Qs Discuss the classification of lubricants?

OR

Qs Write a note on 1) lubricating oils or liquid lubricant
2) Semi solid lubricants or Greases
3) Solid lubricants

OR

Qs How are lubricants classified?

OR

Qs Define and classify the term lubricants?

Ans Lubricants :— See the defination above

Lubricants are classified into 3 types on the basis of there physical state

(A) Liquid lubricant or lubricating Oils :—

Liquid lubricant decreases the frictional resistance between the two moving metallic surfaces.
liquid lubricant or lubricating oil is further classified into

I) Animal & Vegetable oils

Good Characters of Animal & Vegetable oils :—

a) They have a good oiliness:
(oiliness is the property of oil by which it sticks to the surface of machine parts under high temp. & heavy loads)

b) They are used as blending agent with other oils to bring effects in latter

Unwanted Characters of Animal & Vegetable oils :—

a) They are costly.
b) They easily undergo oxidation, & so become thickened on

contact with air.

(II) Mineral or petroleum oils.

Mineral or petroleum oils are obtained by the distillation of petroleum. Mineral or petroleum oils are very cheap and very stable (in the) ~~se~~ or differing service conditions.

Petroleum or mineral oils have low or poor oiliness, and this can be increased by adding high molecular weight compounds like oleic acid, etc. In the Crude liquid petroleum oil lots of impurities are present, so before the use of petroleum oil, these impurities should be removed out, Generally the impurities which are present in the Crude liquid petroleum oil are wax, asphalt, napthene etc.

Various processes performed to remove out these impurities are Dewaxing, Acid refining, Solvent refining.

a) Dewaxing :— In this, process oil is mixed with a particular solvent like propane etc and then ~~it is~~ oil is kept under refrigeration (cold temp.), due to which the wax present in the oil, comes out in form of precipitate ~~out~~ and it is removed up by filleration or centrifugation; thus dewaxed oil is obtained.

b) Acid refining :— After the removal of wax, other impurities like asphaltic and naphthenic impurities are present in the oil, which are removed up by adding conc. H_2SO_4

in the dewaxed oil, due to which some impurities get dissolved in the acid (H_2SO_4) where as some impurities get converted into tarry sludges, which is removed by filtration.

Solvent refining :- In this process oil is mixed with a solvent like nitrobenzene, furfural, mixture of propane and cresol etc; Oil is immiscible in the above solvents, it means oil is insoluble in the above solvents, But the impurities like asphalt etc are soluble in above solvents, so when oil is mixed with above solvent and then it is left undisturbed for some time, then we obtain 2 layers i) Oil layer → which contain some solvent & it is free from impurities

ii) Solvent layer → which contain asphaltic, naphthenic impurities

further oil layer and solvent layer is distilled to recover solvent and refined oil and residue having impurities is left behind.

III) Blended oils :— It includes those oils in which other substances are been added to improve there the particular properties of an oil.

Various substance or additives which are added to improve the property of an oil are

a) Oiliness carriers → it include vegetable oil, fatty acid which increase oiliness of an oil

b) Antifoaming agents → it include glycols, glycerol which decreases foam formation of oil.

c) Corrosion preventer → it include organic compound of phosphorous, antimony etc, they protect the metal from corrosion.

d) Antioxidants → it include aromatic, phenolic compound or inhibitors which retard or slow down oxidation of oil.

e) Thickener → it include polystyrene, polyesters etc, they are added to give lubricating oils higher viscosity.

(B) Greases or Semi Solid lubricants :—

Greases are formed by the combination of petroleum product and soaps. Petroleum product can be petroleum oil or even synthetic oil.

Preparation of Greases :—

For preparing the Grease, firstly saponification (conversion into soaps) of fat is done ~~by~~ with or by help of alkali. such as caustic soda, lime etc. further hot lubricating oil is added with continuous stirring.

Function of soaps in Greases :—

① Soap act as a thickening agent due to which greases stick.

firmly to the metal surfaces.

(2) The temperature uplill which greases can be used, depends on the nature of soap present in the grease.

(3) The resistance of greases to the oxidation also depends on the nature of soap.

(4) The structure of ~~soo~~ Greases, is same as that of gel; ~~functions of~~ and soaps present in the greases are gelling agent, and they give interconneded structure containing the added oil.

Greases are classified on the basis of soap which are used in their preparation or manufacture.

a) Calcium-based greases or cup greases:

These type of greases are formed or prepared by adding required amount of calcium hydroxide ($Ca(OH)_2$) into hot oil with constant agitation or stirring, these greases are used at low temperatures because above 80°c oil & soap begins to separate out.

b) Soda base greases.

These type of greases are formed, or prepared by adding sodium soaps to petroleum oils, due to sodium soaps, petroleum oil get thickened. These greases are not resistant to water, & they can be used upto 175°c.

c) Lithium base greases.

These type of greases are formed or prepared by mixing

lithium soaps into petroleum oils. These greases are water resistant & use at low temp (15°C). V.T.

c) Axle greases :—

These are prepared by adding lime into resin and fatty oils, the mixture which is obtained is kept for some time undisturbed, thus grease floats as stiff mass.

These type of greases are water resistant. These type of greases are also prepared by dispersing solids like graphite, etc in mineral oil.

These Axle greases are used in rail axle boxes, tractor rollers etc.

e) Aluminium based greases :— These are prepared by mixing aluminium soaps into petroleum oils, due to the mixing of the aluminium soaps petroleum oil gets thickened (More viscous), they are water proof, these can be used beyond 90°C.

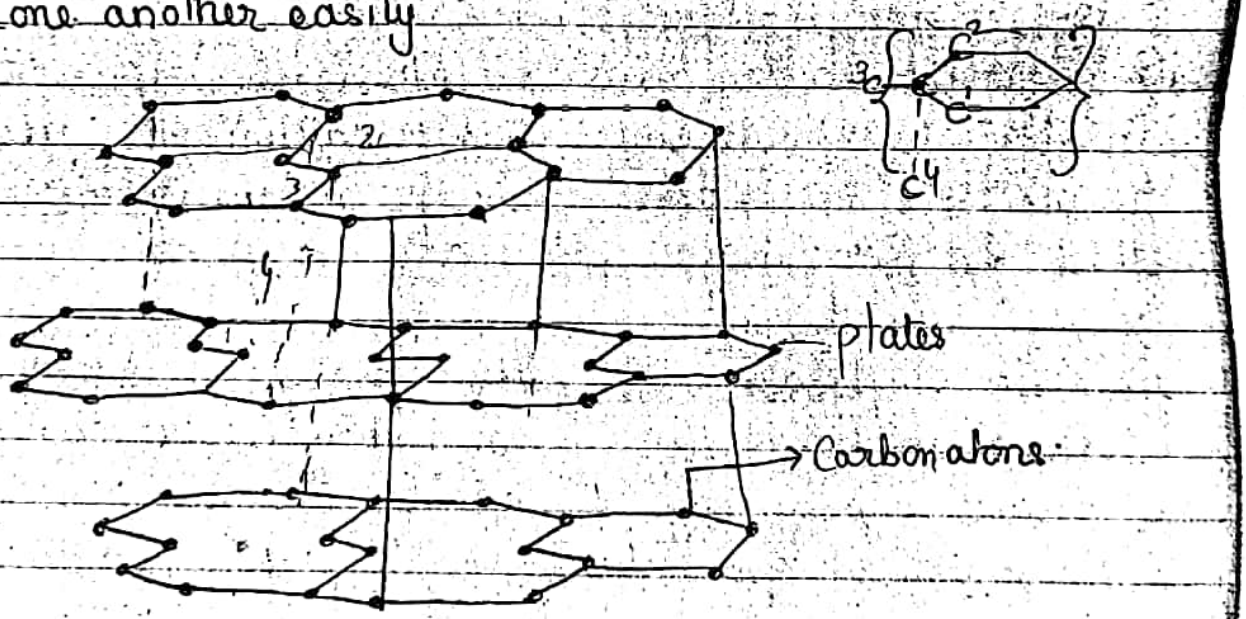
f) Resin soap greases :— These are prepared by dissolving resin oil in lubricating oil, and then further resin oil is reacted with slurry of slaked lime emulsified oil & H_2O, the grease obtained is called as Cold set grease.

(C) Solid lubricants :-

The 2 examples of solid lubricants are graphite and molybdenum disulphide.

(A) Graphite

Structure :- Graphite contains number of plates in which carbon atoms are arranged in regular hexagon; and each carbon atom is linked by covalent bond with other 3 carbon atoms, but the bonding with the 4th carbon is not strong and the bond is also not fixed. So, the different plates are held together by weak bonds and thus they can slide over one another easily



Properties of Graphite

1. It is non inflammable.
2. Graphite did not oxidise in air below 375°C
3. Graphite is used either in powdered form or as Suspensi-on

When the suspension of Graphite in oil or water is made then it is done with the help of an emulsifying agent like tannin.

For making the suspension when the Graphite is dispersed in oil, then it is called oil dag and when Graphite is dispersed in water then it is called as aquadag.

Uses of Graphite :—

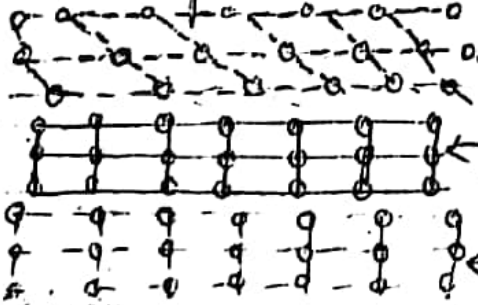
1. Used in food stuff industries.
2. Used in Railway track joints.
3. Used in internal combustion engine. I.C.E

(B) Molybdenum disulphide :—

Structure :— Molybdenum disulphide has sandwich like structure in which a layer of Molybdenum atom lie in between the 2 layers of sulphur atoms, there is very poor attraction between the layers.

Properties of Molybdenum disulphide :—

1. Molybdenum disulphide has low coefficient of friction.
2. It is thermally stable in air upto 400 degree C.
3. Fine powder of Molybdenum disulphide can be sprinkled (spreaded) on the surfaces sliding at high velocities.
4. Molybdenum disulphide used with solvents & greases.



1) Synthetic lubricants have high thermal stability.
2) Synthetic lubricants have high viscosity index.
3) Synthetic lubricants have high chemical stability & high flash points.
4) Synthetic lubricants are non-inflammable.

Various synthetic lubricants are:-

a) Polyglycols :-

it include polyethylene glycols, polypropylene glycols, polyglycidyl ethers & higher polyalkylene oxides.

Polyglycidyl ethers and higher polyalkylene oxides are insoluble in water, and there viscosity index is also high and they are used in roller bearings of sheet glass manufacturing machines. Moreover polyethylene oxides are not useful as lubricant at high temp.

b) Silicones :-

These lubricants have high viscosity index, and they are used in low temp. lubrication, as silicones are quickly oxidised above 200°C & they undergo cracking process at 230°C.

c) Organic amines, imines & amides :-

These lubricants have low pour point & high viscosity index. & they can be used at temp. of -50°C to 250°C

d) Polymerized hydrocarbons :-

it include polyethylene, polypropylene, polybuty

Other substances used as solid lubricants are :—

Soapstone, talc, mica, boron nitride, french chalk, Cadmium chloride, Borax, white lead, lead oxide etc.

Conditions in which Solid lubricants are used are :-

a) When load is very high such that, semi solid lubricant also can't remain in position between two moving surface then solid lubricant is used

b) When (~~contami~~) combustible lubricants does not work. Then solid lubricant is used

c) When contamination of lubricating oil or greases by dust is not acceptable.

Qs Discuss modern synthetic lubricants?

OR

Qs Write a note on synthetic lubricants?

Ans If the extra additives (substances) are added in the mineral oils then also they cannot be used in high temp. and in the chemically reactive atmosphere.

So Synthetic lubricants were developed or made which can be used under drastic conditions.

The various modern synthetic lubricants prepared have following characteristics :—

etc, these are free from non-hydrocarbon impurities and are chemically non reactive.

Disadvantages of synthetic lubricants :-

(1) Some of the synthetic lubricants are very toxic.
(2) Some of the Synthetic lubricants are corrosive at high temp., so cant be used at high temp.
(3) Synthetic lubricants are costly and so they are used only when they are badly needed.

Lubricant →

A substance introduced between two moving or sliding surfaces to reduce the friction between them is known as lubricant.

Lubrication →

The process of introducing the lubricant between the two moving metal surfaces in order to decrease the frictional resistance is called Lubricat

Properties and Testing of lubricating oil

To choose the appropriate lubricant for different working condition properties of lubricart should be known

1. Viscosity and Viscosity Index

Viscosity →

The property of a liquid due to which it offers resistance to its own flow

Unit of Viscosity → poise and centipoise

Viscosity Index →

The rate of change of viscosity with respect to (w.r.t) temperature (temp) is called viscosity Index of oil.

Low Viscosity Index

When viscosity of oil decreases on heating i.e. oil become thin on heating then the oil is said to have low viscosity Index.

ex → Gulf oil → Viscosity index = 0

High Viscosity Index →

When viscosity of oil does not show any change in viscosity or show very slight change in the viscosity of oil on heating then the oil is said to have high viscosity Index.

ex → Pennsylvanian oil
V.I → 100

Determination of Viscosity and Viscosity Index by Redwood Viscometer

To measure the viscosity of oil different apparatus are used

(1) Redwood Viscometer
(2) Saybolt Viscometer
(3) Kinematic Viscometer

Redwood Viscometer →

Redwood viscometers are of two types as Redwood viscometer no. 1 and Redwood viscometer number (no.) 2.

Redwood viscometer no. 1 is used for determining viscosities of thin lubricating oil (low viscous oil) and it has a agate jet of diameter 1.62 mm and length 10mm.

Redwood viscometer no. 2 is used for determining viscosities of (thick) highly viscous oil like fuel oil and it has a agate jet of diameter 3.8 mm and length 50 mm.

Construction :→ It consists of

(1) oil cup → It is a silver plated cylinder. At the bottom agate jet is present (small opening).

Agate jet can be closed or opened with the help of valve rod (small ball).

Pointer is present in oil cups upto which oil filled in oil cup.

oil cup is covered by lid containing small opening (hole) for thermometer which is used for recording the temp. of oil.

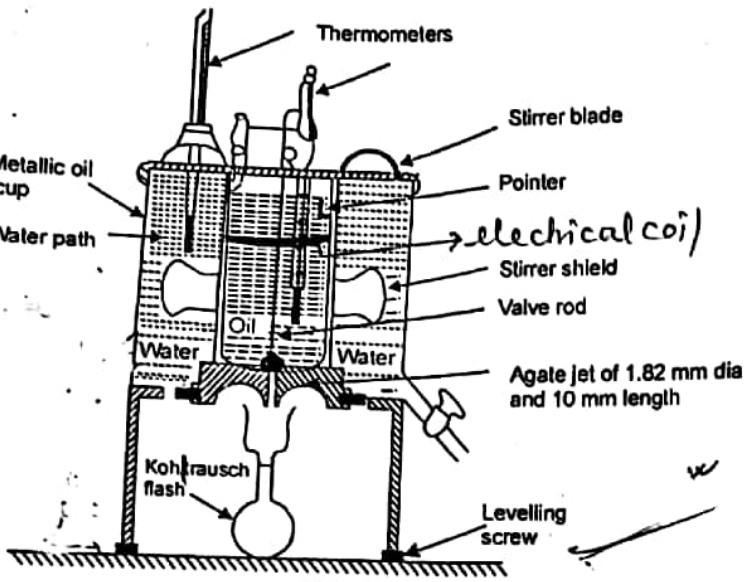


Fig. 6. Redwood Viscometer No. 1.

valve rod and oil cup is filled with oil upto the pointer

(9) Oil is then heated electrically

(10) During heating stirring is done continuously

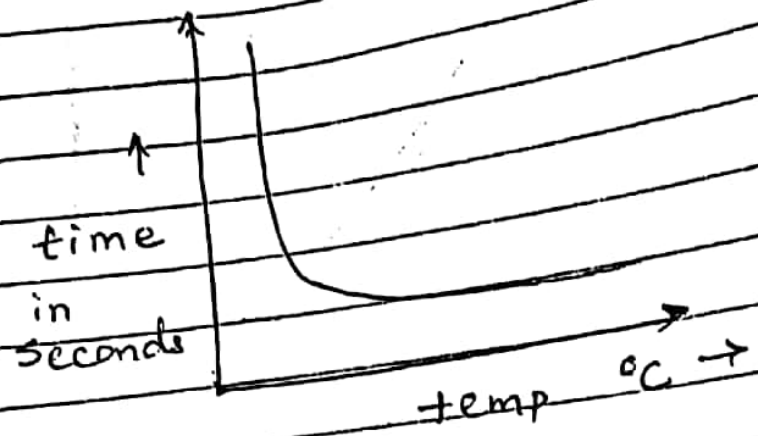
(11) When the temp of oil is raised by 10°C above temp. then again valve rod is shifted and time taken by oil to flow out into the Kohlrausch flask is recorded.

(12) Similarly readings of time measurement are taken at higher temp.

(13) Then graph of temp. v/s time is plotted

(14) If linear curve is obtained which shows that viscosity of oil decreases

with increase in temp.



Significance →

(1) By this property we can select a good lubricating oil for lubrication.

(2) A good lubricant should have high viscosity index.

II] Cloud and Pour Point

Cloud point →

: when oil is cooled slowly the temp at which oil becomes cloudy or hazy in appearance is called its cloud point.

Pour point → The temp at which the oil ceases to flow or pour is called its pour point.

Determination of cloud point and Pour point

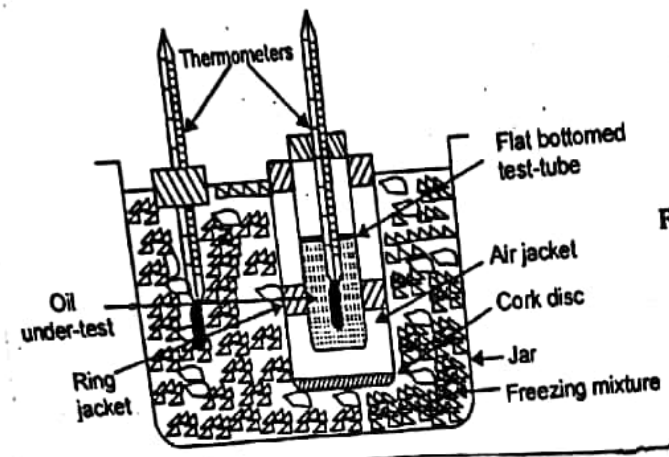


Fig. 8. Cloud and pour-point apparatus.

cooling Mixture
(ice + $CaCl_2$)

Working →

(1) Whole apparatus is cleaned properly.

(2) Flat bottom oil tube is filled with oil, ~~generally oil is filled half the tube~~.

(3) Jar is filled with the cooling mixture.

(4) Oil tube is inserted in the air jacket.

(5) Air jacket is surrounded by cooling mixture present in jar.

(6) Two thermometers are used. One for recording temp of

oil and one for recording the temp. cooling mixture.

(7) Due to the cooling mixture temp of oil falls down.

(8) Initially with every 2°c fall in temp of oil, oil tube taken out from the air jacket for a moment and oil is viewed for checking the transparency of oil.

(9) The temp. at which oil appears cloudy or hazy is recorded as cloud pt.

(10) The cooling of oil is continued, and now with every 1°c fall in temp oil tube is taken out and tilted to check the flow of oil. The temp at which oil ceases to flow along the side of the tube is recorded as pour point.

Significance

By the knowledge of cloud and pour point of an oil we can prevent the jamming of machines in colder region, or during winter season in some areas of India.

By cloud and pour point we can know the lowest temp upto which oil can be suitable as a liquid lubricant.

A good lubricating oil should have low cloud and pour point.

III. Emulsification OR Steam emulsion number

The property of oil to get intimate mixed with water, forming a mixture, called emulsion. This property is calle emulsification.

Emulsion have tendency to collect dirt, grit foreign matter, etc. thus causing abrasion and wearing of lubri-cated parts of the machinery. So a good lubricant should form emulsion with water which breaks off quickly.

This ability of lubricating oil to seperate from water is called demulsibil-ity Oil that separates readily from water has good demulsibility, oil that does not separates readily has poor demulsibility

The tendency of lubricant-water emulsion to break is determined by A.S.T.M. Test.

In this 20 ml of oil is take in a test tube and steam at 100°c is bubbled through it, till temp. is raised to 90°c.

The tube is then placed in a bath maintained at 93°c and time in seconds is noted, when the oil and water seperate out in distinct layers

The time in seconds in which an oil and water emulsion seperates out in distinct layers, is called steam emulsion number (SEN)

Significance →

① In steam turbines oils are contaminated with steam and hence quicker the oil seperation from the ~~emul~~ emulsion formed, better is the lubricating oil.

② In cutting oils ~~the~~ higher the emulsification (SEN) number better is the oil, because emulsion acts as a coolent as well as lubricant.

A good lubricant should have low SEN because Low SEN means less time taken by oil water emulsion to seperate back into different layers of oil & water

A good ideal lubricant should form emulsion which breaks quickly back into oil & H_2O.
, as emulsion cannot be used for lubrication

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Saponification Value

It is defined as the number of miligrams of potassium hydroxide required to saponify [conversion of oil into soap when comes in contact with alkali or base] one gram of oil.

It is the characteristic property of vegetable oil and animal oil but not for mineral oil or synthetic oil

Determination of saponification of an oil :→

A known quantity (w gms) of oil is mixed with known excess of alcoholic KOH solution (0.5 N). The mixture is shaken vigorously and allowed to stand for nearly 24 hours at room temp. Or the mixture is refluxed for about 2 hours, on water bath, using water condenser.

Fatty acids form potassium salts (soaps) and glycerol (glycerin) is released.

oil + alcoholic aq. KOH (known excess) $\xrightarrow{\text{Reflux}}$ soap + glycerol + unreacted KOH

In the reaction oil consume

KOH. The unreacted KOH is titrated by using dil HCl (0.5N). The blank reading (i.e. without oil) is taken. Thus from the vol. of unreacted KOH and total vol. of KOH used (blank reading) vol. of KOH reacted or consumed is calculated.

Vol of KOH consumed =

Total vol of KOH − Vol. of unreacted KOH

Saponification value

Saponification value = $\frac{\text{Amount of KOH consumed (Blank - test)} \times \text{Normality of KOH (0.5N)} \times 56}{\text{Weight of oil taken (W gms)}}$

Significance :→

(1) By the help of saponification value, we can measure the amount of saponifiable matter present in an oil sample.

(2) By the help of saponification value we can know whether oil contain high proportion of lower fatty acid or higher fatty acids.

When the oil contain high percentage of high fatty acid then the oil will have lower saponification value

when the oil contain low percentag of high fatty acid then the oil will have high saponification value.

(3) Also, we can estimate the amount of non-fatty ____ in oil. So by saponification value we can find the extent of adulteration in oil.

Good ideal lubricant should have ~~low~~ high saponification value

V Neutralisation Number :→

The acidity or basicity of oil is determined by Neutralization number.

Determination of acidity is expressed as acid number or acid value. and determination of basicity is expressed as base number or Base value.

Acid value :→

Acid value of an oil is the no. of miligrams of potassium hydroxide required to neutralize free acids present in one ~~g~~ gram of oil.

Base Value :→

Base value of an oil is the no. of miligrams of acid required to neutralize all basic constituents present in one gram oil

Determination of acid value :→

A known mass (W gms, ideally 1 gm) of oil mixed with absolute alcohol (50 ml for 1 gm of sample). The mixture is warmed for 10-15 minutes on water bath.

The mixture is then titrated against standard 0.1 N KOH solution, using phenolphthalein indicator.

The acid value is then calculated as

$$\text{Acid value} = \frac{\text{Quantity of KOH} \times \text{Normality of KOH} \times 56}{\text{weight of oil taken (W gms)}}$$

Significance :→

(1) By the help of acid value we can know the suitability of lubricating oil. Higher the acid value, more the corrosion of machine surfaces, more wear and tear, more maintaince cost for machine.

(2) It also helps to know the freshness of an oil sample.

(3) If the free acids is present in oil then it gives sharp and unpleasant flavour to edible oil.

(4) Free acids in oil are injurious, when used in medicinal or pharmaceutic purposes. So we should have the idea of acid value of an oil.

Good ideal lubricant should have low acid value

Carbon Residue

Oil or lubricant contain high percentage of carbon in combined form. On heating they decompose and deposite certain amount of carbon which is called carbon residue

OR

Lubricating oil have a tendency to form carbon residue on combustion because they have high % of carbon in combined form.

OR

Carbon residue of fuel or oil is the tendency to form carbon deposites under high temperature conditions in an inert atmosphere.

It is the byproduct of fuel is form due to improper combustion fuel.

Determination of Carbon Residue

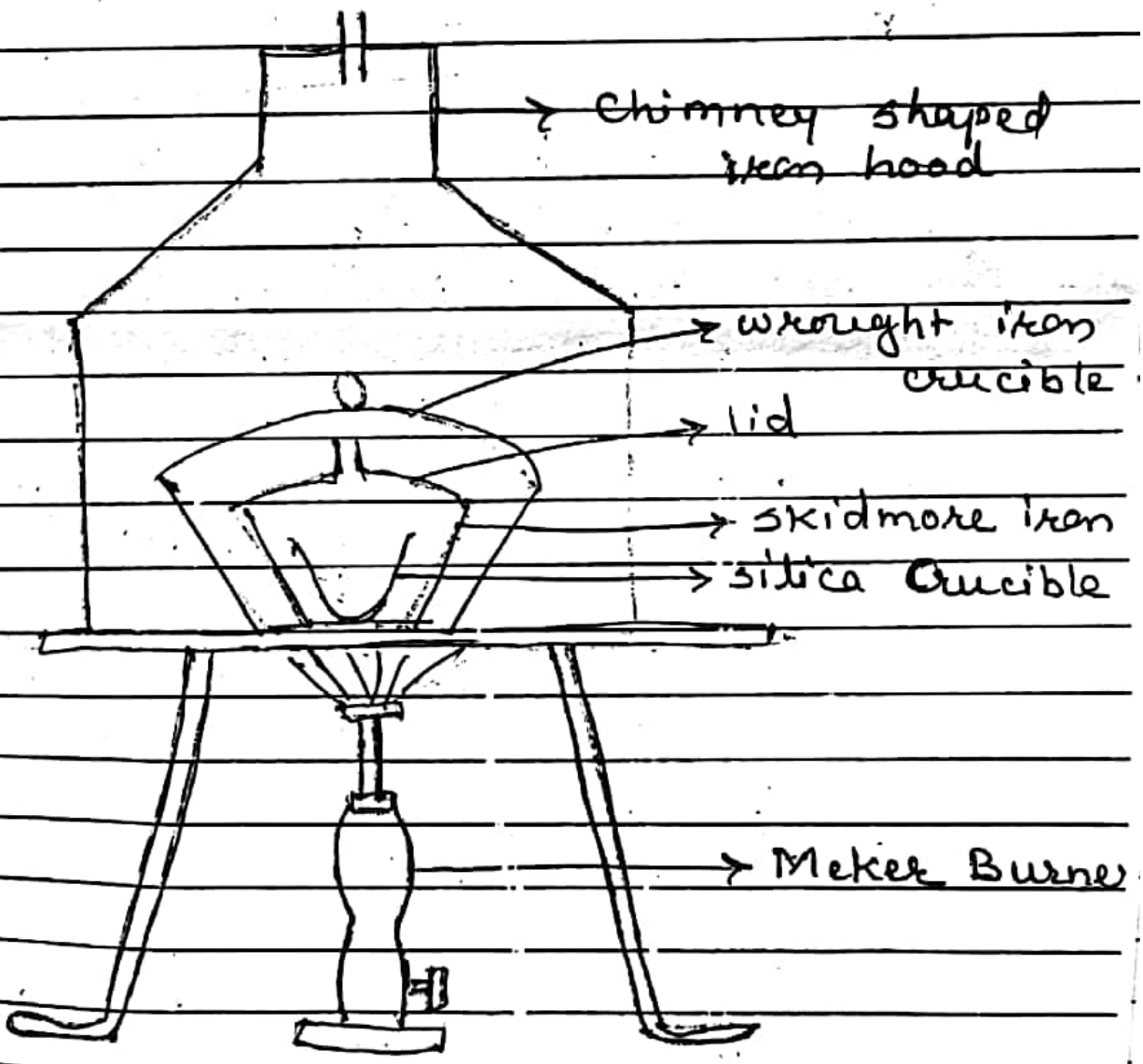
It is determined by
1. Conradson's method
2. Ramsbottom method

Conradson's Method :→

1. A known quantity of oil is taken in a silica crucible, glass beads are added to oil sample.
2. Silica crucible is then kept inside the skidmore crucible having a lid with a small tube type opening for the escape of volatile matter.
3. This combination of silica and skidmore crucible is then placed inside the coreright iron ~~ca~~ crucible.
4. It is then covered by chimney shaped iron hood.
5. The outer iron hood is heated by a meker burner till flame appears.
6. After about 15 minutes when all the vapours are burnt completely. The apparatus is allowed to cool and the

residue left is weighed.

% carbon residue = $\frac{\text{weight of residue in blub}}{\text{weight of origin oil sample}} \times 100$



Conradson's Apparatus

Significance :→

The deposition of carbon residue in machines particularly in the internal combustion engines and air compressor is intolerable, carbon residu decreases the efficiency of machine, so go lubricant should deposite low amount of carbon when it is used.

VII Aniline Point :→

The minimum equilibrium solution temperature for equal volume of aniline and oil sample :

Equal volume of aniline and oil sample are mixed in a test tube, the mixture is then heated until a homogeneous solution is obtained.

cible

Further the tube is allowed to cool at a controlled rate. The temp. at which the oil and aniline phases seperate out is recorded as the aniline point

Significance :→

A lower aniline point of oil means high percentage of aromatic hydrocarbon are present in it.

But aromatic hydrocarbons have a tendency to dissolve natural rubber and certain types of synthetic rubber which are used for sealings, packing, etc.

So, a good lubricant should have higher aniline point means low percentage of aromatic hydrocarbon.

Flash and Fire Point

Flash point → The minimum temp. at which oil gives off enough amount of vapours which ignite for a moment when a test flame is brought near to it is called Flash point.

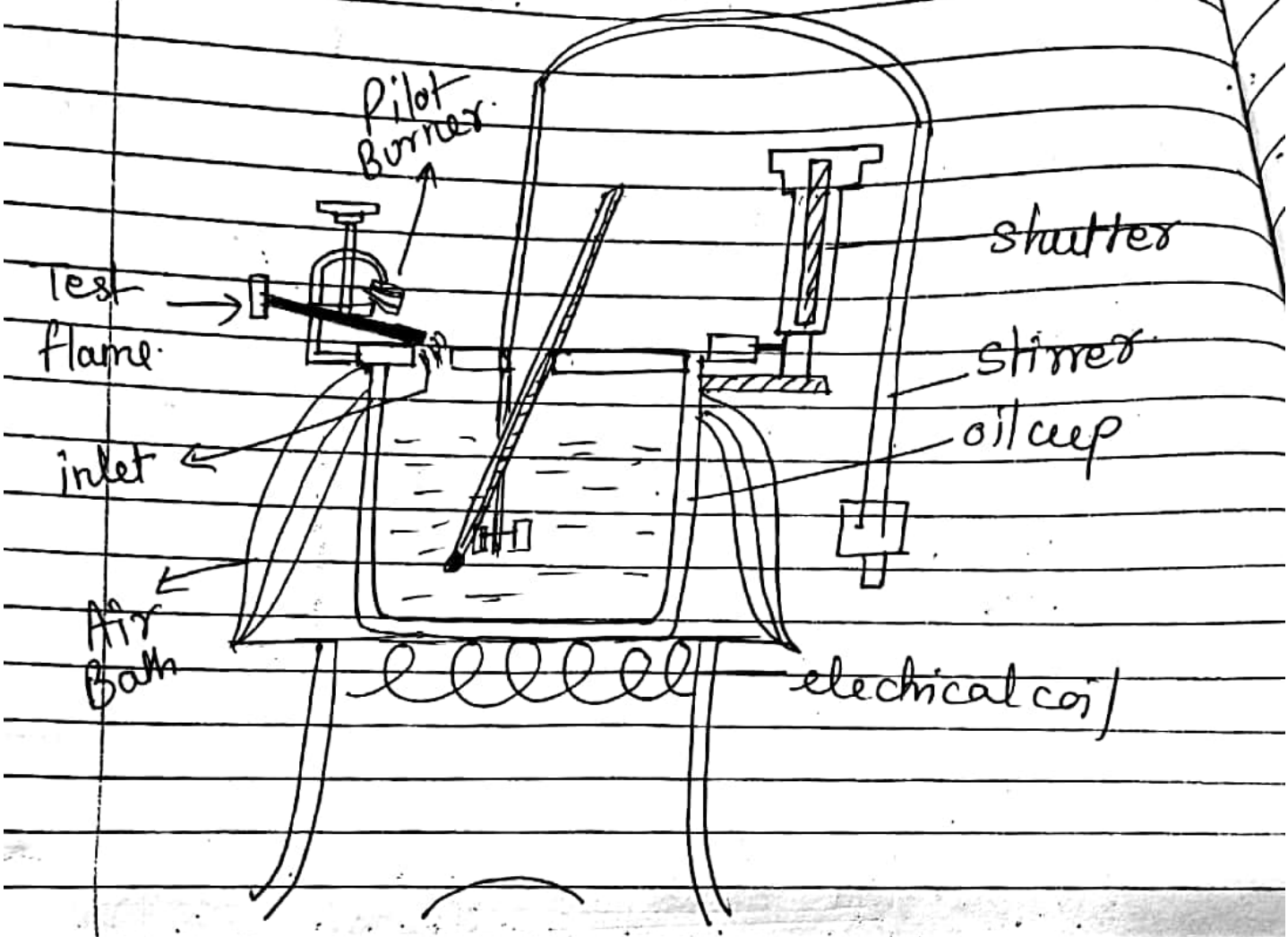
Fire point →
The minimum temp. at which oil gives off enough amount of vapours which burn continuously for atleast 5 seconds when a test flame is brought near to it called fire point.

Determination of flash and fire point

Flash and fire point of oil is determined by

1. Pensky Martens Apparatus
2. Abel's Apparatus
3. Cleveland Apparatus

Pensky Marten's Apparatus



Construction :→ It consist of

① Oil cup → Oil cup is made of brass which 5.5 cm deep and 5 cm in diameter. The lid of cup contain four openings. One is used for thermometer, second is used for stirrer which carrying two brass blades, third for air and fourth for introducing test flame.

② Shutter :→ At the top, shutter is present. By moving shutter

openings in the lid opens and flame (carried by exposure device) is dipped into this opening.

(3) Air bath → cup
Oil ∧ is supported by its flange over an air bath which is heated by a gas burner.

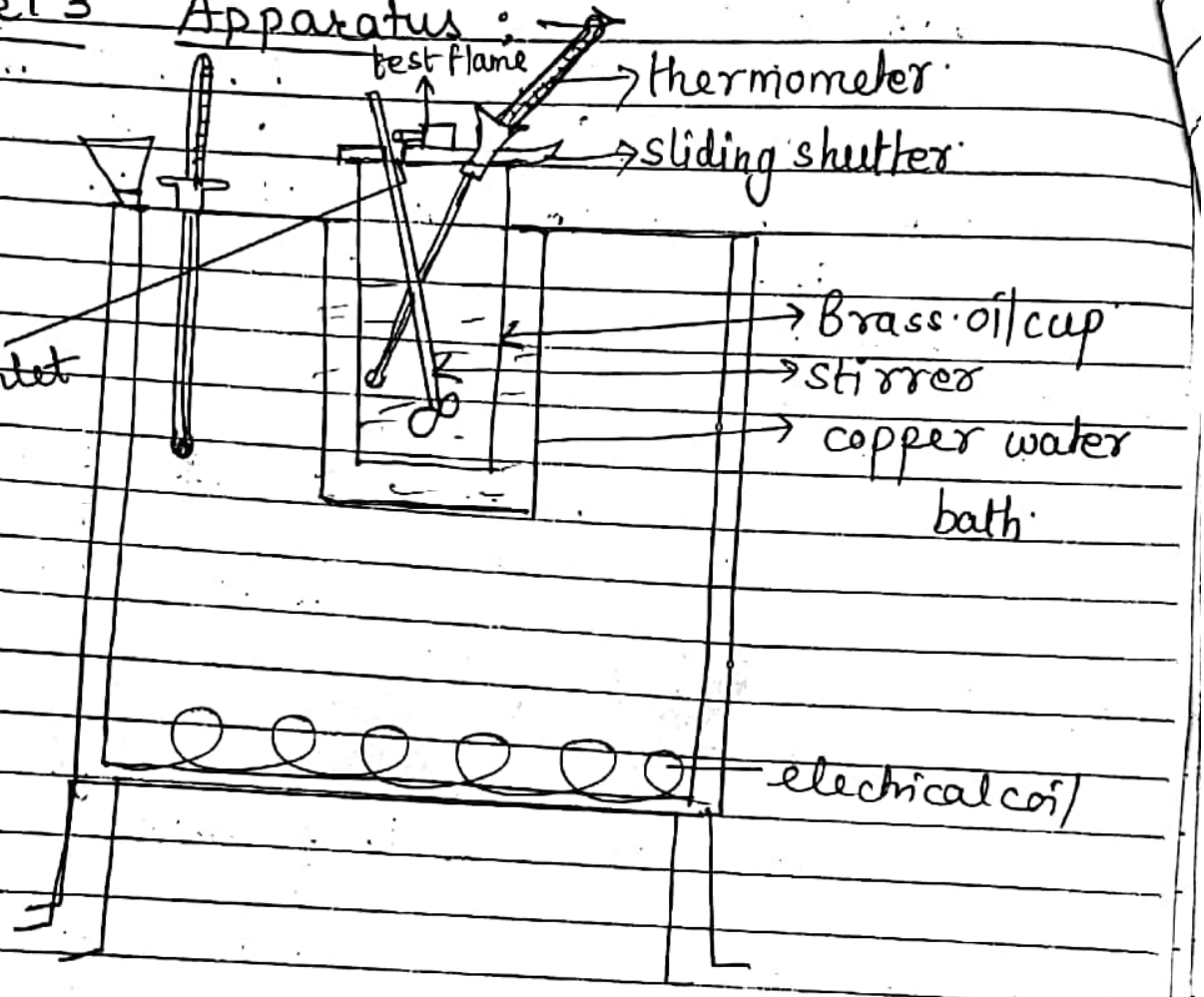
(4) Pilot burner :→
When the test flame is introduced in the opening, it gets extinguished, but when test flame is returned to its original position. It is automatically lighted by pilot burner

Working :→
(1) Oil under examination is filled upto the mark (pointer) in the cup.
(2) Oil heated by heating the air bath electrically.
(3) During heating stirrering is done continuously.
(4) when the temp of oil increases at a constant rate then at every 1°C rise of temp test flame is introduced over ∧ oil vapours for a moment by using shutter
(5) The temp. at which distinct flash appears inside the cup, is recorded as flash point

⑥ Further heating is continued & test is applied as before.

⑦ When a continuous flame is obtained for at least 5 sec. then that temp. recorded as fire point.

Abel's Apparatus :



Working :→

① Clean the oil cup properly.

② Oil cup is filled with oil under test

③ Cover is fitted on oil cup

④ Oil cup is fitted into the apparatus.

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(5) Stirrer, thermometer are adjusted
(6) Water bath is filled with cold water
(7) By the help of sliding shutter opening of inlet is closed, from where test flame is introduced over oil vapour
(8) Test flame is lightened and oil is heated electrically, heating is done in such rate that temp of oil increases at rate of 1 to 1½ °C per minute.
(9) Stir continuously, at every degree rise in temp of oil, opening (inlet) is opened by sliding shutter and test flame is introduced over oil surface, The temp. at which a distinct flash appears inside the cup is recorded a flash point
(10) further heating is continued and test flame is introduced as applied as before
(11) when ~~a distinct flash is~~ b Continuous flame is obtained for 5 seconds, then the temp. is recorded as fire point

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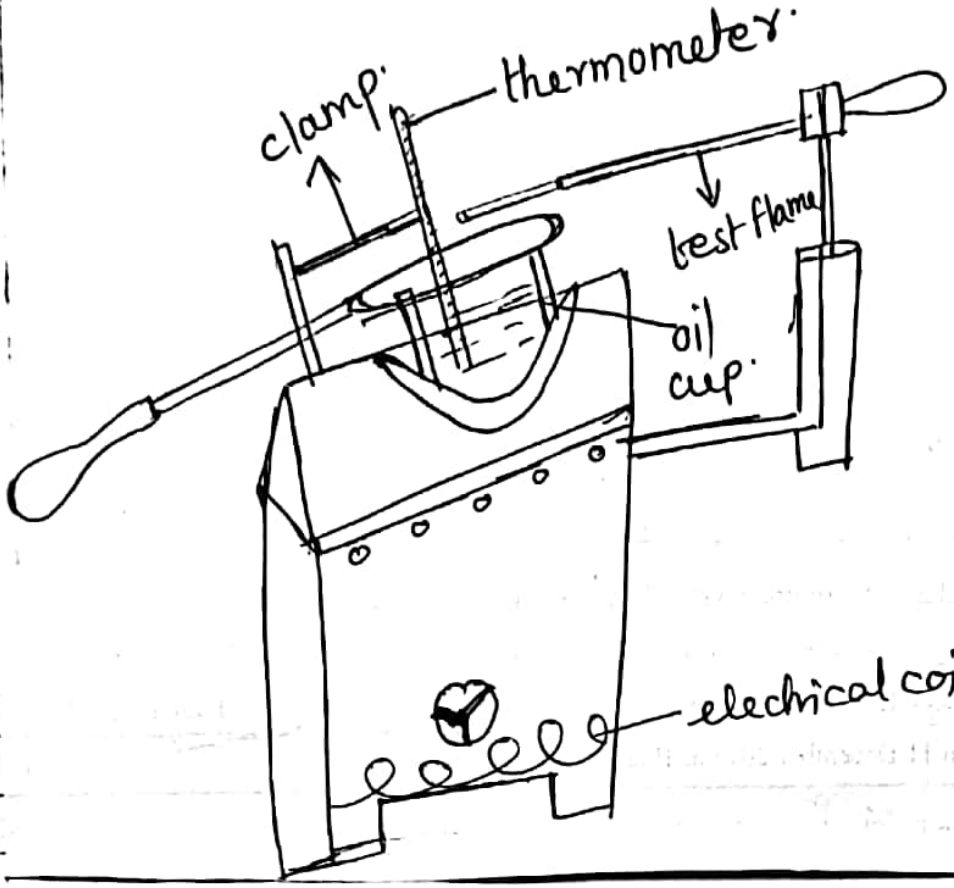
Cleveland's Apparatus



Working :→

① The apparatus is cleared properly, oil cup is filled with oil sample upto the mark.

② Thermometer is adjusted in the oil sample inside the oil cup without touching base.

③ Oil is heated electrically at constant rate.

④ At every 5°C rise in temp test flame is passed over oil surface.

⑤ When a flash appears on

surface of oil, temp. is recorded as flash point.

(6) Further heating is continued & test flame is applied after 1°C rise in temp. on surface of oil, the temp. at which continuous flame is obtained for at least 5 sec is recorded as fire point.

Significance of flash and fire point

⁂ →

(1) By the knowledge of flash and fire point we can prevent fire hazards during storage, transport and use of oil.

(2) It is also useful for identification and detection of contaminants in the oil

(3) A good ideal lubricant should have flash point above the temp at which it is to be used.

A good lubricant should have high flash & fire point

Determination of Aniline point

(37)

Dry and clean the aniline point apparatus at 100 - 110°c by keeping it in electric oven.

Take 5 ml of pure aniline, keep it in contact with KOH pellets, then filter to get dry aniline.

(3) Take 5 ml of the lubricating oil under test, shake it with anhydrous sodium sulphate, filter it to get dry lubricating oil

(4) Transfer 5 ml of each of dry aniline & dry lubricating oil into pyrex glass tube, fit a cork ~~on the m~~ with 2 holes on mouth of pyrex glass tube, through one hole insert a thermometer and through other hole insert glass rod stirrer in the mixture of aniline and oil taken in the pyrex glass tube.

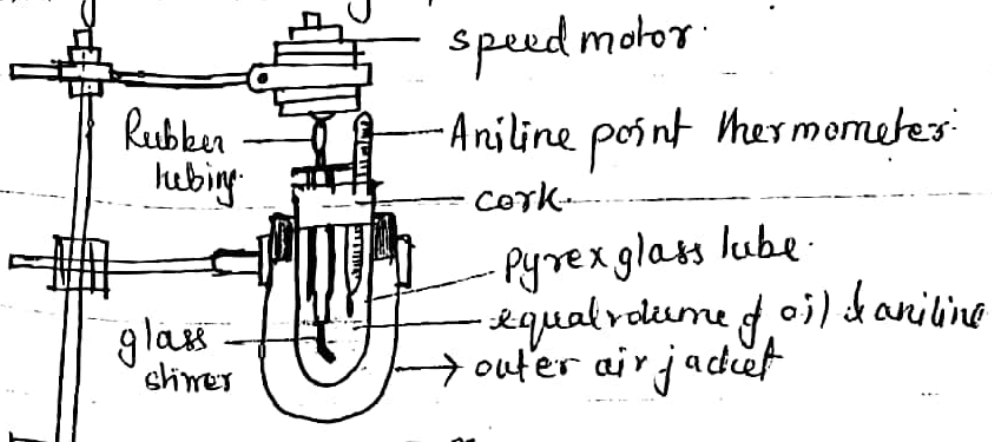
(5) Insert the pyrex glass tube in outer air jacket made of heat resistant glass.

(6) Now Insert the jacket holding the tube in hot bath.

(7) Start the speed motor to start rotation of glass stirrer. Continue stirring/mixing till a homogeneous solution of aniline & lubricating oil is obtained.

(8) Now allow the temp. of the solution to decrease at ~~thus~~ a rate of 1°c per minute (thus remove out the jacket from hot bath.)

(9) Note the temp. at which cloudiness appear due to the separation of aniline & oil. It is known as aniline point of lubricating oil.



Determination of Steam Emulsion Number (SEN)

The ability of lubricating oil to separate from water is called demulsibility.
The tendency of lubricant water emulsion to break is determined by ASTM test.

(1) Steam at 100°c is bubbled through a test tube containing 20ml of oil till the temp. of oil increase to 90°c
(2) Then the test tube is placed in a bath maintained at 90°c and the time in seconds is noted when oil & water separate out in distinct layers.
(3) The time in seconds in which oil & water emulsion separate out in distinct layer is called "Steam emulsion number" (SEN)
(4) A good lubricant should have low SEN, as it indicates less time taken by oil water emulsion to separate, as emulsion have tendency to collect dirt, grit, foreign matter etc. thus causing wearing of lubricated parts of machinery. so, a good lubricant emulsion should break off quickly into oil & water.

Determination of Acid value / Neutralization Number / Total acid No.

(1) A known mass of oil (5 – 10 gm) and 50 ml of alcohol are taken in a flask.
(2) The flask is then heated over a water bath for about half an hour.
(3) The content of flask is then titrated against N/10 KOH using phenolphthalein as indicator, then acid value is calculated as

$$\text{Acid value} = \frac{\text{No. of ml of N/10 KOH used} \times 5.6}{\text{Mass of oil taken in gm}}$$

(* 5.6 is the amount of KOH present in mg in 1 ml of N/10 KOH)

Determination of Saponification value

(1) A known mass (about 5gm) of the oil & 50 ml of N/2 KOH solution in alcohol are taken in flask.
(2) The flask is heated over a water bath for about an hour using a reflux condenser.
(3) The unreacted KOH in the flask is then back titrated against N/2 HCl, using phenolphthalein as indicator, then saponification value is calculated as:

$$\text{Saponification value} = \left[\frac{\text{Number of ml of N/2 KOH taken} - \text{Number of ml of N/2 acid used for back titration}}{\text{N of oil (in gm) taken for saponification}}\right] \times 28$$