University of Kerala
V Semester B.Sc. Chemistry (Core),
CH 1544 LAB COURSE II (Practical) Examination DECEMBER 2012
Physical Chemistry

Model Questions

1. Determine the Partition coefficient of iodine between CCl_4 and H_2O
2. Determine the Critical solution temperature of phenol-water system
3. Determine the concentration of the given hydrochloric acid conductometrically. You are provided with standard acid of normality ……..
4. Determine the K_f / K_t of pure solid solvent/salt hydrate …. A using the given non-volatile solute …. B of molecular mass …….. g/mol by thermal analysis method.
5. Determine the molecular mass of the given non-volatile solute …. B by thermal analysis method being provided with pure solid solvent/salt hydrate …. A of K_f / K_t ……K kg mol^{-1}
6. Determine the concentration of the given Fe^{2+} / KI solution by potentiometric titration. You are provided with standard solution of $K_2Cr_2O_7$ / $KMnO_4$.
7. Determine the miscibility temperature of various mixtures of 5 mL phenol and 5 mL KCl solutions of different concentrations up to 2.0%. Hence determine concentration of the given unknown KCl solution.
8. Determine the rate constant of hydrolysis of methyl acetate using the given HCl solution.
9. Determine the Coefficient of viscosity of binary mixtures of A and B and then determine the concentration of unknown mixture of A & B.
10. Determine the Surface tension of binary mixtures of acetic and water and then determine the concentration of unknown mixture
11. Determine refractometrically the concentration of the given KCl solution.
12. Determination of water equivalent of the given calorimeter and hence determine the heat of neutralization of the strong acid A and the strong base B.

Course code:

CH 1544 Lab II (Physical chemistry experiments)

Time- 6 hrs Weightage: 15

Table 1 Components for end semester evaluation of Physical chemistry experiments (Model)

SI No	i. Main Components and sub components	ii. Grade	iii. Grade point A=4, B=3, C=2, D=1, E=0	iv. wt.	Weighted grade point iii × iv
I	Lab Report-	8 or >8 expts : A 5-7 expts : B 3-4 expts : C <3 expts : D None : E		3	
II	Procedure- 1.Principle of the Experiment 2.Relevant equation /graph 3.Materials and apparatus 4. Procedure	All Four sub components: A Only three: B Only two: C Only one: D None : E		1	
III	Neat tabulation and systematic recording 1.Correct representation of data 2.Graphical representation 3.Satisfactory skill in experimentation 4. Neatness of data and result presentation	All Four sub components: A Only three: B Only two: C Only one: D None : E		2	
IV	Viva	Correct Answer to 4 Questions: A 3 Questions: B 2 Questions: C		1	

		1 Question: D None : E			
V	Performance of experiment, calculation and accuracy of the result	Details of grade distribution given separately		8	

Accuracy

Table 2

% error	Upto 6	6.1 to 8.49	8.5 to 9.99	10 and above
Grade	A	B	C	D

Table 3

% error	Upto 1	1.1 to 1.49	1.5 to 1.99	2 and above
Grade	A	B	C	D

P1. Determination of partition coefficient

Students should be supplied with 3% iodine in CCl_4, 0.1 N thio and 5% KI

Values: 85 to 90 (for values below 85 use 85 and for values above 90 use 90 as standard value

SI No	**i. Main Components and sub components**	**ii. Grade**	**iii. Grade point A=4, B=3, C=2, D=1, E=0**	**iv. Wt**	**Weighted grade point iii × iv**
I	Lab Report-	Refer Table 1		3	
II	Procedure-	Refer Table 1		1	
III	Viva-	Refer Table 1		1	
IV	Neat tabulation and systematic recording-	Refer Table 1		2	
V	Titration of aqueous and organic layer	6 titre values-A 4 titre values-B 2 titre values-C 1 titre value-D		3	
VI	Calculation 1.Correct equation 2.Substitution 3.Final value 4.Unit	All Four sub components: A Only three: B Only two: C Only one: D None : E		2	
VII	Accuracy	(Ref Table 2)		3	
Total Weighted Grade point for Physical Chemistry Experiments					

P2. Determination of Critical solution temperature

Values: 67 to 69 ^{o}C (for values below 67 use 67 and for values above 69 use 69 as standard value)

SI No	i. Main Components and sub components	ii. Grade	iii. Grade point A=4, B=3, C=2, D=1, E=0	iv. Wt	Weighted grade point iii × iv
I	Lab Report-	Refer Table 1		3	
II	Procedure-	Refer Table 1		1	
III	Viva-	Refer Table 1		1	
IV	Neat tabulation and systematic recording-	Refer Table 1		2	
V	Determination of Miscibility temperatures	6 values-A 4 values-B 2 values-C 1 value-D		3	
VI	Graph	Graph with 6 points: A 5-4 points : B 2-3 points : C Only one: D None : E		2	
VII	Accuracy	(Ref Table 2)		3	
Total Weighted Grade point for Physical Chemistry Experiments					

P3. Determination of concentration of HCl conductometrically

Students should be supplied with ~ 0.1 N HCl as standard and unknown and ~ 0.2 N NaOH.

SI No	i. Main Components and sub components	ii. Grade	iii. Grade point A=4, B=3, C=2, D=1, E=0	iv. Wt	Weighted grade point iii × iv
I	Lab Report-	Refer Table 1		3	
II	Procedure-	Refer Table 1		1	
III	Viva-	Refer Table 1		1	
IV	Neat tabulation and systematic recording-	Refer Table 1		2	
V	Measurements of conductance and Graph of standardisation	10 conductance values-A 8 values-B 6 values-C 4 values-D		2	
VI	Measurements of conductance and Graph of Estimation	10 conductance values-A 8 values-B 6 values-C 4 values-D		2	
VI	Calculation 1. Standardisation 2. Estimation 3. Final value 4. Unit	All Four sub components: A Only three: B Only two: C Only one: D None : E		1	
VIII	Accuracy	(Ref Table 2)		3	
Total Weighted Grade point for Physical Chemistry Experiments					

P4 Determination of Molal Transition point depression constant/ Molal freezing point depression constant &
P5 Determination of Molecular mass by Transition point method/ cooing curve method
Salt hydrates that can be given: Sodium thiosulphate pentahydrate (Transition temperature= 48 ^{0}C, K_t= 4.26 K kg mol^{-1}) & Sodium acetate trihydrate (Transition temperature= 58 ^{0}C, K_t= 3.50 K kg mol^{-1})
Solutes that can be given: Glucose, sucrose, urea, and thiourea. Solid sovents - Naphthalene 80°C, K_f (K kg mol^{-1}) 6.95; m-dinitrobenzene 89.5°C, 10.6; Biphenyl 69.5°C, 8.0; Solute: biphenyl, p-dichlorobenzene, acetanilide, p-toluidine)

Sl.No.	**i. Main Components and sub components**	**ii. Grade**	**iii. Grade point A=4, B=3, C=2, D=1, E=0**	**iv. Wt**	**Weighted grade point iii × iv**
I	Lab Report-	Refer Table 1		3	
II	Procedure-	Refer Table 1		1	
III	Viva-	Refer Table 1		1	
IV	Neat tabulation and systematic recording-	Refer Table 1		1	
V	Transition point/Freezing point determination	3 values-A 2 temperature values-B 1 temperature value -C Temperature with error-D		2	
VI	Calculation of K_t / K_f or molecular mass 1.Correct equation 2.Substitution 3.Final value 4.Unit	All Four sub components: A Only three: B Only two: C Only one: D None : E		1	
VII	Graph	3 cooling curves: A 2 cooling curves : B 1 cooling curve: C cooling Curves with error: D None : E		3	
VIII	Accuracy	(Ref Table 2)		3	
Total Weighted Grade point for Physical Chemistry Experiments					

P6. Determination of concentration of Fe^{2+}/KI potentiometrically

Students should be supplied with ~ 0.1 N Fe^{2+} /KI and ~ 0.2 N $K_2Cr_2O_7$ / $KMnO_4$

SI No	i. Main Components and sub components	ii. Grade	iii. Grade point A=4, B=3, C=2, D=1, E=0	iv. Wt	Weighted grade point iii × iv
I	Lab Report-	Refer Table 1		3	
II	Procedure-	Refer Table 1		1	
III	Viva-	Refer Table 1		1	
IV	Neat tabulation and systematic recording-	Refer Table 1		2	
V	Measurements of EMF	10 EMF values-A 8 values-B 6 values-C 4 values-D		1	
VI	Calculation 1.Correct equation 2.Substitution 3.Final value 4.Unit	All Four sub components: A Only three: B Only two: C Only one: D None : E		1	
VII	Graph V vs E,	Graph with 10 points: A 7-9 points : B 4-6 points : C 2-3 points : D None : E		1	
IX	Graph V vs dE/dV	Graph with 6 points: A 5 points : B 4 points : C 3or < 3 points : D None : E		2	
VIII	Accuracy	(Ref Table 2)		3	
Total Weighted Grade point for Physical Chemistry Experiments					

P7. Determination of concentration of KCl

Students should be supplied with 2% KCl and 0.4 to 1.4% KCl as unknown

SI No	i. Main Components and sub components	ii. Grade	iii. Grade point A=4, B=3, C=2, D=1, E=0	iv. Wt	Weighted grade point iii × iv
I	Lab Report-	Refer Table 1		3	
II	Procedure-	Refer Table 1		1	
III	Viva-	Refer Table 1		1	
IV	Neat tabulation and systematic recording-	Refer Table 1		2	
V	Determination of Miscibility temperatures	6 values-A 4 values-B 2 values-C 1 value-D		3	

VI	Graph	Graph with Four points: A Only three: B Only two: C Only one: D None : E		2	
VII	Accuracy	± 0.15 % error-A ± 0.151 to ± 0.30 % -B ± 0.301 to ± 0.50 % -C Above ± 0.50 % -D		3	
Total Weighted Grade point for Physical Chemistry Experiments					

P8 Determine the rate constant of hydrolysis of methyl acetate using HCl of strength (0.5 N to 1.0 N)

SI No	**i. Main Components and sub components**	**ii. Grade**	**iii. Grade point A=4, B=3, C=2, D=1, E=0**	**iv. Wt**	**Weighted grade point iii × iv**
I	Lab Report-	Refer Table 1		3	
II	Procedure-	Refer Table 1		1	
III	Viva-	Refer Table 1		1	
IV	Neat tabulation and systematic recording-	Refer Table 1		1	
V	Titre values including zero and infinite time	5 titre values-A 4 titre values-B 2 titre values-C 1 titre value-D		2	
VI	Calculation 1.Correct equation 2.Substitution 3.Final value 4.Unit	All Four sub components: A Only three: B Only two: C Only one: D None : E		2	
VII	Graph	Graph with Four points: A Only three: B Only two: C Only one: D None : E		2	
VIII	Precision - mutually agreeing values (Ref Table 2)	Four values: A Only three: B Only two: C Only one: D None : E		3	
Total Weighted Grade point for Physical Chemistry Experiments					

P9 Viscosity of binary mixtures and then concentration of unknown mixture of Toluene & Nitrobenzene

SI No	i. Main Components and sub components	ii. Grade	iii. Grade point A=4, B=3, C=2, D=1, E=0	iv. Wt	Weighted grade point iii × iv
I	Lab Report-	Refer Table 1		3	
II	Procedure-	Refer Table 1		1	
III	Viva-	Refer Table 1		1	
IV	Neat tabulation and systematic recording-	Refer Table 1		1	
V	Measurement of time of flow (5 mixtures and 2 pure components)	7 values-A 4 values-B 2 values-C 1 value-D		2	
VI	Calculation of Coefficient of viscosity	Five values: A OnlyFour: B Only three: C Only two: D One or nil : E		1	
VI	Graph (unknown composition)	Graph with Five points: A OnlyFour: B Only three: C Only two: D None : E		3	
VII	Accuracy	± 5% error-A ± 7% error-B ± 9% error-C Above ± 9% error-D		3	
Total Weighted Grade point for Physical Chemistry Experiments					

P10 Surface tension of binary mixtures - Acetic acid (2.5 M to 0.5M) & and then determination of concentration of unknown mixture (1.0 M to 2.0M)

SI No	i. Main Components and sub components	ii. Grade	iii. Grade point A=4, B=3, C=2, D=1, E=0	iv. Wt	Weighted grade point iii × iv
I	Lab Report-	Refer Table 1		3	
II	Procedure-	Refer Table 1		1	
III	Viva-	Refer Table 1		1	
IV	Neat tabulation and systematic recording-	Refer Table 1		1	
V	Surface tension of five mixtures	5 values-A 4 values-B 2 values-C 1 value-D		2	
VI	Graph (unknown composition)	Graph with Four points: A Only three: B Only two: C Only one: D None : E		3	
VII	Accuracy	Refer Table 2		4	
Total Weighted Grade point for Physical Chemistry Experiments					

P11 Refractive index of KCl solution of different concentration(1.0 % to 10.0%) then determination of concentration of unknown mixture (0.3 to 0.7%)

SI No	i. Main Components and sub components	ii. Grade	iii. Grade point A=4, B=3, C=2, D=1, E=0	iv. Wt	Weighted grade point iii × iv
I	Lab Report-	Refer Table 1		3	
II	Procedure-	Refer Table 1		1	
III	Viva-	Refer Table 1		1	
IV	Neat tabulation and systematic recording-	Refer Table 1		1	
V	Five values of refractive index	5 values-A 4 values-B 2 values-C 1 value-D		2	
VI	Graph (unknown composition)	Graph with Five points: A Only Four: B Only Three: C Only Two: D None : E		3	
VII	Accuracy	± 1.5% error-A ± 2.0% error-B ± 3.0% error-C Above ± 3.0% error-D		4	
Total Weighted Grade point for Physical Chemistry Experiments					

P12 Determination of water equivalent of the given calorimeter and hence determine the heat of neutralization of the strong acid A and the strong base B. (1N Acid and 1N Base to be given) (heat of neutralization -57.3 kJ/mol)

SI No	i. Main Components and sub components	ii. Grade	iii. Grade point A=4, B=3, C=2, D=1, E=0	iv. Wt	Weighted grade point iii × iv
I	Lab Report-	Refer Table 1		3	
II	Procedure-	Refer Table 1		1	
III	Viva-	Refer Table 1		1	
IV	Neat tabulation and systematic recording-	Refer Table 1		1	
V	**Water equivalent** Recording of temperature-graph - Determination of heat neutralization - value	4 Points-A 3 Points-B 2 Points -C 1 Point -D		2	
VI	**Heat of neutralization** Recording of temperature-graph - calculation - value	4 Points-A 3 Points-B 2 Points -C 1 Point -D		3	
VII	Accuracy	Refer Table 2		4	
Total Weighted Grade point for Physical Chemistry Experiments					