RPS DEGREE COLLEGE

BALANA (MAHENDERGARH)-123029

Lab Manual

Chemistry (B.Sc. Hons. 1st & 2nd Semester)

Department of Chemistry

PHYSICAL CHEMISTRY

B.Sc. Hons. Ist Year

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SEMESTER 1

EXPERIMENT:- 1

AIM:- Determine solubility of benzoic acid at different temperatures and calculate ΔH of dissolution.

APPRATUS REQUIRED:-
Test tubes, Test tube holder, beaker, stand, burner, thermometer etc.

CHEMICAL REQUIRED:-

1. Benzoic acid
2. Water

OBJECTIVE:-
It was perform to check the solubility of benzoic acid. A graph is plotted between solubility an temperature and from graph solubility an any temperature can be determined by using Vant's Hoff's equation.

$$\text{Log } S_2 - \log S_1 = \text{Type equation here.}$$

PROCEDURE:-

1. Take 4 boiling test tubes and label them as 1,2,3, and 4.
2. Now weigh 0.1 gm, 0.15 gm, 0.20 gm and 0.25 gm of benzoic acid and transfer to the labeled tube.
3. Add 20 ml of water to each tube and place them in beaker containg water.
4. Now stir the contents of tube 1 and note the temperature at which benzoic acid dissolves completely.
5. Similarly note down the temperature of all tubes.

OBSERVATIONS:-

Test tube No	Temperature at Which benzoic acid dissolves	Amount Taken(g)	Solubility Mole/litre

I	t_1	0.10	$\frac{0.1}{122} \times 50$
II	t_2	0.15	$\frac{0.15}{122} \times 50$
III	t_3	0.20	$\frac{0.20}{122} \times 50$
IV	t_4	0.25	$\frac{0.25}{122} \times 50$

CALCULATION:-

Plot a graph between solubility and temperature from the graph determine the solubility of benzoic acid using vant's Hoff's equation.

PRECAUTIONS:-

1. Handle the acid carefully.
2. Temperature should not exceed.

EXPERIMENT:-2

AIM :-

To determine the enthalpy of neutralization of a weak acid (say acetic acid) versus strong base (say NaOH) and determine the enthalpy of ionization of the weak acid.

APPRATUS USED :-

Polyethene bottles thermometer, stirrer $, beakers\ etc$

CHEMICALS REQUIRED :-

$\frac{N}{2}$ acetic acid, $\frac{N}{2}$ $NaOH$, distilled water.

OBJECTIVE :-

It is used to determine the value of enthalpy of neutralization which is defined as enthalpy change accompanying when one gram equivalent of the acid (or base) by base (or an acid) in a dilute solution for strong acids and for strong bases its value comes out to be nearly -58 kJ. It is nearly same for both strong acids and strong bases because in this case all acids and bases are almost completely ionised.

PROCEDURE :-

Determination of water equivalent of polyethene bottle.

(i)Take 100ml of distilled water in polyethene bottle fitted with a stirrer and a thermometer. The thermometer should be 1cm above the bottom of the bottle. When thermal equilibrium is achieved then note down the temperature say it is $t_1{}^oC$.

(ii)Heat 150ml of distilled water in a 250ml beaker at a temperature which is about $10\text{-}20^oC$ higher than the room temperature.

(iii)Take 100ml of hot water, note down its temperature (say it is $t_2{}^oC$) and immediately transfer it into the polyethene bottle already containing 100ml of cold water. Stir well and note down the temperature of water(after mixing hot and cold water) say it is $t_3{}^oC$.

(iv)Throw away water from the polyethene bottle and cool the room temperature.

(v)Take 100ml of 0.5 N acetic acid in a polyethene bottle fitted with a rubber cork with two holes. Insert a thermometer into one hole and a stirrer into the second hole.

(vi)Place 100ml of 0.5 N NaOH in another similar polyethene bottle.

(vii)The temperature of each solution is noted separately. Let these are t_4°C and t_5°C respectively.

(viii)transfer 100ml 0.5 N NaOH into the acid as quickly as possible. The mixture is well stirred.

(ix)The temperature is noted after every minute till a constant temperature is attained. Let it be t_3°C.

OBSERVATIONS :-

(i) Determination of water equivalent

$$100\ (t_2 - t_3) = (100 + w)\ (t_3 - t_1)$$

$$\text{Water equivalent, w} = \left[\frac{100(t2 - t3)}{(t3 - t1)}\right] - 100$$

(ii)Determination of enthalpy of neutralization

Initial temperature of acid = t_4°C

Initial temperature of base = t_5°C

$$\text{Final temperature after neutralization} = \left(t6 - \frac{t4+t5}{2}\right) - 100$$

Water equivalent of polyethene bottle = w g

PRECAUTIONS :-

(I)Temperature should be noted using thermometer graduated to 0.1°C.

(II)The mixture of acid and base should be well stirred.

EXPERIMENT:-3

Aim:

To determine the enthalpy of neutralization of strong acid (hydrochloric acid) and strong base (sodium hydroxide).

Theory:

Heat is evolved during neutralization of an acid with alkali. The neutralization reaction of a strong acid with a strong base is essentially the combination of one equivalent of hydrogen ions with one equivalent of hydroxyl ions.

Enthalpy of neutralization is the heat evolved when one gram equivalent of the acid is completely neutralized by a base in dilute solution.

The chemical reaction is given below.

$\mathbf{H^+ + OH^- \rightarrow H_2O + 13.7\ kcal}$

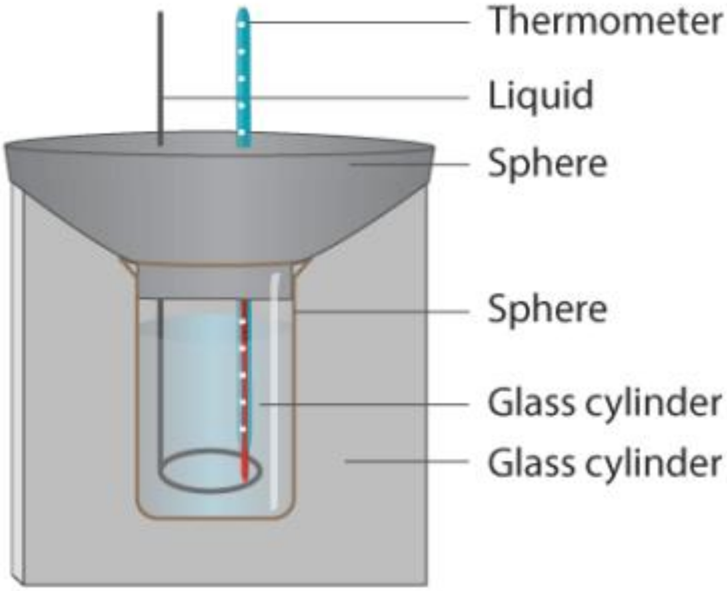
$\mathbf{H^+(aq) + Cl^-(aq) + Na^+(aq) + OH^-(aq) \rightarrow Na^+(aq) + Cl^-(aq) + H_2O + 13.7\ kcal}$

13.7 kcal of heat is liberated out and is the heat of neutralization for all strong acids and bases. Hess in 1840 obtained a constant value of 13.7kcal as the heat of neutralization in almost all the cases of strong acids and strong bases. This constancy of heat of neutralization of a strong acid and strong bases is explained on the basis of ionic theory.

Materials Required:

1. Wide polythene bottle
2. Rubber cork
3. Thermometer
4. Stirrer fitted with a cork
5. Measuring cylinder
6. 0.2M Hydrochloric acid
7. 0.2M Sodium hydroxide solution

Apparatus Setup:



Showing arrangement of calorimeter

Enthalpy of Neutralization of Strong Acid and Strong Base

Procedure:

1. Calculate the water equivalent of the calorimeter.
2. Place 100ml of 0.2M hydrochloric acid solution in it.
3. Now record the temperature of the acid solution.
4. Take another separate vessel and place 100ml of 0.2M sodium hydroxide solution in it.
5. Note down the initial temperature of sodium hydroxide taken.
6. Wait till both the solution attains the same temperature.
7. Now transfer 100ml of sodium hydroxide solution into the hydrochloric acid quickly.
8. Fit the cork immediately which has a thermometer and a stirrer in the mouth.
9. Stir well the solution and note down the temperature after small intervals of time.

10. Keep noting down the temperature till the temperature becomes constant.
11. Record the highest temperature reached.
12. Calculate the heat evolved when the two solutions are mixed by ratio proportion method.

Observation and Inference:

Initial temperature of the acid and base	t_1^{o}
Final temperature after neutralization	$t_2^{o}C$
Change in temperature Δt	$(t_1-t_2)^{o}C$
Mass of the mixture solution after neutralization	200g
Water equivalent of calorimeter	Wg

Calculations:

Enthalpy change during neutralization of 100ml of 0.2M HCl

$= (200\times W)\times(t1-t2)\times4.2$
Therefore the enthalpy change during neutralization of 1000ml of 1M HCl

$= (200\times W)\times(t1-t2)\times4.20.2\times1000100$

Enthalpy of neutralization $= (200\times W)\times(t1-t2)\times4.20.2\times100$kJ

Results and Discussions:

The enthalpy of neutralization of HCl with NaOH is ________ kJ.

Precautions:

1. Due to radiation, some heat is lost to the environment.
2. The solution density is supposed to be 1g / ml.
3. Hydrochloric acid and sodium hydroxide ionization is assumed to be 100 %.
4. The solution's specific heat is taken as 4.189J/g
5. The mixture of HCl and NaOH should be stirred well.
6. Water equivalent calorimeter or beaker should be calculated accurately.

EXPERIMENT:- 4

AIM:- To prepare a colloidal solution of arsenious sulphide.

APPARATUS REQUIRED:-

Conical flask, test tubes, filter paper, Kipp's apparatus for H_2S.

CHEMICAL REQUIRED:-

1. Aresenious oxide (As_2O_3).
2. Distilled water.

THEORY:-

Aresenious sulphide is a lyophobic sol. It can be obtained by passing H_2S gas through arsenic oxide solution.

$$As_2O_3 + 3H_2O \leftrightharpoons 2H_3\,As\,O_3$$

$$2H_3AsO_3 + 3H_2S \rightarrow As_2S_3 + 6H_2O$$

PROCEDURE:-

1. Take a 250ml conical flask and add 1gm arsenious oxide and 200 ml distilled water into the flask.
2. Now heat the contents of the flask to boiling for about 15 minutes.
3. Cool and filtered the solution.
4. Now pass H_2S gas through the above filterate till it develops a yellow colour.

v. Continue to pass H_2S gas till it does not intensify the colour of the solution.
vi. After it bubble H_2 or CO_2 gas into the yellow solution to remove excess of H_2S gas.
vii. Alternatively the sol may be boiled to remove excess of H_2S.
viii. Allow the sol to achieve the room temperature this bright yellow solution is known as arsenious sulphide sol.

PRECAUTIONS:-

i. Use pure H_2S gas.
ii. The whole apparatus should be cleaned before use.
iii. Handle aresenious oxide carefully, since it is poisonous.

EXPERIMENT:-5

AIM :- To study adsorption of acetic acid on the surface of activated animal charcoal.

Theory

Adsorption is the process of transferring material from a fluid phase to a solid phase. It is a separation process in which some materials; (adsorbate) is concentrated from a bulk vapor or liquid phase on to the surface of a porous solid (adsorbent).The adsorption of acetic acid on charcoal is studied using both the Freundlich isotherm and the Langmuir isotherm. The amount of acetic acid (adsorbate) adsorbed per gram of charcoal (adsorbent) will depend on the surface area of the charcoal, the temperature of the solution, and the adsorbate concentration in solution. The adsorption will be followed by titrating the acetic acid not adsorbed by the charcoal, then determining the amount adsorbed by difference.

Isotherms (plots of moles of adsorbate adsorbed per gram of adsorbent versus solution concentration) will be constructed, and then compared with three models: Freundlich, Langmuir, and Amire. In this article, in order to develop understanding of adsorption acetic acid on charcoal and how the amount of acetic acid adsorbed varies with its concentration, this study is carried out using two different adsorption isotherms which are Freundlich and Langmuir isotherms.

Adsorption as a phenomenon is useful in industries for many practical applications, some of which are use of charcoal for decolourisation sugar solutions, removal of gas odours (i.e. as gas mask), recovery of solvent vapours. Purifications of water and wastewater and also for various uses in chromatography.

Physisorption or physical adsorption is a type of adsorption in which the adsorbate adheres to the surface only through Van-der-Waals (weak intermolecular) interactions, which are also responsible for the non-ideal behaviour of real gases.

Chemisorption is a type of adsorption whereby a molecule adheres to a surface through the formation of a chemical bond, as opposed to the Van der Waals forces which cause physisorption. Adsorption is usually described through isotherms, that is, functions which connect the amount of adsorbate on the adsorbent, with its pressure (if gas) or concentration (if liquid).One can find in literature several models describing process of adsorption, namely Freundlich isotherm, Langmuir isotherm, etc.

Reagents and Apparatus

1. Charcoal
2. 0.15 M Acetic Acid
3. 0.03M Acetic Acid
4. Distilled Water
5. 0.1 M NaOH
6. Phenolphthalein Indicator
7. Refrigerator
8. Sets of Erlenmeyer Flasks

Procedure

1. Place approximately 1 g (weighed accurately to the nearest 0.001 g) of charcoal into each of seven dry Erlenmeyer flasks.

2. Prepare solutions of 0.15, 0.12, 0.09, 0.06, 0.03and 0.015 M acetic acid. These solutions can be made by diluting a stock solution of 0.15 M acetic acid.

3. Add 100 mL of a different acetic acid solution to each flask, with100 mL of distilled water to the seventh. An eighth flask should contain 0.03M Acetic acid,

but no charcoal.

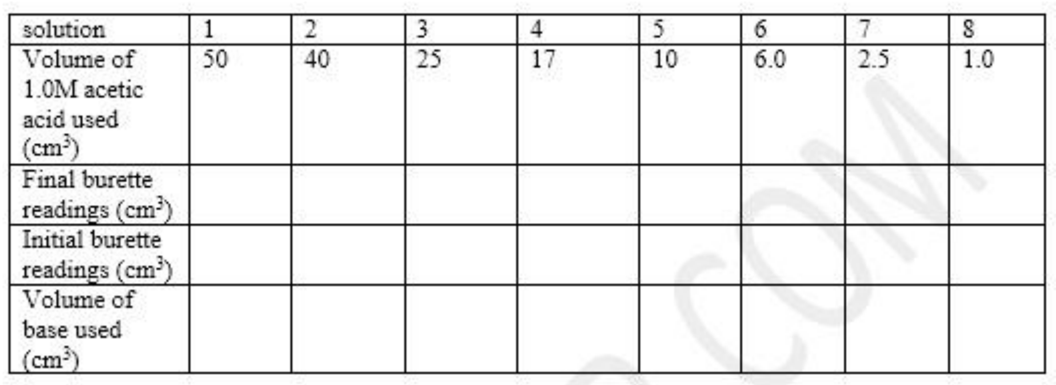
4. The flasks should be tightly stoppered, then shaken periodically for thirty minutes, and allowed to equilibrate for several hours (preferably overnight) in a water bath maintained at a constant temperature.

5. Repeat the procedure above on a second set of Erlenmeyer flasks but place them in the refrigerator to equilibrate at a lower temperature. Make sure to measure both equilibration temperatures.

6. After equilibration, the samples are filtered (discard the first 10 mL of filtrate). Titrate two 25 mL aliquots of each sample with a standardized 0.1 M NaOH solution using phenolphthalein as an indicator.

Results and Calculations

- The result is tabulated as in the table below:



solution	1	2	3	4	5	6	7	8
Volume of 1.0M acetic acid used (cm^3)	50	40	25	17	10	6.0	2.5	1.0
Final burette readings (cm^3)								
Initial burette readings (cm^3)								
Volume of base used (cm^3)								

To calculate the concentration of the diluted solutions; Using the dilution formula,

$$C_2 = \frac{C1\ V1}{V2}$$

- Where:
  C1 is concentration of stock solution = 1.0M

V1 is volume of acid used =
C2 is concentration of the diluted solution = ?
V2 is volume of volumetric flask used = 100ml

- Calculate the concentration C2 for V1 = 50mL, 40 mL, 25 mL, 17 mL, 10 mL, 6 mL, 2.5 mL, and 1.0 mL
- Calculate the Number of Moles of Acetic Acid Adsorbed (H) for Each of the Solutions
  Where
  Equation for the reaction: $CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$
  Molar mass of $CH_3COOH = (12\times1) + (1\times3) + 12 + (16\times2) + 1 = 60$g/mol
- Using the relation

$$\frac{CA\,VA}{CBVB} = \frac{nA}{nB}$$

- Where:
  CB = Concentration of titrant in mol/dm3 = 0.1mol/dm3
  VB = the volume of base used in dm3
  CA = Concentration of acetic acid after adsorption
  VA = Volume of Acetic acid in dm3 nA = nB = 1
- Thus, moles of acetic acid absorbed, X for all eight solutions will be calculated as follows:

$$X = 1/10\left(\frac{V.C1}{100} - CA\right)$$

Where

V = Volume of 1.0M acetic acid used (cm3) = 50mL, 40 mL, 25 mL, 17 mL, 10 mL, 6mL, 2.5 mL, and 1.0 mL respectively.

C1 = 1.0M.

CA is as calculated from above

FREUNDLICH’S ADSORPTION ISOTHERM

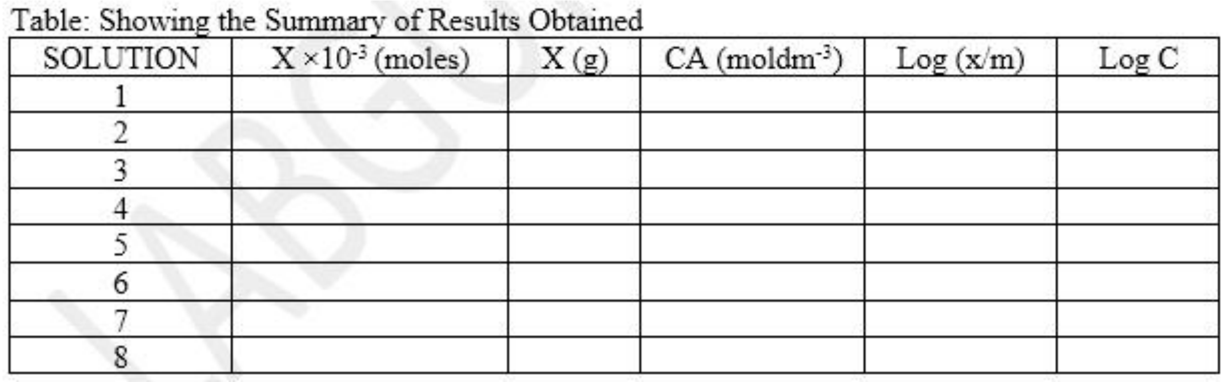


Table: Showing the Summary of Results Obtained

SOLUTION	X ×10^{-3} (moles)	X (g)	CA (moldm^{-3})	Log (x/m)	Log C
1					
2					
3					
4					
5					
6					
7					
8					

Where
X is as calculated above (in moles)
X (in grams) = (60g/mol) x (Xmoles)
CA is as calculated above

- $\frac{x}{m} = kc^n$
- $\text{Log} \frac{x}{m} = \log kc^n$
- $\text{Log} \frac{x}{m} = n\log c + \log k$

Plot a graph of log x/m against log C. Comparing the above equation with the equation of a straight line i.e. y = mx + c, the plot of logx/m against log C should give a straight line with:

- Slope = n
- Intercept = logk
- Slope = y1 – y2 / x1 – x2

LANGMUIR’S ADSORPTION ISOTHERM

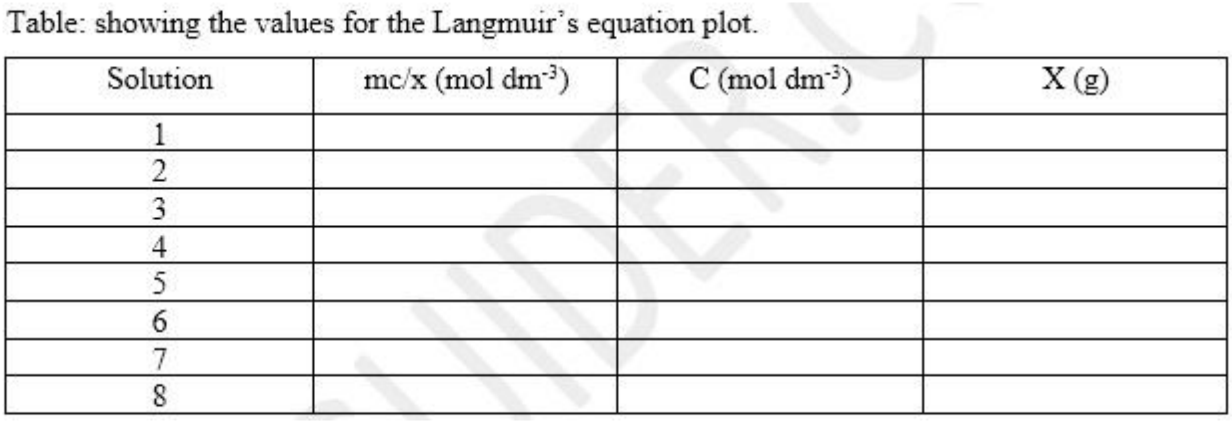


Table: showing the values for the Langmuir’s equation plot.

Solution	mc/x (mol dm^{-3})	C (mol dm^{-3})	X (g)
1			
2			
3			
4			
5			
6			
7			
8			

Where $m = 1$ so it is $mc/x = c/x$ directly.

- $x/m = ac/1+bc$

  Rearranging the equation above, we have

- $x(1+bc) = ac . m$
- $1 + bc/ a = mc/a$
- $mc/x = 1/a + (b/a)c$

Plot a graph of mc/x against c. When compared with the equation of a straight line, $y = mx + c$ implies that the plot of mc/x against c should give a straight line graph with slope = b/a and intercept 1/a

RESULT

Adsorption of acetic acid is dependent on concentration

SEMESTER 2

EXPERIMENT 1

Aim: To determine the composition of a given binary mixture (ethanol-water) from the study of the viscosity-composition curve at lab. temperature.

Requirements: Ostwald viscometer, relative density bottle, pure ethanol, distilled water.

Theory:

The force of friction which one part of the liquid offers to another part of the liquid is called viscosity. For measuring the viscosity coefficient, Ostwald viscometer method is used which is based on Poiseuille's law. According to this law, the rate of flow of liquid, through a capillary tube having viscosity coefficient, η, can be expressed as

$\eta = \pi r^4 tP / 8 vl$

where, v= vol. of liquid (in ml)

t= flow time (in sec.) through capillary

r= radius of the capillary (in cm)

l= length of the capillary (in cm)

P= hydrostatic pressure (in dyne/sq.cm)

η= viscosity coefficient (in poise).

Since, the hydrostatic pressure (the driving force) of the liquid is given by $P = \eta g h$ (where h is the height of the column and ρ is the density of the liquid);

$\eta \propto P t$; Or, $\propto \eta \propto g h t\rho$

If, $\eta 1$ and $\eta 2$ are the viscosity coefficients of the liquids under study, $\rho 1$, $\rho 2$, are their densities and t1 and t2 are their times of flow of equal volume of liquids through the same capillary respectively, then

$$\eta_1 \propto \rho_1 \, g \, h \, t_1 \text{ and } \eta_2 \propto \rho_2 \, g \, h \, t_2$$

Hence, $$\frac{\eta_1}{\eta_2} = \frac{\rho_1 t_1}{\rho_2 t_2}$$

The SI physical unit of viscosity is the pascal-second (Pa·s), (i.e., kg·m−1·s−1). If a fluid with a viscosity of one Pa·s is placed between two plates, and one plate is pushed sideways with a shear stress of one pascal, it moves a distance equal to the thickness of the layer between the plates in one second. The cgs unit for the same is the poise (P), (named after J. L. Marie Poiseuille). It is more commonly expressed, as centipoise (cP). [1 cP = 0.001 Pa·s]. Water at 20 °C has a viscosity of 1.0020 cP.

Procedure:

1) Different compositions of water-ethanol mixtures were prepared (with respect to ethanol).

2) Viscometer was rinsed and filled with specific amount (say 20ml) of mixture.

3) Time of flows were recorded for each solution as well as for the given unknown composition mixture.

4) Specific amount of different composition mixtures were weighted for relative density measurements.

5) $\eta 1/\eta 2$ (on left Y axis) and ρ_l (on right Y axis) vs composition were plotted on the same graph.

Observation and calculation:

a) Relative density measurements:
Wt. of the empty R.D. bottle = ___g
Wt. of the empty R.D. bottle + pure water = ____ g
Wt. of the empty R.D. bottle + pure ethanol = ____ g
Wt. of the empty R.D. bottle + 20% ethanol (v/v in water): ____ g
… …. ….. ….. ….. ….. ….. ….. …… …. … …. ….. ….. ….. ….. ….. ….. …… ….
Wt. of the empty R.D. bottle + 80% ethanol (v/v in water): ____ g

$$\text{Relative density} = \left(\frac{\text{Mass}}{\text{Vol}}\right)_{liq} \Bigg/ \left(\frac{\text{Mass}}{\text{Vol}}\right)_{water} = \frac{(\text{Mass})_{liq}}{(\text{Mass})_{water}} \quad \text{(since, volume is same for all)}$$

b)Combined table for the measurement of flow times and relative densities:

Composition (V% of ethanol in water)	Flow times (sec)				$\frac{\eta_1}{\eta_2}$	ρ_l
	t_1	t_2	t_3	mean		
0						
20						
30						
40						
60						
80						
100						
Unknown						

Composition of binary mixture = (x1+x2)/2 % ethanol in water.

Result: Composition of the given binary mixture of the ethanol-water was found to be X% (v/v) ethanol in water

EXPERIMENT 2

Aim: To determine the composition of a given binary mixture (ethanol-water) from the study of the surface tension-composition curve at lab. temperature.

Requirements: Stalagmometer, rubber tube with screw pinch cock, relative density (R.D.) bottle, stand, balance, weighing box, beaker, unknown liquid, distilled water.

Theory: The measurement of surface tension by stalagmometer is based on the fact that drop of a liquid (at end of the stalagmometer /capillary tube) falls when weight of the drop just equal to the surface tension of the liquid.

Thus, the weight of the drop (due to force of the gravity) which pulls the drop downward is equal to vdg, where, g is the gravitational force, v is volume of the drop and d is the density of the liquid (i.e., mg = vdg).

On the other hand, the force tending to uphold the drop = $2\pi r\gamma$; where $2\pi r$ is the circumference of a circular surface, γ is the surface tension of the liquid. Unit of surface tension are dyne/cm (CGS system) and Newton/meter (SI system) where, 1dyne/cm = 1mN/m

At equilibrium, (i.e. when two forces are balanced): $2\pi r\gamma = vdg$ ………. (i)

If n is the number of drops in volume V of the liquid, the volume of each drop will be $v = V/n$

Then, from equation (i) we have, $2\pi r\gamma = \dfrac{Vdg}{n}$ (ii)

If n_1 and n_2 are the number of drops counted for the same volume of two liquids (**1** & **2**) of densities d_1 and d_2, using the same stalagmometer, then

$$2\pi r\gamma_1 = \frac{Vd_1g}{n_1} \qquad \text{(iii)}$$

$$2\pi r\gamma_2 = \frac{Vd_2g}{n_2} \qquad \text{(iv)}$$

Dividing equation (iii) by (iv); $\dfrac{\gamma_1}{\gamma_2} = \dfrac{n_2d_1}{n_1d_2}$

Therefore, surface tension of the liquid (**1**) γ_1, with respect to liquid (**2**) γ_2 can be expressed as: $\gamma_1 = \dfrac{n_2d_1}{n_1d_2}\gamma_2$

In case, the second liquid is the pure water (w), then surface tension of liquid (l) with respect to water can be expressed by: $\gamma_l / \gamma_w = \dfrac{n_w\, d_l}{n_l\, d_w}$.

Procedure:

1. Note the laboratory temperature.

2. Prepare the various composition of ethanol and water in form of 0%, 20%, 40%, 60%, 80%, 100% ethanol by volume.

3. Take the weight of the empty & filled (with distilled) R.D. bottle (with stopper). Then, weigh the R.D. bottle filled with prepared solution and unknown given liquid.

4. Clean the stalagmometer properly with distilled water. Now fix the stalagmometer on the stand & adjust the number of falling drops in between 15-20 per minute by the help of the screw pinch cock (this adjustment is essential otherwise proper drop will not form).

5. Immerse the lower end of stalagmometer in a beaker containing distilled water, in order to suck water till the upper mark of the stalagmometer.

6. Start counting the number of drops when the water level just reaches the upper mark & stop when the level just passes the lower mark. Take 2 readings for each solution.

7. Repeat the same procedure for the prepared solution as well as for the given unknown composition water-ethanol solution.

Observations:

1. Laboratory temperature: x ̊C

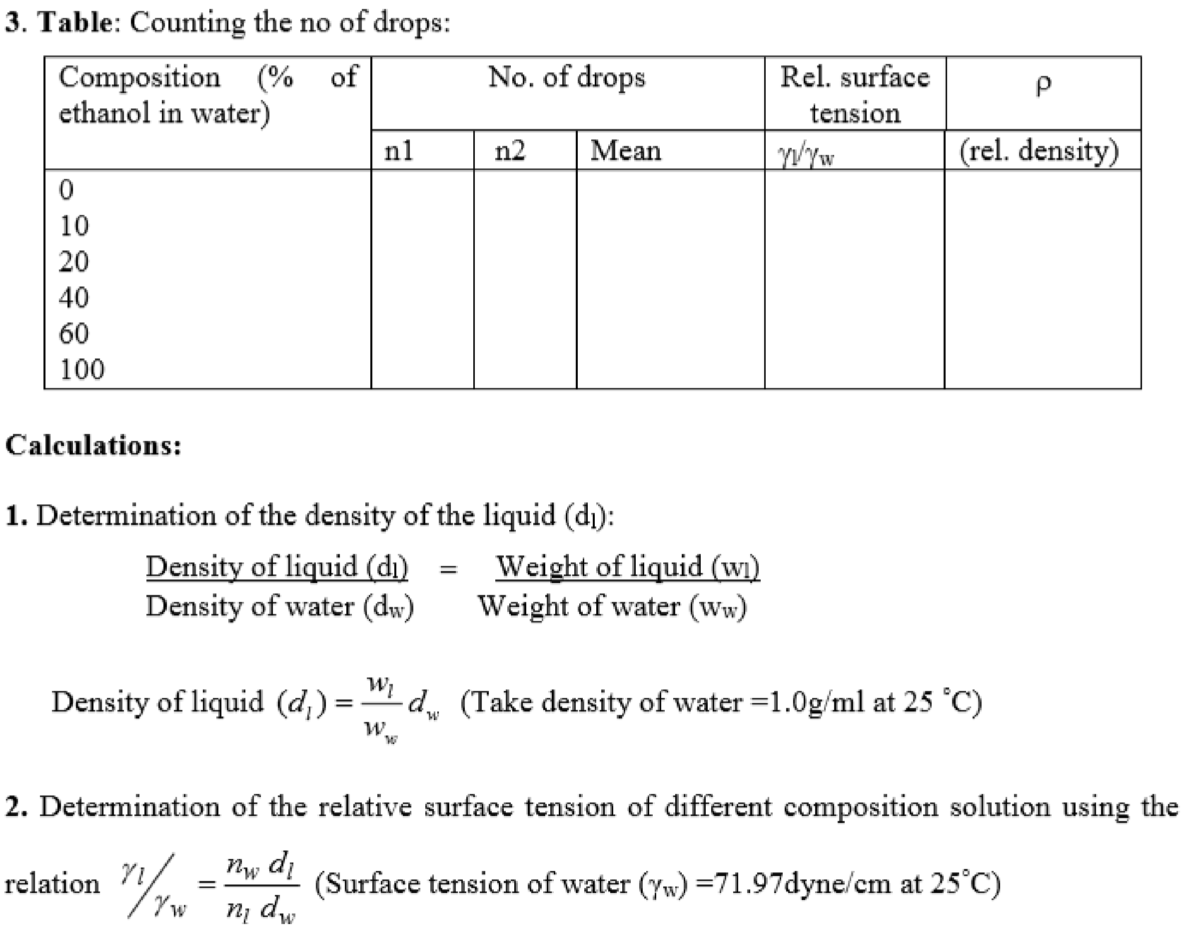
2. Density measurement:

Weight of empty R.D.bottle (w1) =…g.

Weight of R.D.bottle with water (w2) =…g.

Weight of R.D. bottle with 0% mixture (w3) =…g. (similarly weigh for 10, 20, 40, 60, 100% and unknown composition ethanol in water mixture).

Relative density = Wt. of liquid/ Wt. of water



3. Table: Counting the no of drops:

Composition (% of ethanol in water)	No. of drops			Rel. surface tension	ρ
	n1	n2	Mean	γ_l/γ_w	(rel. density)
0					
10					
20					
40					
60					
100					

Calculations:

1. Determination of the density of the liquid (d_l):

$$\frac{\text{Density of liquid } (d_l)}{\text{Density of water } (d_w)} = \frac{\text{Weight of liquid } (w_l)}{\text{Weight of water } (w_w)}$$

Density of liquid $(d_l) = \frac{w_l}{w_w} d_w$ (Take density of water =1.0g/ml at 25 °C)

2. Determination of the relative surface tension of different composition solution using the relation $\gamma_l / \gamma_w = \frac{n_w\, d_l}{n_l\, d_w}$ (Surface tension of water (γ_w) =71.97dyne/cm at 25°C)

Precautions:

1. Drops should be properly formed.

2. The stalagmometer should be kept in vertical position while measuring.

3. Same stalagmometer should be used for water and liquid.

4. Observe carefully when the water and liquid are just passing the upper and lower marks of the stalagmometer.

Result:

The composition of the given binary mixture was found to be ………..% ethanol in water.

EXPERIMENT NO. 3

AIM :-

To determine the CST of phenol – water system.

APPRATUS USED :-

A boiling tube, a stirrer, a thermometer graduated to 0.1 degree, 400ml beaker, iron stand, tripod stand.

CHEMICALS REQUIRED :-

Phenol and distilled water.

THEORY :-

It is based on the fact that when water and phenol are mixed together at room temperature they form heterogeneous mixture having white turbidity. Now when the system is heated a temperature comes where turbidity disappears on cooling turbidity appears again. Noting the temperature at which turbidity disappears and at which it appears the mean of the two temperatures give the temperature of mixing of phenol water system. Now the solutions of phenol od different compositions are prepared and the temperature of miscibility of the two is determined in each case. Then a graph of composition of mixture vs. miscibility temperature is plotted. The temperature corresponding to the maximum is the CST of the system.

PROCEDURE :-

(I)Take 6gm of phenol in a previously weighed boiling tube.

(ii)Add 2ml of distilled water with the help of a graduated pipette into the phenol taken In a boiling tube. Thus the % of phenol by weight is 75%.

(iii)Fill 2/3rd of the 400ml beaker with water and keep it on the wire gauge placed on the tripod stand.

(iv)Clamp the boiling tube into the beaker as shown. Fit the cork with two holes, one for the stirrer and other for thermometer.

(v)Heat the beaker slowly and stir the phenol water mixture. Note the temperature at which turbidity just disappears. Stop heating. Now allow thw mixture to cool and note the temperature when thw turbidity just appears.

(vi)Now again add 2ml of distilled water with the help of a graduated pipette. Thus the % of phenol by weight is 60%. Repeat step (v).

Repeat the process after adding 2ml of distilled water each time taking at least seven or eight readings.

OBSERVATIONS :-

Weight of empty boiling tube = $w_1$gm

Weight of tube + phenol = (w_1 + 6)gm

Weight of phenol = 6.0gm

Density of water = 1gm/ml (assuming)

RESULT :-

(i)CTS of phenol-water system = …………..°C

(ii)Composition of the system

Phenol = …………..%

Water = ……………%

PRECAUTIONS :-

(i)Handle phenol very carefully as it causes severe skin burns.

(ii)Take care that in each case the level of phenol-water system in the tube must be atleast one cm below the level of water in the beaker.

(iii)For gradual and more uniform heating, surrounded the boiling tube with outer jacket (a more bigger tube).

(iv)Stirring inside the solution and outside in water must be done constantly.

(v)The bulb of the thermometer must remain dipping in phenol water system.

EXPERIMENT: 4

AIM :-

To determine the CST of Aniline – water system.

APPRATUS USED :-

A boiling tube, a stirrer, a thermometer graduated to 0.1 degree, 400ml beaker, iron stand, tripod stand.

CHEMICALS REQUIRED :-

Aniline and distilled water.

OBJECTIVE :-

It is based on the fact that when water and aniline are mixed together at room temperature they form heterogeneous mixture having white turbidity. Now when the system is heated a temperature comes where turbidity disappears on cooling turbidity appears again. Noting the temperature at which turbidity disappears and at which it appears the mean of the two temperatures give the temperature of mixing of phenol water system. Now the solutions of aniline of different compositions are prepared and the temperature of miscibility of the two is determined in each case. Then a graph of composition of mixture vs. miscibility temperature is plotted. The temperature corresponding to the maximum is the CST of the system.

PROCEDURE :-

(I)Take 6mL of aniline in a previously weighed boiling tube.

(ii)Add 2ml of distilled water with the help of a graduated pipette into the aniline taken In a boiling tube. Thus the % of aniline by weight is 75%.

(iii)Fill 2/3rd of the 400ml beaker with water and keep it on the wire gauge placed on the tripod stand.

(iv)Clamp the boiling tube into the beaker as shown. Fit the cork with two holes, one for the stirrer and other for thermometer.

(v)Heat the beaker slowly and stir the aniline water mixture. Note the temperature at which turbidity just disappears. Stop heating. Now allow the mixture to cool and note the temperature when the turbidity just appears.

(vi)Now again add 2ml of distilled water with the help of a graduated pipette. Thus the % of aniline by weight is 60%. Repeat step (v).

Repeat the process after adding 2ml of distilled water each time taking at least seven or eight readings.

OBSERVATIONS :-

Weight of empty boiling tube = $w_1$gm

Weight of tube + aniline = (w_1 + 6)gm

Weight of aniline = 6.0gm

Density of water = 1gm/ml (assuming)

RESULT :-

(i)CTS of aniline –water system = …………..^{o}C

(ii)Composition of the system

Aniline = …………..%

Water = ……………%