Frequently asked questions:

1. Define Melting point.

Ans: The melting point is an index of the force of attraction between molecules. The greater the attractive forces between molecules, the more easily they will associate to form a solid. It is harder to separate them when they are in the crystalline form and convert them to a liquid.

2. Discuss about factors affecting melting point.

Ans: The melting points of individual fatty acids depend on chain length, number of double bonds (degree of saturation), and isomeric configuration. All these factors affect the degree of fit and the force of attraction between fatty acid molecules.

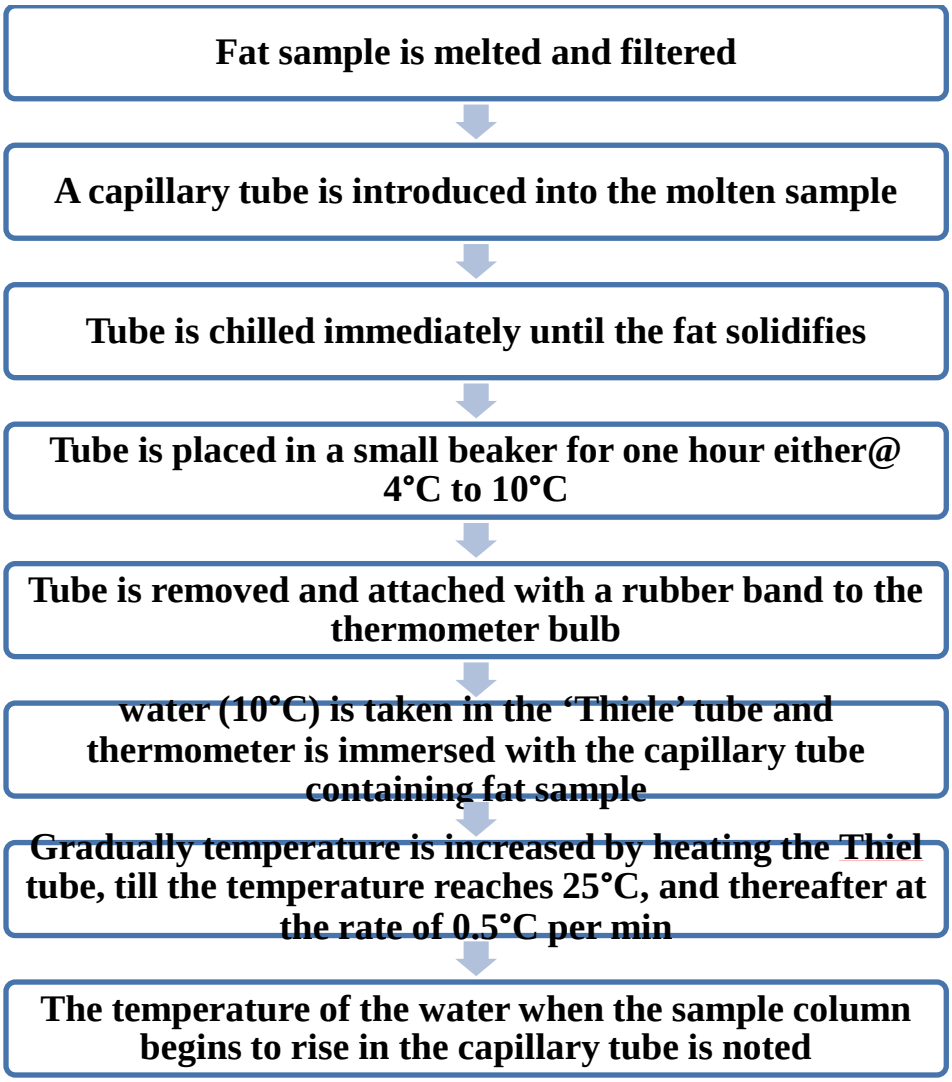
a. *Chain length*: Long-chain fatty acids have a higher melting point than short chain fatty acids. Potential for attraction is more between long chains than there is between short chains. For example, butyric acid (4:0) has a melting point of −7.9°C, whereas stearic acid (18:0) has a higher melting point of 69.6°C. Stearic acid is a crystalline solid and butyric acid is a liquid at room temperature.

b. *Number of double bonds*: As the number of double bonds increases, the melting point decreases. Double bonds introduce kinks into the chain and it is harder for molecules to fit together to form crystals. Thus, the attractive forces between the molecules are weaker.

c. *Isomeric configuration*: Geometric isomers have different melting points. Cis double bond configuration introduces a much bigger kink into the molecule than does the trans configuration. Consequently, the cis isomer has a lower melting point than the trans isomer.

3. How will you determine melting point of Fat?

Ans: Melting point is determined by Open-tube capillary-slip method. The principle in this method is the temperature at which the oil or fat softens or becomes sufficiently fluid to slip or run as determined by the open-tube capillary-slip method. The procedure for estimation of melting point of fats is shown below.



4. Define Softening point of fats. What are the properties of plastic fat?

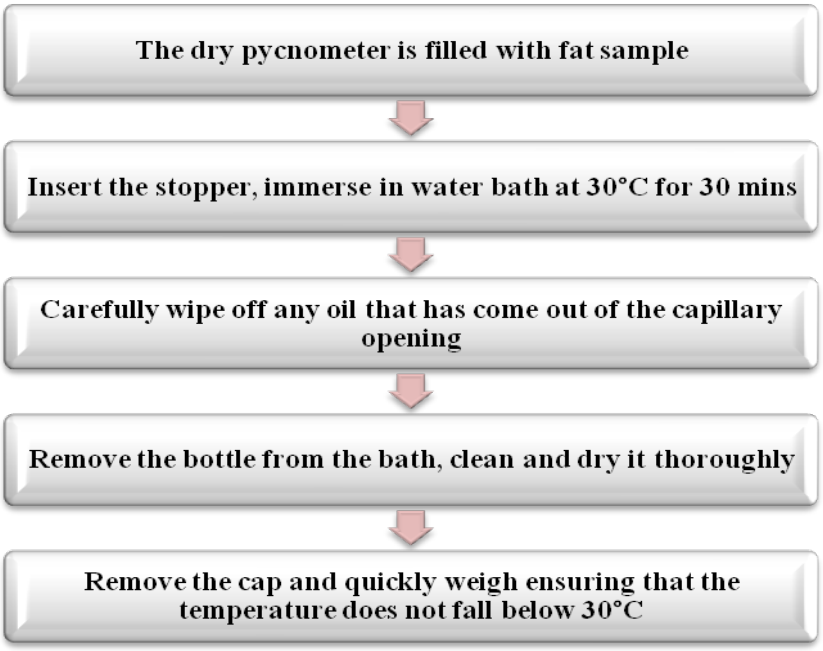
Ans: Fats do not melt immediately, but soften over a range of temperatures. This property is called softening of fats, and gives each fat its unique character. A plastic fat is moldable because it contains both liquid oil and solid crystals of triglycerides. If liquid triglycerides are more, fats will be softer. If solid triglycerides are more, fats will be harder. A plastic fat is a two-phase system, containing solid fat crystals surrounded by liquid oil. The liquid phase acts as a lubricant, enabling the solid crystals to slide past one another. Therefore, fat can be pressed and moulded into shapes without breakage. A fat that contains only solid triglycerides is brittle and cannot be molded. In these, the crystals cannot move past each other.

5. Define specific gravity? What is the specific gravity of fat?

Ans: The term specific gravity is used to denote the ratio between the weight of a substance and the weight of an equal volume of water. The weights are compared at the same temperature. The specific gravity of the fats is less than 1 (about 0.86) and, therefore, they float on water surface. Solid fats are lighter than the liquid fats. Oils spread on water to form thin layers.

6. How will you determine Specific gravity? List specific gravity of few fats.

Ans: Specific gravity is determined using pycnometer and the process is shown below.



$$\text{Specific gravity at } 30°C / 30°C = \frac{A - B}{C - B}$$

Where,

A = weight in gm of specific gravity bottle with oil at 30°C

B = weight in gm of specific gravity bottle at 30°C

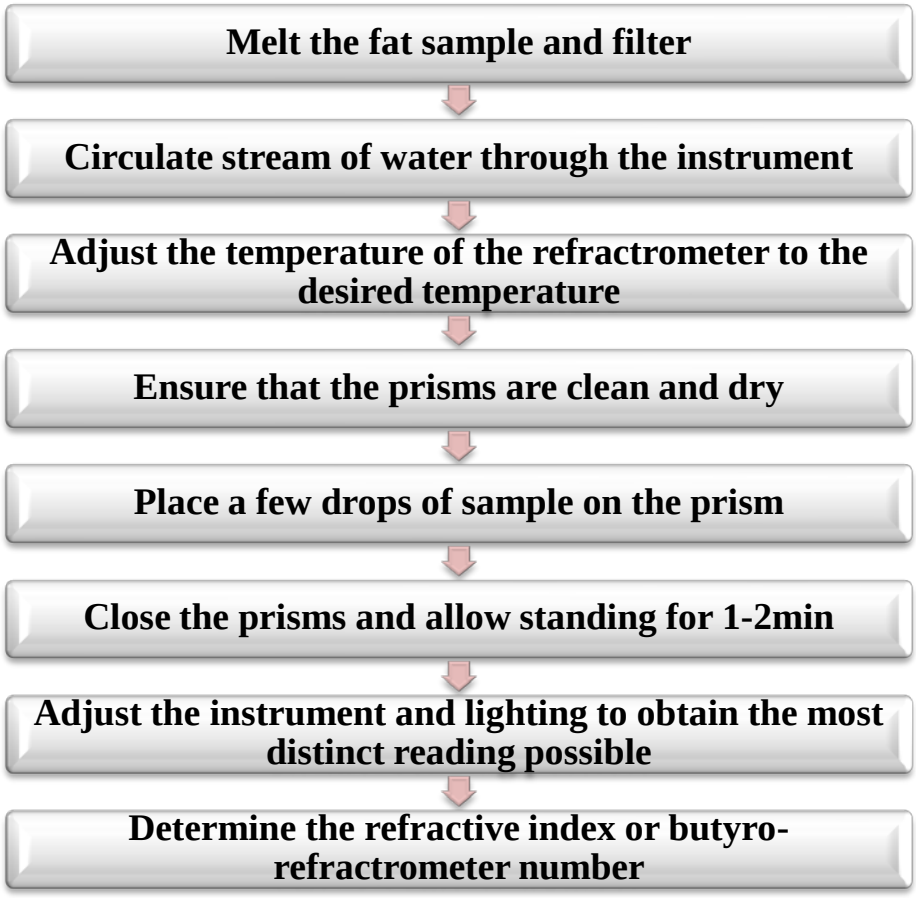
C = weight in gm of specific gravity bottle with water at 30°C

If the specific gravity of an oil is given as 0.919 at 25°/25°C. It means that the weight of the oil at 25°C is compared with the weight of an equal volume of water at 25°C. The average specific gravity of some edible fats and oils are.

- Butter: not <0.905 at 40°/40°C
- Cottonseed oil: 0.917-0.918 at 25°/25°C
- Corn oil: 0.919-0.921 at 25°/25°C
- Lard: 0.931-0.932 at 15°/15°C
- Olive oil: 0.916-0.918

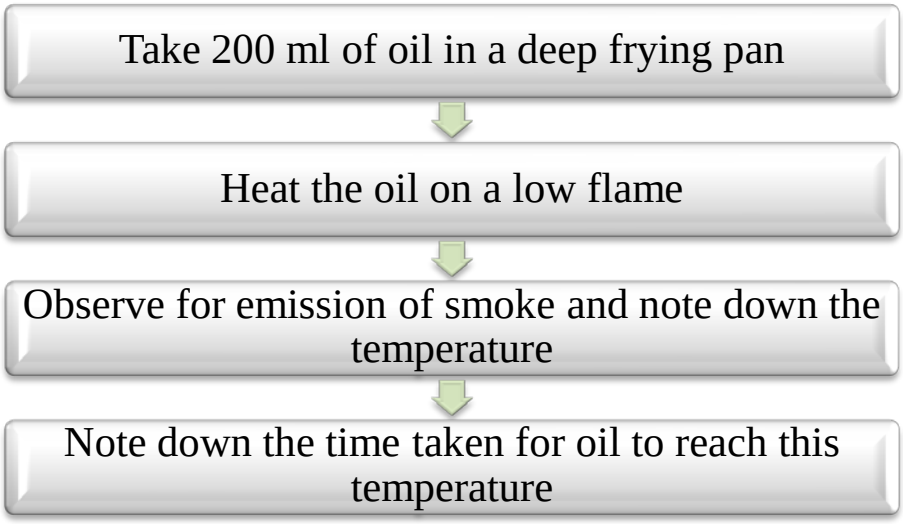
7. What is Refractive Index? Write the procedure to determine Refractive Index.

Ans: Refractive Index is the ratio of velocity of light in vacuum to the velocity of light in the oil or fat. It expresses the ratio between the sine of angle of incidence to the sine of angle of refraction when a ray of light of known wave length passes from air into the oil or fat. Refractive index varies with temperature and wavelength. Measurement of the refractive index of the sample is carried out by means of a suitable refractrometer. The procedure for measuring refractive index is shown below.



8. What is Smoke Point? Write the procedure to determine Smoking Point.

Ans: The smoke point is the temperature at which fat gets heated before continuous puffs of blue smoke come from the surface of the fat under controlled conditions. Smoking point is measured by using the following AOCS Method.



9. Explain about the chemical changes during smoking process. What are the factors affecting smoking point?

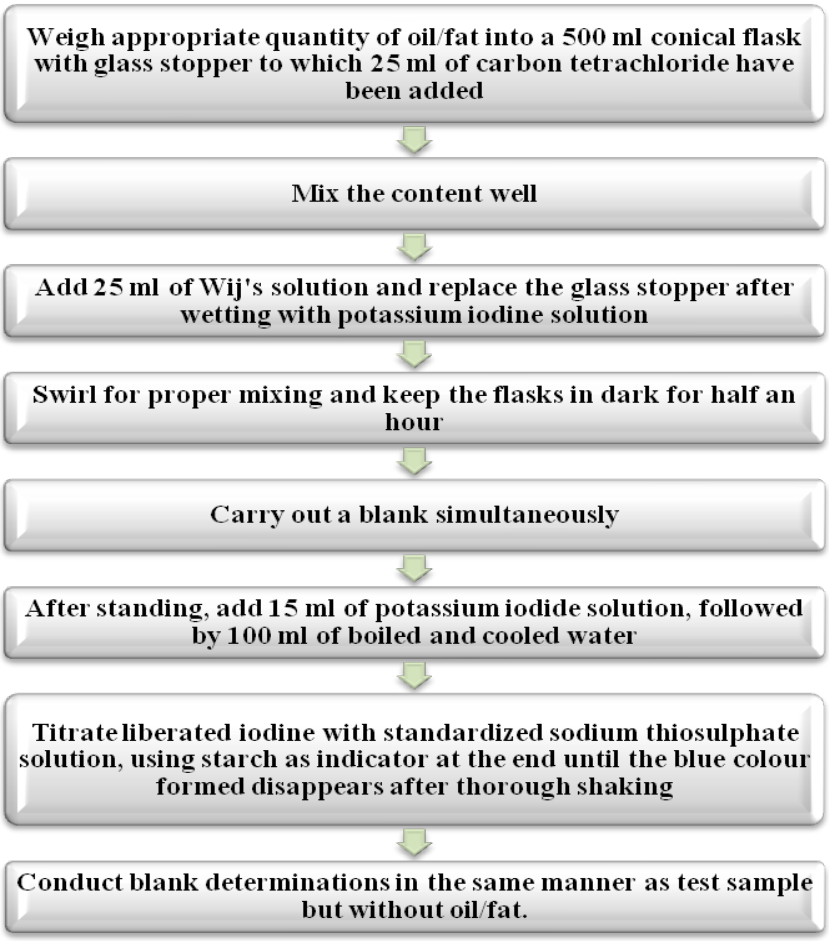
Ans: The presence of smoke during smoking indicates that free glycerol has hydrolyzed to yield acrolein. Acrolein is a mucous membrane irritant. Monoglycerides in hydrogenated shortenings and diglycerides are hydrolyzed more easily than triglycerides. Monoglycerides and diglycerides tend to have a low smoke point. There are many factors which affect the smoking point

Factors affecting Smoking Point

Factor	Effect
Hydrolysis of fat	Smoking point decreases
Repeated use	Decrease in smoking point
Suspended particles	Lowering of smoking point
Greater surface area	Lower smoking point
Shallow wide pans with sloping sides	Lower the smoking point
Vertical sides and small pans	Higher smoking point

10. Define iodine value. Describe the method to analyze Iodine value in fat sample.

Ans: The iodine value is defined as the percentage of iodine absorbed by an oil, fat or wax. The iodine value is a simple and rapidly determined chemical constant for a fat or oil. It is a valuable characteristic in fat analysis that measures unsaturation but does not define the specific fatty acids. Iodine-value analyses are very accurate and provide nearly theoretical values. Iodine value is a useful tool for process control and product specification. Iodine value is a measure of the unsaturation of fats and oils and is expressed as the iodine absorbed per 100 parts by weight of fat. The following method is used to measure iodine value of fat sample.



$$\textbf{Iodine value} = \frac{12.69\ (B - S)\ N}{W}$$

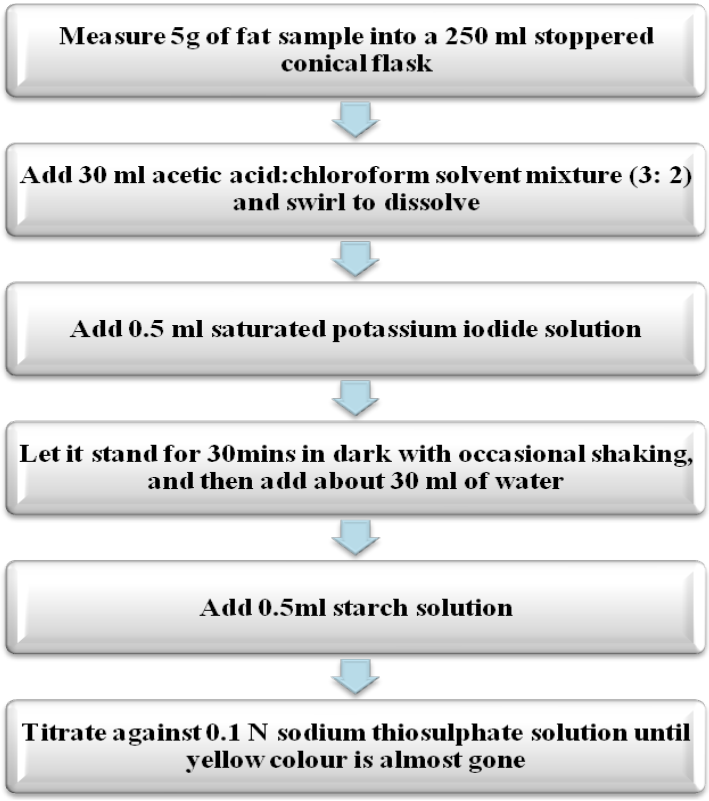
Where,

B = volume in ml of standard sodium thiosulphate solution required for the blank
S = volume in ml of standard sodium thiosulphate solution required for the sample
N = normality of the standard sodium thiosulphate solution

W = weight in g of the sample

11. What is Peroxide Value? Explain the experimental procedure to determine the peroxide value of a given fat sample.

Ans: The peroxide concentration, usually expressed as peroxide value, is a measure of oxidation or rancidity in its early stages. *Peroxide value (PV) measures the concentration of substances (in terms of milliequivalents of peroxide per 1000 grams of sample) that oxidize potassium iodide to iodine.* Peroxide value is one of the most widely used chemical tests for the determination of fats and oils quality. PV shows good correlation with organoleptic flavor scores. The method for estimation of PV is shown below.



Peroxide value expressed as milli equivalent of peroxide oxygen per kg sample (meq/kg):

$$\text{Peroxide value} = \frac{\text{Titre X N X 100}}{\text{Weight of the sample}}$$

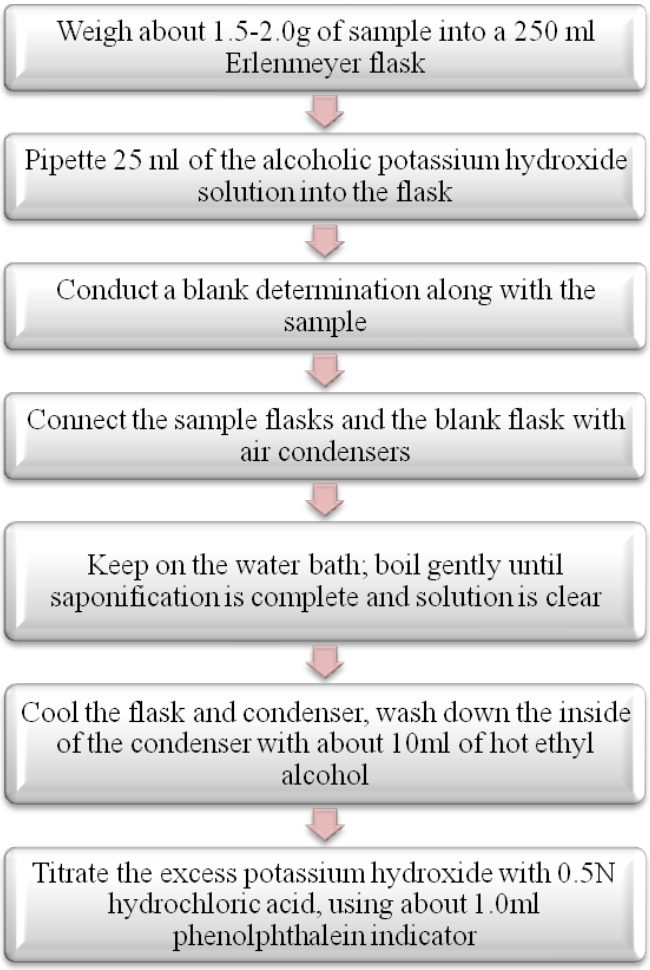
Where,
Titre = ml of Sodium Thiosulphate used (blank)
N = Normality of sodium thiosulphate solution.

12. What is Saponification Value?

Ans: The saponification value is defined as the number of mg of potassium hydroxide required to saponify 1 gram of oil/fat. Saponification value is a measure of the alkali-reactive groups in fats and oils and is useful in predicting the type of glycerides in a sample.

13. How will you estimate Saponification value in a given fat sample?

Ans: The method for estimation of saponification value is shown below.



$$\text{Saponification Value} = \frac{56.1\ (B-S)N}{W}$$

Where,
B = Volume in ml of standard hydrochloric acid required for the blank.
S = Volume in ml of standard hydrochloric acid required for the sample
N = Normality of the standard hydrochloric acid and
W = Weight in gm of the oil/fat taken for the test.

14. What is fire point?

Ans: The fire point is the temperature at which the volatile products will support continued combustion with application of a flame. Measurements of these temperatures are particularly important when selecting lipids that are going to be used at high temperatures (e.g., during baking or frying).

15. Define Flash point. How will you determine a flash point of particular fat

Ans: The flash point is the temperature at which the volatile products generated by the lipid are being produced at a rate where they can be temporarily ignited by application of a flame, but cannot sustain combustion. Flash point is determined by Pensky Marten (Closed Cup) Method. The following method helps to determines the temperature at which the sample will flash when a test flame is applied.