LUKHDHIRJI ENGINEERING COLLEGE, MORBI

This is to Certify That

Mr./Miss.
Enrollment Number:
Branch: Chemical Engineering, Semester: 6th , has satisfactorily completed the term work in the subject code: 3160510 and Name: : Petroleum Refining and Petrochemicals Lukhdhirji Engineering College, Morbi.

Date of Submission:

Staff in charge:

Head of Department : Prof. R. K. Mewada

LUKHDHIRJI ENGINEERING COLLEGE, MORBI

VISION

To provide quality engineering education and transforming students into professionally competent and socially responsible human beings.

MISSION

1. To provide a platform for basic and advanced engineering knowledge to meet global challenges.
2. To impart state-of-art know- how with managerial and technical skills.
3. To create a sustainable society through ethical and accountable engineering practices.

LUKHDHIRJI ENGINEERING COLLEGE, MORBI
CHEMICAL ENGINEERING DEPARTMENT

VISION

To develop professionally competent & socially responsible chemical engineers by providing quality education.

MISSION

1. To provide sound basic engineering knowledge to have a successful career in a professional environment.
2. To develop skill sets among the students to make them professionally competent.
3. To cater ethically strong engineers who shall be able to improve the quality of life and to work for sustainable development of society.

PEO's

PEO-1 To impart knowledge and skills in students to make them professionally competent in chemical process industries.

PEO-2 To motivate students for higher studies in technical and management fields.

PEO-3 To prepare students having soft skills along with leadership quality and management ability to make them successful entrepreneurs.

PEO-4 To implant the ethical principle and norms of engineering practices in terms of health, safety, and environmental context for the sustainable development of society.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

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.

PSO

1) Apply the knowledge of chemical engineering to accomplish the contemporary need of chemical & Allied Industries.
2) To execute the chemical engineering principle and modern engineering tools to design system by considering safety, cost, health, legal, cultural and environmental aspects.

Chemical Engineering Department

Laboratory Safety Rules

1. Behave in a responsible manner at all times in the laboratory.
2. Ask your teacher before preceding any activity.
3. Keep silence.
4. Do not touch any equipment, chemicals, or other materials in the laboratory area until you are instructed to do so.
5. Perform only those experiments authorized by your teacher.
6. Do not eat food, drink beverages, or chew gum in the laboratory.
7. Always work in a well-ventilated area.
8. Work areas should be kept clean and tidy at all times.
9. Wash your hands after performing all experiments.
10. Dress properly during a laboratory activity. Long hair, dangling jewelry, and loose or baggy clothing are a hazard in the laboratory.
11. Never look into a container that is being heated.
12. Obey safety rules.
13. After Completion of Experiments turn off equipment properly.
14. Drain Water After Compilation of Experiments.
15. Before Living the Laboratory turns Off Light/Fan.

Undertaking of Ethics

1. I, hereby, promise to abide by the admissible rules and regulations, concerning discipline, attendance, etc. of the L.E.C.MORBI, and also to follow the Code of Conduct prescribed for the Students of the Institute, as in force from time to time and subsequent changes/modifications/amendment made thereto. I acknowledge that, the Institute has the authority for taking punitive actions against me for violation and/or non-compliance of the same.

I have performed all the experiments and their calculation done myself.

Signature of Student

Enrollment of Student

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EXPERIMENT-01

Redwood Viscometer

(CO-3160510.2)

Sem-6
Year-2021-22
L.E.College-Morbi

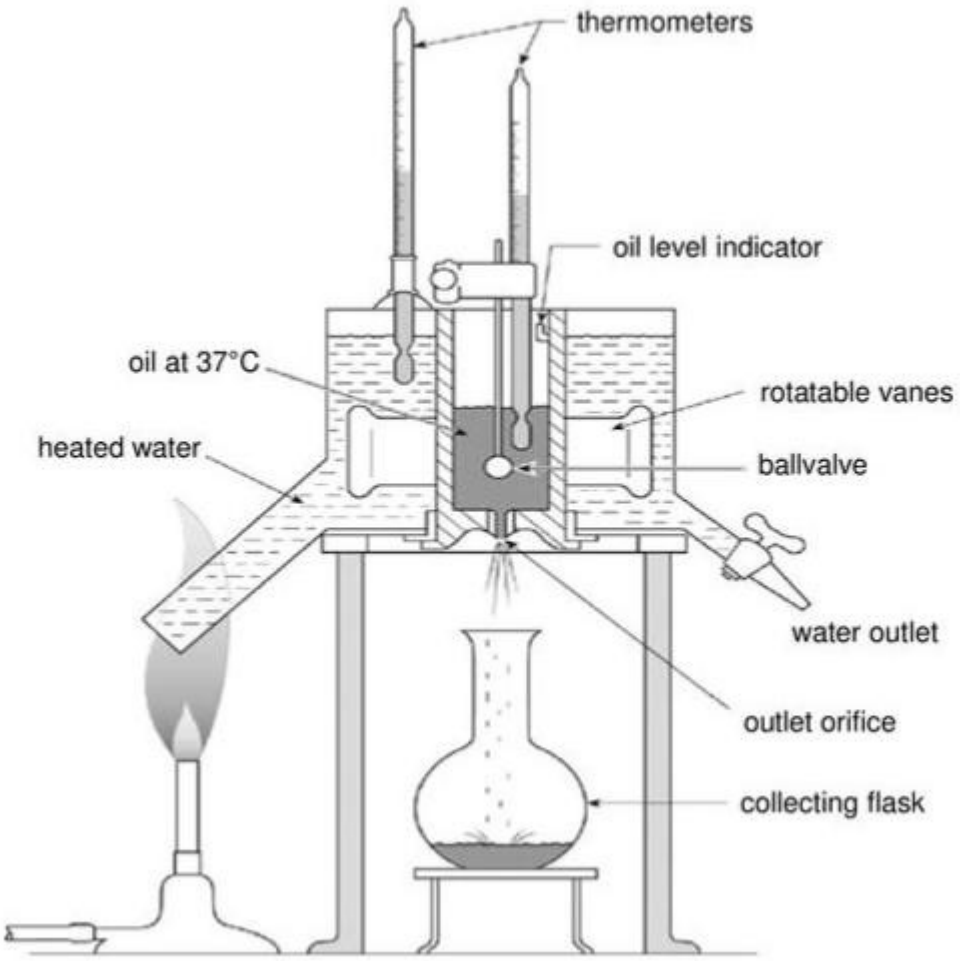


Fig. Redwood Viscometer.

Aim: To determine the viscosity of the given sample using the Redwood Viscometer.

Apparatus: Redwood Viscometer, Measuring cylinder, Thermometer, Stop Watch, Glass beaker.

Chemicals: Petrol, Lubricating oil, Water, Diesel.

Theory:

Viscosity is the property of a fluid that determines its resistance to flow. It is an indicator of flow ability of a lubricating oil; the lowest the viscosity, greater the flow ability. It is mainly due to the forces of cohesion between the molecules of lubricating oil.

Absolute Viscosity is defined as "the tangential force per unit area which is required to maintain a unit velocity gradient between two parallel layers. It is denoted by η(eta). Its Unit in CGS system is poise.

Kinematic Viscosity is the ratio of - absolute (or dynamic) viscosity to density - a quantity in which no force is involved.

Effect of temperature on viscosity:

Viscosity of lubricating oil is inversely proportional to the temperature means with increase of temperature, viscosity decreases. This is due to the decrease in intermolecular attraction. At higher temperature, oil must have sufficient viscosity to carry loads. Hence heavier oils are used at higher temperature. Similarly, light oils are used at low ambient temperature

Significance of viscosity measurement:

- In evaluating load carrying capacity
- In denoting the effect of temperature changes and for determining the presence of contaminants in used oil during service
- Absolute viscosity values are required for use in all bearing design calculations and other lubrication engineering technical design problems.

Redwood Viscometer is normally used for determination of viscosity of petroleum products. It determines the viscosity in terms of seconds (redwood seconds), a time taken by oil to pass through a standard orifice and collection of the same oil in flask. Originally Redwood Viscometer was developed for measurement of viscosity of petroleum products.

Redwood Viscometer is of two types:

1. Redwood Viscometer No.1

(For fluid having viscosity corresponds to Redwood seconds less than2000)

2. Redwood Viscometer No. 2

(For fluid having viscosity corresponds to Redwood seconds greater than 2000)

Time of flow	A	B
40 to 85 seconds	0.264	190
80 to 2000 seconds	0.247	65

Observations:

Sr. No	Temperature	Time (Sec)	Kinematic viscosity	Absolute viscosity
1				
2				

Calculations:

$V = AT – (B / T)$

V = Kinetic Viscosity

= Absolute Viscosity / Density (cm^2 / sec)

T = Time taken (sec)

A = 0.00247

B = 0.50

V= 0.00247 T – (0.50 / T)

Hence, V_1 =

V2 =

Description of the Redwood viscometer:

It is divided in to three parts

1. Oil Cup;

Material-Silver plated brass
Height-90mm
Diameter-46.5mm
It holds the test sample of lubricating oil. The bottom of the cup is fitted with polished-agate discharge tube containing an orifice of specified dimension.

2. Water Bath

Oil cup is surrounded by water bath for adjusting the temperature.

3. Kohlrausch Flask

It receives the oil from polished-agate discharge tube.

Procedure:

- Clean oil cup with Hexane, dry it with tissue paper or any other suitable material.
- Level the instrument with the help of provided spirit level.
- Prepare the test sample by passing it through the filter of the metal gauge, not lower than 100 mesh pour oil.
- On attaining the test temperature of the oil, place oil cup and swing thermometer towards closed cover.
- Place clean dry 50 ml flash receiver below jet.
- Open the outlet hole by lifting up the ball valve from its closing state.
- Record time taken from the drop of the fixed outlet of sample. Also note down the test temperature.
- Repeat the same procedure with the other petroleum product to find out the viscosity.

Applications:

Red wood viscometer apparatus is widely used in Petroleum laboratories, Industries, Oil Refineries, Educational Institutions

Result:

Sr no.	Kinematic viscosity	Absolute viscosity

Conclusion:

Questions:

1. What is viscosity? Define absolute viscosity.
2. What is viscosity index? How viscosity index is determined?
3. Name few lubricants with high and low viscosity index.

EXPERIMENT-02

Saybolt Viscometer

(CO-3160510.2)

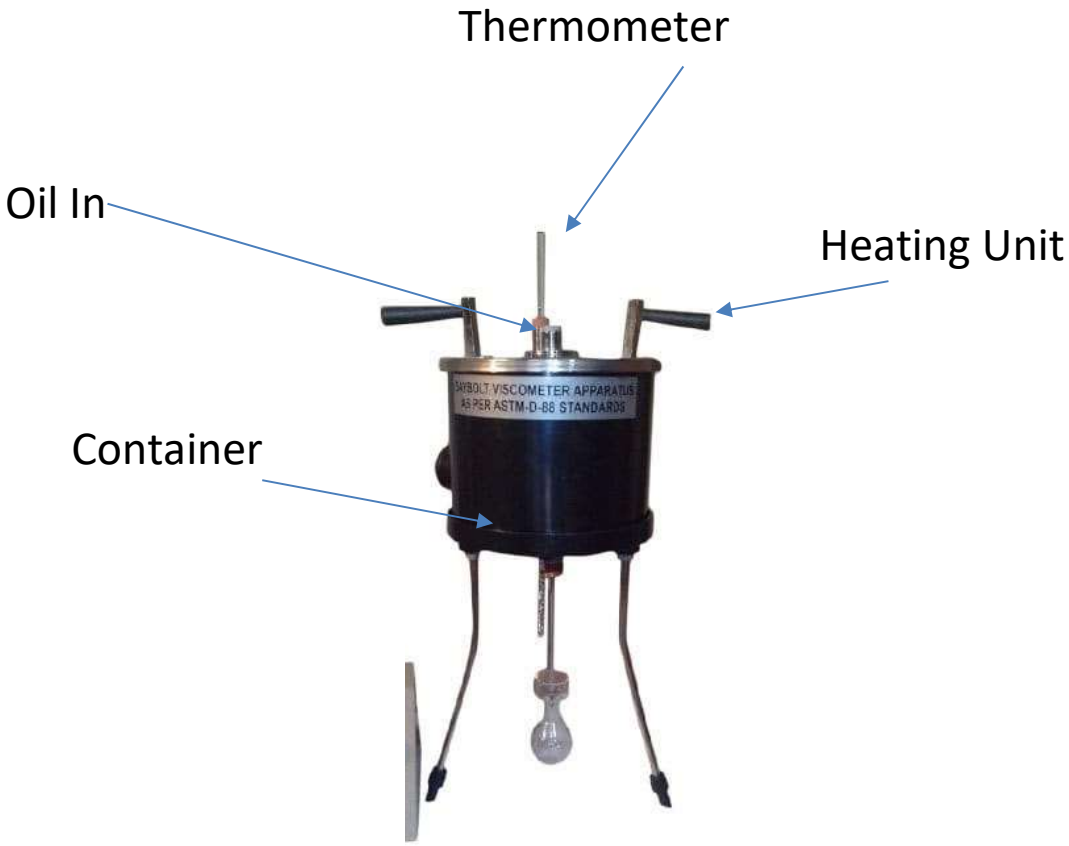


Fig. Saybolt Viscometer

Aim: To determine the viscosity of the given oil sample using saybolt viscometer.

Apparatus: Saybolt viscometer, Thermometer

Chemicals: petrol, Diesel, Lubricating Oil

Theory:

- Viscosity is an important property of all lube oils. Lubrication assists in removing the frictional forces between two moving bodies.
- Viscosity is defined as the force in dynes required to maintain 1 cm^2 plane, with a unit velocity gradient from another similar plane separated by a distance of 1 cm.
- All the laboratory viscometers like U – tube, Pensky, Red wood, Engler give kinematic viscosity however saybolt, universal viscometers.
- However saybolt, universal viscometer gives the time. In records for 60 CCsample reflux, through a standard orifice at a given temperature and is expressed as seconds saybolt universal (SSO).

Procedure:

- The oil tube shall be first cleaned with an effective solvent, excess solvent should be removed.
- Fill the oil with the oil sample by passing it through the 100 mesh wire strainer.
- The bottom cork must be fitted tightly to prevent any loss of the oil.
- The size of the cork should not be less than 0.25 in and greater than 218 inch.
- Fill the water bath with water up to the sufficient level.
- Start the heating and observe the temperature of the bath and oil bath.
- Open the bottom cork and collect the oil sample in flask of given volume.

Observations:

Sr. No	Sample	Time (Sec)	Temperature(^oC)	V
1	**Petrol**			
2	**Diesel**			
3	**Lubricating Oil**			

Calculations:

$V = AT – (B / T)$

V = Kinetic Viscosity

= Absolute Viscosity / Density (cm^2 / sec)

T = Time taken (sec)

A = 0.00247

B = 0.50

V= 0.00247 T – (0.50 / T)

Hence, V_1 =

V_2 =

V_3 =

V_4 =

Result:

The viscosity of the given sample is _____

Conclusion:

Questions:

1. What is viscosity? Discuss importance of the same w.r.t. lube oils.
2. Write down the different formula used to find out the viscosity.
3. What are the factors affecting the viscosity?
4. What do you understand by relative viscosity and kinematic viscosity?
5. Which chemicals are used to reduce the viscosity of oil?

EXPERIMENT-03

Softening Point

(CO-3160510.2)

Sem-6
Year-2021-22
L.E.College-Morbi

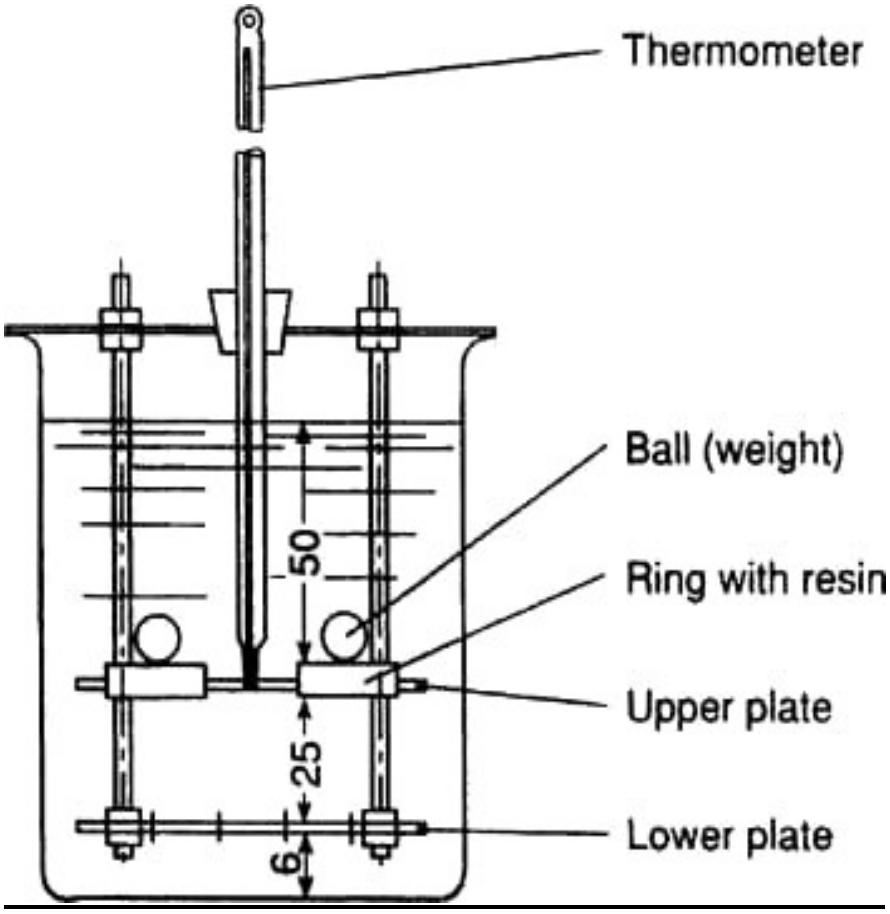


Fig. Ring and Ball Apparatus

Aim: To determine the softening point of lubricating grease.

Apparatus: Ring and ball apparatus, heating mantle, Glass beakers (500 ml), Thermometer, Scrapper.

Chemicals: Lubricating Grease

Theory: The softening point is the temperature at which a material softens beyond some arbitrary softness.

It can be determined, for example, by the following method:-

1. The Vicat method
2. The Heat Deflection Test
3. The Ring and Ball Method

A ring and ball apparatus can also be used for the determination of softening point of bituminous materials. The purpose behind performing the ring and ball test is to determine the temperature at which a given material will soften. The apparatus needed for this test is ring and ball apparatus.

The ring and ball apparatus consist of following:

- Steel balls – two numbers each of 9.5 mm dia. And weighting 3.5 ± 0.05 g.
- Brass rings – two numbers of the ring each having depth of 6.4 mm. The inside diameter at the bottom is 15.9 mm and the top is 17.5 mm.
- Ball guides – to guide the movement of steel balls keeping it in the center.
- Support– that can hold rings in position and this also helps for suspension of a thermometer. The distance between the bottom of the rings and top surface of the bottom plate of the support is 25 mm.
- A thermometer that can read up to 100 ºC with an accuracy of 0.2 ºC.
- Bath – A heat resistance glass beaker not less than 85 mm in diameter and 1220 mm in depth.
- Stirrer

Significance:-

Softening point has particular significance for materials to be used as joint and crack fillers. Higher softening point ensures that they will not flow during service. Higher the softening point, lesser the temperature susceptibility. Bitumen with higher softening point is preferred in warmer places.

Observation

1. Sample taken:_____
2. Room Temperature:_____°C
3. Barometeric Pressure:_____mmHg

Observation Table:

Sr. No.	Test Observation	Result (^{o}C)
1	Temperature at which first ball drop down	
2	Temperature at which second ball drop down	

Procedure:

- Take water in beaker to fill it slightly more than half.
- Put it on heating mantle.
- The screwed provided in the ring must adjusted in such a way that they can provide a diameter equal to the ball and the clearance gap width should be negligible. So that the only ball could pass through the ring having negligible thick larger of the grease sample.
- Take grease to be study in the ring of the apparatus and put ball over the grease in the ring.
- Switch on the heating mantle and allow temperature of water to rise slowly.
- As the temperature increases the grease in the ring softens and at a certain temperature the ball drops down through the ring.
- Note down this temperature as a softening point of grease.

Result:

Average softening point of given lubricating grease = _____.

Conclusion:

Questions:

1. What is Softening Point?
2. What is Significance of Softening point?
3. What is the range of Softening point of asphalt?

EXPERIMENT-04

Cloud and Pour Point Apparatus

(CO-3160510.2)

Sem-6
Year-2021-22
L.E.College-Morbi


Sample
Outlet
Name of Laboratory
PETROLEUM REFINING & PETROCHEMICAL
Name of Instrument
CLOUD AND POUR POINT APPARATUS
Purchase Date
27/04/2015
Supplier Name
LABLINE TECHNOLOGIES PVT. LTD.
Instrument Number
TEQIP-II/LEC_CHEM_CLOUD AND POUR POINT APPARATUS/01
Amount
8268.75
LAB LINE TECHNOLOGIES
AHMEDABAD

Aim: To determine the cloud and pour point of the given sample of oil.

Apparatus: Cloud point and pour point apparatus, Thermometer

Chemicals: Oil sample (Coconut oil), Ice, Salt

Theory:

Cloud point:
It can be defined as that temperature at which a cloud or haze of wax crystal appears at the test when the oil is cooled under prescribed condition.

In the petroleum industry, **cloud point** refers to the temperature below which wax in diesel or bio-wax in biodiesels forms a cloudy appearance. The presence of solidified waxes thickens the oil and clogs fuel filters and injectors in engines. The wax also accumulates on cold surfaces (producing, for example, pipeline or heat exchanger fouling) and forms an emulsion with water. Therefore, cloud point indicates the tendency of the oil to plug filters or small orifices at cold operating temperatures.

In crude or heavy oils, cloud point is synonymous with wax appearance temperature (WAT) and wax precipitation temperature (WPT). Cloud point is always expressed in multiple of 2^{o}.

Significance:-

The cloud point is important for determining storage stability. The presence of other components in a formulation can depress or increase the solution's cloud point.

Pour point:

The pour point of a crude oil, or a petroleum fraction, is the lowest temperature at which the oil will pour or flow when it is cooled, without stirring, under standard cooling conditions. Pour point represents the lowest temperature at which oil is capable of flowing under gravity. It is one of the important low-temperature characteristics of high-boiling fractions. When the temperature is less than the pour point of a petroleum product, it cannot be stored or transferred through a pipeline. Standard test procedures for measuring pour points of crude oil or petroleum fractions are described in the ASTM D97 (ISO 3016 or IP 15) and ASTM D5985 methods. In crude oil a high pour point is generally associated with a high paraffin content, typically found in crude deriving from a larger proportion of plant material. Pour point is always expressed in multiple of 3^{o}.

Observation Table:

1. Sample taken: _____
2. Sample volume: _____ml
3. Room Temperature: _____ ºC
4. Barometric Pressure: _____ mm Hg
5. Time Taken: _____ min

Sr. No.	Test Observation	Test Result (ºC)
1	Temperature at which first crystal form (Cloud Point)	
2	Temperature at which sample unable to have regular flow (Pour Point)	

Significance:-

The pour point is important in appraising flow properties at low temperature. As such, it can become the determining factor in selecting one lubricant from among a group with otherwise identical properties.

Procedure:

Cloud point:

- Bring the oil sample to be tested to a temperature of at least 14^0C above the approximate cloud point, remove any moisture present by any suitable method such as by filtration through dry filter paper until the oil is perfectly clear, but make such filtration at a temperature of at least 14^0C above the approximate cloud point.
- Pour the clear oil into the test jar up to the marked level. Close the test jar tightly by the cork carrying suitable test thermometer. Adjust the position of the cork and the thermometer such that the cork fits tightly, the thermometer and the jar are co axial, and the thermometer bulb is resting on the bottom of the jar.
- Put the test jar in an ice bath with a temperature of about –1 to 0 ^{o} C. Observe the jar at short intervals of time. When distinct cloud appears, the corresponding temperature is the cloud point of that oil sample.

Pour point:

- Fill the oil into the test jar up to the marked level.
- Close the jar tightly with the cork-carrying thermometer.
- The thermometer & jar should be co-axial and the bulb of thermometer should reside on the bottom of the jar.
- Put the test jar in an ice bath with a temperature of about –1 to 0^o C.
- Observe the jar at short intervals of time. The formation of wax will take place. Take out the jar and keep on the horizontal plane for 5 seconds.
- If the sample shows any movement, replace the test jar immediately in the bath.
- Note down the temperature at which the oil just starts to cease the flow while keeping horizontal, the corresponding temperature is the pour point of the given sample of oil.

Result:

Cloud point of the coconut oil: _____ ºC
Pour point of the coconut oil: _____ °C

Conclusion:

Questions:-

Q1. Define: Cloud point and Pour point.

Q2. Why Cloud point is measured ?

Q3.What are the factors affecting the pour point of crude oil ?

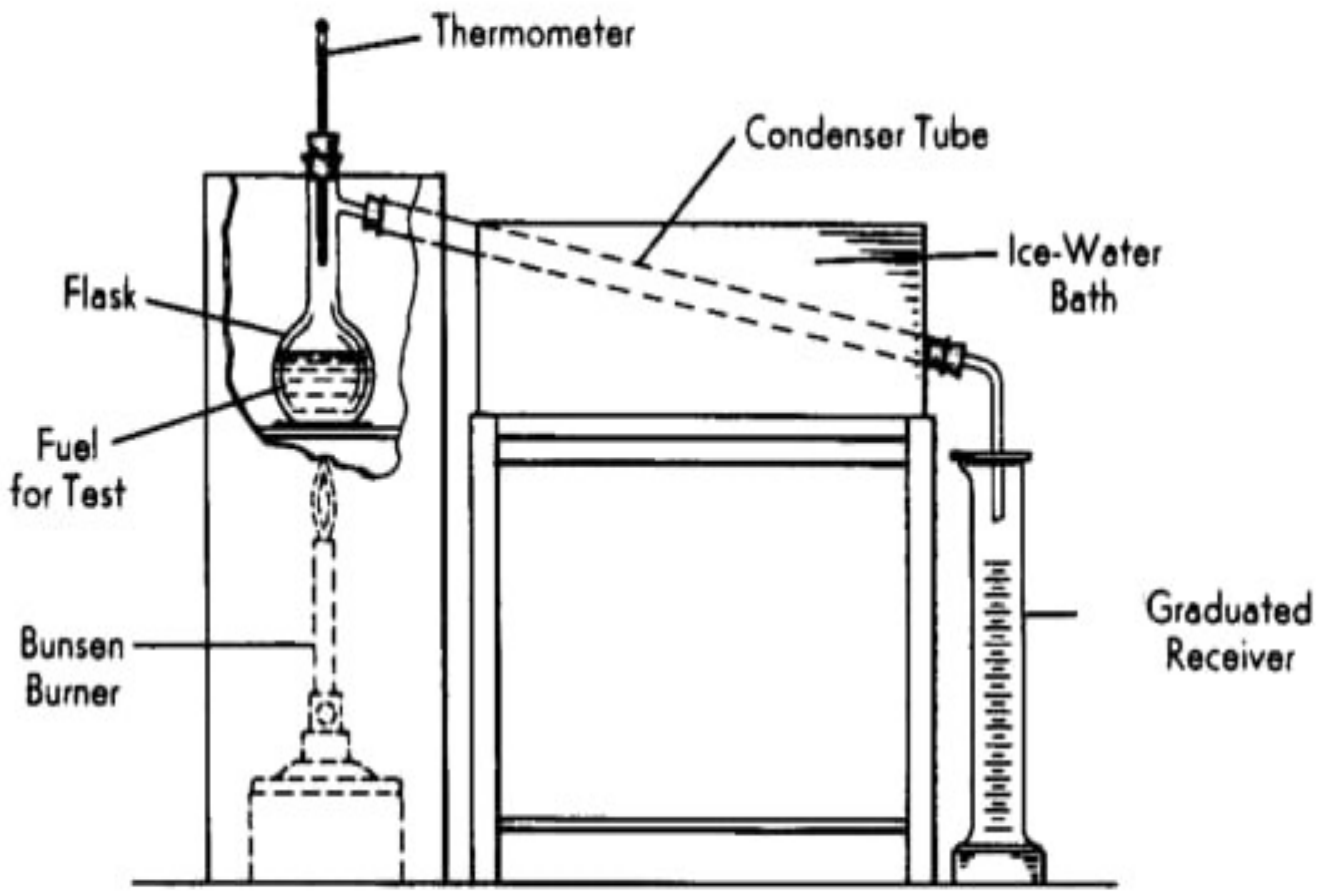
EXPERIMENT-05

ASTM Distillation

(CO-3160510.2)

Sem-6
Year-2021-22
L.E.College-Morbi

Figure: ASTM Distillation



Aim: To study the distillation characteristics of light petroleum product by Distillation.

Apparatus: Distilling flask, condenser,100 ml graduate measuring cylinder, beaker, thermometer, temperature controling device, petroleum sample.

Chemicals: petrol , diesel , kerosene

Theory:

Significance of this exp.varies from product to product. In case of crude oil distillation gives some idea of the fraction that could be collated below 300 0C. If it is true B.P. (T.B.P.) distillation the T.B.P. curve reveals a lot of characteristics that are useful for the design of refinery.

Test Method:

Based on its composition, vapour pressure, expected IBP or expected EP, or combination thereof, the sample is placed in one of four groups. Apparatus arrangement, condenser temperature, and other operational variables are defined by the group in which the sample falls.
A 100-mL specimen of the sample is distilled under prescribed conditions for the group in which the sample falls. The distillation is performed in a laboratory batch distillation unit at ambient pressure under conditions that are designed to provide approximately one theoretical plate fractionation. Systematic observations of temperature readings and volumes of condensate are made, depending on the needs of the user of the data. The volume of the residue and the losses are also recorded.
At the conclusion of the distillation, the observed vapour temperatures can be corrected for barometric pressure and the data are examined for conformance to procedural requirements, such as distillation rates. The test is repeated if any specified condition has not been met.
Test results are commonly expressed as percent evaporated or percent recovered versus corresponding temperature, either in a table or graphically, as a plot of the distillation curve.

Scope:
This test is intended for the determination of the distillation characteristics of natural, gasoline, aviation and motor fuel, special boiling point spirit, white spirit, kerosene and petroleum distillates having volatilities intermediate between those of kerosene and lubricating oil.
Three methods are prescribed they differ according to the volatility of the product being tested. Method A is recommended for natural gasoline and similar petroleum products, method B for aviation and motor fuels, special boiling point spirit and kerosene and method C for gas oil and
CALCULATION AND REPORTING:

Report the data recorded according to requirements. In case of dispute, correct for variations in the barometric pressure, but make no emergent system thermometer corrections.

Observations:

1. Volume of sample taken= _____ ml
2. Volume of distillate=_____ ml
3. Volume of distillate + residue=_____ ml
4. Loss in volume distillation=_____ ml
5. Initial boiling point=_____
6. Final boiling point=_____

Observation table:

SR NO.	SAMPLE	COLLECTED VOLUME	TEMPERATURE	CORRECTED VOLUME
1.		**0 ml**		
2.		**5 ml**		
3.		**10 ml**		
4.		**50 ml**		
5.		**Up to 75 ml**		

similar distillate fuel oils which have volatilities intermediate between those of kerosene and lubricating oil.

Terminology:

For the purpose of these methods, the following definitions shall apply.

DRY POINT:

The temperature indicated by the distillation thermometer when the last drop of liquid leaves the bottom of the distillation flask.

FINAL BOILING POINT:

Maximum temperature indicated during the distillation.

INITIAL BOILING POINT :

The temperature indicated by the distillation thermometer at the instant the first drop of condensate leaves the end of the condenser tube.

OUTLINE OF METHODS:

The sample is distilled in specified apparatus under prescribed conditions of heat input and rate of distillation. One hundred millimeters of the sample are distilled in method A and method B, and 200 ml in method C. temperature are observed on the specified total immersion thermometer in order to obtain the initial and final boiling points of the distillation and the dry point if required. Either the percentage of distillate recovered at prescribed temperature intervals or the temperature at which prescribed percentages of distillate are collected in the receiver are recorded. Correction of the observed temperatures for incomplete immersion of the thermometer is not made.

PREPARATION OF SAMPLE:

Collect the sample in a previously cooled bottle preferable by immersing the bottle in the liquid and discarding the first sample. When immersion is not possible draw off the sample into a previously cooled bottle, keeping agitation at a minimum. Close the bottle mmediate with a tight stopper and place it in ice bath or a refrigerator to bring the sample to a temperature between 0° and 5° C.

Significance and Use:

The basic test method of determining the boiling range of a petroleum product by performing a simple batch distillation has been in use as long as the petroleum industry has existed. It is one of the oldest test methods under the jurisdiction of ASTM Committee D02, dating from the time when it was still referred to as the Engler distillation. Since the test method has been in use for such an extended period, a tremendous number of historical data bases exist for estimating

CALCULATION:

1. % recovery of distillate=_____%

(Vol. of distillate / Vol. of sample) × 100

2. % residue=_____%

= (vol. of residue / Vol. of sample) × 100

3. % total recovery=_____%

=(Vol. of distillate + vol. of residue / Vol. of sample) × 100

4. % loss=_____%

100 - % total recovery

end-use sensitivity on products and processes.

The distillation (volatility) characteristics of hydrocarbons have an important effect on their safety and performance, especially in the case of fuels and solvents. The boiling range gives information on the composition, the properties, and the behaviour of the fuel during storage and use. Volatility is the Major determinant of the tendency of a hydrocarbon mixture to produce potentially explosive vapours.
The distillation characteristics are critically important for both automotive and aviation gasoline's, affecting starting, warm-up, and tendency to vapour lock at high operation

Volatility, as it affects rate of evaporation, is an important factor in the application of many solvents, particularly those used in paints.

Distillation limits are often included in petroleum product specifications, in commercial contract agreements, process refinery/control applications, and for compliance to regulatory rules.

Procedure:

- Take a 100 ml of the sample in the distillation flask.
- Heat this flask at a regulated rate, so that a uniform average rate of condensation in ml/min is maintained.
- When the first drop appears at the lower end of the condenser tube, record the reading(vapour temperature) of thermometer.
- Consider this temperature as initial boiling point.
- Record the temperature at different volume% of condensed liquid.
- Note down the highest temperature of distillate at which no more vapour can be driven over into the condensing apparatus.
- Consider this temperature as final boiling point.
- After cooling the flask remaining volume of the liquid is measured and and recorded as the recovery.

$$C=0.00012\ (760-P)\ (273+t)$$

Where

C = the correction to be added to the observed temperature c; and

P= actual barometric pressure in millimeter of mercury

Table 1 is a convenient approximation of the corrections as calculated from the above. equation.

Result:

(1) Initial boiling point =_____°C
(2) End boiling point = _____°C
(3) % total recovery =_____%
(4) % recovery=_____%
(5) % residue=_____ %
(6) % loss=_____ %

Conclusion:

Questions:

1. Define: (a) Initial Boiling Point (b) Final Boiling Point
2. What is A.S.T.M. distillation? What is the importance of the same?
3. List out the other different types of distillations used for the petroleum product analysis.
4. How will you utilize ASTM data to estimate flash point of any fuel?
5. Ease of starting is governed by which parameter of ASTM distillation?
6. Which chemicals are used as pour point depression?

EXPERIMENT-06

Aniline Point

(CO-3160510.2)

Sem-6
Year-2020-21
L.E.College-Morbi

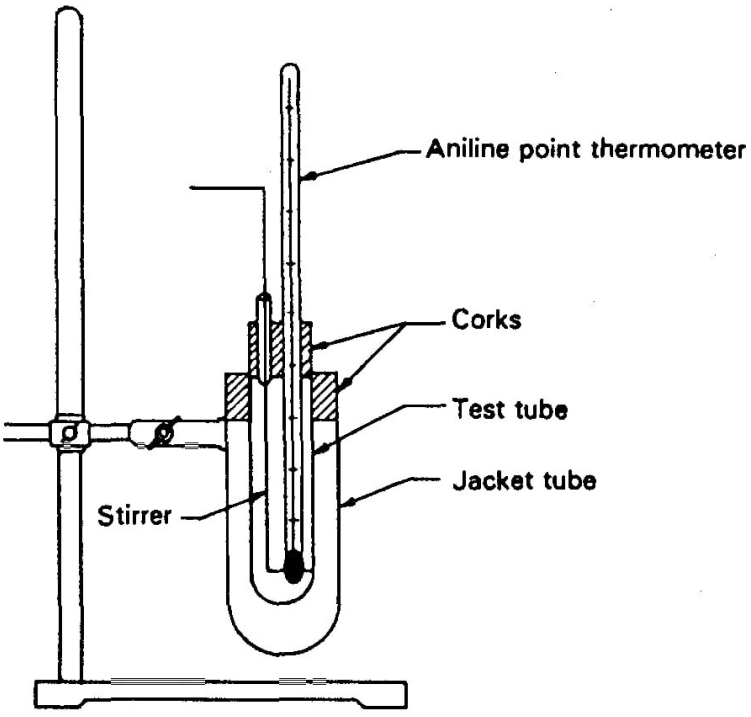


Fig. Aniline point Apparatus

ANILINE POINT TEST APPARATUS (BY U-TUBE METHOD)

AIM: To determine the Aniline point of the given sample.

APPARATUS: Test tube, heating and cooling bath, Thermometer, Glass U tube , Lighting System , Glass Bath (jar).

CHEMICALS: Aniline, Petroleum product sample (Petrol , Diesel , Kerosene)

THEORY:

The Aniline point of oil is defined as the minimum temperature at which equal volumes of Aniline and Lubricant oil are miscible, i.e. form a single phase upon mixing.

The value gives an approximation for the content of aromatic compounds in the oil, since the miscibility of aniline, which is also an aromatic compound, suggests the presence of similar (i.e. aromatic) compounds in the oil. The lower the aniline point, the greater is the content of aromatic compounds in the oil.

The aniline point serves as a reasonable proxy for aromaticity of oils consisting mostly of saturated hydrocarbons (i.e. alkanes, paraffins) or unsaturated compounds (mostly aromatics). Significant chemical functionalization of the oil (chlorination, sulfonation, etc.) can interfere with the measurement, due to changes to the solvency of the functionalizedoil.

OPTIONAL ACCESSOIRES TO BE REQUIRED WITH INSTRUMENT:

- Pipette for suction of liquid.
- Thermometer
- Aniline Solution

ASSEMBLY OF INSTRUMENT:

- First fix up Lighting System in Vertical rod.
- Then Fix up FHP electric motor stirrer on rod.
- Set up heater unit and glass water bath and cover in its Position.
- Clamp the U tube.

SIGNIFICANCE:

- To determine aromatic content of oil.
- If the aniline point is lower than the aromatic content is higher and vice v

OBSERVATIONS:

1. Room temperature……..°C
2. Barometric pressure……..mm Hg

OBSERVATION TABLE:

Sr.no	Test observation	Result of test(°C)
1	Temperature at which aniline and given sample is completely mixed	

CALCULATIONS:

Diesel Index = Aniline Gravity Product/100

Aniline Gravity Product = Aniline Point in °F x API Gravity

PROCEDURE:

- Put on electric stirrer, light connection on back side of control box.
- The FHP motor stirrer is lowered in bath (jar) and so adjusted that stirrer is within the glass test tube.
- Another stirrer on just behind U tube.
- By adjusting position of U tube when both stirrers can be moved freely. Charge 10 ml. of dried sample and 10ml. Aniline solution.
- Place thermometer on the other end of tube.
- Stir the Aniline sample mixture and heat the bath so that temperature of mixture rises slowly.
- When the mixture becomes clear enough for the wire or thermometer bulb to be visible trough the cell.
- Close the heating source and allow mixture to cool at the rate of 1°C per minute and stirring it rapidly.
- Record the temperature at which the wire or thermometer bulb just becomes obscure by the turbidity of the mixture as the Aniline point of oil.
- Repeat the operation until three readings agree within 1°C.

RESULT: Aniline point of the given sample of diesel……..

CONCLUSION:

Questions:

1.What is Aniline Point? Give the Significance of Aniline point.

2.What is significance of diesel index? What is it's effect on ignition quality of fuel?

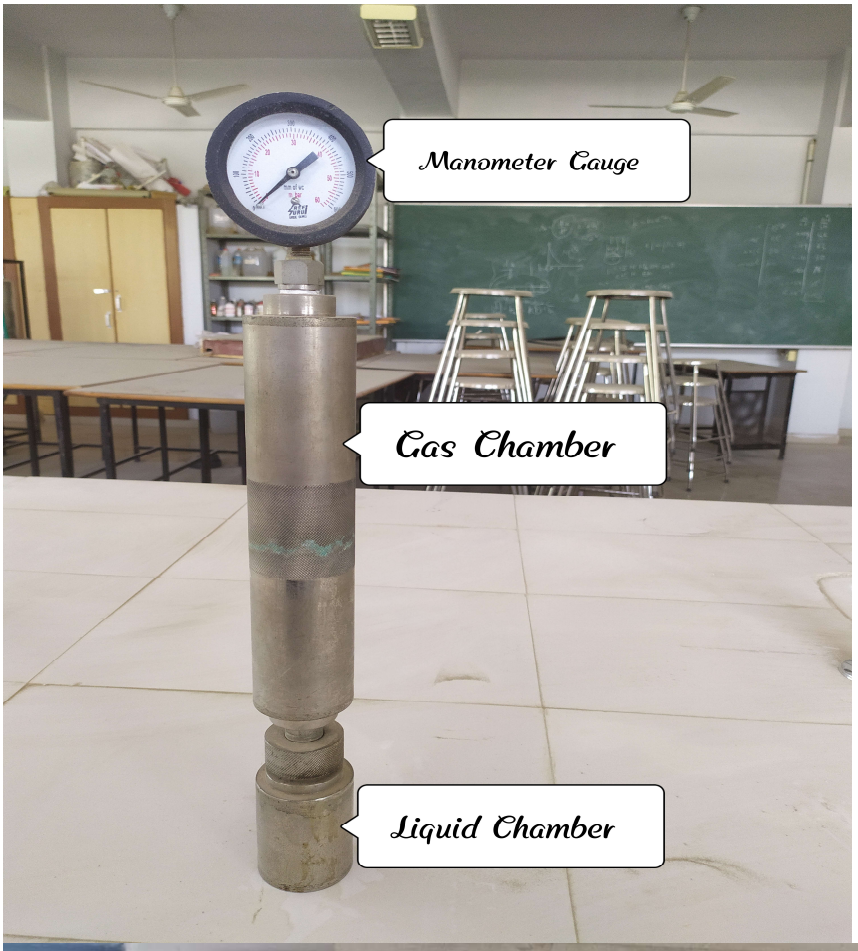
3.How to calculate diesel index from Aniline point?

Experiment-07

Reid vapor pressure

(CO-3160510.2)

Sem-6
Year 2020-21
L.E.College-Morbi


Manometer Gauge
Gas Chamber
Liquid Chamber


STANDARD
MAINS
SHIVAKI
Lab Tech
TEGIP-II/LEC-CHEM-RIED VAPOUR PRESSURE TEST APPARATUS

Aim: To determine the Reid vapor pressure of petroleum products

To compare the Reid vapor pressure of different petroleum products

Apparatus :

- Air Chamber approximately 2" in diameter & 10" high made of brass nickel plated. At one end the pressure gauge & at the other end gasoline chamber may be fitted.
- Gasoline chamber without cock of similar dimension.
- Pressure gauge-bourdon type 2" dial. The range of the gauge will depend on the sample to be tested.
- Heater bath of such dimension that the air chamber with the gasoline chamber is fully immersed and maintained at the temperature 37.8°C

Chemical :different types of petroleum product like petrol, diesel, kerosene & different types of oil.

Theory:

1. Vapor Chamber (Upper section)

A cylindrical vessel with inner surfaces of the ends slightly sloped to provide complete drainage from the either end when held in a vertical position. On one end of the vapor chamber, a gauge coupling is provided to a gauge connection. In the other end of the r chamber, an opening is provided
for coupling with the liquid chamber.

2. Liquid Chamber (Lower section)

A cylindrical vessel with inner surface of the coupling end is sloped to provide complete drainage when inverted. In one end of the liquid chamber an opening is provided for coupling with the vapor chamber. The other end of the chamber shall be completely closed.

Note: To maintain the correct volume ratio between the vapor chamber and the liquid chamber, paired chambers shall not be interchanged without recalibration to ascertain that the volume ratio is within the required limits.

Figure 1: Vapor Pressure Apparatus

3. Pressure Gauge

The range and graduations of the pressure gauge shall be governed by the vapor pressure of the samples being tested in accordance with Table 1. When the gauge reading differs from the pressure measuring device reading or dead weight tester reading when testing gauge above 180kPa (26psi), by more than 1% of the scale range of the gauge, the gauge shall be considered inaccurate.4.

Observation :

Sample taken :
Temperature given :
Vapour pressure of product :

Observation Table:-

Sr no	Sample	Temperature of the bath °C	Vapor pressure of product Kg/cm²
1			
2			
3			

4. Water Bath

A large chamber where the vapor pressure apparatus can be immersed horizontally to at least 1inch above the top of the vapor chamber. The water bath should be maintained at a constant temperature of 37.8oC (100oF).

The vapor pressure apparatus shall rotate at its axis 350oC in one direction and then 350oC in the opposite direction in repetitive fashion.

Experiment Material

1. Diesel
2. Kerosene / Petrol
3. Lubricating oil

Procedure

Preparation of the vapor pressure apparatus

1. Fill up the liquid chamber with oil sample (Diesel).
2. Assemble the liquid chamber to the vapour chamber together with a transducer

connector. 3.Fill up the water bath with ¾ water.

4. Switch on the main plug and the machine.
5. Press the „HEAT" and „START" button on the bath control unit and wait for the bath temperature reaches 37.8oC.
6. Assemble the vapor pressure apparatus into the water bath. Make sure the vapor Pressure apparatus is immersed completely (1inch above the vapor chamber).
7. Press the „TEST", „STIRRER" and „START" button on the bath control unit.
8. Wait for the pressure readings to be stable or 5 minutes until the readings stabilized.
9. Record the results from the pressure digital meter (kPa/psi).
10. Repeat step 1 until 9 for different type of oil (diesel, kerosene/petrol, lubricating oil).

Shut Down

1. Press „TEST", „STIRRER", „HEAT" and „START" button on the bath control unit. (Make sure to follow the sequence).
2. Turn off the machine.
3. Release the water in the water bath.
4. Switch off the main plug.

RESULT:

The vapor pressure of the sample product is = _____kg/cm²

Conclusion :

Questions:

1. What is the difference between Reid Vapour Pressure (RVP) and True Vapour Pressure (TVP)?
2. Discuss the relationship of Reid Vapour Pressure (RVP) between diesel, kerosene, petrol and lubricating oil.
3. Discuss the effects of Reid Vapour Pressure (RVP) on engine performance.

EXPERIMENT-08

Cleveland Open Cup Apparatus

(CO-3160510.2)

Sem-6

Year-2021-22

L.E.College Morbi

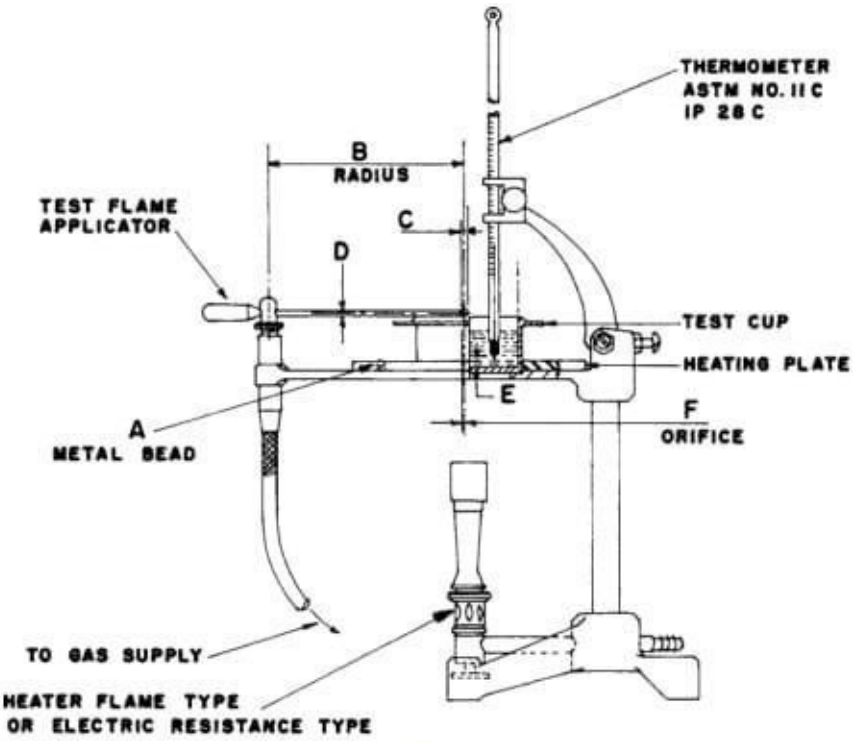


Fig.: Claveland open cup Apparatus

Aim:- To determine flash and fire point of petroleum product by Cleveland (open) cup method.

Apparatus: - Cleveland open cup apparatus, thermometer, beaker, petroleum sample.

Chemicals: - Petrol**,** Diesel, kerosene.

Theory:-

This method describes the procedure for determining the flash and fire points of petroleum products. Except fuel oils and those products having an open cup flash point below 70°C.

Fire point may be considered as the lowest temperature of the liquid at which vapor combustion and burning commences (at least for 5 sec.). A fire point happens when an ignition source is applied and the heat produced is self-sustaining, as it supplies enough vapors to combine with air and burn even after the removal of the ignition source.

The flammability of a substance is therefore characterized by:

The conditions under which a substance can be ignited and those under which it continues to burn – known respectively as the FLASH POINT and FIRE POINT.

The concentration range over which the vapor/oxidant mixture is flammable, i.e. the upper and lower flammability limits. These limits vary depending on the oxidant, pressure and the minimum oxygen concentration required for the combustion reaction.

Due to the importance of flash point test results for safety and regulatory purposes, the testmethod identification should always be included with the test result.

The fundamental reason for the requirement of flash point measurements is to assess the safety hazard of a liquid or semi-solid with regard to its flammability and then classify the liquid into a group. The lower the flash point temperature, the greater the risk. This classification is then used to warn of a risk and to enable the correct precautions to be taken when using, storing or transporting the liquid.

Specifications quote flash point values for quality control purposes as well as for controlling the flammability risk. A change in flash point can indicate the presence of potentially dangerous volatile contaminants or the adulteration of one product by another.

Observations:-

Sample taken = Diesel

Observation table :-

Sr. No.	Temperature °C	Flash Observed

Sr. No.	Temperature °C	Fire Observed for continuous 5 sec

The classification of chemicals including petroleum products helps to identify the hazards of a substance or preparation. It is important that the classification of the hazard is correct, otherwise the label, safety data sheet and the packaging may be incorrectly assigned.

The Cleveland open cup method is one of the three main methods in chemistry for determining the flash point of petroleum product using Cleveland open cup apparatus or Cleveland open cup tester. First the cup of the apparatus is filled to a certain level with a portion of product. Then temperature of this chemical is increased rapidly & then at a slow, constant rate as it approaches the theoretical flash point. The increase in temperature will cause the chemical to begin to produce flammable vapor in increasing quantities & density. The lowest temperature at which a small test flame parsing over the surface of the liquid causes the vapor to the ignite is considered the chemicals flash point. This apparatus may also be used to determine the chemicals fire point which is considered to have been reached when the application of the test flame produces at least five continuous seconds of ignition.

OUTLINE OF THE METHOD :-

The test cup is filled to specified level with the sample. The temperature of the sample is increased fairly rapidly at first and then at a slow constant rate as the flash point approached at specified intervals. A small test flame is pressed across the cup the lowest temperature at which application of the test flame causes the vapor above the surface of the liquid to ignite momentarily is taken as the flashpoint

To determine the fire point, the test is continued until the application of the test flame causes the oil to ignite and burn for at least 5 seconds.

Procedure :-

- Fill the cup at any continent temperature (See Note) so that the top of the meniscus is exactly at the filling line. If too much sample has been added to the cup, remove the eexces.
- Using a pipette or other suitable device, however if there is sample on the outside of the apparatus empty Clean and refill it. Remove any air bubbles on the surface of theSample.
- Light the test flame and adjust it to a diameter of 3 2 to 4 8 mm, the size of the comparison bead, if one is mounted on the apparatus.
- Apply heat initially so that the rate of temperature rise of the sample is 14 to 16 deg per minute, when the sample temperature of approximately 56 deg below the anticipated

- flash point, decrease the heat so that the rate of temperature rise for the last 28 deg before the flesh point is 5 to 6 deg per minute.

  Starting at least 28 deg below the flash point, apply the test flame when the temperature read on the thermometer reaches each successive 2 deg mark Pass the test flame across the centre of the cup at right angles to the diameter which passes through the thermometer With a smooth continues motion, apply the flame either in a straight line or along the circumference of a circle having a radius of at least 150 mm the centre of the flame shall move in n plane not more than 2mm above the plane of the upper edge of the cup passing in one direction first then in the opposite direction the next time. The time consumed in passing the test flame across the cup shall be about I second.
- Record as the flash point the temperature read on the thermometer when a flash appears at any point on the surface of the oil, but does not confuse the true flash with the bluish halo that sometime surrounds the test flame.
- To determine the fire point continue heating so that the sample temperature increase at the rate of 5 to 6 deg per minute continues the application of test flame at 2deg inverse until the oil ignites and continues to burn for at least 5 seconds. Record the temperature at the point as the fire point of the oil.

Result :-

By open cup apparatus for Diesel. following results are obtained.

Flash point of Diesel = _

Fire point of Diesel =

Conclusion:

By performing this experiment we want measured flash & fire point of diesel. The sample is taken from 'NAYARA ENERGY'. Flash point & fire point of given sample is obtained _____°C &_____°C respectively. Further we have also taken more obtained data is 46°C & 54°C.

Questions:

1. What is flash and fire point?
2. Mention the significance of fire and flash point measurement.
3. How can you classify the oils considering fire point limits?

EXPERIMENT-09

Pensky Martens Apparatus

(CO-3160510.2)

Sem-6
Year 2021-22
L.E.College-Morbi

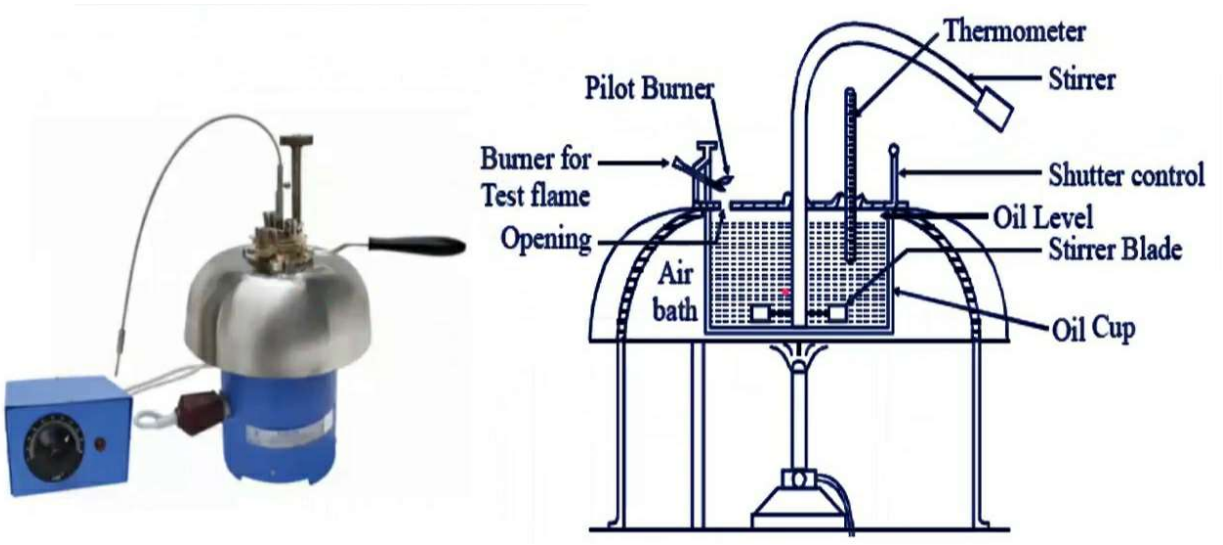


Fig. Pensky marten close cup tester

Aim : To determine the flash and fire point of the given sample of oil by using

Pensky Marten Close Cup Tester.

Chemicals : Kerosene, Diesel.

Apparatus : Pensky Martens Close Cup Tester, Measuring cylinder

Theory :

In the Pensky-Marten's closed cup flash point test, a brass test cup is filled with a test specimen and fitted with a cover. The sample is heated and stirred at specified rates depending on what it is that's being tested. An ignition source is directed into the cup at regular intervals with simultaneous interruption of stirring until a flash that spreads throughout the inside of the cup is seen. The corresponding temperature is its flash point. Pensky-Martens closed cup is sealed with a lid through which the ignition source can be introduced periodically. The vapour above the liquid is assumed to be in reasonable equilibrium with the liquid. Closed cup testers give lower values for the flash point (typically5-10 K) and are a better approximation to the temperature at which the vapour pressure reaches the Lower Flammable Limit (LFL).

Outline of Method:

The sample is heated in a test cup at a slow and constant rate with continuous stirring. A small test flame is directed into the cup at regular intervals with simultaneous interruption of stirring. The flash point is taken as the lowest temperature at which the application of the test flame causes the vapour above the sample to ignite momentarily.

Description:

This apparatus is used to determine the flash point of fuel oils and lubricating oils. Flashing above 49 ^{O}C. It consists of an oil cup with a circular marking for oil level indication. A lid to cover the oil cup with sliding shutters with ports, oil stirring mechanism and dipping wick holder, cast iron oil cup holder (air bath), electric heater with control.

Observation:

1. Room Temperature: _____ ºC
2. Barometric Pressure: _____ mm Hg

Observation Table:

Sr. No.	Test Observation	Result of Test (ºC)
1	The Flash point of Diesel, ºC	
2	The Fire point of Diesel, ºC	
3	The Flash point of Kerosene, ºC	
4	The Fire Point of Kerosene, ºC	

Procedure:

1. Fill the given sample in such a way that the sample level is exactly up to the mark in the cup .
2. Fix the cup in to the apparatus and cover with lid . Insert thermometer in the thermometer holder given in the cup in such a manner that it will not directly touch the lower bottom of the cup and the paddle stirrer inside the cup .
3. Fill the water bath with the cold water . Close the sliding shutter and light the standard flame . Adjust the size of flame (4mm diameter) with respect to the metal bead .
4. Stir the oil using paddle stirrer . Introduce the flame by opening the shutter and check the appearance of the flash . Now heat the apparatus and set the rate of temperature increase at the rate of 1 to 2 ° C per minute .
5. Check the flash point of give sample the interval of 3 ° C rise in the temperature . Discontinue the stirring the sample during the introduction of the test flame .
6. On observing a flash , stop the heating process and allow the temperature to decrease Check the occurrence of a flash at every 1 ° C drop in temperature at which the flash is observed as the flash point of the sample .

Precautions:

1. One shall exercise care and take appropriate safety precautions during the performance of this test method.
2. Light the Test Jet Carefully.
3. The temperature of the test specimen is increased rapidly at first and then at a slower constant rate.
4. Check the gas pressure supply if experiment perform with Gas test jet.

Results:

1. Flash point of Kerosene is_____ ^{o}C and Fire point is _____ ^{o}C.
2. Flash point of Diesel is_____ ^{o}C and Fire point is _____ ^{o}C.

Conclusion :

<u>Questions</u>:

1. Define: Flash Point and Fire Point.
2. Give the Significance of Flash and Fire point.
3. What is the relation between flash point and selection of floating roof storage tank?

EXPERIMENT-10

Smoke Point

(CO-3160510.2)

Sem-6
Year 2021-22
L.E.College-Morbi

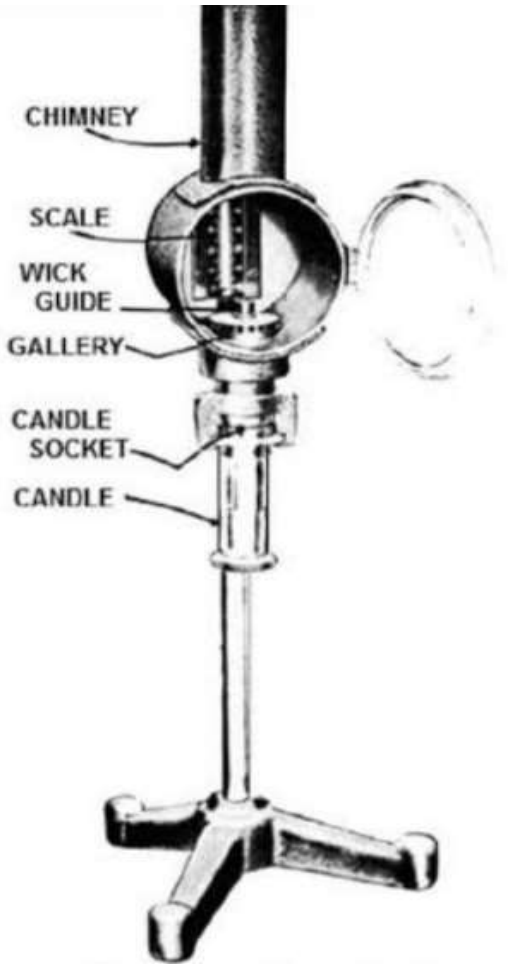


Fig. Smoke point apparatus

AIM: Determination of smoke point of light petroleum products.

APPARATUS : smoke point apparatus, beaker, petroleum sample.

CHEMICAL : Kerosene

THEORY: By performing this experiment smoke point of petroleum products will be observed.

SIGNIFICANCS : Smoke point is an important product quality specification for jet fuel and other grades of kerosene. Specifically, it is a measure of a fuel's tendency to generate smoke when burned. This is caused by the formation of carbonaceous particles that do not completely combust.

SMOKE POINT:

It is the max. flame height in mm at which the sample burns without smoke. Smoke point is related with the aromatic content of the liquid and it is inversely proportional to the aromatic content. Smoke point is used to determination of smoking tendency. Smoking tendency is proportional to the aromatic content and is given by Eq. Smoking tendency=320/smoke point in mm.

PROCEDURE:

Clean the sample container with suitable solvent and dry it. Fill the sample container up to desired level and introduce a wick in the container. Place this assembly in the burning chamber of the apparatus. Open the glass door, light the flame and closed the glass door. By adjustment of sliding screw observe the condition and height of the flame. If it is giving smoke, reduce the flame height to stage 1, them a further to stage Il and also familiarized with the flame height decrease to 3" stage. Adjust the point of the flame so that it burns without smoke. Note this height in mm using scale on the back side. Repeat it to get a constant reading.

OBSERVATION :

1. Sample - _____
2. Smoke point of sample - _____mm

OBSERVATION TABLE :

Sr. No	Sample	Smoke Point	Smoking Tendency
1.	Kerosene		
2.	Kerosene		

CALCULATIONS :

Smoking tendency = 320/Smoke point (mm)

RESULTS :

The smoke point of the following sample taken =_____mm

CONCLUSION :

By performing the experiment we can find out the smoke point of kerosene

QUETIONS :

What is Smoke Point?

Give the significance of smoke point of kerosene.

What is smoke point of kerosene which is better to use domestic purpose?

What is the superior kerosene that is use as the aviation fuel?

How can we convert kerosene into superior kerosene?

Experiment-11

Abel's Apparatus

(CO-3160510.2)

Sem-6
Year 2022-23
L.E.College-Morbi

Abel's Flash Point Apparatus: Assembly plus heating Vessel

AIM : To find out the Flash point of petroleum products and mixtures above 19^{o}C and below 70^{o}C ranging by Abel' apparatus.

Chemicals: Diesel

Principle:

Flash point is defined as the temperature at which an oil gives sufficient vapor to form an inflammable mixture with air and catches fire momentarily flashes when flame is applied. Flash point gives the idea about the nature of the boiling point diagram of the system, amount of low boiling fraction present in the liquid fuel, explosion hazards, volatility of the liquid fuels. Beside oil's volatility and inflammability limits of the vapor-air mixture the flash point also depends on the design of the apparatus, the test procedure and barometric pressure.

Apparatus:

There are two basic types of flash point measurement: open cup and closed cup. In open cup devices the sample is contained in an open cup (hence the name) which is heated, and at intervals a flame is brought over the surface. The measured flash point will actually vary with the height of the flame above the liquid surface, and at sufficient height the measured flash point temperature will coincide with the fire point.

The apparatus is made of brass /gun metal machined cup cover fitted with shutter mechanism, test flame arrangement, stirrer and thermometer socket. The total assembly of the apparatus rests in stainless double jacketed copper/stainless steel water bath. Other components like a funnel, an overflow pipe, and split thermometer socket are fixed on the top of the heating bath and its outer jacket of the bath is fitted with a stand. At the bottom of the apparatus, an electric heater is fitted with a flexible cord.

Theory :

- This application is used to determine flash point of petroleum product
- Flash and fire point are important when oil is exposed to high temperature service. This test provides safe guard against decomposition and fire hazard during storage, transportation, handling and other uses.

Observation :

Sample Taken:

Observation Table :
Characteristics of the sample:

Sr. No.	Temperature (^oC)	FLASH OBSERVED
1		
2		
3		
4		
5		
6		
7		

- Flash point is used to assess the overall hazard of a material and is used shipping and safety regulations to define “flammable” and “combustible” materials.
- The flash point is an empirical measurement rather than a fundamental physical parameter. The measured value will vary with equipment and test protocol variations, including temperature ramp rate (in automated testers), time allowed for the sample to equilibrate, sample volume and whether the sample is stirred.
- Flash point values may be used in shipping, storage, handling and safety regulations, as a classification property to define “flammable” and “combustible” materials. Precise definition of the classes is given in each particular regulation. A flash point value may indicate the presence of highly volatile material(s) in a relatively non-volatile or nonflammable material and flash point testing may be a preliminary step to other investigations into the composition of unknown materials.

Procedure :

- The test portion is placed in the test cup of an Abel apparatus and heated to give a constant temperature increase with continuous stirring.
- A small test flame is directed through an opening in the test cup cover at regular temperature intervals with simultaneous interruption of stirring.
- The lowest temperature at which application of the test flame causes the vapour of test portion to ignite and propagate over the surface of the liquid is recorded as the flash point at the ambient barometric pressure.
- The temperature is corrected to standard atmospheric pressure using an equation. Separate test procedures are defined for liquids with expected flash points between –30 °C and 18,5 °C inclusive, and between 19 °C and 70 °C inclusive.

RESULT:

The flash point of the sample of product =

CONCLUSION :

QUESTIONS :

1. Define Flash point and Fire point of petroleum oil.
2. What are the factors that affect flash and fire point?
3. What should be the flash point of a good lubricant?
4. What is the difference between Abel's and Pensky Marten's Apparatus?

EXPERIMENT-12

Ramsbottom Carbon Residue Apparatus

(CO-3160510.2)

Sem-6
Year 2021-22
L.E.College-Morbi

Fig. Ramsbottom Carbon Residue Apparatus

Aim: To determine the amount of carbon and residue apparatus.

Apparatus: Ramsbottom carbon residue apparatus.

Chemicals: Oil sample

Theory:

In this method, the sample is carrying fed into a glass bulb which has a capillary end. The bulk is kept at 550°C. The sample is allowed to decompose for 20 minutes. After heating is over the bulb is cooled and weighed to find the Carbon formed. Amount of material to be taken is inversely proportional to coking tendency of the oil.

Expected carbon residue	Size of sample for experimentation
2.0%	4 gm
2.4%	2 gm
4.0%	1 gm

Best quality of oils give less carbon residue compared to naphthalene oil.

This apparatus is used to know the property of cracking. Heavy oils being delicate to high temperature have a tendency to crack with the deposition of carbon.

Procedure:

- The given oil sample after being in to special glass tube having capillary of opening is placed in metal furnace maintain at 550^0C.
- The sample is taken quickly and heated. The point at which all volatile material is evaporated out of bulk without decomposition.
- While the heavier residue remaining in the bulk undergoes cracking and cokeing reaction.
- In the later portion of heating period, the cake subjected to further slow decomposed due to possibility of breathing air into the bulk.
- The residue remains is calculated as % age of the original sample of repeated as the ramsbottom apparatus.

Observation:

1] Sample taken=_____ gm

2] Weight of the sample = _____ ml

3] Temperatures given=_____ °C

4] weight of empty coking bulb(W1) = _____ gm

5] Weight of sample with coking bulb(W2) = _____ gm

6] Weight of carbon with coking bulb(W3)=_____gm

Observation Table:

Sr no.	Sample	Weight of sample in (ml)	Temperature(°c)	Weight of sample after heating	Carbon residue(%)

Calculation:-

1. Carbon residue = _____ gm
2. % Carbon residue =

Result:-

Conclusion:-

Questions:

1. What is the significance of residue carbon content?
2. List the methods used to measure residue carbon.
3. Paraffin oils have _____ carbon residue compared to naphthenic oils.
4. What is the standard test method for determining carbon content in feed stock oils?

EXPERIMENT-13

PENETROMETER

(CO-3160510.2)

Sem-6
Year 2021-22
L.E.College-Morbi

FIGURE: PENETROMETER

OPERATING INSTRUCTION FOR STANDARD PENETROMETER

AIM: To determine penetration by standard penetrometer.

APPARATUS: Penetrometer, stand of penetrometer.

CHEMICAL: types of Greece.

THEORY: Penetrometer is used for penetration process of petroleum products.

- The 'HT Standard Penetrometer consists of a vertical pillar mounted on a base, with levelling screws. The head together with dial plunger rod and penetrometer cone (or Bitumen Needle as the case may be) slides on the pillar and can be clamped at any desired height by a knurled clamping screw. The rack opinion and pointer assembly on the head which provides line adjustment of needle or cone tip to sample incorporates a slipping clutch mechanism which makes reading of penetration and subsequent resetting a simple and accurate operation. Release and stopping of the plunger fall is by a spring-loaded push-button. The dial is graduated 400 $1/10^{th}$ millimetre sub-divisions and red needle pointer against black figures makes for easy reading.
- Coarse and fine vertical up and down movement of the penetrometer head is achieved by a system of micrometre differential gearing enabling accurate positioning of the cone or needle rip relative to the surface of the specimen.
- A4 1/2" dial Indicator graduated 0-400 in 1/10 mm division is provided for plunger return to zero is automatic a feature that enhances its value in laboratories making large numbers at routine tests with this instrument
- A stop watch holder Is very useful for laboratory timing and in particular for such operation as multiple viscosity determinations: The instantaneous and positive action and the optimum viewing position result in a considerable saving of operational rime and assist in giving increased accuracy The push button operates the watch for start, stop and reset by a single lever mechanism which is adjustable for different sizes of watches.

Significance:-

- Cone penetration test results provide one measure of the consistency of a grease. Worked penetration results are required to determine to which NLGI consistency grade a grease belongs. Undisturbed penetration results provide a means of evaluating the effect of storage conditions on grease consistency.

PROCEDURE:

- Clean the needle and place a weight above the needle.
- Pour the sample into a container to depth of at least 15 mm in excess of expected penetration.
- Keep the container on the stand of the penetration apparatus.
- Adjust dial reading zero.
- Mount the needle on specimen, such that it should just touch the surface of specimen.

OBSERVATION:

1 Sample taken =_____

2. Time taken (in seconds) =_____ Sec

3. Penetration reading of sample=_____mm

OBSERVATION TABLE:

Sr.no	**Sample**	**Time in second**	**Penetration reading of the sample**
1			
2			

- Then start the stopwatch and allow the penetration needle to penetrate freely at same time for 5 seconds. After 5 seconds
- stop the penetration.
- Result will be the grade of specimen
- Take at least one reading.

MAINTANANCE:

- Clean the needle and Penetrometer cone before and after use. Keep the rack gears and support pillar lubricated with a few drops of thin oil.

RESULT: The penetration of the sample product=_____

CONCLUSION: