EXPERIMENT NO – 1

ABEL'S FLASH AND FIRE POINT TEST

AIM

To determine the flash and fire point of the given sample of oil using Abel's apparatus closed cup methods.

APPARATUS

1. Abel's apparatus,
2. Thermo meter (0-110°C).

THEORY

This method determines the closed cup flash and fire points of petroleum products and mixtures to ascertain whether they give off inflammable vapours below a certain temperature.

FLASH POINT:

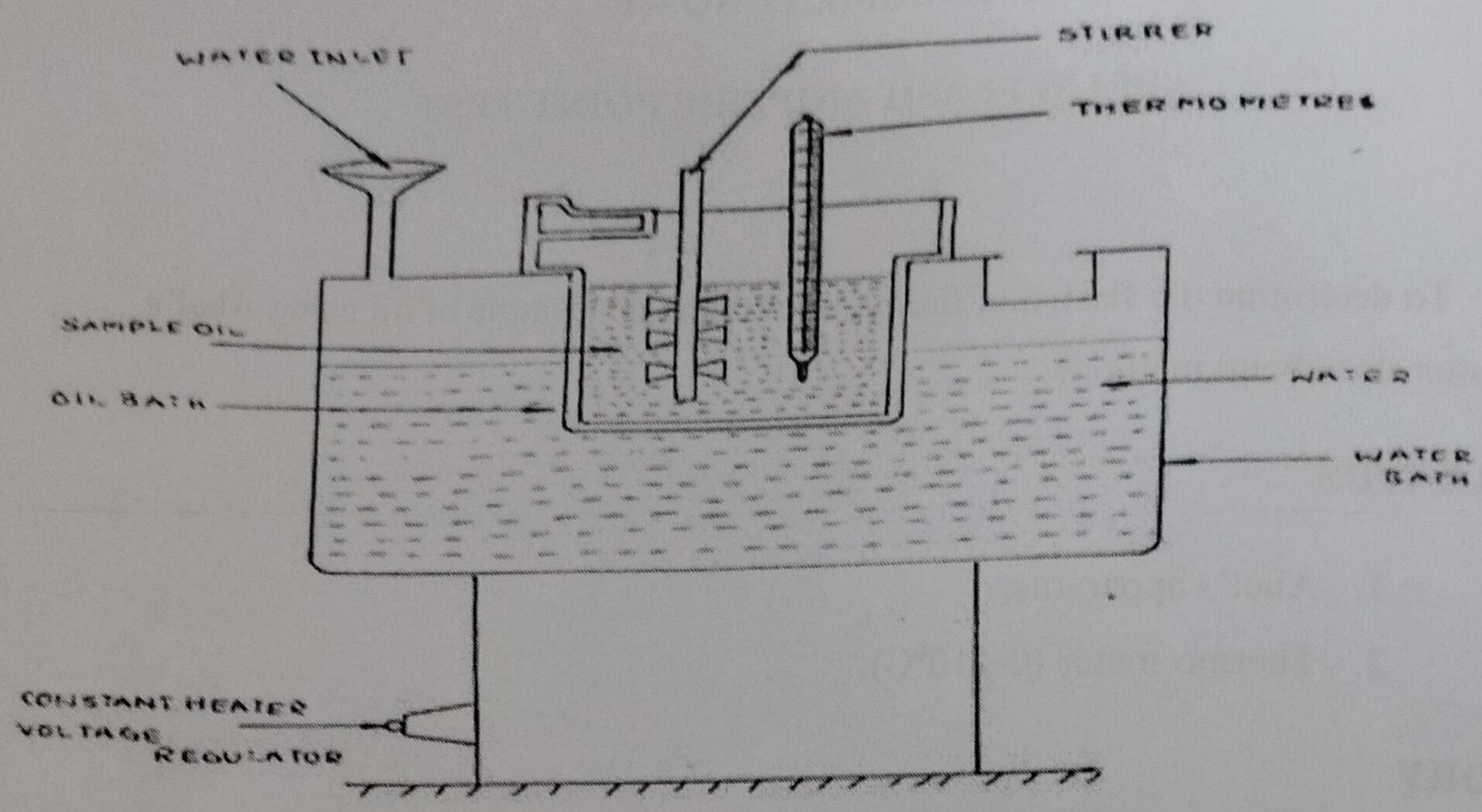
It is the lowest temperatures of the oil, at which, application of test flame causes the vapour above the sample to ignite with a distinct flash inside the cup.

FIRE POINT:

It is the lowest temperature of the oil, at which, application of test flame causes burning for a period of about five seconds.

DESCRIPTION

The apparatus consists of a brass cup and cover fitted with shutter mechanism, test flame arrangement, hand stirrer, thermometer socket. The brass cup is heated by water bath (with energy regulator), fitted with a funnel and overflow pipe.



ABEL'S FLASH AND FIRE POINT TEST

PROCEDURE

1. Clean the oil cup and fill the up to the mark with the sample oil.
2. Insert the thermometer into the oil cup through the provision to note down the oil temperature.
3. Using the Energy regulator, control the power supply given to the heater and rate of heating
4. The oil is heated slowly when temperature of oil rises; it is checked for the flash point for every one-degree rise in temperature.
5. After determining the flash point, the heating shall be further continued. The temperature at which time of flame application that causes burning for a period at least 5 seconds shall be recorded as the fire point.
6. Repeat the experiment 2 or 3 times with fresh sample of the same oil
7. Take the average value of flash and fire points.

PRECAUTIONS:

1. Stir the oil bath continuously to maintain the uniform temperature of sample oil.
2. The bluish halo that some time surrounds the test flame should not be confused with true flash.

OBSERVATIONS:

Sample oil	Flash Point, ^0C	Fire Point, ^0C

RESULT

The flash point is observed at _____ ^0C

The fire point is observed at _____ ^0C.

EXPERIMENT NO - 2

PENSKY MARTEN'S FLASH AND FIRE POINT TEST

AIM

To determine the flash and fire point of the given sample of oil using Pensky Marten's apparatus by both open and closed cup methods.

APPARATUS

1. Pensky Marten's apparatus,
2. Thermometer (0-110oC).

THEORY

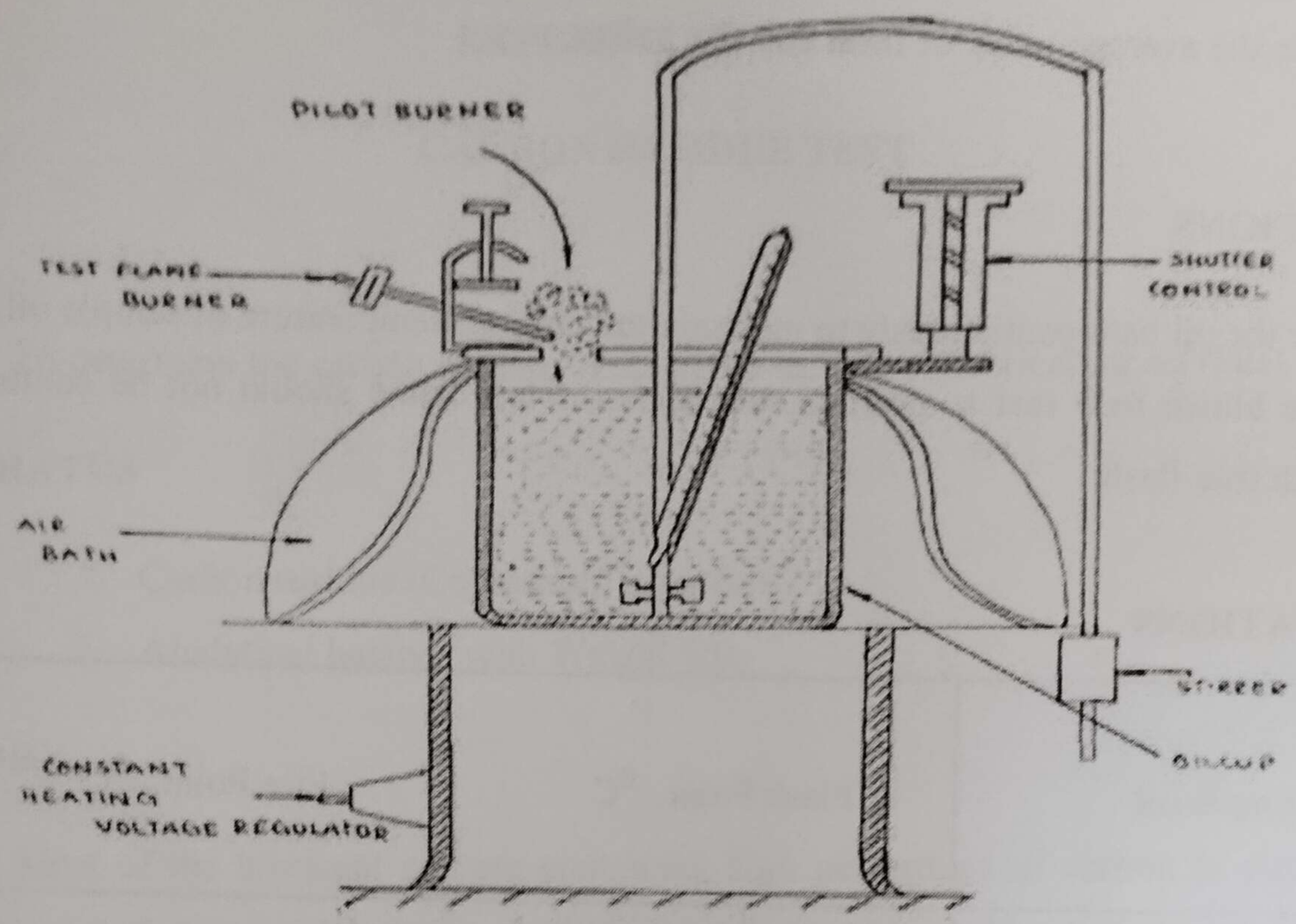
This method determines the closed cup and open cup flash and fire points of petroleum products and mixtures to ascertain whether they give off inflammable vapours below a certain temperature.

Flash Point: It is the lowest temperatures of the oil at which application of testflame causes the vapour above the sample to ignite with a distinct flash inside the cup.

Fire point It is the lowest temperature of the oil, at which, application of testflame causes burning for a period of about five seconds.

DESCRIPTION

The apparatus consists of a brass cup and cover fitted with shutter mechanism without shutter mechanism (open cup), test flame arrangement, hand stirrer (closed cup), thermometer socket, etc., heated with energy regulator, a thermometer socket made of copper.



PENSKY MARTEN'S FLASH AND FIRE POINT TEST

PROCEDURE

1. Clean the oil cup thoroughly and fill the oil cup with the sample oil to be tested up to the mark.
2. Insert the thermometer into the oil cup through a provision, which measures the rise of oil temperature.
3. Using the Energy regulator, control the power supply given to the heater and rate of heating
4. The oil is heated slowly when temperature of oil rises, it is checked for the flash point for every one degree rise in temperature.
5. After determining the flash point, the heating shall be further continued. The temperature at which time of flame application which causes burning for a period at least 5 seconds shall be recorded as the fire point.
6. Repeat the experiment 2 or 3 times with fresh sample of the same oil.

7. Take the average value of flash and fire points.

PRECAUTIONS

1. Stir the oil bath continuously to maintain the uniform temperature of sample oil.
2. The bluish halo that some time surrounds the test flame should not be confused with true flash.

OBSERVATIONS

Sample oil	Flash Point, ^0C	Fire Point, ^0C

RESULT

The flash point is observed at _____ ^0C

The fire point is observed at _____ ^0C

EXPERIMENT NO - 3

CARBON RESIDUE TEST

AIM

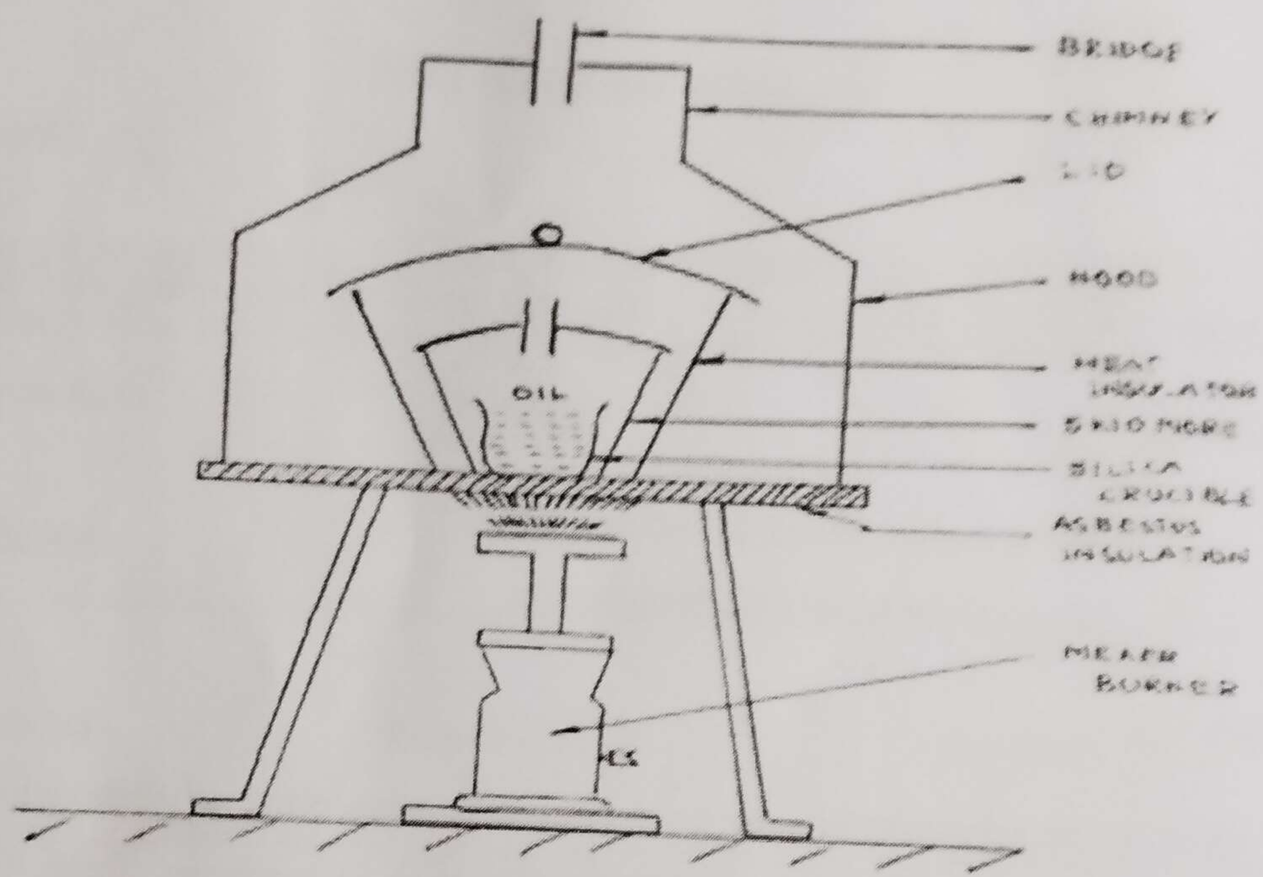
To determine the carbon residue of the given sample of lubricating oil /Fuel.

APPARATUS

1. Carbon residue (Conradson) apparatus,
2. Analytical balance with Weight box.

THEORY

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.



CARBON RESIDUE TEST

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 the crucible W_1 = *gms*
2. Weight of the crucible with oil W_2 = *gms*
3. Weight of crucible with residue W_3 = *gms*

$$\text{Percentage of carbon residue} = \frac{\text{Weight of residue}}{(\text{originalweightofsample})} \times 100$$

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

RESULT:

The percentage of carbon present in given sample of lubricating oil is_____%

EXPERIMENT NO - 4

SAYBOLT VISCOMETER

AIM

To determine the viscosity in Saybolt seconds of the given sample of oil and to plot the variation of Saybolt seconds, kinematic and dynamic viscosity with temperature.

INSTRUMENTS

1. Saybolt viscometer,
2. Stop watch,
3. Thermometer (0-1100C),
4. Measuring flask (60 c.c)

THEORY

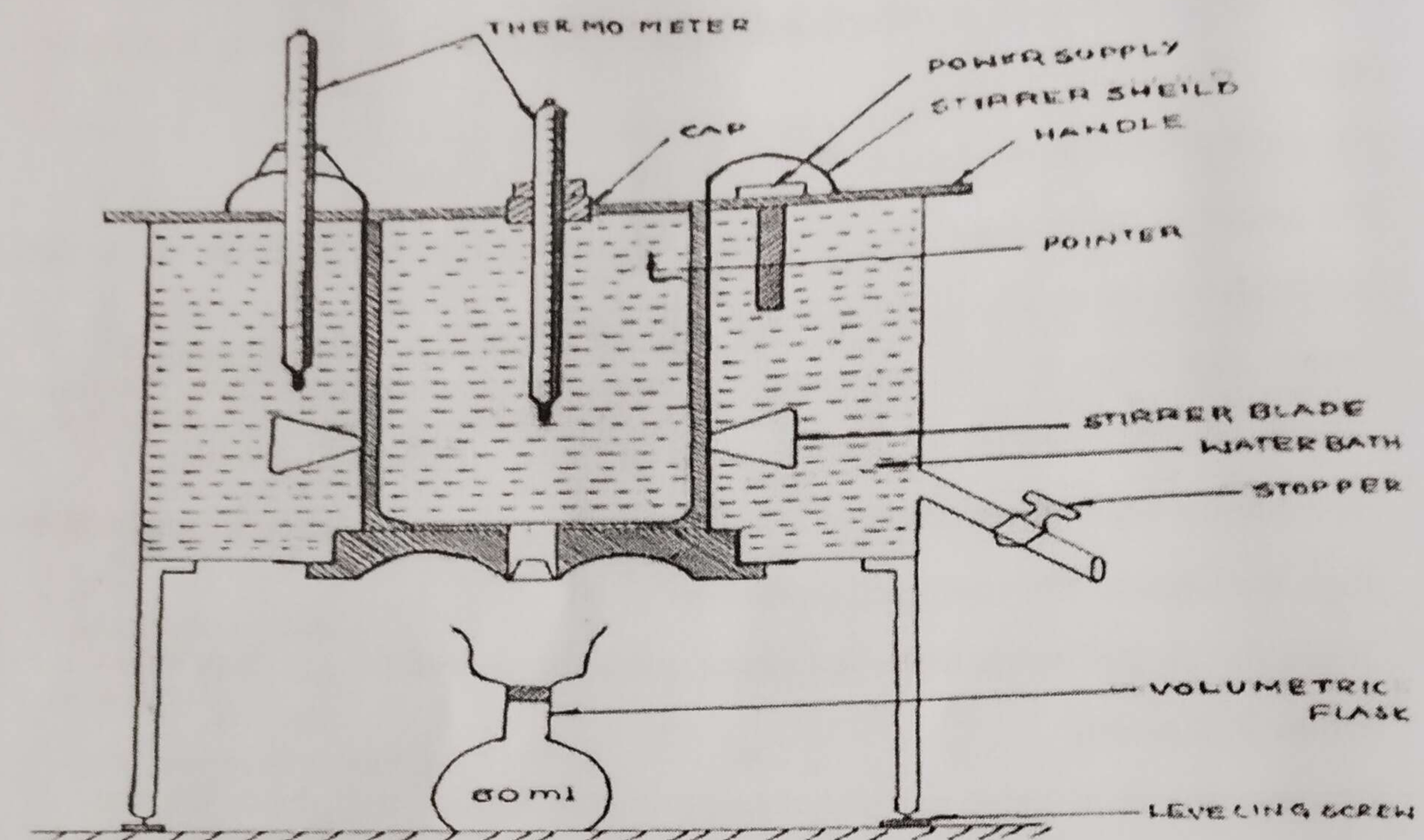
The viscosity of given oil is determined as the time of flow in Saybolt seconds. The viscosity of a fluid indicates the resistance offered to shear under laminar condition. Dynamic viscosity of a fluid is the tangential force on unit area of either of two parallel planes at unit distance apart when the 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 iscm^2/sec.

DESCRIPTION

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

PROCEDURE

1. Clean the oil cup with a suitable solvent thoroughly and dry it using soft tissue paper.
2. Keep the cork in its position so as to keep the orifice closed.
3. The water is taken into the water bath and the oil whose viscosity is to be determined is taken into the oil cup up to the mark.
4. Before switch on the electric supply, at room temperature note down the time taken in Saybolt seconds for a collection of 60 c.c. of oil with a stop watch.
5. Heat the bath and continuously stir it taking care to see that heating of the bath is done in a careful and controlled manner.
6. When the desired temperature is reached, place the cleaned 60 c.c. flask below the orifice in position.
7. Remove the cork valve and simultaneously start a stopwatch. Note the time of collection of oil up to the 60 c.c. Mark.
8. During the collection of oil don't stir the bath.
9. Repeat the process at various temperatures.



SAYBOLT VISCOMETER

OBSERVATIONS

S. No.	Oil Temperature ^0C	Time for collecting 50 c.c. of Oil/sec	Kinematic viscosity $v = A \times t - \frac{B}{t}$ cm^2/sec	Density (ρ) gm/c.c	Absolute Viscosity $\mu = v \times \rho$ dyne –sec/cm^2

Where

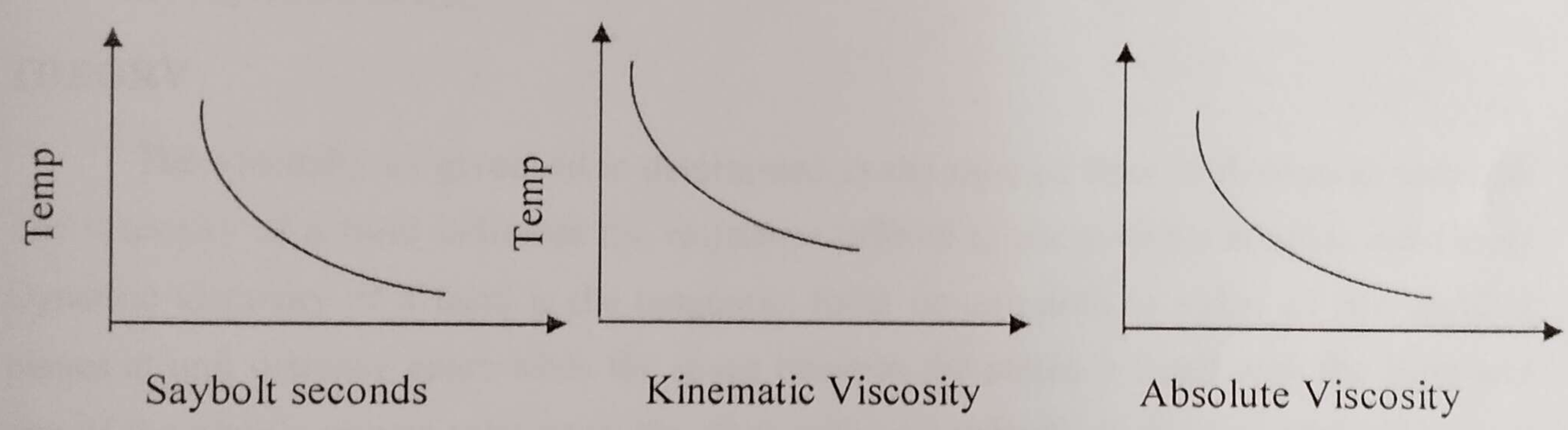
$A=0.00226\ cm^2/sec^2$

B=1.8 cm^2

GRAPHS TO BE DRAWN

1. Saybolt seconds vs. temperature
2. Kinematic Viscosity vs. temperature
3. Dynamic Viscosity vs. temperature

MODEL GRAPHS



PRECAUTIONS

1. Stir the water continuously so that the temperature of the oil and water are equal.
2. Before collecting the oil at a temperature, check whether the oil is up to the level.
3. Always take the readings at a stable temperature.
4. Ensure proper setting of the cork to avoid leakage.

RESULT

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

EXPERIMENT NO – 5

REDWOOD VISCOMETER

AIM

To determine the viscosity in Redwood seconds of the given sample of oil and to plot the variation of Redwood seconds, kinematic and dynamic viscosity with temperature.

APPARATUS

- Redwood viscometer-I,
- Stopwatch,
- Thermometer (0-1100C)
- Measuring flask. (50 c.c.)

THEORY

The viscosity of given oil is determined as the time of flow 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 cm^2/sec.

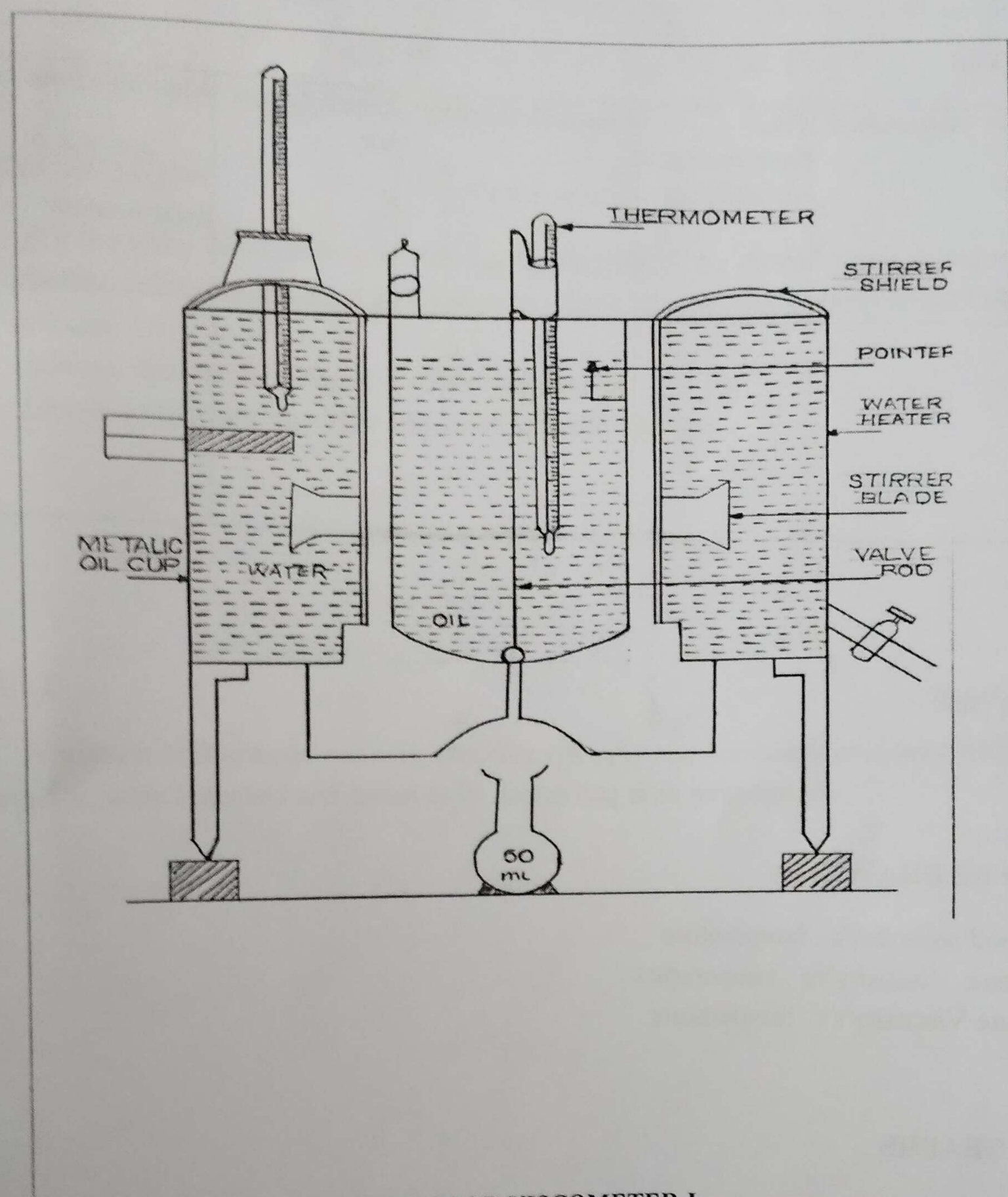
DESCRIPTION

Redwood viscometer-I consists of a water bath and oil bath, both provided with two thermometers inside them. There is a ball valve, which is located at center of oil bath to flow of oil through the orifice. A heater with regulator is fixed for heating purpose.

PROCEDURE

1. Clean the oil cup with a suitable solvent thoroughly and dry it using soft tissue paper.
2. Keep the ball valve in its position so as to keep the orifice closed.
3. The water is taken into the water bath and the oil whose viscosity is to be determined is taken into the oil cup up to the mark.

4. Note down the time taken in Redwood seconds for a collection of 50 cc .of oil with a stopwatch at the room temperature without supply of electric supply.
5. Heat the bath and continuously stir it taking care to see that heating of the bath is done in a careful and controlled manner.
6. When the desired temperature is reached, place the cleaned 50 c.c. Flask below the orifice in position.
7. Remove the ball valve and simultaneously start a stopwatch. Note the time of collection of oil up to the 50 c.c. Mark.
8. During the collection of oil don't stir the bath. Repeat the process at various temperatures.



REDWOOD VISCOMETER-I

OBSERVATIONS

S. No.	Oil Temperature °C	Time forcollecting50 c.c. ofOil/sec	Kinematicviscosity $v = A \times t - \frac{B}{t}$ cm²/sec	Density(ρ)gm/ c.c	AbsoluteViscosity $\mu = v \times \rho$ dyne –sec/cm²

Where

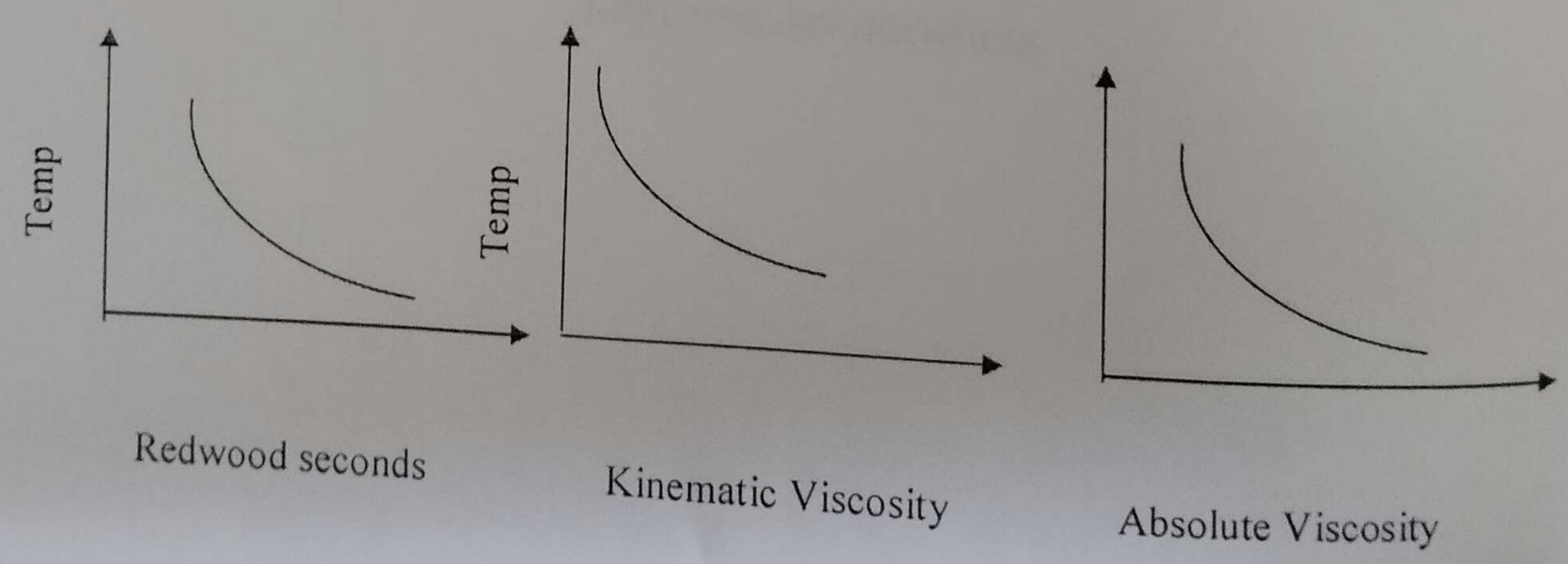
A = 0.0026 cm^2/sec^2

B = 11.2 cm^2

GRAPHS TO BE DRAWN

1. Redwood secondsVs . temperature
2. Kinematic ViscosityVs . temperature
3. Absolute ViscosityVs . temperature

MODEL GRAPHS



PRECAUTIONS

1. Stir the water continuously so that the temperature of the oil and water are equal.
2. Before collecting the oil at a temperature, check whether the oil is up to the Indicator in the oil cup.
3. Always take the readings at a stable temperature
4. Ensure proper setting of the ball valve to avoid leakage

RESULT

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

EXPERIMENT NO – 6

ENGLER VISCOMETER

AIM

To determine the viscosity in redwood second of the given samples of oil and to plot the variation of Redwood seconds, kinematic and dynamic viscosity with temperature.

INSTRUMENTS:

1. Redwood viscometer-II,
2. Stopwatch,
3. Thermometer (0-1100C),
4. Measuring flask.(50 c.c.)

THEORY

The viscosity of given oil is determined as the time of flow 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 cm^2/sec

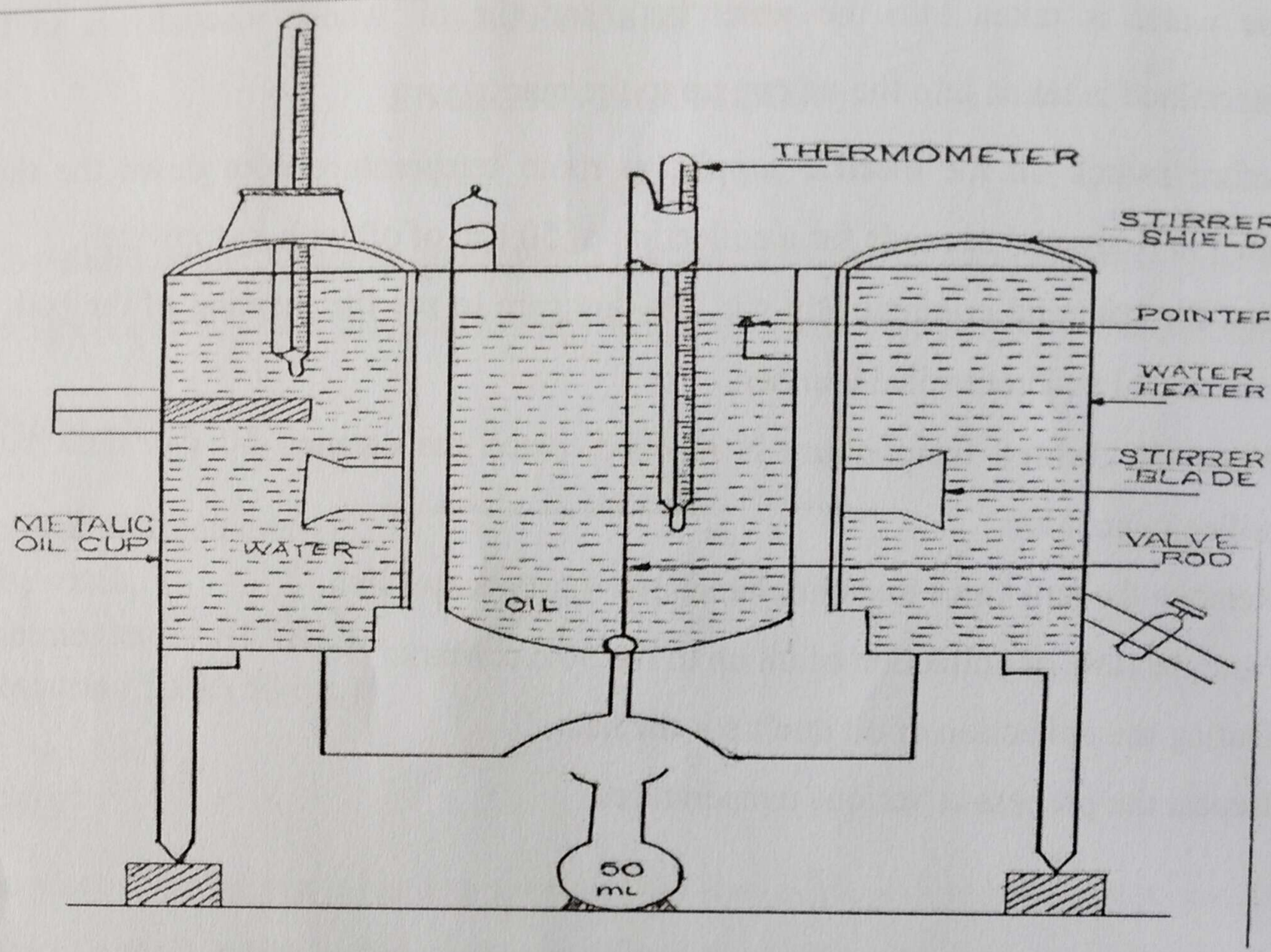
DESCRIPTION

Redwood viscometer-II consists of a water bath and oil bath, both provided with two thermometers inside them. There is a ball valve, which is located at center of oil bath to flow of oil through the orifice. A heater with regulator is fixed for heating purpose.

PROCEDURE

1. Clean the oil cup with a suitable solvent thoroughly and dry it using soft tissue paper.
2. Keep the ball valve in its position so as to keep the orifice closed.

3. The water is taken into the water bath and the oil whose viscosity is to be determined is taken into the oil cup up to the mark.
4. Before switch on the electric supply, at room temperature note down the time taken in Redwood seconds for a collection of 50 c.c. of oil with a stopwatch.
5. Heat the bath and continuously stir it taking care to see that heating of the bath is done in a careful and controlled manner.
6. When the desired temperature is reached, place the cleaned 50 c.c. flask below the orifice in position.
7. Remove the ball valve and simultaneously start a stopwatch.
8. Note the time of collection of oil up to the 50 c.c. Mark.
9. During the collection of oil don't stir the bath.
10. Repeat the process at various temperatures



REDWOOD VISCOMETER-II

OBSERVATIONS

S. No.	Oil Temperature °C	Time for collecting 50 c.c. of Oil/sec	Kinematic viscosity $v = A \times t - \frac{B}{t}$ cm²/sec	Density (ρ) gm/c.c	Absolute Viscosity $\mu = v \times \rho$ dyne –sec/cm²

Where

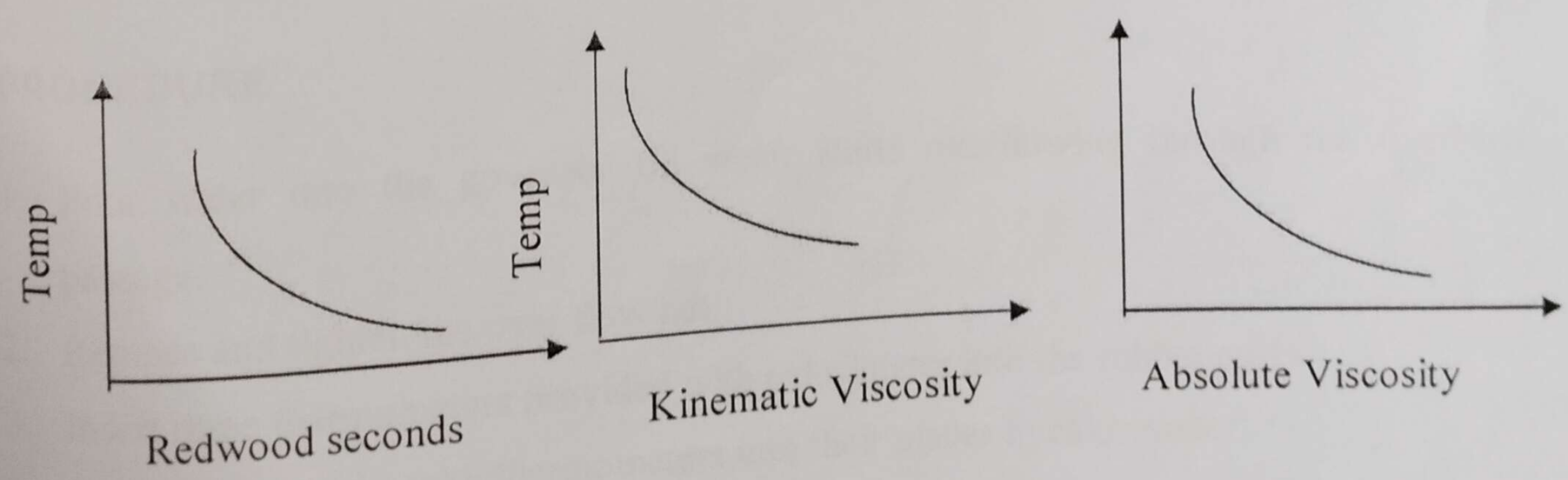
$A = 0.0026\ cm^2/sec^2$

$B = 11.2\ cm^2$

GRAPHS TO BE DRAWN

1. Redwood seconds Vs . temperature
2. Kinematic Viscosity Vs . temperature
3. Absolute Viscosity Vs . temperature

MODEL GRAPHS



PRECAUTIONS:

1. Stir the water continuously so that the temperature of the oil and water are equal.
2. Before collecting the oil at a temperature, check whether the oil is up to the Indicator in the oil cup.
3. Always take the readings at a stable temperature.
4. Ensure proper setting of the ball valve to avoid leakage.

RESULTS

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

EXPERIMENT NO - 7

JUNKER'S GAS CALORIMETER

AIM

To find the calorific value of given gaseous fuel.

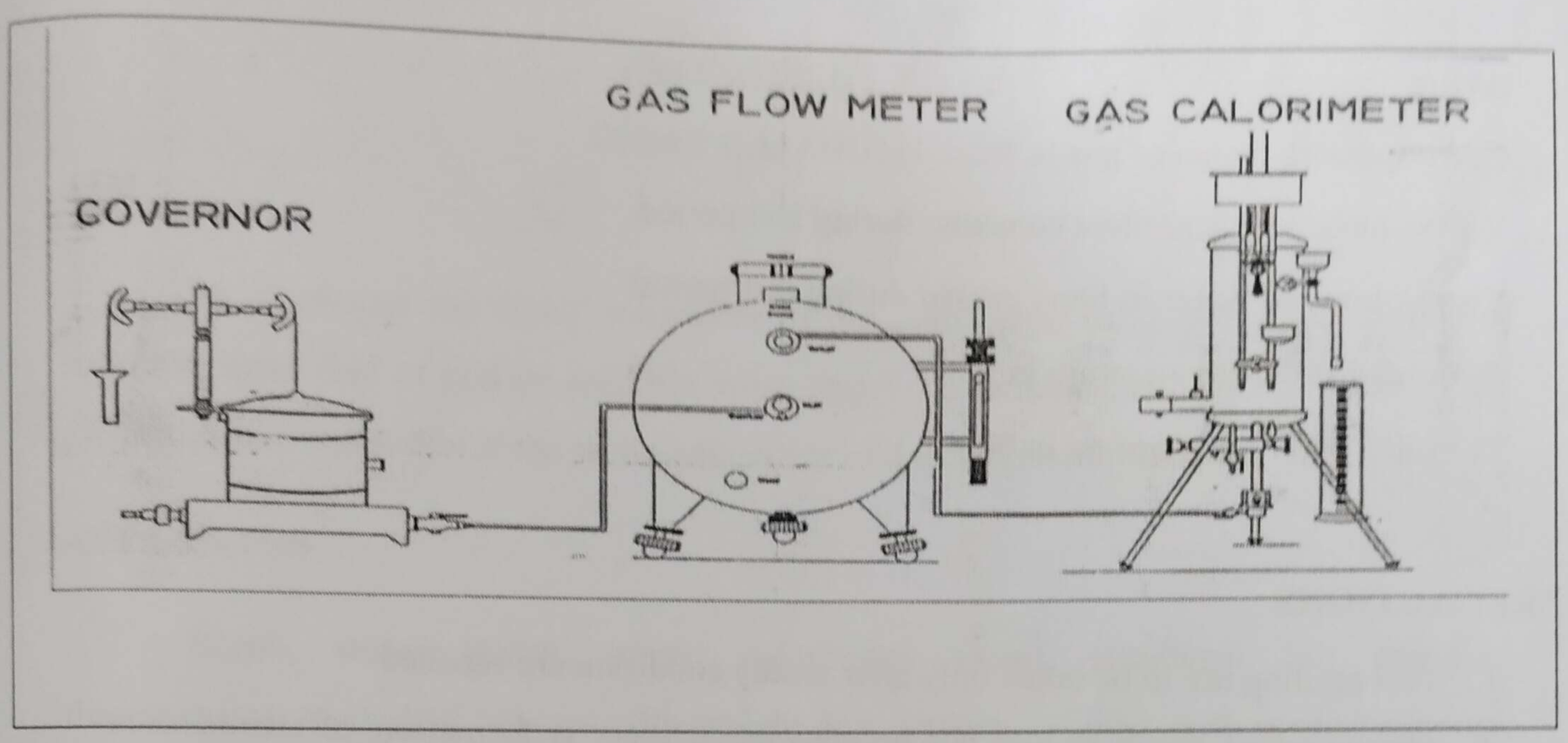
APPARATUS

- Calorimeter
- Main calorimeter body
- Three thermometers
- Gas flow meter
- Main gas flow meter body
- Inlet / outlet nozzles
- Union net with washer for thermometers
- Pressure governor
- Pressure governor body
- Balancing beam arrangement
- Counter balance tube
- Inlet and outlet union nuts with washers and
- Jars 2000 ml& 50 ml

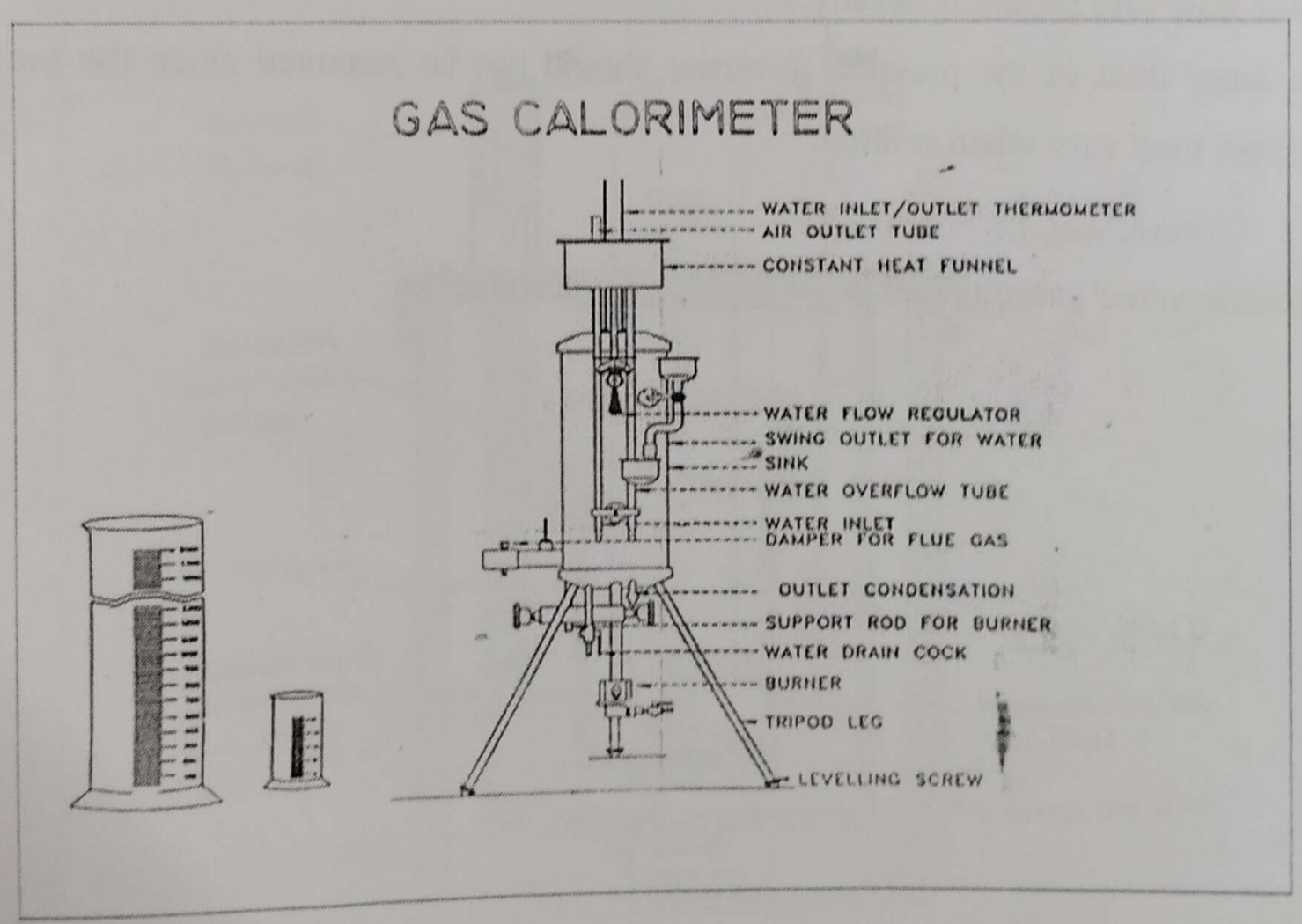
PROCEDURE

1. Pour water into the governor till water starts overflowing through the overflow passage.
2. Replace and tighten the over flow nut.
3. Insert three thermometers provided with calorimeter into the rubber corks.
4. Insert rubber corks with thermometers into their places in calorimeter.

5. Insert burner into its support rod in the bottom of the calorimeter and turn the knurled knob so that the burner is fixed tightly.
6. The burner must go into the center of the calorimeter body.
7. Connect the calorimeter, the flow meter and the pressure governor as shown in figure using rubber tubing provided. Do not connect gas supply line. Take care to see that the water regulator of calorimeter is in OFF position.
8. Turn water regulator knob on calorimeter to ON position. Allow water to flow through the calorimeter from overhead tank/ tap. Allow water to flow for 3 to 4 min into laboratory sink, through the calorimeter.
9. Ensure that outlet tap of governor is closed. Connect gas supply line to governor inlet. Remove burner from calorimeter then open governor outlet tap. Allow gas to pass through the burner.
10. Light up the burner by holding a lighted match stick near the mesh at the top.
11. Adjust the air regulator sleeve at the bottom of the burner to get a blue, non-luminous flame. Adjust water regulator on calorimeter to get a temperature difference of 12 0C to 15 0C between the inlet water & outlet water as indicated by the respective thermometers at the top of the calorimeter
12. Allow 20 to 30 min for outlet water temperature to become steady.
13. Measure the water flow rate with the help of measuring jar. Simultaneously, note the flow meter reading.
14. Note down the inlet &outlet water temperatures.
15. Repeat the test with same volume of gas 3 or 4 times and take average temperatures of inlet and outlet water.



JUNKER'S GAS CALORIMETER



CALCULATIONS

The formula to be used to calculate the calorific value to the test gas is as follows

$$CV = \frac{V_W}{V_G} \times (T_2 - T_1) \times 100 \text{ Kcal}$$

Where

C.V = calorific value of gas in Kcal

V_G= volume of gas in liters consume during test period

V_W= volume of water in liters passed during test period

T_2= outlet water temperature in ^0C

T_1= inlet water temperature in ^0C

PRECAUTIONS

1. Test reading are to be taken only after steady condition are reached
2. Formation of steam should not be allowed. If there is formation of steam, then increase the flow of water or reduce the gas flow rate
3. Water flow rate should be steady.
4. The inner float of the pressure governor should not be removed since the outlet pressure may vary when refitted.

RESULT

The calorific value gaseous fuel is _____Kcal/m^3

EXPERIMENT NO - 8

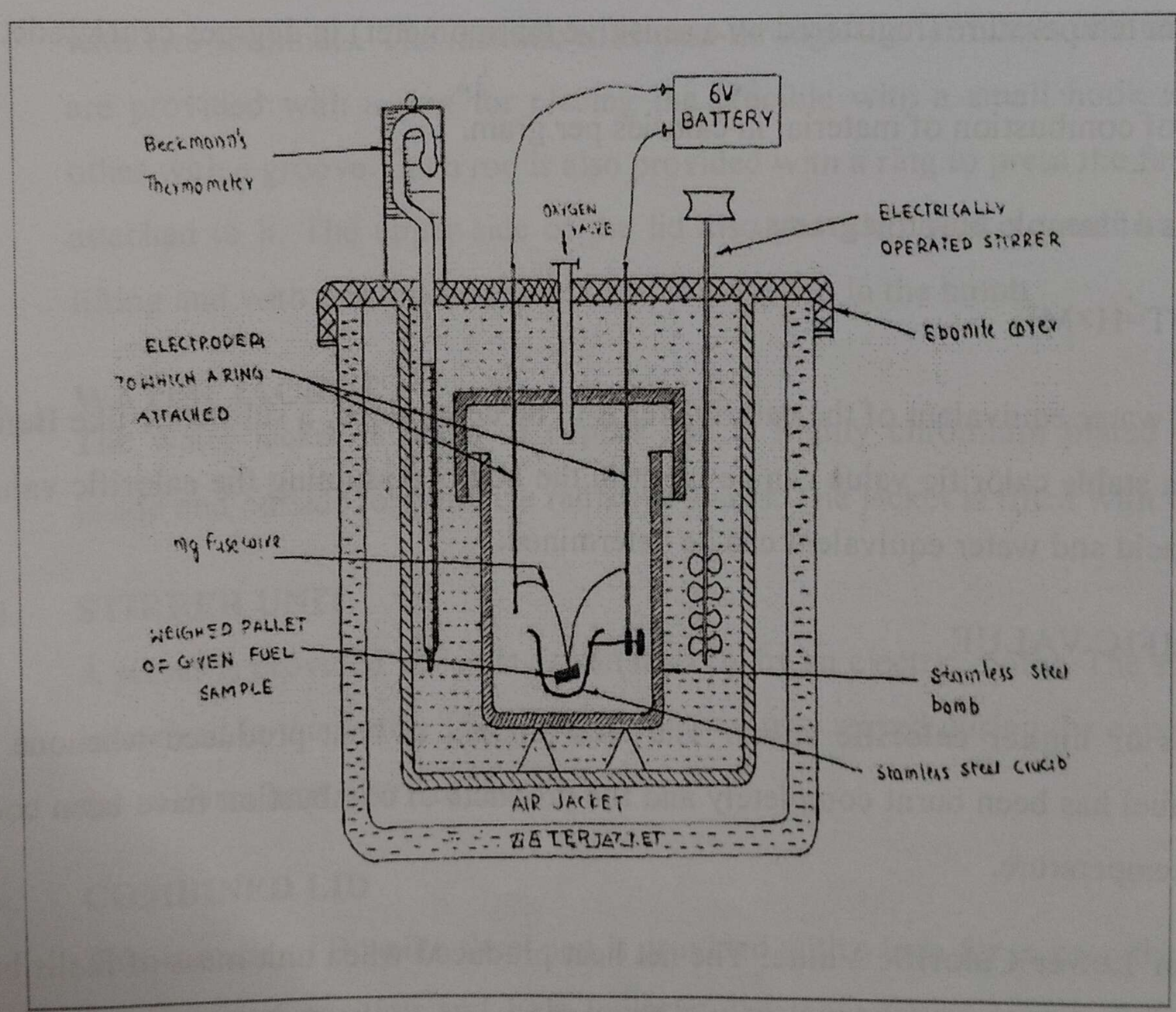
BOMB CALORIMETER

AIM

To determine the water equivalent of the calorimeter using the given sample of solid or liquid fuel of known calorific value (or) To determine the calorific value of the given solid or liquid fuel if the water equivalent of the calorimeter known.

APPARATUS

Bomb, water jacket, stirrer, calorimeter vessel, combined lid, sensitive thermometer, analytical balance with weight box, oxygen cylinder with pressure gauge, fuse wire, cotton thread, firing unit, regulating valve and crucible hand pellet press



BOMB CALORIMETER

PRINCIPLE OF OPERATION

A Bomb Calorimeter will measure the amount of heat generated when matter is burnt in a sealed chamber (Bomb) in an atmosphere of pure oxygen gas. A known amount of the sample of fuel is burnt in the sealed bomb, the air in the bomb being replaced by pure oxygen under pressure. The sample is ignited electrically. As the sample burns heat is produced and rises in the temperature. Since the amount of heat produced by burning the sample must be equal to the amount of heat absorbed by the calorimeter assembly, and rise in temperature enables the determination of heat of the combustion of the sample.

If

W = Water equivalent of the calorimeter assembly in calories per degree centigrade.

T = Rise in temperature (registered by a sensitive thermometer) in degrees centigrade.

H= Heat of combustion of material in calories per gram.

M = Mass of sample burnt in grams.

Then $W \times T = H \times M$

If the water equivalent of the calorimeter is to be determined, a substance like Benzoic acid has a stable calorific value can be burnt in the bomb. Assuming the calorific value of Benzoic acid and water equivalent can be determined.

CALORIFIC VALUE

Gross or higher calorific value: The total amount of heat produced whenone unit mass of fuel has been burnt completely and the products of combustion have been cooled to room temperature.

Net or Lower Calorific Value: The net heat produced when unit mass of fuelis burnt completely and the products are permitted to escape.

$$LCV = HCV - \textit{Latent heat of water vapour formed}$$

DESCRIPTION

i. BOMB

The bomb consists of three parts i.e. bomb body, lid and the cap. Bomb Body and the lid are made of corrosion resistant stainless steel containing Chromium, Nickel and Molybdenum. The bomb body is cylindrical vessel having a capacity of 300 *ml*. The walls are strong enough to withstand the normal operating pressure (30atm) to extreme high pressures (300 atm.). During burning at high pressure the nitrogen and sulphur contents are oxidized to nitric acid and sulphuric acid respectively. The corrosion resistant nature of the bomb material protects it from corrosive vapors. The bomb has lid, which is provided with two terminals. The metallic rods pass through the terminals one of which are provided with a ring for placing the crucible with a small hook and the other with a groove. Each rod is also provided with a ring to press the fuse wire attached to it. The upper side of the lid also provided with a small hook rod lifting and with a Schrader valve for filling oxygen in the bomb

ii. WATER JACKET

The water jacket is made of copper and is highly chromium plated on the inside and outside to minimize radiative losses. The jacket is filled with water.

iii. STIRRER UNIT

A stirrer is provided which is driven directly by an electric motor. The stirrer is immersed in the water. The water is continuously stirred during the experiment for uniform heat distribution.

iv. COMBINED LID

This is made of Borolite sheet and is provided with a hole for to keep the stirrer unit in fixed position and hole to insert the temperature sensor. It has also

another hole to take out the connecting wires from the terminals on the bomb lid to firing unit.

v. **HAND PELLET PRESS**

It is used for pressing the powder into a pellet.

vi. **CRUCIBLE**

It is made of stainless steel. The fuel to be burnt is weighed in this crucible.

vii. **IGNITION WIRE**

It is recommended that platinum wire used but an alternative nichrome wire is also being offered.

viii. **FIRING UNIT**

It consists of the firing key, provision to give power to the stirrer motor, a switch for operating the stirrer motor, two indicating lamps. When the circuit is completed the indicating lamp glows. After the firing key is closed on, the fuse wire burns, the indicating lamp stops glowing indicating the burning of the fuse wire.

PROCEDURE

1. About 0.5 to 1 *gram* of finely ground benzoic acid (Preferably compressed into a pellet) is accurately weighed and taken into crucible.
2. Place the bomb lid on the stand provided and stretch pieces of fuse wire across the electrodes (metal rods) provided in the lid tie about 5 *cm* of sewing cotton round the wire.
3. Place the crucible in position and arrange the loose end of the cotton thread to contact the Benzoic acid pellet in the crucible.
4. About 10 *ml* of distilled water are introduced into the bomb to absorb vapors of sulphuric acid and nitric acids formed during the combustion and lid of the bomb is screwed.

5. Charge the bomb slowly with oxygen from the oxygen cylinder to a pressure of 25 atm. close the value and detach the bomb from the oxygen supply.
6. Fill the calorimeter vessel with sufficient water to submerge the cap of the bomb to a depth of at least 2mm leaving the terminals projecting lower the bomb carefully in the calorimeter vessel and after ascertaining that it is gas tight, connect the terminals to the ignition circuit.
7. Adjust the stirrer and place the temperature sensor and cover in position. Start the stirring mechanism, which must be kept in continuous operation during the experiment after stirring for 5 minutes note the temperature reading of the calorimeter. Close the circuit momentarily to fire the charge and continue the observations of the temperature at an interval of one minute till the rate of change of temperature becomes constant.
8. Afterwards stop the stirrer and remove the power supply to the firing unit. Remove the bomb from the calorimeter and relax the pressure by opening the value. Verify that the combustion is complete and washout the contents of the bomb clean and dry.
9. Calculate the calorific value of the fuel or water equivalent of thecalorimeter.

OBSERVATIONS:

Weight of the empty crucible (W_1)	=	*gm*
Weight of the empty crucible + Benzoic acid pellet (W_2)	=	*gm*
Weight of the benzoic acid pellet (W_2-W_1)	=	*gm*
Weight of water taken in the calorimeter (W_3)	=	*gm*
Temperature of the water just before firing (t_1)	=	^0C
Temperature of the water after firing (t_3)	=	^0C

CALCULATIONS

Heat produced by burning of benzoic acid + Heat produced by burning of fuse wire and cotton wire etc = Heat absorbed by calorimeter.

$$(W_2 - W_1) \times C_v = (W_3 - W_e) \times (t_2 - t_1)$$

PRECAUTIONS

Sample should not exceed 1 *gram*.

Don't charge with more oxygen than is necessary.

Don't fire the bomb if gas bubbles are leaking from the bomb when it is submerged in water.

RESULT

Water equivalent of calorimeter (We) = gm

Calorific value of sample (Cv) = Cal/gm

EXPERIMENT NO - 9
GREASEPENETRATION TEST

AIM

To determine the penetration of the given sample with the help of Penetrometer

APPARATUS

1. Penetrometer,
2. Needle,
3. Sample,
4. Cup,
5. Weights.

DESCRIPTION

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

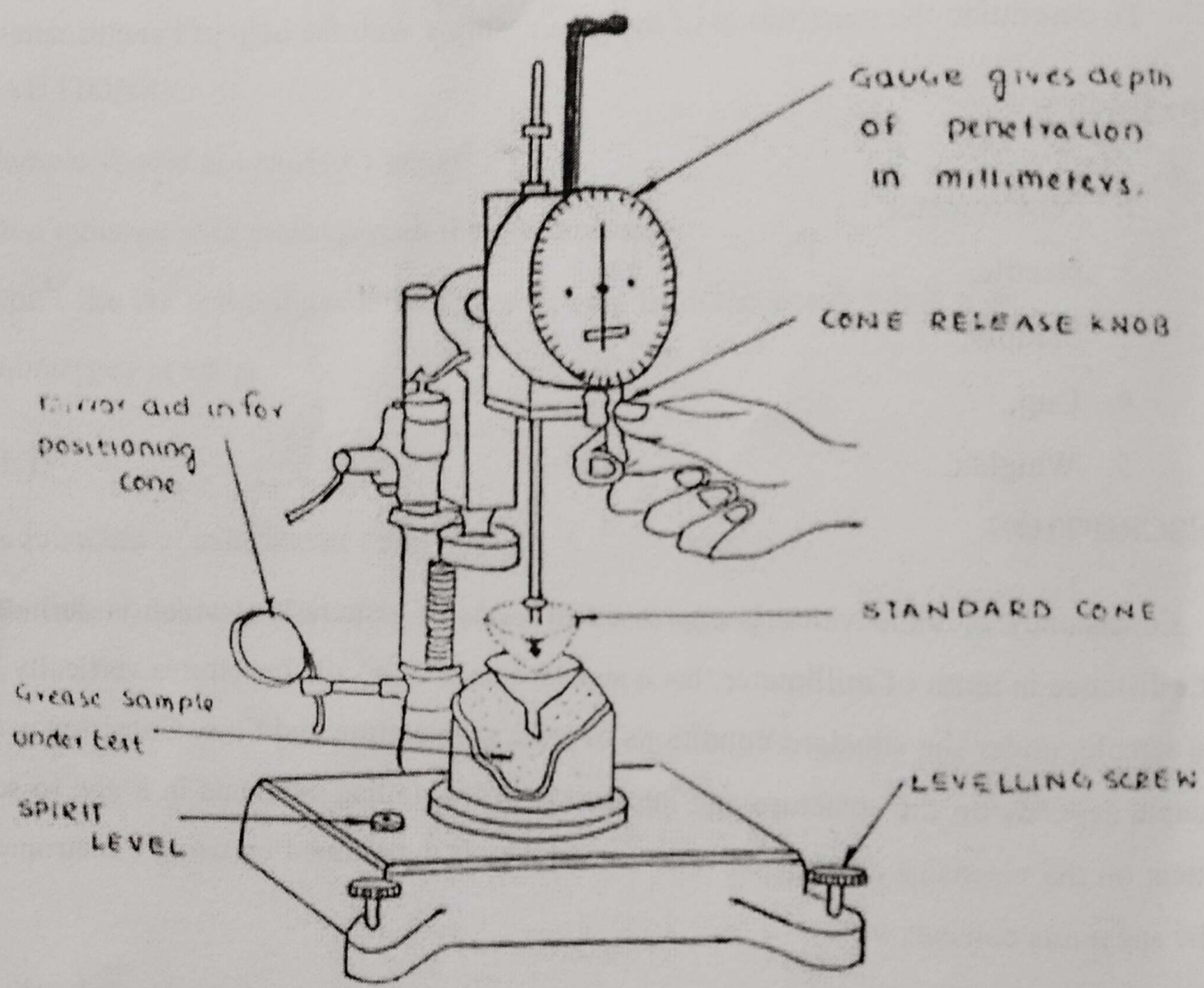
Heavy base (of cast iron alloy): It is one which is provided with spirit level, leveling screws and a plain table, over which a box containing the sample under test is placed.

Vertical support: It 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.

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

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

Mirror: Vertical rod is provided with an adjustable mirror for removing parallax error while positioning the cone or needle in contact with sample surface.



GREASE PENETRATION TEST

PROCEDURE

1. The apparatus is leveled, the cone or needle cleaned and the sample under-test, in a box, is placed below the cone or needle.
2. The height of the cone or needle is so adjusted, that the tip of the cone or needle just touches the sample.
3. 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.

4. The differences of the two dial readings given the penetration.
5. This is repeated for three times and noted the total penetration in 6 sec.

OBSERVATIONS:

TIME (sec)	INITIAL READING OF DIAL d_1 mm	FINAL READING OF DIAL d_2 mm	PENETRATION $(d_2 - d_1)$mm

RESULT

Penetration is found to be decreased with increasing temperature and time.

EXPERIMENT NO – 10

ASTM DISTILLATION TEST APPARATUS

AIM:

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

APPARATUS:

The ISL Distillation Analyzer AD86 5G2 has been designed for the automatic distillation of hydrocarbons under prescribed conditions. A given volume of sample is distilled under appropriate conditions. Temperatures and volumes of condensate and times are systematically recorded. The distillation (or volatility) characteristics are calculated from the resulting data and are in turn used to determine the safety and performance of the sample.

MATERIAL:

100ml Kerosene

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 vapour when the first drop of condensate dripped from the condenser is recorded as the initial boiling point (IBP). The vapour 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 agree (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.

PROCEDURE:

1. Preparation of the analyzer and apparatus
2. Swab the condenser tube using the pull through.
3. Place the ceramic (flask support) board with centered opening on the heating element support.
4. Put small quantity of pumice stone in the flask to stop lathering.
5. Pour the 100ml of prepared sample into the flask, taking care that none of it flows into the vapour tube.
6. Pass the vapour temperature probe through the D86 Flask Stopper, so that the top of

the platinum coil of the probe is level with the bottom inner wall of the vapour tube.

7. Adjust the flask in vertical position, fitting the vapour tube (by means of its silicon stopper), so that it extends into the vapour tube between 25 and 50mm.
8. Turn the knob on the bottom of the heating block thus raising up the heating block so thatthe support boards fits snugly against the flask.
9. Place the provided rubber collar on the projecting lower end of the condenser tube in the receiver chamber.
10. Without drying the graduate, place it with its receiver deflector in position, under the lower end of the condenser tube.
11. The graduations of the graduate should be to the front and the tip of the receiver deflector should be in contact with the front inner wall of the graduate. Make sure the indicator lamp for the detection of the drops is not lit up.
12. Push down the rubber collar (on the end of the condenser tube) to cover the top of the graduate.
13. Close the door of the graduate compartment

OBSERVATION:

Volume Percent distilled	Temperature ^{o}C
FBP	

The Final Boiling point of the product =_____^{o}CVolume Distilled =____mL

Residue left =

_____m

L Evaporated =_____mL

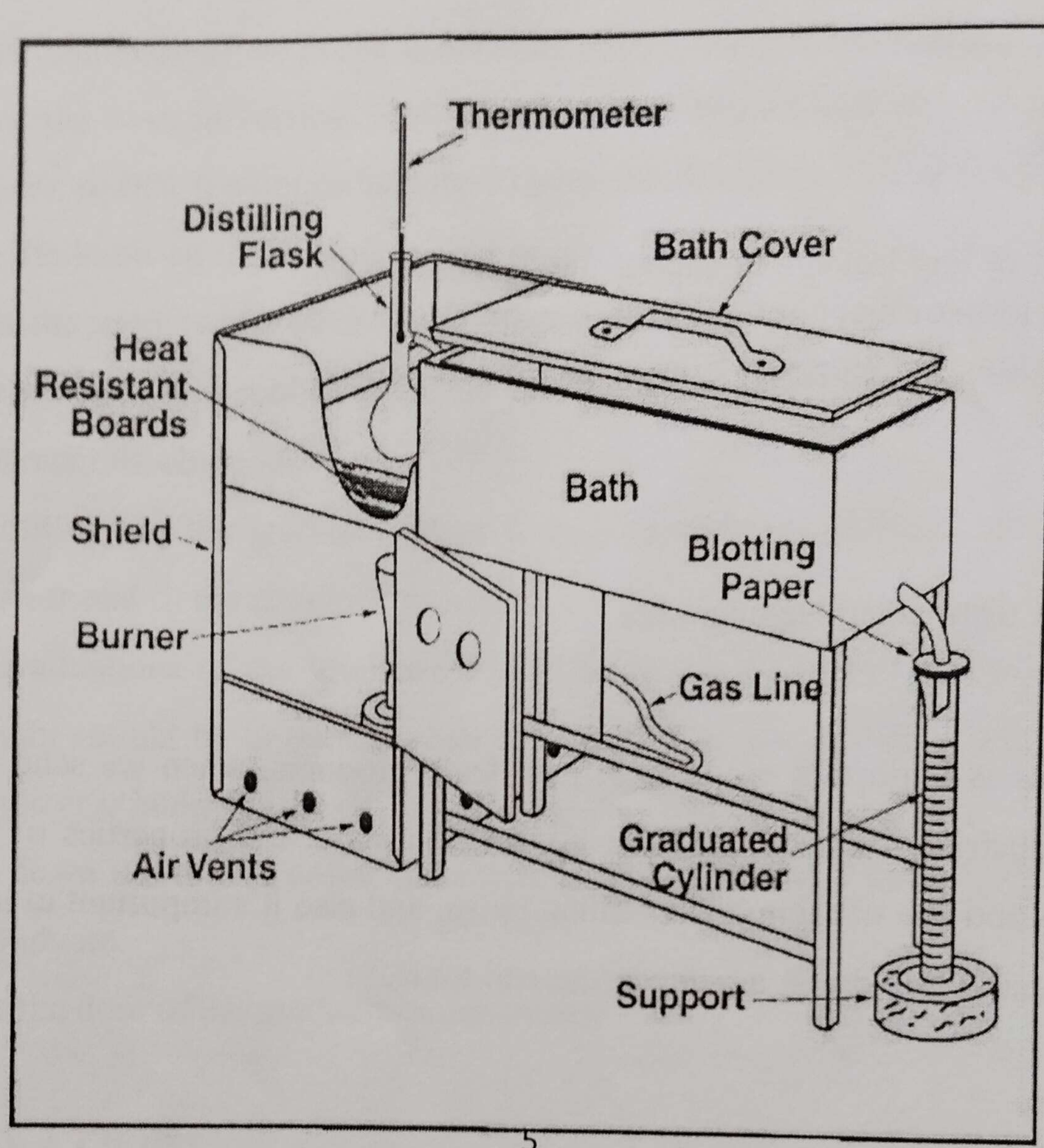
PRECAUTIONS:

1. There should not be any leakage of vapour fuel from the flask.
2. Collect the pure form of fuel after distillation without any wastage.
3. Clean the flask properly before use to prevent from impurities.

RESULT:

Plot volume percent distilled and temperature

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.


Thermometer
Distilling Flask
Bath Cover
Heat Resistant Boards
Bath
Shield
Blotting Paper
Burner
Gas Line
Air Vents
Graduated Cylinder
Support

5

EXPERIMENT NO – 11

CLOUD & POUR POINT TEST

AIM:

To determine the cloud & pour point of a given fuel / lubricant / oil, using cloud &pour point apparatus

APPARATUS:

Cloud & pour point apparatus, Digital stem thermometer

THEORY:

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

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

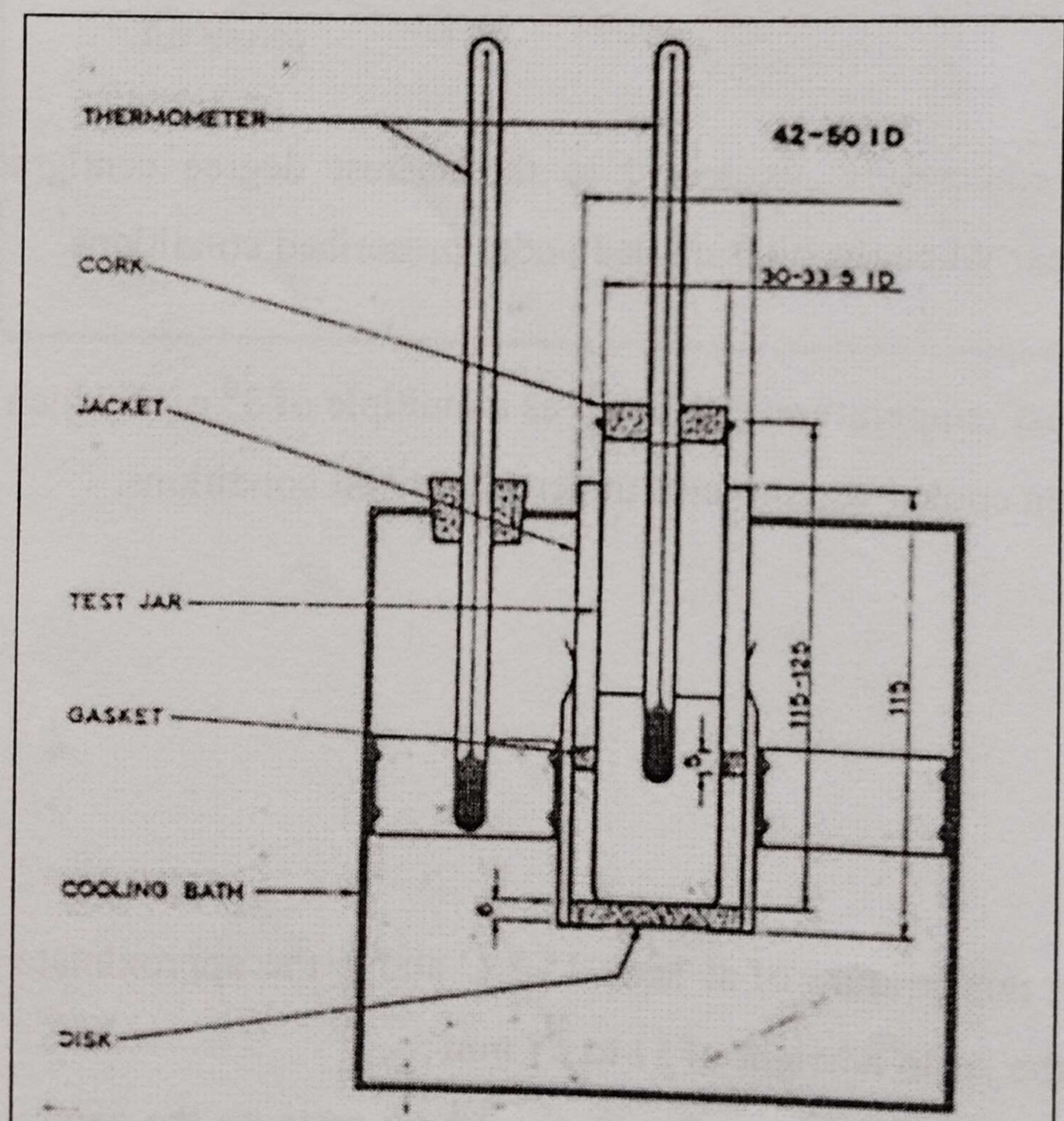
PROCEDURE:

CLOUD POINT:

1. Bring the sample to a temperature of at least 15 ^{0} C above the approximate cloud pointand pour it into the jar to a height of 51 to 57 mm .
2. Close the jar with the cork so that the thermometer bulb rests on the centre of the bottomof the jar.
3. Fit the gasket on to the jar 25 mm from the bottom and insert the jar into gasket.
4. Support the jacket and jar in a vertical position in the bath so that not more than 25

mm projects from the cooling medium.

5. At each thermometer reading of one degree centigrade, remove the jar from the jacket quickly but without disturbing the oil, inspect the material for cloud, and replace the jar, this complete operation shall not take more than 3 sec .
6. If the sample does not show a cloud when it has been cooled 10 $^0 C$ · Place the jar andjacket in another bath maintained at a temperature of -15 ^{0}c to 18 $^0 C$
7. If the sample does not show a cloud when it has been cooled to -7 $^0 C$. Place the jar andjacket in another bath maintained at a temperature of-32 $^0 C$ to -35 $^0 C$.
8. When an inspection of the sample first reveals a distinct cloudiness or haze at the bottom of the jar, record the reading of the thermometer as the cloud point after correcting the thermometer errors if necessary.



CLOUD & POUR POINT APPARATUS

POUR POINT:

1. The sample has cooled enough to allow the formation of the crystals.
2. Maintain the bath temperature at -1 ^{0} C to 2 ^{0} C
3. Support the jacket and jar in a vertical position in the bath so that not more than 25 mm projects from the cooling medium.
4. Beginning at a temperature 12 ^{0} C above the expected pour point, at each thermometer reading which is a multiple of 3 ^{0} C , remove the jar from the jacket carefully, and tilt it just enough to see whether the oil will move and the replace it, this complete operation shall not take more than 3 sec .
5. As soon as the sample ceases to flow when the jar is tilted, hold the jar in horizontal position for exactly 5 sec.
6. If the sample shows any movement replace the jar in the jacket and cool down the sample for another 3 ^{0} C. If the oil shows no movement during the 5 sec , record the reading of the thermometer.
7. Add 3 ^{0} C to the temperature recorded above and corrected for thermometer errors if necessary, and note down the result as the pour point.

OBSERVATIONS:

OIL	CLOUD POINT (^{0} C)	POUR POINT (^{0} C)

PRECAUTIONS:

1. The disc, the gasket, and jacket shall be kept clean and dry.
2. Don't disturb the mass of sample nor don't permit the thermometer to shift in the sample. Any disturbance of the spongy network of crystals will lead to false results.

RESULT:

For a given sample of oil the Cloud & Pour point s are_____and___respectively.