EXPERIMENT NO. (1): Determine the surface tension of a given liquid by using stalagmometer.

Theory: Consider a molecule in the interior of a liquid. It is being attracted by the neighbouring molecules equally in all directions and hence the resultant force on it is zero. Now consider another molecule at the surface. Here the molecule is not attracted equally in all directions. It is experiencing a net downward force or pull because of greater attraction for the molecules in the liquid than for the molecules in the vapour state above the liquid. This is the case with all molecules at the surface. As a result of this inward pull all the molecules at the surface tends to contract. Hence the liquid surface behaves like a stretched membrane. This force in the surface of liquid is called as surface tension. *The force acting at a right angle on a unit length along the surface of a liquid is known as surface tension.*

Procedure: Suppose we want to determine the surface tension of benzene. Take a stalagmometer, wash it with ether and dry, then fill it with distilled water upto the upper mark X by sucking through rubber tube. Release the liquid at a very slow rate and count the number of drops of water from the upper mark X to the lower mark Y. Also count the no. of drops of benzene in a similar way. Repeat this experiment for three times.

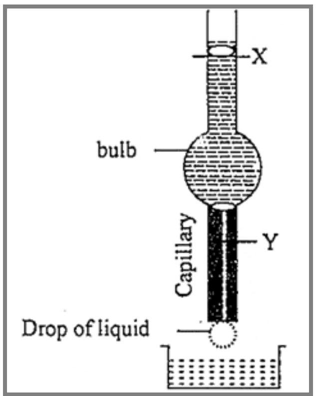


Figure: Stalagmometer

Take a specific gravity bottle, fill it with distilled water and weigh it. Then fill it with benzene and weigh it. Calculate the weight of distilled water and benzene by subtracting the weight of empty bottle from the total weights of bottle filled with water and filled with benzene. Calculate the density of liquid as follows:

$$\text{Density of liquid} = \frac{\text{wt. of liquid}}{\text{wt. of water}} \times \text{density of water}$$

Note the density of water at the temperature of room from literature table. Then calculate the surface tension by using the formula.

Precautions:

1. To clean stalagmometer, wash it in the following order: chromic acid ⟶ tap water ⟶ distilled water ⟶ alcohol ⟶ ether.
2. Adjust the flow of liquid with the help of rubber tube and screw cock. Adjustment should remain the same for all liquids.
3. Adjust the flow of liquid such that number of drops can be calculated.
4. No bubbles should get entrapped in the liquid column of the stalagmometer.

Apparatus:

Stalagmometer, specific gravity bottle, rubber tube, screw type pinch cock, beakers etc.

Observations and Calculations:

Room temperature = 34 °C

Liquids	Number of drops	Surface tension
Distilled water	25 26 Mean = 26 26	γ_w = 70.54 dynes/cm (at 34 °C)
Benzene	59 58 Mean = 59 59	γ_ℓ =?

Weight of empty specific gravity bottle = 13.17 g

Weight of empty specific gravity bottle + distilled water = 37.19 g

Weight of empty specific gravity bottle + liquid = 34.33 g

Hence,

Weight of water = 37.19 – 13.17 = 24.02 g

Weight of liquid = 34.33 – 13.17 = 21.16 g

Density of water at 34 °C = 0.995 ≃ 1 g/ml

And, Density of liquid = $\frac{21.16}{24.02} \times 1 = 0.8809$ g/ml

Therefore,

$$\text{Surface tension of liquid} = \frac{\text{Density of liquid}}{\text{Density of water}} \times \frac{\text{No. of drops of water}}{\text{No. of drops of liquid}} \times \gamma_w$$

$$\gamma_\ell = \frac{0.8809}{1} \times \frac{26}{59} \times 70.54 = 27.38 \text{ dynes/cm}$$

Result:

Surface tension of unknown liquid = 27.38 dynes/cm

EXPERIMENT NO. (2): Determine the parachor value of a given liquid. The molecular weight of the liquid is 78.

Theory:

It has been shown by Sudgen (1924) that if molar volume (M/D) is multiplied by the fourth root of the surface tension, it leads to a constant which is known as parachor.

$$[P] = \frac{M}{D}\gamma^{1/4}$$

Where M is the molar mass and D is the density of the liquid. Thus, parachor may be defined as the molar volume of a liquid when the surface tension of that liquid is unity. It is both an additive and constitutive property.

Procedure:

Suppose we want to determine the surface tension of benzene. Take a stalagmometer, wash it with ether and dry, then fill it with distilled water upto the upper mark X by sucking through rubber tube. Release the liquid at a very slow rate and count the number of drops of water from the upper mark X to the lower mark Y. Also count the no. of drops of benzene in a similar way. Repeat this experiment for three times.

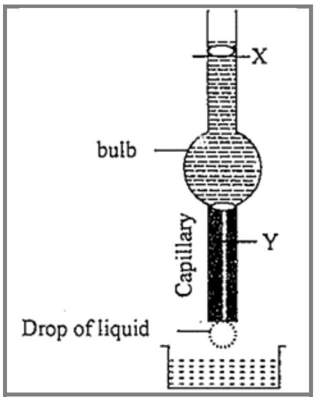


Figure: Stalagmometer

Take a specific gravity bottle, fill it with distilled water and weigh it. Then fill it with benzene and weigh it. Calculate the weight of distilled water and benzene by subtracting the weight of empty bottle from the total weights of bottle filled with water and filled with benzene. Calculate the density of liquid as follows:

$$\text{Density of liquid} = \frac{\text{wt. of liquid}}{\text{wt. of water}} \times \text{density of water}$$

Note the density of water at the temperature of room from literature table. Then calculate the surface tension by using the formula. Using this value of surface tension, we can calculate the parachor value of the given liquid.

Precautions:

1. To clean stalagmometer, wash it in the following order: chromic acid ⟶ tap water ⟶ distilled water ⟶ alcohol ⟶ ether.
2. Adjust the flow of liquid with the help of rubber tube and screw cock. Adjustment should remain the same for all liquids.
3. Adjust the flow of liquid such that number of drops can be calculated.
4. No bubbles should get entrapped in the liquid column of the stalagmometer.

Apparatus:

Stalagmometer, specific gravity bottle, rubber tube, screw type pinch cock, beakers etc.

Observations and Calculations:

Room temperature = 34 °C

Liquids	Number of drops	Surface tension
Distilled water	25 26 Mean = 26 26	γ_w = 70.54 dynes/cm (at 34 °C)
Benzene	59 58 Mean = 59 59	γ_ℓ =?

Weight of empty specific gravity bottle = 13.17 g

Weight of empty specific gravity bottle + distilled water = 37.19 g

Weight of empty specific gravity bottle + liquid = 34.33 g

Hence,

Weight of water = 37.19 – 13.17 = 24.02 g

Weight of liquid = 34.33 – 13.17 = 21.16 g

Density of water at 34 °C = 0.995 ≃ 1 g/ml

And, Density of liquid = $\frac{21.16}{24.02} \times 1 = 0.8809$ g/ml

Therefore,

$$\text{Surface tension of liquid} = \frac{\text{Density of liquid}}{\text{Density of water}} \times \frac{\text{No. of drops of water}}{\text{No. of drops of liquid}} \times \gamma_w$$

$$\gamma_l = \frac{0.8809}{1} \times \frac{26}{59} \times 70.54 = 27.38 \text{ dynes/cm}$$

And Parachor $[P] = \frac{M}{D}(\gamma_l)^{\frac{1}{4}}$

$$[P] = \frac{78}{0.8809}(27.38)^{\frac{1}{4}}$$

$$\log[P] = \log(88.54) + \frac{1}{4}\log(27.38) = 2.306$$

$$[P] = \text{anti}\log(2.306) = 202$$

Result: Parachor value of given liquid = 202.

EXPERIMENT NO. (3): Determine the %age composition of unknown mixture of ethanol and distilled water by using stalagmometer.

Theory: Consider a molecule in the interior of a liquid. It is being attracted by the neighbouring molecules equally in all directions and hence the resultant force on it is zero. Now consider another molecule at the surface. Here the molecule is not attracted equally in all directions. It is experiencing a net downward force or pull because of greater attraction for the molecules in the liquid than for the molecules in the vapour state above the liquid. This is the case with all molecules at the surface. As a result of this inward pull all the molecules at the surface tends to contract. Hence the liquid surface behaves like a stretched membrane. This force in the surface of liquid is called as surface tension. *The force acting at a right angle on a unit length along the surface of a liquid is known as surface tension.*

Procedure:

Suppose the given liquid mixture is of ethanol and distilled water. The composition of this mixture can be determined as follows:

Prepare various compositions of ethanol and distilled water as follows:

No. of samples	1	2	3	4	5	6
%age composition	0%	20%	40%	60%	80%	100%
Ethanol (ml)	0	2	4	6	8	10
Distilled water (ml)	10	8	6	4	2	0

Find out the number of drops of each composition using stalagmometer. Also find the number of drops of unknown mixture of liquids. Plot a graph between the percentage compositions of the self-prepared mixtures (given above) and their respective number of drops. The %age composition of unknown mixture can be determined by inserting its number of drops into the graph.

Precautions:

1. To clean stalagmometer, wash it in the following order: chromic acid ⟶ tap water ⟶ distilled water ⟶ alcohol ⟶ ether.
2. Adjust the flow of liquid with the help of rubber tube and screw cock. Adjustment should remain the same for all liquids.
3. Adjust the flow of liquid such that number of drops can be calculated.
4. No bubbles should get entrapped in the liquid column of the stalagmometer.
5. Use distilled water throughout the experiment.

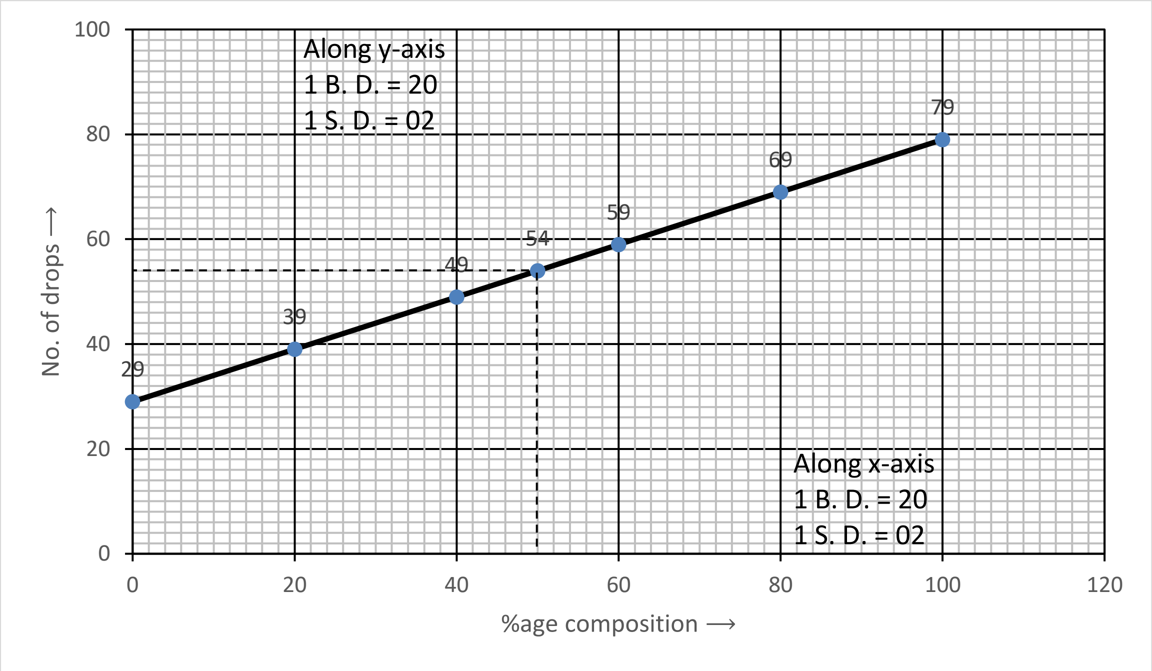
Apparatus:

Stalagmometer, specific gravity bottle, rubber tube, screw type pinch cock, beakers etc.

Observations and Calculations:

No. of samples	1	2	3	4	5	6	unknown
%age composition	0%	20%	40%	60%	80%	100%	-
Ethanol (ml)	0	2	4	6	8	10	-
Distilled water (ml)	10	8	6	4	2	0	-
No. of drops	29	39	49	59	69	79	55

Graph: Graph between %age composition and no. of drops.



Result: Hence, from graph the %age composition of unknown mixture is 50%.

EXPERIMENT NO. (4): Determine the viscosity of a given liquid by using viscometer.

Theory:

The internal resistance of a liquid to its flow is called viscosity. The resistance to flow is because of the internal friction among the layers of molecules. Liquids which flow very slowly like honey or glycerin have high viscosities as compared to ether and water having low viscosities. It is difficult to determine the absolute value of viscosity. For the sake of convenience, the viscosities of various liquids are compared in terms of coefficient of viscosity which may be defined as *the force of resistance per unit area which will maintain unit velocity difference between two layers of a liquid at a unit distance from each other.* It is denoted by η.

Procedure:

A simple form of viscometer designed by Ostwald is shown in figure. First of all, clean the viscometer with chromic acid then wash thoroughly with distilled water and then rinse with ether and dry. A definite volume of the liquid whose coefficient of viscosity is to be determined is introduced into the bulb C. It is then drawn up by suction into the bulb A and the time taken by the liquid to flow between the marks X and Y is accurately measured with the help of the stop watch. The viscometer is then thoroughly cleaned. The other liquid of known viscosity is introduced and the whole operation is repeated. Take at least three readings in each case. Determine the density of liquid with the help of specific gravity bottle. Then calculate the viscosity by using the formula.

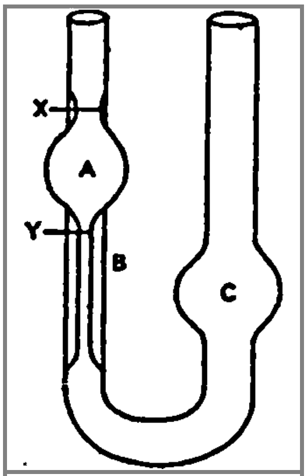


Figure: Viscometer

Precautions:

1. The viscometer should be properly clean and dry before use.
2. Volume of every liquid introduced should be same every time.
3. Pinch cock pressure should remain constant throughout the experiment.
4. Rubber tube should remain dry.
5. Fix the viscometer in vertical position.
6. Pipette can be used to add liquid or water into the viscometer.

Apparatus:

Viscometer, specific gravity bottle, rubber tube, screw type pinch cock, beakers etc.

Observations and Calculations:

Room temperature = 34 °C

Liquids	Time of flow	Viscosity
Distilled water	17 18 Mean = 18 sec 18	η_w = 7.43 x 10^3 poise (at 34 °C)
Benzene	15 14 Mean = 15 sec 15	η_ℓ =?

Weight of empty specific gravity bottle = 13.17 g

Weight of empty specific gravity bottle + distilled water = 37.19 g

Weight of empty specific gravity bottle + liquid = 34.33 g

Hence,

Weight of water = 37.19 – 13.17 = 24.02 g

Weight of liquid = 34.33 – 13.17 = 21.16 g

Density of water at 34 °C = 0.995 ≃ 1 g/ml

And, Density of liquid = $\frac{21.16}{24.02} \times 1 = 0.8809$ g/ml

Therefore,

$$\text{Viscosity of liquid} = \frac{\text{Density of liquid}}{\text{Density of water}} \times \frac{\text{Time of flow of liquid}}{\text{Time of flow of water}} \times \eta_w$$

$$\eta_\ell = \frac{0.8809}{1} \times \frac{15}{18} \times 7.43 \times 10^3 = 5.45 \times 10^3 \text{poise}$$

Result:

Viscosity of unknown liquid = 5.45 x 10^3 poise

EXPERIMENT NO. (5): Determine the rheochor value of a given liquid. The molecular weight of the liquid is 78.

Theory:

It has been shown by Newton Friend that if molar volume (M/D) is multiplied by the eighth root of the coefficient of viscosity, it leads to a constant which is known as rheochor.

$$[R] = \frac{M}{D}\eta^{1/8}$$

Where M is the molar mass and D is the density of the liquid. Thus, the rheochor may be defined as the molar volume of a liquid when the viscosity of that liquid is unity. Like parachor, rheochor is both additive and constitutive.

Procedure:

A simple form of viscometer designed by Ostwald is shown in figure. First of all, clean the viscometer with chromic acid then wash thoroughly with distilled water and then rinse with ether and dry. A definite volume of the liquid whose coefficient of viscosity is to be determined is introduced into the bulb C. It is then drawn up by suction into the bulb A and the time taken by the liquid to flow between the marks X and Y is accurately measured with the help of the stop watch. The viscometer is then thoroughly cleaned. The other liquid of known viscosity is introduced and the whole operation is repeated. Take at least three readings in each case. Determine the density of liquid with the help of specific gravity bottle. Then calculate the viscosity by using the formula. Using this value of viscosity, we can calculate the rheochor value of the given liquid.

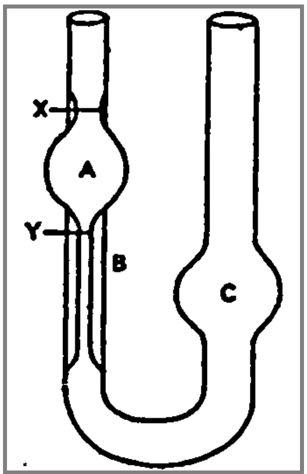


Figure: Viscometer

Precautions:

1. The viscometer should be properly clean and dry before use.
2. Volume of every liquid introduced should be same every time.
3. Pinch cock pressure should remain constant throughout the experiment.
4. Rubber tube should remain dry.
5. Fix the viscometer in vertical position.
6. Pipette can be used to add liquid or water into the viscometer.

Apparatus:

Viscometer, specific gravity bottle, rubber tube, screw type pinch cock, beakers etc.

Observations and Calculations:

Room temperature = 34 °C

Liquids	Time of flow	Viscosity
Distilled water	17 18 Mean = 18 sec 18	η_w = 7.43 x 10^3 poise (at 34 °C)
Benzene	15 14 Mean = 15 sec 15	η_ℓ =?

Weight of empty specific gravity bottle = 13.17 g

Weight of empty specific gravity bottle + distilled water = 37.19 g

Weight of empty specific gravity bottle + liquid = 34.33 g

Hence,

Weight of water = 37.19 – 13.17 = 24.02 g

Weight of liquid = 34.33 – 13.17 = 21.16 g

Density of water at 34 °C = 0.995 ≃ 1 g/ml

And, Density of liquid = $\frac{21.16}{24.02} \times 1 = 0.8809$ g/ml

Therefore,

$$\text{Viscosity of liquid} = \frac{\text{Density of liquid}}{\text{Density of water}} \times \frac{\text{Time of flow of liquid}}{\text{Time of flow of water}} \times \eta_w$$

$$\eta_l = \frac{0.8809}{1} \times \frac{15}{18} \times 7.43 \times 10^3 = 5.45 \times 10^3 \text{poise}$$

And Rheochor $[R] = \frac{M}{D}(\eta_l)^{\frac{1}{8}}$

$$[R] = \frac{78}{0.8809}(5.45 \times 10^3)^{\frac{1}{8}}$$

$$\log[P] = \log(88.54) + \frac{1}{8}\log(5.45 \times 10^3) = 2.414$$

$$[P] = \text{anti}\log(2.414) = 259$$

Result: Parachor value of given liquid = 259.

EXPERIMENT NO. (6): Determine the %age composition of unknown mixture of ethanol and distilled water by using viscometer.

Theory:

The internal resistance of a liquid to its flow is called viscosity. The resistance to flow is because of the internal friction among the layers of molecules. Liquids which flow very slowly like honey or glycerin have high viscosities as compared to ether and water having low viscosities. It is difficult to determine the absolute value of viscosity. For the sake of convenience, the viscosities of various liquids are compared in terms of coefficient of viscosity which may be defined as *the force of resistance per unit area which will maintain unit velocity difference between two layers of a liquid at a unit distance from each other.* It is denoted by η.

Procedure:

Suppose the given liquid mixture is of ethanol and distilled water. The composition of this mixture can be determined as follows:

Prepare various compositions of ethanol and distilled water as follows:

No. of samples	1	2	3	4	5	6
%age composition	0%	20%	40%	60%	80%	100%
Ethanol (ml)	0	2	4	6	8	10
Distilled water (ml)	10	8	6	4	2	0

Find out the time of flow of each composition using viscometer. Also find the time of flow of unknown mixture of liquids. Plot a graph between the percentage compositions of the self-prepared mixtures (given above) and their respective time of flow. The %age composition of unknown mixture can be determined by inserting its time of flow into the graph.

Precautions:

1. The viscometer should be properly clean and dry before use.
2. Volume of every liquid introduced should be same every time.
3. Pinch cock pressure should remain constant throughout the experiment.
4. Rubber tube should remain dry.
5. Fix the viscometer in vertical position.
6. Pipette can be used to add liquid or water into the viscometer.
7. Use distilled water throughout the experiment.

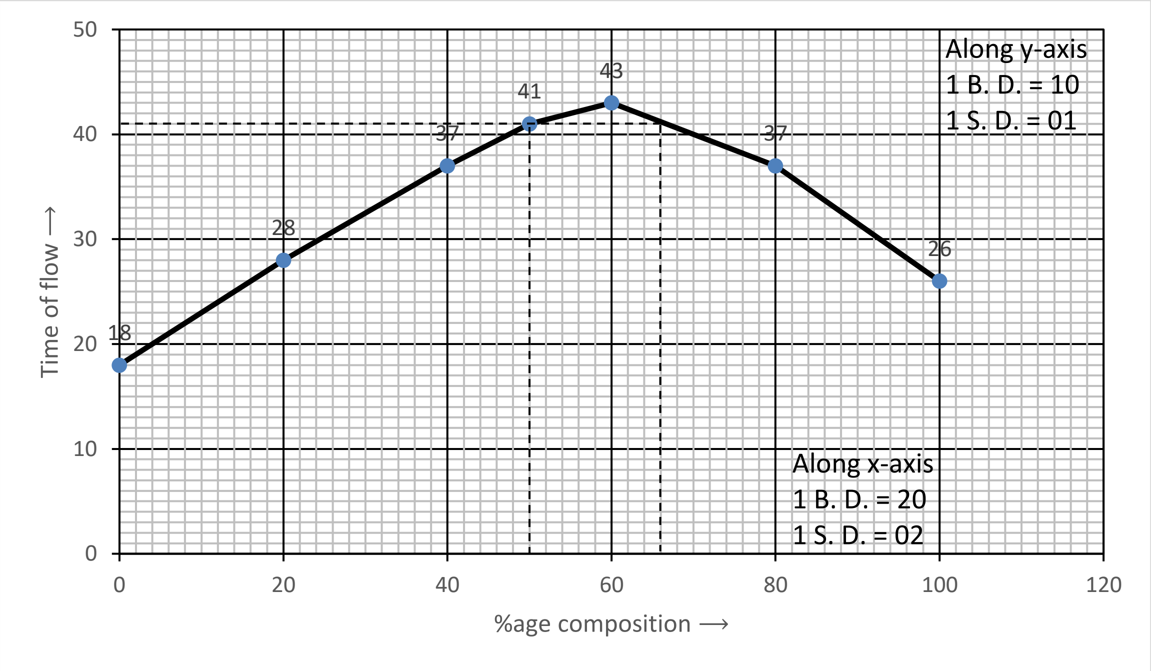
Apparatus:

Viscometer, specific gravity bottle, rubber tube, screw type pinch cock, beakers etc.

Observations and Calculations:

No. of samples	1	2	3	4	5	6	unknown
%age composition	0%	20%	40%	60%	80%	100%	-
Ethanol (ml)	0	2	4	6	8	10	-
Distilled water (ml)	10	8	6	4	2	0	-
Time of flow	18	28	37	43	37	26	41

Graph: Graph between %age composition and time of flow.



Result: Hence, from graph the %age composition of unknown mixture is 50%.

EXPERIMENT NO. (7): Find out the refractive index of a given liquid by using refractometer.

Theory:

When a ray of light passes from air into a denser medium, say liquid, it is bent or refracted towards normal. The ratio of the sine of the angle of incidence and that of refraction is constant and characteristics of that liquid (Snell's law). The constant ratio is called as refractive index of the liquid. It is denoted by n.

$$n = \frac{\sin i}{\sin r}$$

Where, i is the angle of incidence and r is the angle of refraction.

Procedure:

In order to determine the refractive index of a liquid, open the refractometer, wash the prism with acetone or chloroform. When it dries, put a drop of liquid under examination and make its film with a glass rod. Close the refractometer. Focus the cross wires of the telescope by rotating the eyepiece and adjust the mirror so as to get good illumination. The assembly of the prisms is rotated with the help of side knob till the diametric edge of the bright and dark half circles coincides with the crossing point of the cross wires in the telescope. Note the refractive index through another eyepiece. Suppose for water it is 1.331. See the refractive index of water from the literature, suppose it is 1.333. Then 0.002 is the error which should be added in every reading taken after for the other liquids under examination repeating the same procedure.

Precautions:

1. Make a film of liquid under examination on the prism of refractometer by means of a glass rod.
2. Error of the refractometer should be calculated with standard value of water. It should be added or subtracted in the observed values accordingly.

Apparatus:

Abbe’s refractometer, glass rod, cotton wool, beakers etc.

Observations and Calculations:

Room temperature = 34 °C

Refractive index of water (observed) = 1.331

Refractive index of water (exact) = 1.333

Therefore, error = 1.333 – 1.331 = 0.002

1. Refractive index of D_1 (observed) = 1.353

   Refractive index if D_1 (exact) = 1.353 + 0.002 = 1.3550
2. Refractive index of D_2 (observed) = 1.3597

   Refractive index if D_2 (exact) = 1.3597 + 0.002 = 1.3617
3. Refractive index of D_3 (observed) = 1.4892

   Refractive index if D_3 (exact) = 1.4892 + 0.002 = 1.4912
4. Refractive index of D_4 (observed) = 1.4532

   Refractive index if D_4 (exact) = 1.4532 + 0.002 = 1.4552
5. Refractive index of D_5 (observed) = 1.5872

   Refractive index if D_5 (exact) = 1.5872 + 0.002 = 1.5892

Result:

By matching the refractive index with literature, we find that,

D_1 = Acetone

D_2 = Ethanol

D_3 = Toluene

D_4 = Carbon tetrachloride

D_5 = Aniline

EXPERIMENT NO. (8): Find out the molar refractivity of a given liquid. The molecular weight of the liquid is 78.

Theory:

The refractive index of a liquid varies with temperature. To eliminate the effect of temperature, Lorentz and Lorenz (1880) derived independently the following relationship between refractive index and density of a liquid.

$$[R_s] = \frac{n^2-1}{n^2+2} \cdot \frac{1}{d}$$

Where, R_s is called the **specific refractivity**, n the refractive index and d the density of the liquid. When the temperature of the liquid changes then the values of n and d change in such a way that the quantity R remains the same.

When specific refractivity is multiplied with the molar mass of the substance then another quantity known as the molar refractivity is obtained i.e.,

$$[R_m] = \frac{n^2-1}{n^2+2} \cdot \frac{M}{d}$$

Where, R_m is **molar refractivity** and M is molar mass. The molar refractivity like specific refractivity is independent of temperature. It is both an additive and constitutive property.

Procedure:

In order to determine the refractive index of a liquid, open the refractometer, wash the prism with acetone or chloroform. When it dries, put a drop of liquid under examination and make its film with a glass rod. Close the refractometer. Focus the cross wires of the telescope by rotating the eyepiece and adjust the mirror so as to get good illumination. The assembly of the prisms is rotated with the help of side knob till the diametric edge of the bright and dark half circles coincides with the crossing point of the cross wires in the telescope. Note the refractive index through another eyepiece. Suppose for water it is 1.331. See the refractive index of water from the literature, suppose it is 1.333. Then 0.002 is the error which should be added in every reading taken after for the other liquids under examination repeating the same procedure. Using this value of refractive index, we can calculate the molar refractivity of the given liquid.

Precautions:

1. Make a film of liquid under examination on the prism of refractometer by means of a glass rod.
2. Error of the refractometer should be calculated with standard value of water. It should be added or subtracted in the observed values accordingly.

Apparatus:

Abbe's refractometer, glass rod, cotton wool, beakers etc.

Observations and Calculations:

Room temperature = 34 °C

Refractive index of water (observed) = 1.331

Refractive index of water (exact) = 1.333

Therefore, error = 1.333 – 1.331 = 0.002

Refractive index of liquid (observed) = 1.493

Refractive index of liquid (exact) = 1.493 + 0.002 = 1.4950

Weight of empty specific gravity bottle = 13.17 g

Weight of empty specific gravity bottle + distilled water = 37.19 g

Weight of empty specific gravity bottle + liquid = 34.33 g

Hence,

Weight of water = 37.19 – 13.17 = 24.02 g

Weight of liquid = 34.33 – 13.17 = 21.16 g

Density of water at 34 °C = 0.995 ≃ 1 g/ml

And, Density of liquid = $\frac{21.16}{24.02} \times 1 = 0.8809$ g/ml

Therefore,

$$[R_m] = \frac{n^2 - 1}{n^2 + 2} \cdot \frac{M}{d}$$

$$[R_m] = \frac{(1.4950)^2 - 1}{(1.4950)^2 + 2} \cdot \frac{78}{0.8809} = 25.82 \text{ cm}^3\text{mol}^{-1}$$

$$[R_m] = 25.82 \times 10^{-6} \text{ m}^3\text{mol}^{-1}$$

$$[R_m] = 2.582 \times 10^{-5} \text{ m}^3\text{mol}^{-1}$$

Result:

Molar refractivity of given liquid is 2.582 x 10^{-5} m^3 mol^{-1}.

EXPERIMENT NO. (9): Determine the %age composition of unknown mixture of acetone and toluene by using refractometer.

Theory:

When a ray of light passes from air into a denser medium, say liquid, it is bent or refracted towards normal. The ratio of the sine of the angle of incidence and that of refraction is constant and characteristics of that liquid (Snell's law). The constant ratio is called as refractive index of the liquid. It is denoted by n.

$$n = \frac{\sin i}{\sin r}$$

Where, i is the angle of incidence and r is the angle of refraction.

Procedure:

Suppose the given liquid mixture is of acetone and toluene. The composition of this mixture can be determined as follows:

Prepare various compositions of acetone and toluene as follows:

No. of samples	1	2	3	4	5	6
%age composition	0%	20%	40%	60%	80%	100%
Acetone (ml)	0	2	4	6	8	10
Toluene (ml)	10	8	6	4	2	0

Find out the refractive index of each composition using refractometer. Also find the refractive index of unknown mixture of liquids. Plot a graph between the percentage compositions of the self-prepared mixtures (given above) and their respective refractive indices. The %age composition of unknown mixture can be determined by inserting its refractive index into the graph. The shape of the curve depends upon the nature of experiments.

Precautions:

1. Make a film of liquid under examination on the prism of refractometer by means of a glass rod.
2. Error of the refractometer should be calculated with standard value of water. It should be added or subtracted in the observed values accordingly.

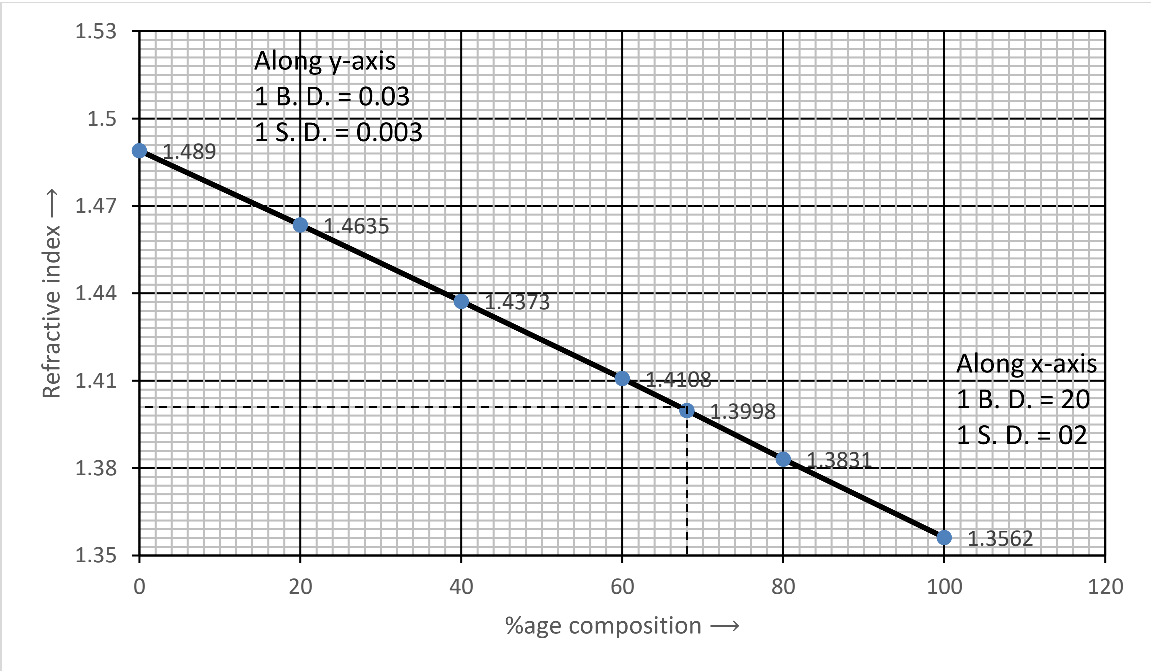
Apparatus:

Abbe's refractometer, glass rod, cotton wool, beakers etc.

Observations and Calculations:

No. of samples	1	2	3	4	5	6	Unknown
%age composition	0%	20%	40%	60%	80%	100%	-
Acetone (ml)	0	2	4	6	8	10	-
Toluene (ml)	10	8	6	4	2	0	-
Refractive indexes	1.4890	1.4635	1.4373	1.4108	1.3831	1.3562	1.3998

Graph: Graph between %age composition and refractive indices.



Result: Hence, from graph the %age composition of unknown mixture is,

Acetone = 68%

Toluene = 32%