '.
- The two identical masses are placed symmetrically on either side of the suspension wire as far as possible to the centre of the disc, and measure d2 which is the distance between the centres of the disc and one of the identical masses.
- Find the time for 20 oscillations thrice and determine the mean period of oscillation ' T2 '.
- Find the moment of inertia of the disc and rigidity modulus of the suspension wire using the given formulae.

RESULT

Rigidity modulus of the material of the wire = -----Nm^{-2}

Moment of inertia of the Disc = -----kgm^2

OUTCOMES

Able to understand the Rigidity modulus of the material of the wire.

Able to understand the Moment of inertia of the disc.

11. SURFACE TENSION BY DROP WEIGHT METHOD

OBSERVATIONS

To find the mass (m) of one drop of water

Mass of the beaker (10^{-3} Kg)		Mean W_1 $\times 10^{-3}$ Kg	Mass of the beaker + 50 drops of water (10^{-3} Kg)		Mean W_2 $\times 10^{-3}$ Kg	Mass of 50 drops of water ($W_2 - W_1$) (10^{-3} Kg)
Trial 1	Trial 2		Trial 1	Trial 2		

Mass of one drop of water $= \frac{W_{2} - W_{1}}{50}$ Kg

To find the radius (r) of the tube using screw gauge

Least Count of screw gauge $= \frac{\textit{Value of one pitch scale reading}}{\textit{Number of head scale divisions}} = \frac{1}{100} = 0.01$ **mm**

Zero Error = ; Zero Correction =

S.No.	PSR (mm)	HSC (div)	CHSC = HSC ± ZC	Corrected HSR = CHSC X LC	TR = PSR + CHSR (mm)
1.					
2.					
3.					
4.					
5.					

11. SURFACE TENSION BY DROP WEIGHT METHOD

AIM

To determine the surface tension of water by drop weight method.

REQUIREMENTS

Clean glass tube, Funnel, Beaker, Screw gauge etc.,

FORMULAE USED

Surface tension of water

$$\sigma = \frac{mg}{3.8\, r}\ \text{N/m}$$

Where,

m → Mass of one drop of water

$= \frac{W_{2} - W_{1}}{50}$ Kg

r → Radius of glass tube (m)

PROCEDURE

1. The liquid whose surface tension is to be determined was sucked into the capillary tube, then it is allowed to fall down due to gravity.
2. Collect 50 drops of liquid in a beaker. Determine the weight of the drops by using electronic balance.
3. Repeat the procedure twice to obtain the mean value.

RESULT

The surface tension of water by drop weight method =

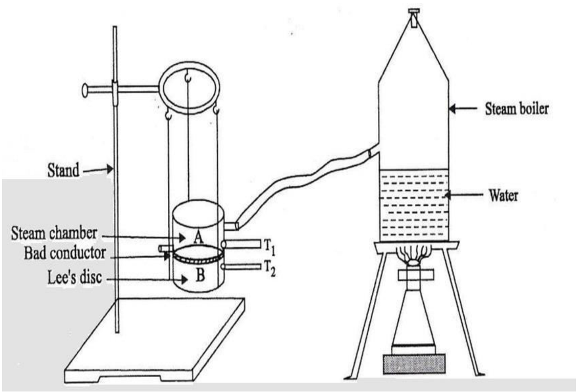
OUTCOME

Students are able to

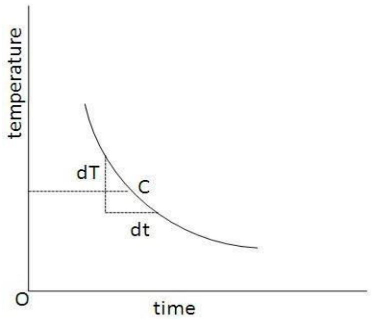
- gain knowledge to measure surface tension of water by drop weight method.
- measure surface tension of different kinds of liquids like kerosene, paraffin, castoroil etc.,

12. THERMAL CONDUCTIVITY OF BAD CONDUCTOR BY LEE'S DISC METHOD

CIRCUIT DIAGRAM



MODEL GRAPH



12. THERMAL CONDUCTIVITY OF BAD CONDUCTOR BY LEE'S DISC METHOD

AIM

To determine the coefficient of thermal conductivity of a bad conductor using Lee's disc apparatus.

APPARATUS REQUIRED

Lees disc apparatus, Steam boiler, Screw gauge, Two thermometer, Card board, Vernier caliper, Stop watch.

FORMULA USED

$$K = \frac{MC\frac{d\theta}{dt}d(r+2l)}{\pi r^2(\theta_1-\theta_2)(2r+2l)} \; Wm^{-1}K^{-1}$$

Where,

K	=	Thermal conductivity of card board
M	=	Mass of metallic disc
C	=	Specific heat capacity of the metallic disc
d	=	Thickness of the card board disc
r	=	Radius of the metallic disc
l	=	Thickness of the metallic disc
θ_1	=	Steady temperature of steam chest
θ_2	=	Steady temperature of metallic disc
$\frac{d\theta}{dt}$	=	Rate of cooling at steady temperature

PROCEDURE

- Measure the thickness of metal disc and bad conductor with a screw gauge. Take observation at five spots and take the mean value.
- Measure the diameter of metal disc and bad conductor with vernier calipers.
- Find the mass M of the metal disc by a balance.
- Fill the boiler with water nearly half and heat it to produce steam.
- Keep the bad conductor between metal disc and steam chamber.
- Introduce thermometers through holes in the steam chamber and in the metal disc. Check if both of them are displaying reading at room temperature

OBSERVATION

S.No	Time (sec)	Temperature (^{0}C)
1		
2		
3		
4		
5		

To measure the thickness of the given bad conductor using screw gauge

Least Count of Screw gauge= $\frac{\textit{Value of one pitch scale reading}}{\textit{Number of head scale divisions}}$

$= \frac{1}{100}$

= 0.01 mm

Zero Error =----------div

Zero Correction =---------mm

S.No	PSR (mm)	HSC (div)	CHSC (mm)	CHSR= CHSCXLC (mm)	Total reading =PSR+CHSR (mm)
1					
2					
3					
4					
5					

- Pass steam through the chamber until the temperature indicated by thermometers become steady and note the steady temperature.
- Remove the bad conductor.
- Remove the steam chamber when the temperature of the metal disc is 10^0 C above its steady temperature.
- Start a stop clock and take time-temperature observation for every 5^0.
- Plot a time-temperature graph.

RESULT

Using Lee's disc apparatus, the thermal conductivity of the given bad conductor K = …….. $Wm^{-1}K^{-1}$

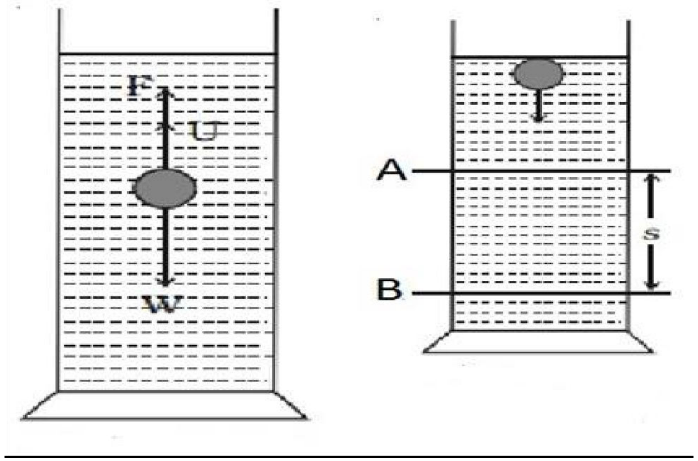
OUTCOME

Able to understand how the heat is transferred to bad conductor like cardboard, wood, etc.

Able to understand the connection between the times versus temperature curve.

13. VISCOSITY OF LIQUID BY STOKES' METHOD

EXPERIMENTAL FIGURE



OBSERVATIONS

Least Count of Screw gauge = $\frac{\text{Value of one pitch scale reading}}{\text{Number of head scale divisions}} = \frac{1}{100}$ = **0.01 mm**

Zero error =.............div

Zero correction =......... div

13. ISCOSITY OF LIQUID BY STOKES' METHOD

AIM

To determine the coefficient of viscosity of a highly viscous liquid (like castor oil) by Stokes Method

APPARATUS REQUIRED

A jar of Castor oil, Ball ,Screw gauge, Stop watch.

FORMULA USED

$$\eta = \frac{2r^2(\rho - \rho')g}{9v}$$

Where,

η	=	Coefficient of viscosity of a highly viscous liquid
r	=	Radius of the ball
ρ	=	Density of the material of the ball
ρ'	=	Density of the material
G	=	Acceleration due to gravity
v	=	Terminal velocity of the ball

PROCEDURE

- Set up the apparatus as shown in the diagram.
- Use a screw gauge to measure the diameter of all ball.
- Record the time of the oil at the start and at the end of the experiment.
- Drop a ball gently into the oil and Start the recording of time when the ball reaches A. The recording must be stopped when the ball reaches B.
- Measure the length AB and hence determine the mean velocity of the ball (v).
- You are to assume that this is also the terminal velocity of the ball through the oil.
- Repeat the procedure for all the ball.

S.No	Radius of the ball (r)					Distance Travelled			Time Taken T (sec)	Velocity $v = \frac{AB}{2}$ (m/s)	$\frac{r^2}{v} * 10^{-4}$ (ms)
	PSR (mm)	HSC (div)	CHSR (mm)	Total Reading (mm)	$r=\frac{D}{2}$ (mm)	A (cm)	B (cm)	AB (cm)			
1.											
2.											
3.											
4.											
5.											
6.											
7.											
8.											
9.											
10.											
											Mean=……

RESULT

The coefficient of viscosity of the liquid =………Ns/m^2

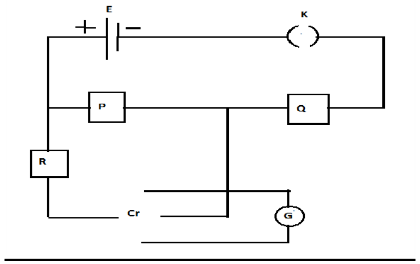
OUTCOMES

Able to understand the properties of the fluids.

Able to understand the meaning of terminal velocity

14. VOLTAGE AND CURRENT SENSITIVITY OF GALVANOMETER

CIRCUIT DIAGRAM



P,Q, R = resistance box

Cr = commutator

14. VOLTAGE AND CURRENT SENSITIVITY OF GALVANOMETER

AIM

To determine the voltage and current sensitivity of the moving coil galvanometer.

APPARATUS REQUIRED

Spot galvanometer, Accumulator, Three resistance boxes, Commutator, Key, Connecting wires.

FORMULA USED

Voltage sensitivity $S_v = \frac{E}{P+Q}\frac{P}{d} \times 10^6$ µv/div

Current sensitivity $S_c = \frac{E}{P+Q}\frac{P}{d}\frac{1}{R_g} \times 10^6$ µA/div

E = emf of the accumulator (volts)

P,Q,R = Resistance introduced in the resistance box (ohms)

d = deflection on the scale (divisions)

Rg = resistance on the galvanometer (ohms)

PROCEDURE

- Two resistance boxes P and Q and key K are connected in series with the accumulator of emf E
- Between the ends of P a resistance box R and the mirror galvanometer through commutator are connected.
- Make sure that plugs of the resistance boxes are tight.
- Introduce low resistance(say 1 Ω) is introduced in P and high resistance (say 9999) in Q
- Keep resistance box R in zero.
- Galvanometer shows a certain deflection. Record the observations in a tabular column.

OBSERVATION

EMF of the accumulator = 2 volt

P+Q = 10000

S.No	P ohms	Q ohms	Deflection (division)			P/d div	Resistance introduced to make half deflection (Ω)		
			Left d1	Right d2	Mean $d=\frac{d1+d2}{2}$		Left R1	Right R2	Mean $Rg=\frac{(R1+R2)}{2}$

- Change the commutator key the Galvanometer shows a deflection in opposite side. Record the value in tabular column.
- Without changing the value of P, Q adjust the R resistance box such that galvanometer shows deflection which is exactly half of the previous reading.
- Record the value of low resistance box.
- The experiment is repeated for various values of P (P+Q) Constant.

RESULT

Voltage sensitivity of the galvanometer = ------ µv/div

Current sensitivity of the galvanometer = ---- µA/div

OUTCOME

Able to understand the various components used in the experiment.

Able to construct circuits based on circuit diagrams.

Able to learn the concept figure of merit.

15. YOUNG'S MODULUS BY NON UNIFORM BENDING USING TELESCOPE

OBSERVATIONS

Least count of the microscope $= \frac{Value\ of\ one\ main\ scale\ reading}{Number\ of\ vernier\ scale\ divisions} = \frac{0.05}{50} = 0.001$ cm

S.No.	Load in kg $X10^{-3}$	Telescope Reading (m) X 10^{-2} Load Increasing	Load Decreasing	Mean$X10^{-2}$ m	Shift in scale for a load of 100 gm $X10^{-2}$ m
1.	W				
2.	W + 50				
3.	W + 100				
4.	W + 150				
5.	W + 200				

Breadth of the beam using vernier caliper:

Least Count of the vernier caliper $= \frac{Value\ of\ one\ main\ scale\ division}{Number\ of\ vernier\ scale\ divisions} = \frac{0.1}{10} = 0.01$ **cm**

S.No.	MSR (cm)	VSC (div)	Corrected VSR = VSC X LC	TR = MSR + VSR (cm)
1.				
2.				
3.				
4.				
5.				

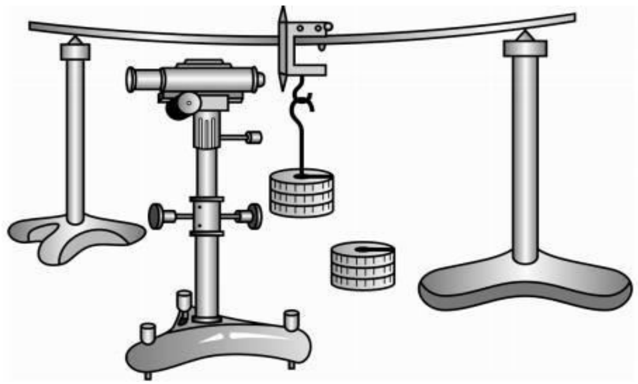
15. YOUNG'S MODULUS BY NON UNIFORM BENDING USING TELESCOPE

AIM

To determine Young's modulus of the material of the given beam by measuring the depression of its centre when loaded at its centre.

REQUIREMENTS

A uniform rectangular beam, Two knife edges, Two weight hangers with slotted weights, Scale and telescope, Optic lever, Vernier caliper and Screw gauge etc.,



FORMULAE USED

Young's modulus of the material of the beam

$$E = \frac{mgl^3 2D}{4bd^3 Ps} \text{ N m}^{-2}$$

m → The load producing the depression of the beam (kg)

g → Acceleration due to gravity (m / s^2)

P → Perpendicular distance between the single leg and the line joining the other two (m)

D → Distance between mirror and scale (m)

l → length of the beam between knife edges (m)

b → Breadth of the beam (m)

d → Thickness of the beam (m)

s → Shift in scale reading for a load (m)

Thickness of the beam using screw gauge

Least Count of screw gauge= $\frac{\text{Value of one pitch scale reading}}{\text{Number of head scale divisions}} = \frac{1}{100}$ **= 0.01 mm**

Zero Error =; Zero Correction =

S.No.	PSR (mm)	HSC (div)	CHSC = HSC ± ZC	Corrected HSR = CHSC X LC	TR = PSR + CHSR (mm)
1.					
2.					
3.					
4.					
5.					

PROCEDURE

1 Support the given bar symmetrically on two knife edges. Measure the length *l* of the bar between the knife edges.

2 Suspend a weight hanger exactly at the midpoint of the bar. Place an optic lever vertically at the midpoint of the bar.

3 Arrange the telescope in front of the set up.

4 Focus the scale in the telescope at the mirror of optic lever.

5 Add the slotted weights one by one on both the weight hangers and removed one by one a number of times, so that the bar is brought into an elastic mood.

6 With the some "dead load" W_0 on each weight hanger, adjust the telescope so that the image of the scale is focussed in the mirror of optic lever.

7 Note down the reading of the telescope. Add weights one by one and note down the corresponding readings. From these readings, determine the mean depression (e) of the mid-point of the bar for a given mass.

RESULT

Young's modulus of the material of the beam E =

OUTCOME

Students are able to

- gain knowledge to measure Young's modulus of wooden beam of material.
- measure Young's modulus of different kinds of materials like plastic, iron, steel etc.,

16. YOUNG'S MODULUS BY UNIFORM BENDING USING MICROSCOPE

OBSERVATIONS

Least count of the microscope = $\frac{Value\ of\ one\ main\ scale\ reading}{Number\ of\ vernier\ scale\ divisions} = \frac{0.05}{50}$ = 0.001 cm

S.No.	Load in kg $X10^{-3}$	Microscope Reading (m) X 10^{-2} Load Increasing	Load Decreasing	Mean$X10^{-2}$ m	Mean Elevation for a load of 100 gm $X10^{-2}$ m
1.	50				
2.	100				
3.	150				
4.	200				
5.	250				

To Find the Breadth of the beam using vernier caliper

Least Count of the vernier caliper = $\frac{Value\ of\ one\ main\ scale\ division}{Number\ of\ vernier\ scale\ divisions} = \frac{0.1}{10}$ = **0.01 cm**

S.No.	MSR (cm)	VSC (div)	Corrected VSR = VSC X LC	TR = MSR + VSR (cm)
1.				
2.				
3.				
4.				
5.				

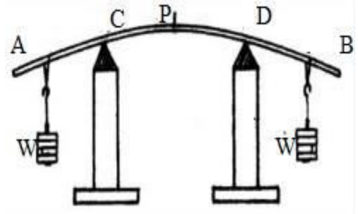
16. YOUNG'S MODULUS BY UNIFORM BENDING USING MICROSCOPE

AIM

To determine Young's modulus of the material of the given beam by measuring the elevation of its centre when equally loaded at its ends.

REQUIREMENTS

A uniform rectangular beam, Two knife edges, Two weight hangers with slotted weights, Pin, Microscope, Vernier caliper and Screw gauge etc.,



AB → Rectangular Beam

C, D → Knife Edges

W → Weight Hanger with Slotted Weights

P → Pin

FORMULAE USED

Young's modulus of the material of the beam

$$E = 3mgal^2 / 2bd^3y \text{ N m}^{-2}$$

m → The load producing the elevation of the beam (kg)

g → Acceleration due to gravity (m / s^2)

a → Distance between the point of suspension of the load and nearer knife edge (m)

l → length of the beam between knife edges (m)

b → Breadth of the beam (m)

d → Thickness of the beam (m)

y → Elevation at the midpoint of the beam due to a load (m)

To Find the Thickness of the beam using screw gauge

Least Count of screw gauge= $\frac{\textit{Value of one pitch scale reading}}{\textit{Number of head scale divisions}} = \frac{1}{100}$ **= 0.01 mm**

Zero Error = ; Zero Correction =

S.No.	PSR (mm)	HSC (div)	CHSC = HSC ± ZC	Corrected HSR = CHSC X LC	TR = PSR + CHSR (mm)
1.					
2.					
3.					
4.					
5.					

PROCEDURE

1. Place the bar symmetrically on two knife edges.
2. Suspend two weight hangers at equal distance from the knife edges. Measure the distance 'l'between knife edges and distance 'a' of weight hangers from knife edges.
3. Fix a pin vertically at the midpoint of the bar with its pointed end upwards.
4. Arrange the microscope in front of the pin and focus the tip of the pin.
5. Add the slotted weights one by one on both the weight hangers and remove one by one a number of times, so that the bar is brought into an elastic mood.
6. With the some "dead load" W_0 on each weight hanger, adjust the microscope so that the image of the tip of the pin coincides with the point of intersection of cross wires.
7. Note down the reading of the main scale and vernier of microscope. Add weights one by one and note down the corresponding readings.
8. From these readings, determine the mean elevation (y) of the mid-point of the bar for a given mass is determined. Measure the breadth of the bar (b) by using verniercalipers and thickness of the bar (d) is by using screw gauge.
9. Calculate the Young's modulus by substituting the values in the formula.

RESULT

Young's modulus of the material of the beam E =

OUTCOME

Students are able to

- gain knowledge to measure Young's modulus of wooden beam of material.
- measure Young's modulus of different kinds of materials like plastic, iron, steel etc.,

17. YOUNG'S MODULUS OF CANTILEVER USING TELESCOPE

OBSERVATION

(i). To determine shift in load for 100 gm

S.No	Load*10^{-3} (kg)	Telescope Reading		Mean (cm)	Shift in load for 100 gm
		Load Increasing	Load Decreasing		
					Mean =………

(ii). To determine the breath of the beam using vernier caliper:

Least Count of the vernier caliper= $\frac{\text{Value of one main scale division}}{\text{Number of vernier scale divisions}} = \frac{0.1}{10}$ **= 0.01 cm**

S.No	MSR (cm)	VSC (div)	VSR = VSC*LC (cm)	TR= MSR+ (VSC*LC) (cm)
				Mean =……..

17. YOUNG'S MODULUS OF CANTILEVER USING TELESCOPE

AIM

To determine the Young's Modulus of Cantilever by measuring the depression at the loaded end using vernier scale and telescope.

Apparatus Required

A uniform beam, Travelling Microscope, A weight hanger with slotted weight, G clamps, Vernier caliper, Screw gauge and meter scale.

Formula

Young's modulus of the material of the cantilever $= \frac{12mgl^{2}D}{bd^3s}$ N/m^2

Where,

m = Load

g = Acceleration due to gravity

l = Length of the beam between the clamped and loaded end

b = Breadth of the beam

d = Thickness of the beam

s = Depression produced for a load

PROCEDURE

- A rectangular beam is rigidly clamped at on end.
- Small plane mirror fixed at another end.
- Attach the weight hanger in free end.
- Arrange the vertical scale and telescope in front of the mirror.
- Focus the scale in the telescope at the mirror of optic lever.
- Add the weights one by one on weight hangers
- Note the readings of the scale observed in the telescope.
- Remove one by one and note the readings decreasing load also.
- Measure the distance between the mirror and scale.
- Measure the thickness and breadth of the beam.

(iii). To determine the thickness of the beam using Screw Gauge:

Least Count of Screw gauge= $\frac{\textit{Value of one pitch scale reading}}{\textit{Number of head scale divisions}} = \frac{1}{100}$ **= 0.01 mm**

Zero Error =…….(div)

Zero Correction = ……(div)

S.No	PSR (mm)	HSC (div)	CHSC (div)	CHSR= CHSC*LC (mm)	TR = PSR +CHSR (mm)
					Mean = …….

RESULT

Young’s modulus of the material of the cantilever =............N/m^2

OUTCOMES

Able to understand the young’s modulus of the any material like wood, steel etc.

Able to gain knowledge about young’s modulus of the material of the cantilever