LABORATORY MANUAL

FUELS AND LUBRICANTS LAB

II B.TECH -I Semester

DEPARTMENT OF MECHANICAL ENGINEERING

2017-18

CMR ENGINEERING COLEGE

(Approved by AICTE, New Delhi & Affiliated JNTU, Hyderabad)

Kandlakoya (V), Medchal Road, RR.Dist – 501401

VISION OF THE INSTITUTE

To be recognized as a premier institution in offering value based and futuristic quality technical education to meet the technological needs of the society.

MISSION OF THE INSTITUTE

1. To impart value based quality technical education through innovative teaching and learning methods
2. To continuously produce employable technical graduates with advanced technical skills to meet the current and future technological needs of the society
3. To prepare the graduates for higher learning with emphasis on academic and industrial research.

VISION OF THE DEPARTMENT

To be a center of excellence in offering value based and futuristic quality technical education in the field of mechanical engineering.

MISSION OF THE DEPARTMENT

M1. To impart quality technical education imbibed with values by providing state of the art laboratories and effective teaching and learning process.

M2. To produce industry ready mechanical engineering graduates with advanced technical and lifelong learning skills.

M3. To prepare graduates for higher learning and research in mechanical engineering and its allied areas.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS):

PEO 1: The Graduates will exhibit strong knowledge in mathematics, sciences and engineering for successful employment or higher education in mechanical engineering.

PEO 2: The Graduates will design and implement complex modeling systems, conduct research and work with multi disciplinary teams.

PEO 3: The Graduates will be capable of communicating effectively with lifelong learning attitude and function as responsible members of global society.

PROGRAM OUTCOMES (POS):

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAM SPECIFIC OUTCOMES(PSOs):

PSO.1 Design a Thermal system for efficiency improvement as per industrial needs.

PSO.2 Design and manufacture mechanical components using advanced manufacturing technology as per the industrial needs.

COURSE NAME: FUELS AND LUBRICANTS LAB

CO No.	Course Outcomes (CO's)
CO1	Measure the kinematic and dynamic viscosity of fuels and steady variation with temperature
CO2	Determine of Flash point and Fire point of Liquid Fuels / Lubricants
CO3	Estimate the Calorific Value of Solid/Liquid/Gaseous Fuels
CO4	Determine the properties of grease
CO5	Perform the Distillation of liquid fuels
CO6	Determine the carbon percentage in various fuels

COURSE OUTCOMES (COs) – PROGRAM OUTCOMES (POs) MATRIX:

CO's/ PO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	3	-	3	-	-	-	-	-	-
CO2	3	3	-	3	-	3	-	-	-	-	-	-
CO3	3	3	-	3	-	3	-	-	-	-	-	-
CO4	3	3	-	3	-	3	-	-	-	-	-	-
CO5	3	3	-	3	-	3	-	-	-	-	-	-
CO6	3	3	-	3	-	3	-	-	-	-	-	-

COURSE OUTCOMES (CO) – PROGRAM SPECIFIC OUTCOMES (PSO) MATRIX:

CO's/PSO's	PSO1	PSO2
CO1	3	-
CO2	3	-
CO3	3	-
CO4	3	-
CO5	3	-
CO6	3	-

GENERAL INSTRUCTIONS FOR LABORATORY CLASSES

1. All the students must follow the prescribed dress code (apron, formals, shoes) wear their ID cards
2. All the students should sign in login register.
3. All students must carry their observation books and records without fail.
4. Students must take the permission of the laboratory staff before handling the machines in order to avoid any injury.
5. The students must have basic understanding about the theory and procedure of the experiment to be conducted.
6. Power supply to the test table/test rig should be given in the presence of only through the lab technician.
7. Do not LEAN on and do not come CLOSE to the equipment.
8. Instruments like TOOLS, APPARATUS and GUAGE sets should be returned before leaving the lab.
9. Every student is required to handle the equipment with care and follow proper precautions
10. Students should ensure that their work areas are clean.
11. At the end of each experiment, the student must take initials from the staff on the data / observations taken after completing the necessary calculations.
12. The record should be properly written with following section in each experiment:

a) Aim of the experiment
b) Apparatus / Tools / Instruments required
c) Procedure / Theory
d) Model Calculations
e) Schematic Diagram
f) Specifications / Designs Details
g) Tabulations.
h) Graph
i) Result and discussions.

13. Students should attend regularly to all lab classes.
14. Day- to- day evaluation of student performance is carried out and recorded for finalizing internal marks.

SCHEME OF EVALUATION FOR EXTERNAL LABS

Correctness of Write up and Precautions	Conduct Experiment & observations	Model Calculations	Results and Graphs	Viva
Marks: 10	**Marks: 25**	**Marks: 15**	**Marks: 15**	**Marks: 10**
Total Marks: 75 Marks				

SCHEME OF EVALUATION FOR INTERNAL LABS

Day to Day Evaluation ------15 Marks					**Internal Exam------10 Marks**				
Uniform	Observation &Record	Performance of experiment	Results	Viva Voce	Correctness of Write up and Precautions	Conduct Experiment & observations	Model Calculations	Results and Graphs	Viva Voce
Marks:2	**Marks:3**	**Marks:3**	**Marks:4**	**Marks:3**	**Marks:2**	**Marks:2**	**Marks:2**	**Marks:2**	**Marks:2**
Total Marks: 15+10=25 Marks									

LIST OF EQUIPMENT

Sl.No	Equipment Name
1	REDWOOD VISCOMETER-1
2	REDWOOD VISCOMETER-2
3	SAYBOLT VISCOMETER
4	ENGLER'S VISCOMETER
5	CLEAVELAND FLASH & FIRE POINT APPARATUS
6	PENSKY-MARTEN'S FLASH –POINT APPARATUS
7	ABEL FLASH - POINT APPARATUS
8	CLOUD & POUR - POINT APPARATUS
9	BOMB CALORIMETER
10	CARBON RESIDUE (CONRADSON) APPARATUS
11	ASMT DESTILLATION
12	JUNKER'S CALORIMETER
13	PENETROMETER
14	DROP POINT APPARATUS

LIST OF EXPERIMENTS

1.REDWOOD VISCOMETER

INTRODUCTION

The property of the fluid, which offers resistance to the movement of one layer of fluid over another adjacent layer of the fluid, is called viscosity.

The viscosity of given oil is determined as the time off low in Redwood seconds. The viscosity of a fluid indicates the resistance offered to shear under laminar condition. Dynamic viscosity of a fluid is the tangential force on unit area of either of two parallel planes at unit distance apart when the space between the plates is filled with the fluid and one of the plate's moves relative to the other with unit velocity in its own plane. The unit of dynamic viscosity is dyne-sec/cm^2. Kinematic viscosity of a fluid is equal to the ratio of the dynamic viscosity and density of the fluid. The unit of kinematic viscosity is m^2/sec

Here the resistance offered by the fluid or oil while it passes through the orifice is considered as the factor for viscosity measurement. Also, when the fluid is much thicker it takes more time to pass through the orifice and as temperature increases the fluid goes on becoming less viscous and it would take less time to pass through the orifice and hence the time factor is criterion here. In the following paragraphs you find the brief description of the apparatus and the procedure for conducting the experiment for different fluids.

DESCRIPTION OF THE APPARATUS:

The apparatus consists of an oil cup with cover and oil gauge. The oil cup is provided with the standard orifice for the oil the oil to flow and is also being designed in such a way that the small spherical ball is used to stop and run the flow. Thermometer points are provided on the cup cover and the bath to measure the temperature. The cup is place in the water/oil* bath made of SS and consists of the heater with controller. The arrangement is rested on the power coated MS frame with leveling screws. The arrangement confirms to **IP 70 standards**.

APPARATUS

- Redwood viscometer-I, o Stopwatch,

	Redwood viscometer No.1- Universal	**Redwood viscometer No.2- Admir**
Dimensions of orifice	**Length-10mm, Dia-1,62mm**	**Length-50mm, Dia-3.8mm**
Useful for	**Low viscous oil having flow time**	**Higher viscous oils having flow**
	between 30s-2000s	**time greater than 2000s**

	e.g. Kerosine oil and mustard oil	**e.g. Fuel oil, mobile oil**

- Thermometer (0-110^{0}C) o Measuring flask (50cc)

Fig: Redwood Viscometer Apparatus

EXPERIMENTATION:

AIM:

The experiment is conducted to determine the Viscosity of the given oil by using Redwood Viscometer apparatus.

PROCEDURE:

1. Prepare the apparatus by cleaning the cup with carbon tetrachloride or any suitable solvent and dry clean.
2. Clean the jet hole using the fine thread.
3. Fill fluid (under test) by placing the cup on the flat surface till the mark provided.
4. Place the cup in the **water/oil*** bath and insert the thermometer.
5. Start the heater from the lowest level to heat the bath, while doing so gently stir the fluid using the stirrer provided.
6. Continue heating till the test temperature is steady.
7. Place the receiving jar of 50ml exactly below the cup.
8. Now, slowly open the orifice at the bottom to allow the fluid flow and measure the time required for it.
9. Repeat the steps 1 to 8 for different temperatures.
10. Note down the result obtained.
11. Before closing the experiment switch of the heater and allow it cool.
12. Now, remove the cup and clean it for next use.
13. Repeat the steps 1 to 10 for conducting the experiment for different fluids.

NOTE

1. For testing the Fluids below 90º C use the water bath and above 100º C use oil bath.
2. Do not stir the sample while testing.
3. For fluids having flow time > 2000 use Redwood viscometer No.2.
4. If needed use the Barometer for pressure measurement.

OBSERVATIONS:

Sl. No.	Temperature, T^o C	Flow Time 't' sec
1	57.5	150
2	72	180
3	75.5	67

CALCULATIONS

1. Viscosity in Redwood Number, n

$$n = \frac{K \times t \times S}{ts \times Ss}$$

Where

K = Constant = 100 for standard oil.

t = time taken for flow of 50cc of oil, sec.

t_s = 535 sec, for time taken for flow of 50cc of standard oil.

S = Specific gravity of oil being tested.

S_s = 0.915 = Specific gravity of standard oil.

$$n = \frac{100 \times 150 \times 8 \times 10^{-4}}{535 \times 0.915} = 0.024$$

2. Kinematic Viscosity, η

$$\eta = (0.260t - \frac{179}{t}) \times 10^{-6}\ m^2/sec \text{ for } 34 < t < 100$$

$$\eta = (0.247t - \frac{50}{t}) \times 10^{-6}\ m^2/sec \text{ for } 100 < t < 2000$$

Where

t = time taken for flow of 50cc of oil, sec.

$$\eta = \left[0.247 \times (150) - \frac{50}{150}\right] \times 10^{-6}$$

$$= 3.6 \times 10^{-5}$$

3. Dynamic Viscosity, μ

$\mu = \eta \times \rho$ N-sec/m²

Where, ρ = density of the fluid under test in kg/m³, sec.

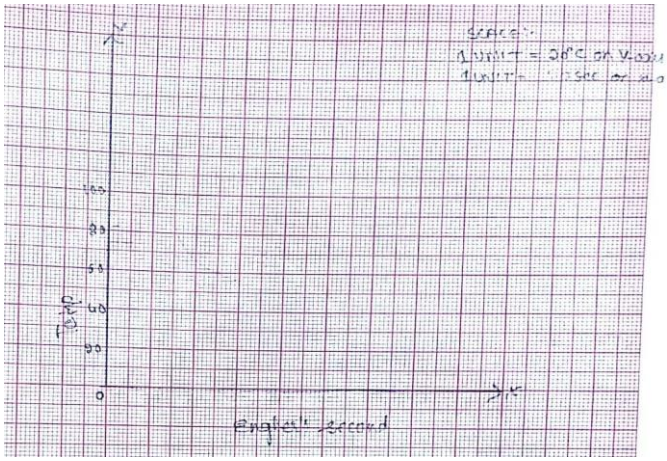
$$\mu = 3.6 \times 10^{-5}$$

TABULATION:

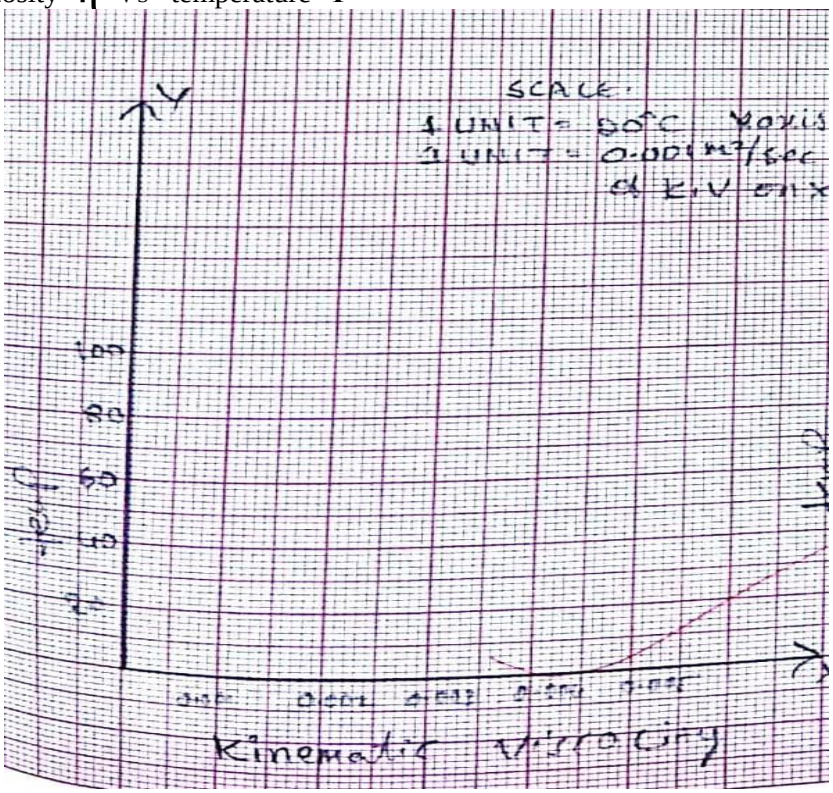
Sl. No.	Redwood Viscosity No.	Kinematic Viscosity 'η'	Dynamic Viscosity 'μ'
1	0.024	36×10^{-5}	2.88×10^{-8}
2	0.013	1.91×10^{-5}	1.52×10^{-8}
3	0.01	1.58×10^{-5}	1.264×10^{-8}

GRAPHS:

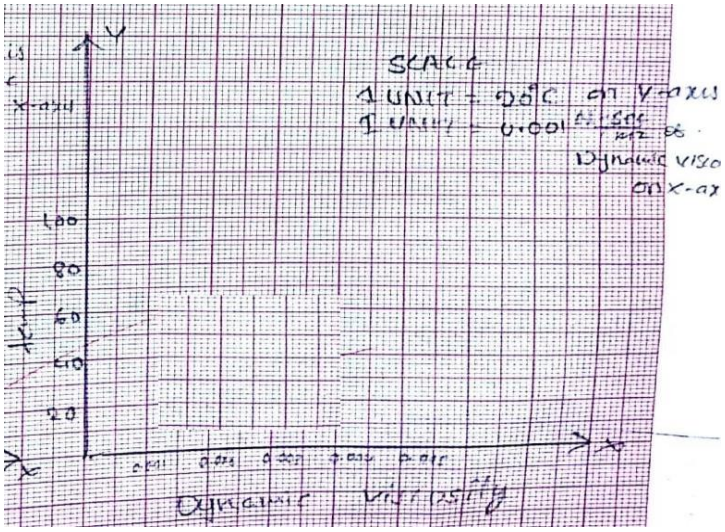
Graph of time **'t'** Vs temperature **'T'**



Graph of Kinematic Viscosity **'η'** Vs temperature **'T'**



Graph of Dynamic Viscosity **'η'** Vs temperature **'T'**



RESULTS:

Variation of Redwood seconds, absolute viscosity and Kinematic viscosity with temperature, were observed and found to be decreasing with temperature.

PRECAUTIONS

1) Do not switch on the heater when dry.
2) Clean the tanks regularly after use.
3) Do not run the equipment if the voltage is below 180V.
4) Check all the electrical connections before running.
5) Before starting and after finishing the experiment the mains should be off.
6) Do not attempt to alter the equipment as this may cause damage to the whole system.
7) Stir the water continuously so that the temperature of the oil and water are equal.
8) Before collecting the oil at a temperature, check whether the oil is up to the Indicator in the oil cup.
9) Always take the readings at a stable temperature
10) Ensure proper setting of the ball valve to avoid leakage

2.SAYBOLT VISCOMETER

INTRODUCTION

The property of the fluid, which offers resistance to the movement of one layer of fluid over another adjacent layer of the fluid, is called viscosity.

Here the resistance offered by the fluid or oil while it passes through the orifice is considered as the factor for viscosity measurement. Also, when the fluid is much thicker it takes more time to pass through the orifice and as temperature increases the fluid goes on becoming less viscous and it would take less time to pass through the orifice and hence the time factor is criterion here. In the following paragraphs you find the brief description of the apparatus and the procedure for conducting the experiment for different fluids.

DESCRIPTION OF THE APPARATUS:

The apparatus consists of an oil cup with cover and oil gauge. The oil cup is provided with the standard orifice for the oil to flow and is also being designed in such a way that the simply cork is used to stop and run the flow. Thermometer points are provided on the cup cover and the bath to measure the temperature. The cup is placed in the water bath made of SS and consists of the heater with controller. The arrangement is rested on the power coated MS frame with leveling screws. The setup confirms to **ASTMD - 88 specifications**

Fig: Saybolt viscometer Apparatus

EXPERIMENTATION:

AIM:

The experiment is conducted to

Determine the Viscosity of the given oil by using SayBolt Viscometer apparatus.

PROCEDURE:

1.Prepare the apparatus by cleaning the cup with carbon tetrachloride or any suitable solvent and dry clean.

2.Fill fluid (under test) to the cup till the mark.

3.Place the cup in the **water** bath and insert the thermometer.

4.Start the heater from the lowest level to heat the bath, while doing so gently stir the fluid using the stirrer provided.

5.Continue heating till the test temperature is steady.

6.Place the receiving jar of 60ml exactly below the cup.

7.Now, slowly open the orifice at the bottom to allow the fluid flow and measure the time required for it.

8.Repeat the steps 1 to 8 for different temperatures.

9.Note down the result obtained.

10. Before closing the experiment switch of the heater and allow it cool.

11. Now, remove the cup and clean it for next use.

12. Repeat the steps 1 to 10 for conducting the experiment for different fluids.

NOTE

10. Temperature of testing the Fluids should be below 90º C.
11. Do not stir the sample while testing.
12. If needed use the Barometer for pressure measurement.

OBSERVATIONS:

Sl. No.	Temperature, T^o C	Flow Time 't' sec
1	60	148
2	70	132
3	80	102

CALCULATIONS

1. Kinematic Viscosity, η

$$\eta = (0.22\ t - \frac{180}{t}) \times 10^{-6}\ m^2/sec \text{ for } t < 2000$$

Where

t = time taken for flow of 60cc of oil, sec.

$$\eta = (0.22\ (148) - \frac{180}{148}) \times 10^{-6}$$

$$= 3.134 \times 10^{-5}$$

2. Dynamic Viscosity, μ

$$\mu = \eta \times \rho \text{ N-sec/m}^2$$

Where, ρ = density of the fluid under test in kg/m³, sec.

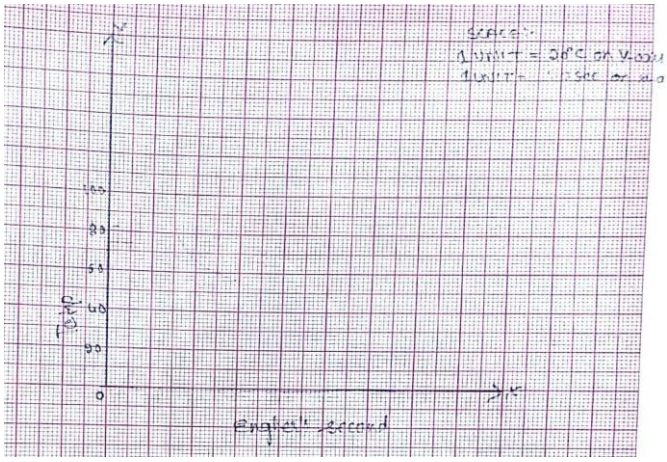
$$\mu = 3.134 \times 10^{-5} \times 7.16 \times 10^{-6}$$

TABULATION:

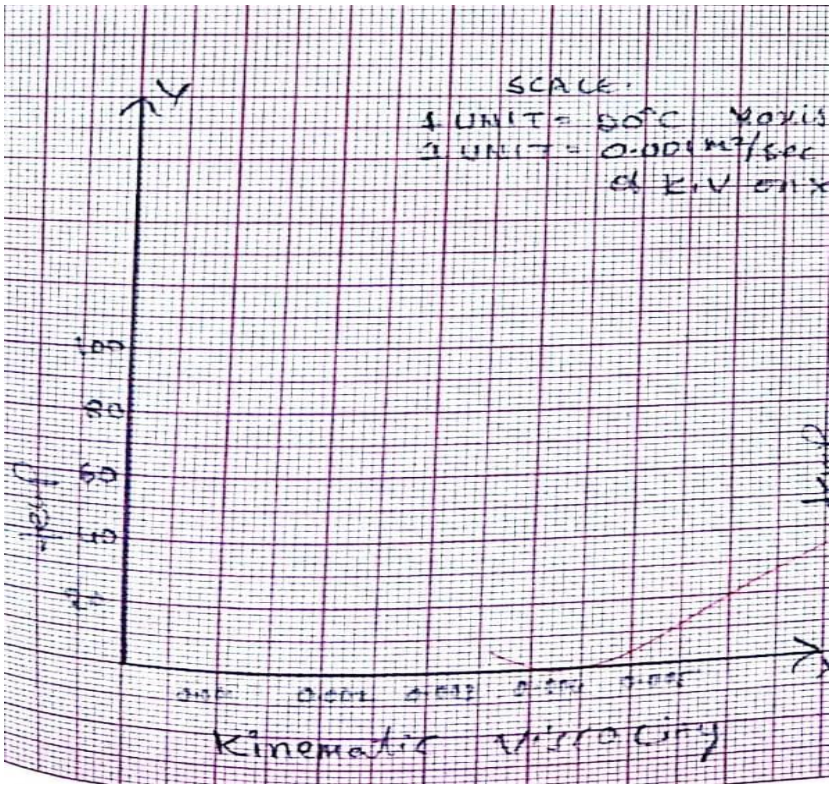
Sl. No.	Kinematic Viscosity 'η'	Dynamic Viscosity 'μ'
1	3.13×10^{-5}	2.2×10^{-8}
2	2.76×10^{-5}	1.98×10^{-8}
3	2.06×10^{-5}	1.47×10^{-8}

GRAPHS:

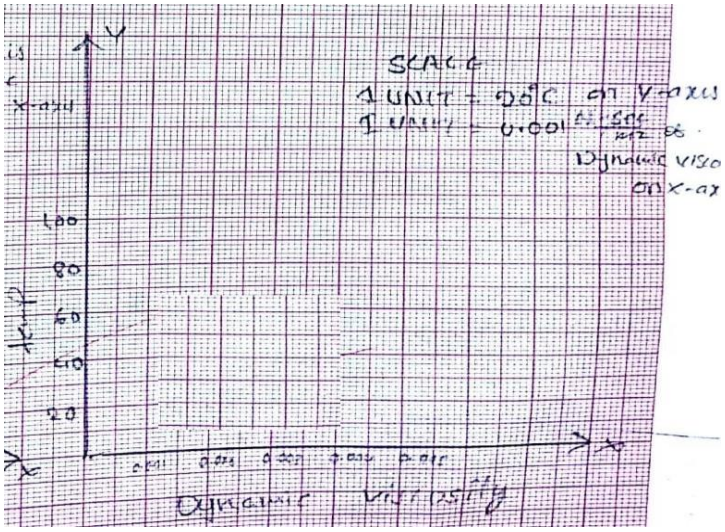
Graph of time **'t'** Vs temperature **'T'**



Graph of Kinematic Viscosity **'η'** Vs temperature **'T'**



Graph of Dynamic Viscosity **'η'** Vs temperature **'T'**



RESULTS:

Variation of Saybolt Seconds, Absolute viscosity and Kinematic viscosity with temperature, were observed and found to be decreasing with temperature.

PRECAUTIONS

1. Do not switch on the heater when dry.
2. Clean the tanks regularly after use.
3. Do not run the equipment if the voltage is below 180V.
4. Check all the electrical connections before running.
5. Before starting and after finishing the experiment the mains should be off.
6. Do not attempt to alter the equipment as this may cause damage to the whole system.

3.ENGLER'S VISCOMETER

INTRODUCTION

The property of the fluid, which offers resistance to the movement of one layer of fluid over another adjacent layer of the fluid, is called viscosity.

Here the resistance offered by the fluid or oil while it passes through the orifice is considered as the factor for viscosity measurement. Also, when the fluid is much thicker it takes more time to pass through the orifice and as temperature increases the fluid goes on becoming less viscous and it would take less time to pass through the orifice and hence the time factor is criterion here. In the following paragraphs you find the brief description of the apparatus and the procedure for conducting the experiment for different fluids.

DESCRIPTION OF THE APPARATUS:

Engler's viscometer consists of a water bath and oil bath, both provided with two thermometers inside them. There is an ebonite valve stick, which is located at center of oil bath to flow of oil through the orifice. A heater with regulator is fixed for heating purpose.

EXPERIMENTATION:

AIM:

The experiment is conducted to

- Determine the Viscosity of the given oil by using Engler's Viscometer apparatus.

PROCEDURE:

1.Prepare the apparatus by cleaning the cup with carbon tetrachloride or any suitable solvent and dry clean.

2.Clean the jet hole using the fine thread.

3.Fill fluid (under test) by placing the cup on the flat surface till the mark provided.

4.Place the cup in the **water/oil*** bath and insert the thermometer.

5.Start the heater from the lowest level to heat the bath, while doing so gently stir the fluid using the stirrer provided.

6.Continue heating till the test temperature is steady.

7.Place the receiving jar of 200ml exactly below the cup.

8.Now, slowly open the orifice at the bottom to allow the fluid flow and measure the time required for it.

9.Repeat the steps 1 to 8 for different temperatures.

10. Note down the result obtained.

11. Before closing the experiment switch of the heater and allow it cool.

12. Now, remove the cup and clean it for next use.

13. Repeat the steps 1 to 10 for conducting the experiment for different fluids.

OBSERVATIONS:

Sl. No.	Temperature, T° C	Flow Time 't' sec
1	60.5	191
2	74	153
3	82.5	129

CALCULATIONS

1. Kinematic Viscosity, η

$$\eta = (0.260\ t - \frac{180}{t}) \times 10^{-6}\ m^2/sec \text{ for } t < 2000$$

Where

t = time taken for flow of 200cc of oil, sec.

$$\eta = (0.260\ (191) - \frac{180}{191}) \times 10^{-6}$$

$$4.84 \times 10^{-5}$$

2. Dynamic Viscosity, μ

$$\mu = \eta \times \rho N\text{-sec/m}^2$$

Where, ρ = density of the fluid under test in kg/m³, sec.

$$\mu = 4.84 \times 10^{-5} \times 0.86$$

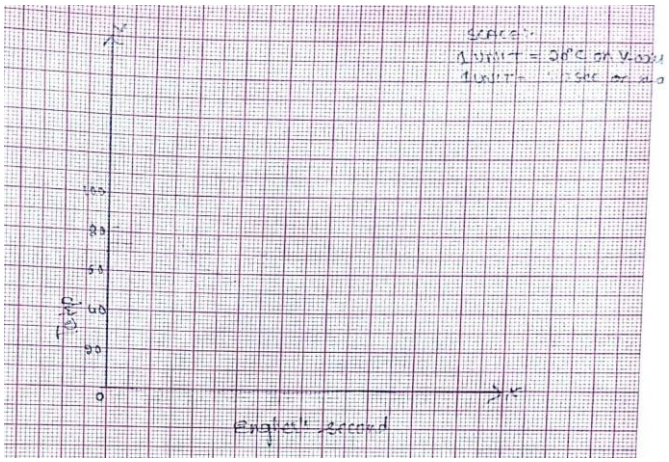
$$= 4.05 \times 10^{-5} \times 0.86$$

TABULATION:

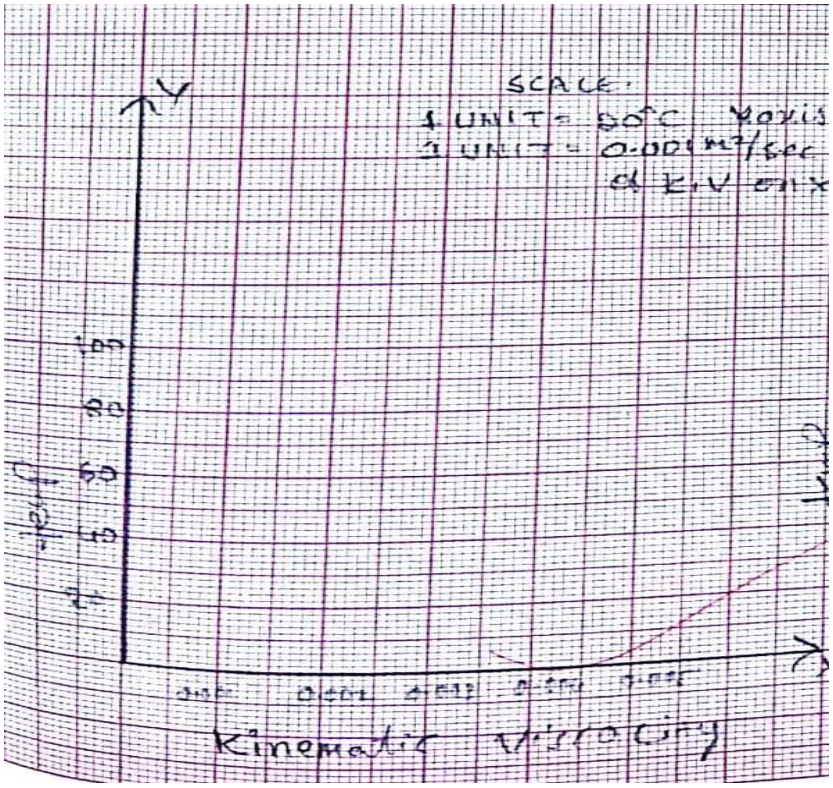
Sl. No.	Kinematic Viscosity 'η'	Dynamic Viscosity 'μ'
1	4.8×10^{-5}	4.05×10^{-5}
2	3.06×10^{-5}	3.33×10^{-5}
3	3.214×10^{-5}	2.76×10^{-5}

GRAPHS:

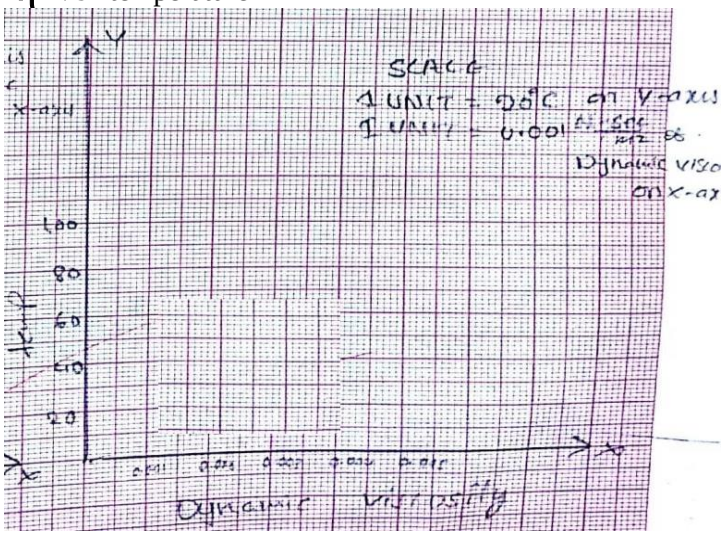
Graph of time **'t'** Vs temperature **'T'**



Graph of Kinematic Viscosity **'η'** Vs temperature **'T'**



Graph of Dynamic Viscosity **'η'** Vs temperature **'T'**



RESULTS:

Variation of Engler's seconds, Absolute viscosity and Kinematic viscosity with temperature, were observed and found to be decreasing with temperature.

PRECAUTIONS:

1. Do not switch on the heater when dry.
2. Clean the tanks regularly after use.
3. Do not run the equipment if the voltage is below 180V.
4. Check all the electrical connections before running.
5. Before starting and after finishing the experiment the mains should be off.
6. Do not attempt to alter the equipment as this may cause damage to the whole system.

4.PENSKY-MARTEN'S FLASH –POINT APPARATUS

INTRODUCTION

A flash point can be described as the temperature at which the material gives so many vapors that this vapor with the mixture of air forms an ignitable mixture and gives the momentary flash when exposed to the pilot flame.

DESCRIPTION OF THE APPARATUS:

The apparatus consists of an oil cup with cover and oil gauge. The cover of the cup consists of ports for introduction of the flame for observation (one at the center and other on the side). Flame wick with the oil jet is provided to run the flame and the slide to introduce the flame. A thermometer point is provided on the cup cover to measure the temperature. The cup is place in the Hot Air bath made of SS and consists of the heater with controller. The arrangement is rested on the power coated MS frame. The setup confirms to **IP - 34** and **ASTMD - 93 specifications**.

EXPERIMENTATION

AIM:

The experiment is conducted to

- Determine the flash and fire point of the given liquid by Pensky Marten's apparatus.

PROCEDURE:

1. Fill the cup with the fluid (under test) by placing the cup on the flat surface till the mark provided.
2. Place the cup in the Air bath and insert the thermometer.
3. Adjust the test flame.
4. Start the heater from the lowest level to heat the bath, while doing so gently stir the fluid (say 1 or 2 rps) using the stirrer provided.
5. Continue heating till 10º C below the expected flash point.
6. Now, slowly open the test flame to the fluid for every 1º C rise in the temperature of the test fluid till flash is obtained.
7. Note down the result obtained for every exposure.
8. Continue heating and introducing the test flame to obtain the fire point.(At fire point the fluid under test has to burn for at least five seconds when test flame is introduced).
9. Note down the result obtained for every exposure.
10. Before closing the experiment switch of the heater and allow it cool.
11. Now, remove the cup and clean it for next use.
12. Repeat the steps 1 to 10 for conducting the experiment for different fluids.

NOTE

1. Do not stir the sample while applying the test flame.
2. Don't relate the blue flame surrounding the test flame as the flash because flash will be the combination of a very weak sound and light.
3. If needed use the Barometer for pressure measurement.

OBSERVATIONS:

Sl. No.	Temperature, T° C	Result (Flash)	Result (Fire)
1	210	✓	-
2	240	-	✓

RESULTS:

The flash point of given oil is 210 ˚C

The flash point of given oil is 240˚C

PRECAUSTIONS:

1) Clean the tanks regularly after use.
2) Do not run the equipment if the voltage is below 180V.
3) Check all the electrical connections before running.
4) Before starting and after finishing the experiment the mains should be off.

5.ABEL FLASH - POINT APPARATUS

INTRODUCTION

A flash point can be described as the temperature at which the material gives so many vapors that this vapor with the mixture of air forms an ignitable mixture and gives the momentary flash when exposed to the pilot flame.

Abel flash point apparatus determines the flash point temperature by adopting the closed cup method. This apparatus is suitable for the liquids having flash points between 18º C to 70º C.

DESCRIPTION OF THE APPARATUS:

The apparatus consists of an oil cup with cover and oil gauge. The cover of the cup consists of ports for introduction of the flame for observation (one at the center and other on the side). Flame wick with the oil jet is provided to run the flame and the slide to introduce the flame. A thermometer point is provided on the cup cover to measure the temperature. The cup is placed in the hot water bath made of SS and consists of the heater with controller. The arrangement is rested on the power coated MS frame. The setup confirms to **IP - 33** and **IP - 170 specifications**.

EXPERIMENTATION:

AIM:

The experiment is conducted to determine the flash and fire point of the given oil by Abel's apparatus.

PROCEDURE:

1.Fill the water to the water bath through the funnel provided.

2.Fill the cup with the fluid (under test) by placing the cup on the flat surface till the mark provided.

3.Place the cup in the water bath and insert the thermometer.

4.Adjust the test flame.

5.Start the heater from the lowest level to heat the bath, while doing so gently stir the bath using the stirrer provided.

6.Now, slowly open the test flame to the fluid for every 1º C rise in the temperature of the test fluid.

7.Note down the result obtained for every exposure.

8.Stop the experiment after obtaining the flash.

9.Before closing the experiment switch of the heater and allow it cool.

10. Now, remove the cup and water from the water bath and clean it for next use.

11.Repeat the steps 1 to 10 for conducting the experiment for different fluids.

NOTE

12. For fluids having Flash Point < 32.2º C, water used in the bath should be initially cooled to 5 – 6º C below their expected flash point temperature.

13. For fluids having Flash Point > 32.2º C, normal water is used in the bath.

14. Fluids having the flash point < 18º C and > 50º C should not be us

OBSERVATIONS:

Sl. No.	Temperature, Tº C	Result (Flash)	Result (Fire)
1	35		
2	40	✓	
3	45		
4	50		
5	55		✓

RESULTS:

The flash point of given oil is 40˚C

The flash point of given oil is 55˚C

PRECAUTIONS

1) Clean the tanks regularly after use.
2) Do not run the equipment if the voltage is below 180V.
3) Check all the electrical connections before running.
4) Before starting and after finishing the experiment the mains should be off.
5) Do not attempt to alter the equipment as this may cause damage to the whole system.

6.CLOUD & POUR - POINT APPARATUS

INTRODUCTION

Pour point is the temperature 3°F above that at which oil ceases to flow when cooled. It is nothing but the freezing point of the oil. It is essential is know the pour point data of different grades of petroleum oils to handle them under adverse cold conditions when they are pumped through pipelines.

CLOUD POINT: The temperature, expressed to the nearest degree centigrade, at which a cloud or haze appear when the oil is cooled under prescribed conditions.

POUR POINT: The lowest temperature, expressed as a multiple of 3^0c, at which the oil is observed to flow when cooled & examined under prescribed conditions.

When the oil is cooled at a specified rate, the temperature at which it becomes cloudy or hazy is called cold point of oil. this haziness is due to the separation of crystals. of wax or incase of viscosity at low temperature.

Cloud point is important for fuel oils which have to pass through unheated filters of fine mesh. Example a jet plane may be exposed to 60°C and if solid wax separate from fuel oil the carburetor may be blocked up cloud point is 5 or 10°F higher than pour point unless the pour point has depressed by additives.

DESCRIPTION OF THE APPARATUS:

The apparatus is built according to IP15 & IS 1448 (P 10) 1970 specifications. The apparatus consists of main cooling bath made of Stainless Steel sheet and stand unit with drain plug and cover has provision for fitting the thermometer and a filling aperature for adding freezing mixture. A glass jar for containing oils, jacket, disc and gasket as specified are also provided.

EXPERIMENTATION:

AIM:

The experiment is conducted to determine the cloud and pour point of the given oil.

PROCEDURE:

1. Fill the ice and salt mixture as the bath for cooling the oil in test.
2. Fill the test jar with suitable oil up to the mark provided on it.
3. Now, note the temperature of the oil in test.
4. Observe the change in the oil temperature and note down the reading when the gaze on the oil just appears. This temperature is known as Cloud point temperature.
5. Continue cooling until the oil under test just starts to freeze i.e., just stops to flow. This temperature is known as Pour point temperature.
6. Repeat the experiment for the repeatability and also for other oils.

OBSERVATIONS:

Sl. No.	Temperature, T° C	Result (Cloud/ Pour point)
1	0	**Cloud**
2	1	-
3	2	-
4	3	**Pour**

RESULTS:

For a given sample of oil the Cloud & Pour point s are 3°Cand 0°Crespectively.

PRECAUTIONS

1) Clean the tanks regularly after use.
2) Do not attempt to alter the equipment as this may cause damage to the whole system.

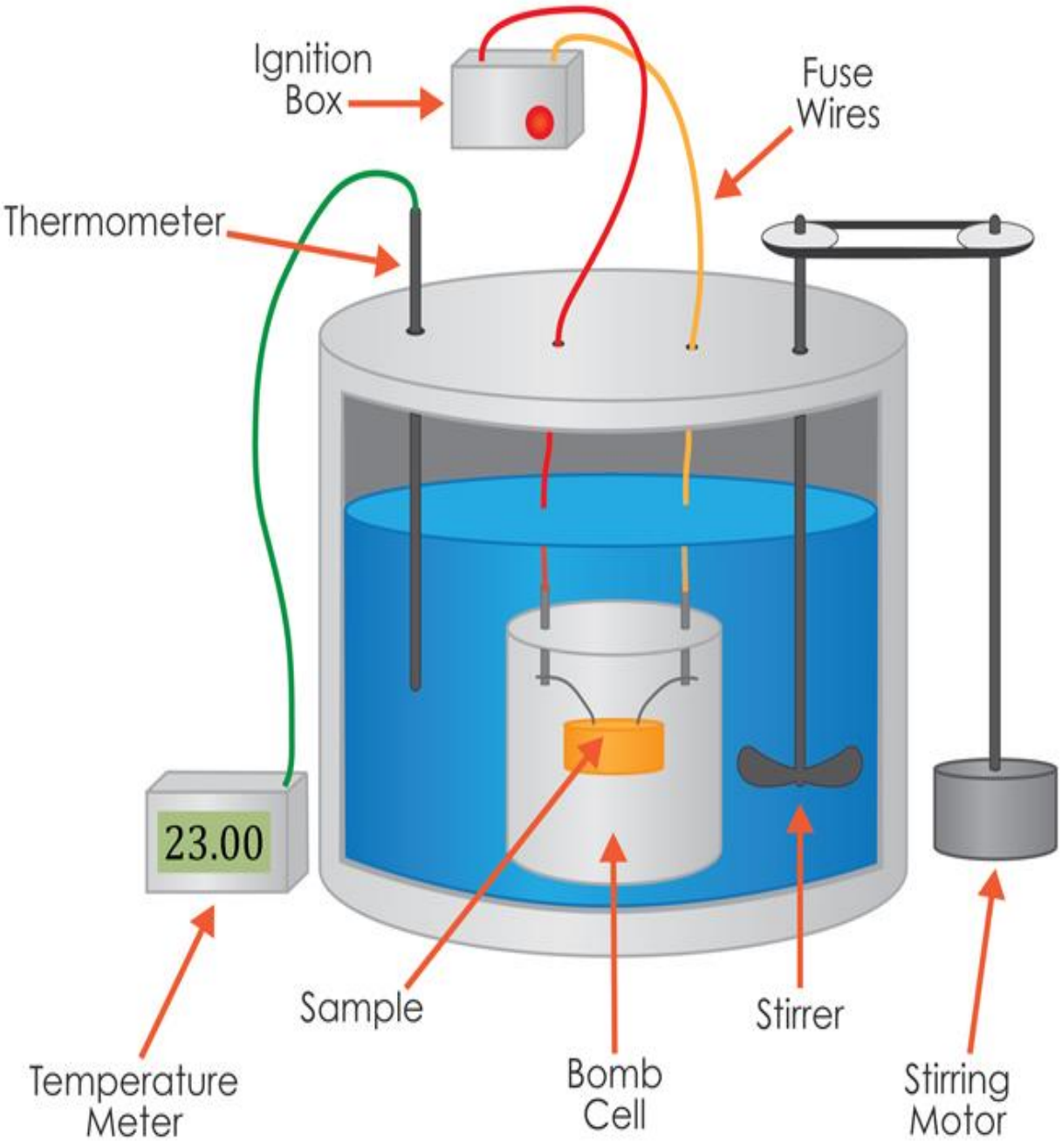
7.BOMB CALORIMETER

A bomb calorimeter is a type of constant-volume calorimeter used in measuring the heat of combustion of a particular reaction. Bomb calorimeters have to withstand the large pressure within the calorimeter as the reaction is being measured. Electrical energy is used to ignite the fuel; as the fuel is burning, it will heat up the surrounding air, which expands and escapes through a tube that leads the air out of the calorimeter. When the air is escaping through the copper tube it will also heat up the water outside the tube. The change in temperature of the water allows for calculating calorie content of the fuel.

In more recent calorimeter designs, the whole bomb, pressurized with excess pure oxygen (typically at 30atm) and containing a weighed mass of a sample (typically 1-1.5 g) and a small fixed amount of water (to saturate the internal atmosphere, thus ensuring that all water produced is liquid, and removing the need to include enthalpy of vaporization in calculations), is submerged under a known volume of water (ca. 2000 ml) before the charge is electrically ignited. The bomb, with the known mass of the sample and oxygen, form a closed system - no gases escape during the reaction. The weighed reactant put inside the steel container is then ignited. Energy is released by the combustion and heat flow from this crosses the stainless steel wall, thus raising the temperature of the steel bomb, its contents, and the surrounding water jacket. The temperature change in the water is then accurately measured with a thermometer. This reading, along with a bomb factor (which is dependent on the heat capacity of the metal bomb parts), is used to calculate the energy given out by the sample burn. A small correction is made to account for the electrical energy input, the burning fuse, and acid production (by titration of the residual liquid). After the temperature rise has been measured, the excess pressure in the bomb is released.

Basically, a bomb calorimeter consists of a small cup to contain the sample, oxygen, a stainless steel bomb, water, a stirrer, a thermometer, the dewar or insulating container (to prevent heat flow from the calorimeter to the surroundings) and ignition circuit connected to the bomb. By using stainless steel for the bomb, the reaction will occur with no volume change observed.

Bomb Calorimeter



EXPERMENTATION:

AIM:

The experiment is conducted to determine the higher calorific value of the given solid (or liquid) fuel by Bomb Calorimeter.

DESCRIPTION OF THE APPARATUS:

Bomb Calorimeter is used to determine the higher calorific value of a solid or liquid fuel by burning it at constant volume in at atmosphere of oxygen. The body is made of stainless steel. At the top of the bomb there is an oxygen valve for admitting oxygen and products release valve for the exhaust gases. The bottom of the bomb is screwed into a cover, which forms the base. The bottom cover of the bomb supports two pillars, one of them carrying a ring to support crucible in which a known weight of fuel is placed. A fine wire made up of Nichrome or Platinum dips into the crucible. The bottom of the pillars is provided with insulating plugs through which the leads from the main supply are taken. The bomb is placed inside a copper vessel known as calorimeter, which contains a known quantity of water (2500cc.)

The calorimeter is provided with a stirrer to agitate the water in the calorimeter and a thermometer to measure the temperature of water up to an accuracy of 0.001 °C. The calorimeter is further surrounded by a jacket and an air space provided between the two to reduce the loss of heat due to radiation.

The setup confirms to **IP - 12 specifications**.

PROCEDURE:

TO FIND THE WATER EQUIVALENT

1. A dry sample of **Benzoic Acid** is taken and compresses it in to the briquette press.
2. Weigh the briquette accurately, usually of 0.75 to 1gm.
3. Place the briquette in the crucible.
4. Attach the fuse wire of 0.1mm. in diameter and 150mm in length to the ignition rods and the crucible is swung round until the loop of wire touches the briquette.
5. Couple the oxygen cylinder to the bomb, till the pressure in the bomb rises to 20 – 25 atmospheres with the release valve in closed position.
6. Place the charged bomb in the calorimeter, which is filled with 1500 cc. of water.
7. Fix the thermometer and start the stirrer.
8. When the bomb and its contents attain a steady state, note the initial temperature.
9. Now, test for continuity and fire the bomb.
10. Note the temperature of the water till it reaches the steady state with respect to time.
11. In the meantime the stirrer is switched on continuously.
12. After the expt. The bomb is taken out of the calorimeter.
13. The products of combustion are released with the help of release valve. It is dried and opened.
14. Un - burnt fuse wire if any is collected and weighed for the use in calculation.

OBSERVATIONS AND CALCULATION:

Water equivalent 'w', gm:

$$= \frac{HCV * (m) + \{(F*C_F) + (T* C_T)\}}{4.187*(T_2 - T_1)} - W$$

Where, HCV = calorific value of the known fuel (Benzoic Acid).= 40.56 MJ/kg

m = mass of the fuel used =2gms

C_F = Calorific value of the fuse wire in use= 1400 J/gm for nickel-chromium wire

T = Mass of Cotton Thread=0.02gms

C_T = Calorific value of the cotton thread in use = 17,490 J/gm

W = Weight of the water in use. = 2×1000×2000

T_1 = Initial temperature of water in the calorimeter in °C=26.56°C

T_2 = Final temperature of water in the calorimeter in °C.=25.56°C

F = Mass of fuse wire burned in gm.

$$\frac{40.56 \times 10^6 \times 2 \times 10^{-3} + [(0.01 \times 1400) + (0.02 \times 17.49)]}{4.187 \times (25 - 200}$$

=1875.53gms

OBSERVATIONS AND CALCULATION:

Higher calorific value C = $\frac{(W+w)*(T_2-T_1) * 4.187 - \{(F*C_F) + (T* C_T)\}}{P}$

Let P = Mass of fuel taken in the crucible in gm.

F = Mass of fuse wire burned in gm.

W = Mass of water taken in the calorimeter in gm.

w = Water equivalent of the calorimeter in °C.

T1 = Initial temperature of water in the calorimeter in °C.

T2 = Final temperature of water in the calorimeter in °C.

C_f = Calorific value of fuse wire in J/gm. = 1400 J/gm

T = Weight of the Cotton Thread.

C_T = Calorific value of the cotton thread in use = 17,490 J/gm

$$\frac{[(\mathbf{2000 + 1875.53}) \times (\mathbf{24 - 20}) \times \mathbf{4.187}] - [\mathbf{90.01 \times 1400}) + (\mathbf{0.02 \times 17.49})]}{\mathbf{2 \times 10^3}}$$

=32.45 Kj/Kg

RESULT:

Waterequivalent of calorimeter(W_e)=1875.53gm

Calorific valueofsample(C_v)=32.45 Kj/Kg

PRECAUTIONS

1. Check all the electrical connections before running.
2. Do not run the equipment if the voltage is below 180V.
3. Check the tubing of the gas for any leakage before conducting the experiment.
4. Do not run the equipment if any leakage is found.
5. Light the gas immediately without any delay.
6. Before starting and after finishing the experiment the mains should be off.
7. Do not attempt to alter the equipment as this may cause damage to the whole system.

8. CARBON RESIDUE (CONRADSON) APPARATUS

INTRODUCTION

Most of the lubricant oils are containing high percentage of carbon in combined form and fuels containing less percentage of carbon in combined form. On heating, they decompose depositing a certain amount of carbon. The deposition of such carbon in machine is intolerable, particularly in internal combustion engines and air compressors. A good lubricant should deposit least amount of the carbon in use.

The carbon residue of a fuel is the tendency to form carbon deposits under high temperature conditions in an inert atmosphere. It may be expressed as Rams bottom Carbon Residue (RCR), Conradson Carbon Residue (CCR) or Micro Carbon Residue (MCR).Numerically, the CCR value is the same as that of MCR. The carbon residue value is considered by some to give an approximate indication of the combustibility and deposit forming tendencies of the fuel.

The carbon residue of a fuel is the tendency to form carbon deposits under high temperature conditions in an inert atmosphere, and may be expressed commonly as MicroCarbon Residue (MCR) or alternatively Conradson Carbon Residue (CCR). It should be noted that numerically MCR is effectively the same as CCR.

The overall relationship between actual diesel engine performance and carbon residue ispoor, however, the carbon residue value is considered by some to give an indication of the combustibility and carbonaceous deposit forming tendencies of a fuel.

The carbon residue provides information on the carbonaceous deposits which will result from combustion of the fuel. For fuels with a high carbon- high carbon/hydrogen ratio, it is proved more difficult to burn them fully, which results in increased deposits in the combustion and exhaust spaces. Fuels with a high carbon residue value may cause problems in older engines when they are operating under part load conditions. The carbon residue value of a fuel depends on the refinery processes employed in its manufacture

DESCRIPTION OF THE APPARATUS:

The apparatus consists of an oil cup with cover and oil gauge. The cover of the cup consists of ports for introduction of the flame for observation (one at the center and other on the side). Flame wick with the oil jet is provided to run the flame and the slide to introduce the flame. A thermometer point is provided on the cup cover to measure the temperature. The cup is place in the Hot Air bath made of SS and consists of the heater with controller. The arrangement is rested on the power coated MS frame. The setup confirms to **IP - 34** and **ASTMD - 93 specifications**.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EXPERIMENTATION:

AIM:

The experiment is conducted to

To determine the carbon residue of the given sample of lubricating oil / Fuel.

PROCEDURE:

1. The weighed porcelain or silica crucible with approximately 2 grams of sample is placed in the center of skid more crucible.
2. The skid more crucible is provided with lid, having a small tube type opening for the escape of volatile matter.
3. The combination is then placed in a wrought iron crucible covered with chimney shaped iron hood.
4. The wrought iron crucible is heated slowly till flame appears. Slow heating continues for 5 minutes more.
5. Finally, strong heating is done for about 15 minutes till vapors of all volatile matter are burnt completely.
6. Apparatus is then allowed to cool and weight of residue left is determined.
7. The result is expressed as percentage of the original weight of oil taken.

OBSERVATIONS:

1) Weight of crucible W_1= 25 gms
2) Weight of crucible with oil W_2= 30 gms
3) Weight of crucible with residue W_3= 29gms

Parentage of carbon residue $= \frac{Weight of Residue}{Original Weight of Sample} \times 100$

$$\frac{W_3 - W_1}{W_2 - W_1} \times 100$$

$$\frac{29-25}{30-25} \times 100 = 80\%$$

RESULT:

The Percentage of Carbon Present in given sample of lubricating oil is **80**%.

PRECAUTIONS

1) Clean the tanks regularly after use.
2) Do not run the equipment if the voltage is below 180V.
3) Check all the electrical connections before running.
4) Before starting and after finishing the experiment the mains should be off.
5) Do not attempt to alter the equipment as this may cause damage to the whole system.

9.JUNKER'S GAS CALORIMETER

AIM:

The experiment is conducted to determine the calorific value of given gaseous fuel using Junker's Calorimeter.

PROCEDURE:

1.Give necessary electric connection to the instrument.

2.Allow the water to flow through the jacket of the calorimeter and set the flow rate.(Max. 3lpm)

3.Connect the gas burner and place below the calorimeter.

4.Connect the gas regulator to the cylinder.

5.Close the gas controller in the panel and open the gas regulator of the cylinder.

6.Now, slowly open the gas controller and set the pressure of flow. (say 1kg/cm2)

7.Using the Gas flow meter set the rate of flow of the gas.

8.Light the gas burner with the match stick.

9.Conduct the experiment till steady state is reached.

10. Record the gas temperature and cooling water temperature at inlet.

11. Repeat the experiment for different gas and water flow rates and find the average Calorific value.

OBSERVATIONS

Sl.No	Gas Pressure, 'P' kg/cm²	Gas Flowrate, 'Q_g' LPH	Water Flowrate, 'Q_w' LPM	Temperature °C			
				T1	T2	T3	T4
1	1.2	0.4	0.2	32	30	36	63
2	1.2	2.5	0.2	32	30	36	67

CALCULATIONS

1. Heat carried away by the cooling water, Qw

$$Q_W = m_w \times C_{PW} \times (T_2 \sim T_1)$$

Where,

m_w = mass flow rate of water

C_{PW}= specific heat of water = 4180 J/kg-°K

T_2 = Outlet temperature of Water

T_1 = Inlet temperature of Water

$$Q_w = 0.2 \times 4180 \times (36-30)$$

$$83.6w$$

2. Higher Calorific Value of the fuel burnt, HCV @ ROOM TEMPERATURE AND PRESSURE

$$HCV = Q_w/(\text{Vol. Of gas burnt})$$

Where,

Volume of gas burnt = $(Q_g)/ 60$

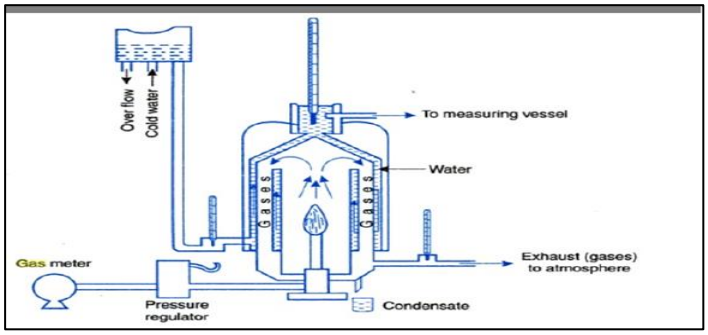
$$\frac{0.4}{60} = 6.6 \times 10^{-3} \text{ kg/sec}$$

RESULTS:

The calorific value given gaseous fuel is 12.66 Kj/kg

PRECAUTIONS

1. Check all the electrical connections before running.
2. Do not run the equipment if the voltage is below 180V.
3. Check the tubing of the gas for any leakage before conducting the experiment.
4. Do not run the equipment if any leakage is found.
5. Light the gas immediately without any delay.
6. Before starting and after finishing the experiment the mains should be off.
7. Do not attempt to alter the equipment as this may cause damage to the whole system.



10a. PENETROMETERAPPARATUS

DESCRIPTION OF THE APPARATUS:

Consistency or yield value is expressed in terms of penetration, which is defined as "the distance in tenth of millimeter that a standard cone or needle penetrates vertically into the sample, under the standard conditions of load, temperature and time. Consistency of a sample depends on the structure and interaction of the gelling elements in it and to some extent on the viscosity of oil used. The consistency is determined by using Penetrometer. The apparatus consists of

1.Heavy base (of cast iron alloy):

It is one which is provided with spirit level, leveling screws and a plain table, over which a box containing the sample under test is placed.

2.**Vertical support** is an iron rod fitted to the base. On this are slotted marks,around which a holder can be moved up and down. The holder has a screw, which can be tightened in any of the slots.

3.**Circular dial:** The holder carries a circular dial gauge, which is graduated in millimeters.

4.**Moving dial rod:** It is arranged behind the dial by a mechanical mechanism. Therod is provided with a clutch arrangement for disconnecting or connecting it to the circular dial.

EXPERIMENTATION:

AIM:

The experiment is conducted to determine the penetration of the given sample with the help of Penetrometer.

PROCEDURE:

The apparatus is leveled, the cone or needle cleaned and the sample under-test, in a box, is placed below the cone or needle. The height of the cone or needle is so adjusted, that the tip of the cone or needle just touches the sample. Initial dial reading is noted. The cone is then released for exact 2 sec , by pressing a button is released and final dial reading is noted. The differences of the two dial readings given the penetration. This is repeated for three times and noted the total penetration in 6 sec.

OBSERVATIONS:

Load (gms.)	**Initial Reading of Dial(d_1) in mm**	**Final Reading of Dial(d_2) in mm**	**Penetration (d_2- d_1) in mm**
0	**0**	**185**	**185**
200	**0**	**223**	**223**
500	**0**	**256**	**256**

RESULT:

Penetration is found to be decreased with increasing load

PRECAUTIONS

1) Clean the tanks regularly after use.
2) Do not run the equipment if the voltage is below 180V.
3) Check all the electrical connections before running.
4) Before starting and after finishing the experiment the mains should be off.
5) Do not attempt to alter the equipment as this may cause damage to the whole system.

10b. DROP POINT OF GREASE

INTRODUCTION:

Dropping point, n—a numerical value assigned to a grease composition representing the temperature at which the first drop of material falls from the test cup; that temperature being the average of the thermometer readings of the sample and bath.

A sample of lubricating grease contained in a cup suspended in a test tube is heated in an oil bath at a prescribed rate. The temperature at which material falls from the hole in the bottom of the cup is averaged with the temperature of the oil bath and recorded as the dropping point of the grease.

In general, the dropping point is the temperature at which the grease passes from a semisolid to a liquid state under the conditions of test. This change in state is typical of greases containing as thickeners soaps of conventional types. Greases containing as thickeners materials other than conventional soaps can, without change in state, separate oil. This test method is useful to assist in identifying the grease as to type and for establishing and maintaining bench marks for quality control. The results are considered to have only limited significance with respect to service performance as dropping point is a static test.

DESCRIPTION OF APPARATUS:

Grease Cup — A chromium-plated brass cup conforming to the dimensions. Test Tube—A test tube of heat-resistant glass,6 with rim, 100 to 103 mm in length and 11.1 to 12.7 mm in inside diameter provided with three indentations about 19 mm from the bottom, equally spaced on the circumference. The depth of these indentations shall be such as to support the grease cup at about the point.

Thermometers, two, having ranges as shown below and conforming to the requirements prescribed in Specification E 1: Thermometer Number Temperature Range ASTM IP 0 to + 360°C

Accessories—A stirred oil bath consisting of a 400-mL beaker, a ring stand and ring for support of the oil bath, clamps for thermometers, two corks ,a polished metal rod 1.2 to 1.6 mm in diameter and 150 to 152 mm in length, a cup plug gage and thermometer depth gage, (Warning—The fluid for the oil bath must have a flash point in excess of the maximum temperature at which the bath is to be used7 and allowance must be made for thermal expansion to prevent overflow. Heating is preferably done by an immersed electrical-resistance heater regulated by voltage control. An open flame must not be used as the heating source.) (Warning—when a hot plate is used, care must be taken to avoid spilling oil on the hot surface.)

EXPERIMENTATION:

AIM:

The experiment is conducted to

This test method covers the determination of the dropping point of lubricating grease

PROCEDURE:

1. Fill a test cup with sample by pressing the larger opening into the grease to be tested until the cup is filled. Remove excess grease with a spatula. Gently press the cup, held in a vertical position with the smaller opening at the bottom, down over the metal rod until the latter protrudes about 25 mm. Press the rod against the cup in such a manner that the rod makes contact at both upper and lower peripheries of the cup. Maintain this contact, rotating the cup on the rod along the index finger to give a spiral-like motion down the rod to remove a conical section of the grease which adheres along the rod. As the cup approaches the end of the rod, carefully slip the rod out of the cup so that a smooth film, free of air bubbles and of reproducible thickness, remains inside the cup.

2. Place the corks on the thermometer to be used in the test tube with the thermometer depth gage in position in the test tube, adjust the position of the upper cork on the thermometer so that the thermometer bulb bottoms snugly in the depth gage. Observe the relative position of the top edge of the upper cork to the thermometer stem as well as the relative position of the top edge of the test tube to the cork. Care must be taken to be certain that the thermometer is inserted to the same depth when the apparatus is reassembled with the grease cup in position.

3. Replace the depth gage with the grease cup so that the thermometer is inserted to the previously gauged depth. When properly inserted, the bulb of the thermometer does not touch either the grease sample or the cup.

4. Suspend the test tube in the oil bath to a depth corresponding to the 76 mm immersion mark on the thermometer. This should leave the test tube rim at least 6 mm above the oil level.

5. Suspend the second thermometer in the oil bath so that its bulb is at approximately the same level as the bulb of the test tube thermometer.

6. Stir the oil bath and heat at a rate of 4 to 7°C/min until the bath reaches a temperature of approximately 17°C below the expected dropping point of the grease. At this point reduce the rate of heating so that the temperature difference between the test tube and the oil bath is maintained between 1 and 2°C. This condition is established when the oil bath is heated at a rate of about 1 to 1.5°C/min. As the temperature increases, material will gradually protrude through the orifice of the grease cup. When a drop of material falls, note the temperatures on the two thermometers and record their average to the nearest degree as the dropping point of the grease.

Reporting

Report the temperature recorded in section (5) C to the nearest 1 deg C as the drop point , IP 31

Precision

Results of duplicate tests should not differ by more than the following amounts

Grease type	repeatability	reproducibility
Lime base grease		
Soda base grease		
Other Greases		

Repeatability—The difference between two test results obtained by the same operator with the same apparatus under constant operating conditions on identical test material would, in the long run, in the normal and correct operation of the test method, exceed the following value only in one case in twenty

Reproducibility—The difference between two single and independent results obtained by different operators working in different laboratories on identical test material would, in the long run, in the normal and correct operation of the test method, exceed the following value in only one case in twenty

Result:

Drop point Temperature of Given Grease 96°C

Precautions:

1) Clean the tanks regularly after use.
2) Do not run the equipment if the voltage is below 180V.
3) Check all the electrical connections before running.
4) Before starting and after finishing the experiment the mains should be off.

11.DISTILLATION APPARATUS

1. INTRODUCTION

ASTM Distillation is the most common method for obtaining distillation data (volume % distilled vs. temperature) of gasoline, naphtha, kerosene and gas oil. In ASTM distillation, 100 ml of sample is distilled at uniform rate of 5ml per min, the distillate is condensed. The temperature of the vapor when the first drop of condensate dripped from the condenser is recorded as the initial boiling point (IBP). The vapor temperature is also recorded as each successive 10% is collected. When 95% has been distilled, the burner flame may need to be increased and the maximum temperature is recorded as the final boiling point (FBP). FBP is an important specification or way of describing gasoline, naphtha or middle distillates.

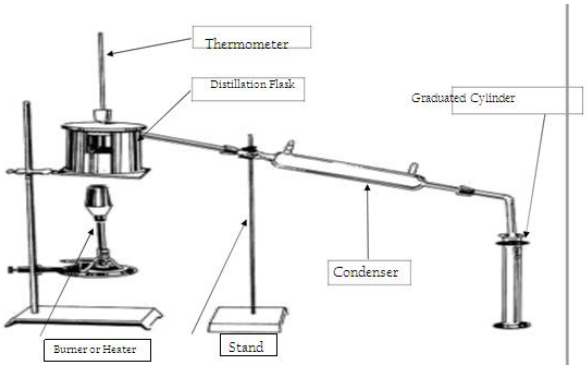
Definitions:

- **Final Boiling Point (FBP):** The maximum thermometer reading obtained during the test. Usually occurs after the evaporation of all liquid from the bottom of the flask.
- **Initial Boiling Point (IBP):** The temperature at the instant the first drop falls from the lower end of the condenser tube.
- **Percent Residue**: Percentage volume of residue left in the flask (measured in accordance with the standard in a 5ml flask).
- **Percent Recovery**: Volume measured after 2 minutes interval to successive observations agrees (measured in accordance with standard method).
- **Percent Total Recovery:** Combination of percent recovery and percent residue in the flask. Deduct from 100 to obtain percentage loss.

DESCRIPTION OF THE APPARATUS:

The apparatus consists of

1. Distillation Flasks.
2. Condenser and Condenser Bath.
3. Heater.
4. Thermometer



EXPERIMENTATION:

AIM:

The experiment is conducted to

1. To determine the percentage of distilled amount against temperature of petroleum product sample.
2. To determine the initial and final boiling points of petroleum sample.
3. To determine the quantity of various fractions of petroleum sample.

.PROCEDURE:

1. Pour the 100ml of prepared sample into the flask, taking care that none of it flows into the vapor tube.
2. We heat this flask in a regulated rate, so that a uniform average rate of condensation in mL/min is maintained.
3. When the first drop appears at the lower end of the condenser tube, the thermometer reading (vapor temperature) is recorded, this temperature is the initial boiling point (IBP).
4. We record the temperature at several Volume% distilled up to the final boiling point (FBP) and heating discontinued.
5. After flask cooled the volume of remaining liquid is measured and recorded as the recovery

OBSERVATIONS:

Volume Percent distilled	Temperature ^{o}C
20	67
40	73
60	77
80	81
100	93

The Final Boiling point of the product = 93^{o}C

Volume Distilled =100mL

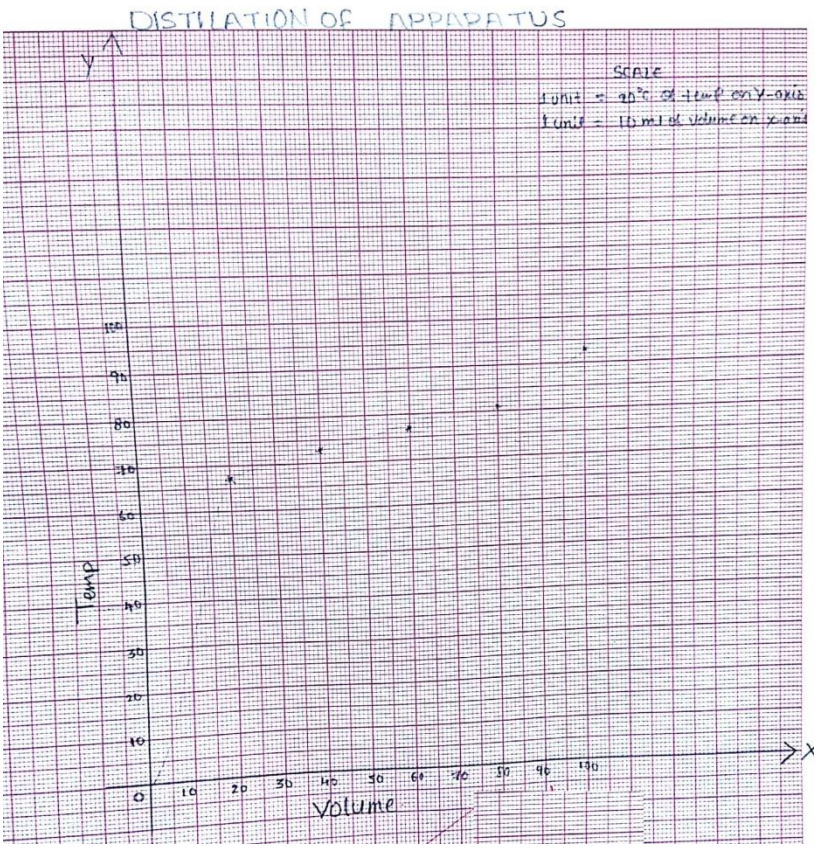
Residue left = 500mL

Evaporated = 100mL

Result:

Boiling range points is important property of petroleum products, when we send the products to the industries, they should have information about the properties of the petroleum products and one of them is the boiling range, and also it's important to take careful from the volatile liquid that are dangerous and toxic.

A plot of volume percent distilled and temperature can be plotted as shown below:



LEAD EXPERIMENT

COMPARISON OF FLASH AND FIRE POINT OF GIVEN FUELS BY USING CLEVELAND FLASH AND FIRE POINT

INTRODUCTION

A flash point can be described as the temperature at which the material gives so much vapor that this vapor with the mixture of air forms an ignitable mixture and gives the momentary flash when exposed to the pilot flame. Cleaveland's apparatus determines the flash and Fire point temperature by adopting the open cup method. This apparatus is suitable for the liquids having flash points between 18º C to 300º C.

DESCRIPTION OF THE APPARATUS:

This apparatus is used for determination of flash point and fire point of petroleum products as per specification IP36 and IS:1448 (P: 69) 1969. The apparatus consists of a cup, heating plate to specific dimension thermometer clip and test flame attachment with swivel joint for passing over test liquid surface in the prescribed manner. Heating is controlled by means of heater regulator provided.

EXPERIMENTATION:

AIM:

The experiment is conducted to compare the flash and fire point of the given fuels by using cleaveland apparatus.

PROCEDURE:

1. Fill the cup with the fluid (under test) by placing the cup on the flat surface till the mark provided.
2. Place the cup in the heater bath and insert the thermometer.
3. Adjust the test flame.
4. Start the heater from the lowest level to heat the bath,
5. Now, slowly open the test flame to the fluid for every 1º C rise in the temperature of the test fluid.
6. Note down the result obtained for every exposure, say Flash or Fire.
7. Stop the experiment after obtaining the fire.
8. Before closing the experiment switch of the heater and allow it cool.
9. Now, remove the cup and clean it for next use.
10. Repeat the steps 1 to 9 for conducting the experiment for different fluids.

OBSERVATIONS:

For 2T oil

Sl. No.	Temperature, T^o C	Result (Flash/Fire)
1	56	Flash
2	76	Fire

For Kerosine

Sl. No.	Temperature, T^o C	Result (Flash/Fire)
1	65	Flash
2	70	Fire

RESULTS:

The flash point of given2T oil is 56˚C

The flash point of given 2T oil is 76 ˚C

The flash point of given kerosene is 65˚C

The flash point of given kerosene 70 ˚C

PRECAUTIONS

1) Clean the tanks regularly after use.
2) Do not run the equipment if the voltage is below 180V.
3) Check all the electrical connections before running.
4) Before starting and after finishing the experiment the mains should be off.
5) Do not attempt to alter the equipment as this may cause damage to the whole system.