Densities, Viscosities and Apparent Molar Volumes of $KClO_3$ in Water and Some Aqueous Electrolyte Solutions at Different Temperatures

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Abstract:

The densities and viscosities of $KClO_3$ in water and aqueous solutions of some electrolytes like potassium chloride, potassium nitrate and ammonium nitrate have been measured at the temperatures (298.15, 303.15, 308.15,and 313.15)K.Six different concentrations ranging from 0.0065 to 0.0365 M were prepared. The apparent molar volumes (ϕ_v) and viscosity B coefficients of these salts are obtained. The limiting apparent molar volumes (ϕ_v^0) and experimental slopes (s_v) derived from the Masson's equation have been interpreted in terms of ion-solvent and ion-ion interactions, respectively. The viscosity data have been analyzed using the Jones-Dole equation, and the derived parameters B and A have also been interpreted in terms of ion-solvent and ion-ion interactions. The structure making/breaking capacities of these salts investigated have been discussed.

Keywords:*$KClO_3$, density, viscosity, B-coefficient, apparent molar volumes.*

I. INTRODUCTION

The electrolytes play important role in biochemical reactions. For common and industrially important electrolytes, a number of compilations of density exist, based upon data from studies carried out over more than a century [1-3].The volumetric properties of electrolyte solutions have proven to be a very useful tool in elucidating the structural interactions occurring in solution, because they may give us information about the presence of components in solution. The design and operations ofbiochemical processes that involve electrolyte solutions require knowledge of rigorous models or experimental data to represent the non-ideality of the mixtures. Accurate predictions of densities and viscosities of mixed electrolyte solutions are of great importance in industry [4].Studies on viscosities, densities, and apparent molar volumes of ionic solutions assist in characterizing the structure and properties of solutions. Various types of interactions exist between the ions in solutions, and of these, ion-ion and ion-solvent interactions are of current interest in all branches of chemistry. These interactions help in better understanding the nature of solute and solvent, that is, whether the solute modifies or distorts the structure of the solvent. The present electrolytes have been selected for study because they are important constituents ofbody fluids, soil fluids and used in electrochemistry to construct salt bridge due to their special features. The main ionic solutes in bio-fluids are the alkali cations, viz., NH_4^+ and K^+ in small amounts; the anions are the small amounts of Cl^- andNO^{3-}. The present investigation has been undertaken to provide better understanding of various electrolytes in water and to throw light on structural interactions.

II. EXPERIMENTAL SECTION

Potassium chlorate, ammonium nitrate, potassium nitrate, and potassium chloride(all A.R.) were used as such; only after drying over P_2O_5 in a desiccator for more than 48 h. Freshly distilled conductivity water was used. The aqueous solutions of all electrolytes were made by mass, and conversion of molality into molarity was done.

A. Density Measurements:

A bicapillary pycnometer having a bulb volume of ~12 cm^3 and an internal diameter of the capillary of about 0.1 cm was calibrated at(298.15,303.15, 308.15 and 313.15) K by measuring the densities of triple distilled water. The densities of distilled organic liquids like acetone, carbon tetra chloride, aniline, and nitrobenzene were evaluated with respect to density of water. The density was measured with an uncertainty of ±1.48 $\times10^{-4}$g.cm^{-3}. The densities of $KBrO_3$ solutions in aqueous KCl,KNO_3,$NH_4NO_3$and pure water were measured bycalibrated bicapillary pycnometer at different temperatures. The water bath temperature was maintained by means of electric thermoregulatory system and measured by digital thermometer with accuracy of ±0.1 K.

B. Viscosity Measurements:

The different compositions of solutions ranging 0.0065M to 0.0365M of $KClO_3$wereprepared in aqueous KCl,KNO_3,NH_4NO_3 and pure water solvent systems. The viscosities prepared solutions were measuredat 298.15, 303.15, 308.15, and 313.15K temperatures for sixdifferent concentrations. The solution viscosities were measured with an uncertainty of ± 2.4×10^{-3}mPa.s by using Ubbelohde viscometer. The flow time will be measured at the accuracy of ± 0.01 s.The experimental values of concentrations (*c*), densities(ρ), viscosities (η), and apparent molar volumes of aqueous solutions of $KClO_3$at various temperatures are recorded in Table 1.

III. DATA EVALUATION

The apparent molar volumes (ϕ_v) were determined from the solution densities using the following equation [5],

$$\phi_v = \frac{1000\,(\rho 0 - \rho)}{C\rho 0} + \frac{M}{\rho} \qquad \ldots 1$$

Where *M* is the molecular weight of the solute, *c* is the molarity of the solution, and the other symbols have their usual significance.The limiting apparent molar volumes (ϕ_v^0) were calculated using the least-squares treatment of the plots of $\phi_v$versus $C^{½}$using the Masson equation[6].

$$\phi_v = s_v C^{½} + \phi_v^0 \qquad \ldots 2$$

where ϕ_v^0 is the partial molar volume at infinite dilution and s_v the experimental slope. The viscosity data have been analyzed using the Jones-Dole equation [7].

$$(\eta/\eta_0) = 1 + A\sqrt{c} + Bc$$

$$\{[(\eta/\eta_0) - 1] / \sqrt{c}\} = A + B\sqrt{c} \qquad \ldots 3$$

Whereη and η_0 are the viscosities of solution and solvent respectively. *A* and*B* are constants.

IV. RESULTS AND DISCUSSION

The value of densities (ρ), viscosities (η)and apparent molar volumes (ϕ_v),of $KClO_3$ in water at various temperatures are listed in table-I.Densities, viscosities and apparent molar volumeof $KClO_3$ in 0.1%, 0.2%, 0.3% and 0.4% KCl at various temperatures are listed in table-II and III. Densities, viscosities and apparent molar volumeof $KClO_3$ in 0.1%, 0.2%, 0.3% and 0.4% KNO_3 at various temperatures are listed in table-IV and V. Densities, viscosities and apparent molar volumeof $KClO_3$ in 0.1%, 0.2%, 0.3% and 0.4% NH_4NO_3at various temperatures are listed in table-VI and VII. It is observed that the densities increases with increase in concentration while decreases with increase in temperatures. Similar observations are noted for viscosities. The increase in density with concentration is due to increase in molar mass of electrolytes against constant molar volume of solution. It decreases with increase in temperature is due to increase in molar volume of solution against constant molar mass.

The density and viscosity values of $KClO_3$ are higher in KNO_3 and follows the trend as

$KClO_3$ in KNO_3>$KClO_3$ in NH_4NO_3>$KClO_3$ in KCl>$KClO_3$ in water

The apparent molar volumes follow the trend as

$KClO_3$ in water >$KClO_3$ in KCl>$KClO_3$ in NH_4NO_3>$KClO_3$ in KNO_3

The trend shows that there are more interactions in the system of $KClO_3$ in KNO_3 as that in the system of $KClO_3$ in water. This suggests that the cluster formation favors that in the system of $KClO_3$ in KNO_3 as compared with other systems investigated.

The ϕ_v^0 and s_v parametersof $KClO_3$in water and different composition of KClat different temperatures are reported in table-8. Similarly the ϕ_v^0 and s_v parametersof $KClO_3$in different composition of KNO_3, and NH_4NO_3at different temperatures are reported in table-9 and 10 respectively. Since ϕ_v^0 is a measure of ion-solvent interactions (as ionic interactions vanish at infinite dilution), therefore, it is evident that the values of ϕ_v^0 are positive and large at different temperatures, indicating the presence of strong ion-solvent interactions. These interactions are further strengthened with the rise in temperature, indicating that solvent molecules are loosely attached to solute, which expands with increase of temperature. Similar results are reported for some 1:1 electrolytes in aqueous DMF [8-9]. It is also evident that the values of ϕ_v^0 increases in magnitude with increase in temperature, suggesting that the behavior of $KClO_3$ in KCl, NH_4NO_3 and $KNO_3$is similar to that of symmetrical tetra alkyl ammonium salts [10-11].

Hepler [12] developed a technique of examining the sign of$(\delta^2\phi_v^0/\delta T^2)_\rho$ for various solutes in terms of long-range structure making and breaking capacity of the solutes in aqueous solutions using the general thermodynamic expression. On the basis of this expression it has been deduced that structure making solutes should have positive values, whereas structure breaking solutes should have negative values. In the present systems, it is evident that $(\delta^2\phi_v^0/\delta T^2)_\rho$ is positive, suggesting thereby that $KClO_3$acts as a structure maker in KCl, NH_4NO_3 and KNO_3 solutions. The values of s_v reported in table-VIII-X are all negative. Since s_v is a measure of solute-solute/ion-ion interactions, the results indicating the presence of weak ion-ion interactions.

The values of *A* and *B* coefficients are estimated by a computerized least-squares method and recorded in table-VIII-X. The values of the *A* coefficient of $KClO_3$ studied in water and other electrolytes at different temperatures are very small and positive as well as negative, thereby showing the presence of very weak solute-solute interactions. In other words, these results indicate that $KClO_3$ in water, KCl, NH_4NO_3 and KNO_3solutions shows a perfect solvation of its ions resulting in either no or weak solute-solute interactions. It is also found that the *B* coefficients for $KClO_3$ studied here in water and other electrolytes at various temperatures are small but positive thereby suggesting the presence of ion solvent interactions. The results evaluated supports thereby presence of ion solvent interactions and perfect solvation of $KClO_3$ in different electrolyte solutions.

V. CONCLUSION

The evaluated data shows the presence of strong interactions between $KClO_3$ and the salt solution systems. The other parameters also support the same nature. $KClO_3$ acts as structure maker in selected salt solution systems. The data may be highly useful in marine engineering, fluid mechanics, pharmacist, electrochemistry, thermodynamics and many industrial processes.

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Table-I: Concentration(C),Density(ρ),Viscosity(η)and Apparent Molar Volume(ϕ_v),of $KClO_3$ in Water at Various Temperatures.

(C) mol/dm^3	ρ g.cm^{-3}	η cp	ϕ_v cm^3.mol^{-1}	ρ g.cm^{-3}	η cp	ϕ_v cm^3.mol^{-1}
	298.15^{0}K			303.15^{0}K		
0.0065	0.99863	0.8955	122.42	0.99769	0.81280	122.47
0.0105	0.99982	0.8965	122.26	0.99882	0.8159	122.34
0.0155	1.00131	0.8978	122.06	1.00022	0.8197	122.18
0.0215	1.00305	0.8993	121.85	1.00188	0.8244	121.98
0.0285	1.00518	0.9010	121.58	1.00386	0.8297	121.74
0.0365	1.00756	0.9030	121.29	1.00589	0.8359	121.50
	308.15^{0}K			313.15^{0}K		
0.0065	0.99559	0.7307	122.80	0.99396	0.6578	122.97
0.0105	0.99678	0.7359	122.63	0.99523	0.6609	122.79
0.0155	0.99826	0.7426	122.44	0.99682	0.6649	122.59
0.0215	1.00001	0.7505	122.22	0.99869	0.6696	122.36
0.0285	1.00206	0.7596	121.96	1.00095	0.6751	122.08
0.0365	1.00453	0.7701	121.66	1.00349	0.6814	121.76

Table-II : Concentration(C),Density(ρ),Viscosity(η) and Apparent Molar Volume(ϕ_v)of $KClO_3$ in 0.1% and 0.2% KCl at Various Temperatures.

C (mol/dm3)	ρ g.cm-3	η cp	Φ_v cm3.mol^{-1}	ρ g.cm-3	η cp	Φ_v cm3.mol^{-1}
	KClO3 in 0.1% KCl					
	298.15 K			303.15 K		
0.0065	0.99899	0.8966	122.33	0.99726	0.8162	122.59
0.0105	1.00030	0.8974	122.16	0.99859	0.8186	122.39
0.0155	1.00197	0.8983	121.95	1.00022	0.8217	122.18
0.0215	1.00392	0.8994	121.70	1.00221	0.8253	121.93
0.0285	1.00623	0.9007	121.42	1.00448	0.8296	121.64
0.0365	1.00888	0.9022	121.10	1.00732	0.8344	121.29
	308.15 K			313.15 K		
0.0065	0.99602	0.7301	122.71	0.99434	0.6580	122.91
0.0105	0.99734	0.7339	122.52	0.99566	0.6602	122.73
0.0155	0.99892	0.7388	122.32	0.99753	0.6630	122.48
0.0215	1.00096	0.7446	122.06	0.99956	0.6663	122.22
0.0285	1.00326	0.7514	121.78	1.00186	0.6702	121.94

0.0365	1.00590	0.7591	121.46	1.00450	0.6746	121.62
	KClO3 in 0.2% KCl					
	298.15 K			303.15 K		
0.0065	1.00006	0.8997	122.15	0.99852	0.8181	122.41
0.0105	1.00126	0.9001	122.02	0.99971	0.8206	122.25
0.0155	1.00278	0.9006	121.84	1.00123	0.8236	122.06
0.0215	1.00546	0.9011	121.48	1.00405	0.8272	121.66
0.0285	1.00679	0.9018	121.36	1.00523	0.8314	121.56
0.0365	1.00918	0.9025	121.07	1.00762	0.8363	121.27
	308.15 K			313.15 K		
0.0065	0.99698	0.7347	122.59	0.99545	0.6618	122.76
0.0105	0.99830	0.7382	122.41	0.99690	0.6652	122.56
0.0155	0.99982	0.7426	122.22	0.99841	0.6695	122.38
0.0215	1.00236	0.7478	121.88	1.00096	0.6746	122.03
0.0285	1.00382	0.7540	121.73	1.00242	0.6805	121.89
0.0365	1.00621	0.7610	121.44	1.00480	0.6873	121.60

Table-III : Concentration(C),Density(ρ),Viscosity(η) and Apparent Molar Volume(ϕ_v)of $KClO_3$ in 0.3% and 0.4% KCl at Various Temperatures.

C (mol/dm^3)	ρ g.cm^{-3}	η cp	ϕ_v cm^3.mol^{-1}	ρ g.cm^{-3}	η cp	ϕ_v cm^3.mol^{-1}
	$KClO_3$ in 0.3% KCl					
	298.15 K			303.15 K		
0.0065	1.00124	0.9042	121.93	0.99969	0.8222	122.10
0.0105	1.00233	0.9060	121.79	1.00091	0.8249	121.99
0.0155	1.00370	0.9083	121.62	1.00228	0.8284	121.86
0.0215	1.00534	0.9110	121.48	1.00392	0.8325	121.68
0.0285	1.00726	0.9141	121.29	1.00570	0.8374	121.49
0.0365	1.00945	0.9177	121.14	1.00789	0.8429	121.34
	308.15 K			313.15 K		
0.0065	0.99828	0.7387	122.33	0.99688	0.6673	122.46
0.0105	0.99936	0.7423	122.18	0.99795	0.6726	122.32
0.0155	1.00087	0.7468	122.03	0.99946	0.6792	122.18
0.0215	1.00251	0.7522	121.85	1.00110	0.6871	122.01
0.0285	1.00429	0.7585	121.66	1.00288	0.6964	121.82
0.0365	1.00647	0.7657	121.46	1.00506	0.7069	121.66
	$KClO_3$ in 0.4% KCl					
	298.15 K			303.15 K		
0.0065	1.00210	0.9095	121.69	1.00085	0.8252	121.86
0.0105	1.00338	0.9115	121.56	1.00197	0.8282	121.76
0.0155	1.00462	0.9139	121.45	1.00320	0.8318	121.69
0.0215	1.00605	0.9169	121.35	1.00478	0.8362	121.54
0.0285	1.00781	0.9204	121.20	1.00625	0.8413	121.40
0.0365	1.00976	0.9244	121.10	1.00820	0.84701	121.29
	308.15 K			313.15 K		
0.0065	0.99913	0.7433	121.99	0.99712	0.67011	122.29
0.0105	1.00056	0.7469	121.92	0.99887	0.67455	122.12
0.0155	1.00179	0.7516	121.85	1.00024	0.68010	122.03
0.0215	1.00337	0.7571	121.71	1.00224	0.68676	121.92
0.0285	1.00484	0.7636	121.57	1.00343	0.69452	121.73
0.0365	1.00679	0.7709	121.46	1.00537	0.70340	121.56

Table-IV : Concentration(C),Density(ρ),Viscosity(η) and Apparent Molar Volume(ϕ_v)of $KClO_3$ in 0.1% and 0.2% KNO_3 at various Temperatures.

C (mol/dm^3)	ρ g.cm^{-3}	η cp	ϕ_v cm^3.mol^{-1}	ρ g.cm^{-3}	η cp	ϕ_v cm^3.mol^{-1}
	$KClO_3$ in 0.1% KNO_3					
	298.15 K			303.15 K		
0.0065	1.00009	0.9037	122.25	0.99855	0.8260	122.42
0.0105	1.00151	0.9079	121.99	1.00009	0.8302	122.16
0.0155	1.00328	0.9133	121.77	1.00173	0.8355	121.96
0.0215	1.00544	0.9197	121.50	1.00388	0.8419	121.69
0.0285	1.00785	0.9271	121.21	1.00629	0.8493	121.39
0.0365	1.01068	0.9356	120.95	1.00912	0.8578	121.12
	308.15 K			313.15 K		
0.0065	0.99715	0.7476	122.63	0.99589	0.6730	122.78
0.0105	0.99868	0.7533	122.33	0.99741	0.6772	122.54
0.0155	1.00032	0.7604	122.13	0.99892	0.6824	122.31
0.0215	1.00246	0.7689	121.86	1.00105	0.6886	122.04
0.0285	1.00488	0.7789	121.56	1.00348	0.6959	121.74
0.0365	1.00770	0.7903	121.31	1.00629	0.7043	121.48
	$KClO_3$ in 0.2% KNO_3					
	298.15 K			303.15 K		
0.0065	1.00139	0.9069	122.09	1.00017	0.8294	122.21
0.0105	1.00286	0.9111	121.83	1.00167	0.8347	121.95
0.0155	1.00469	0.9162	121.59	1.00347	0.8412	121.73
0.0215	1.00681	0.9224	121.33	1.00570	0.8491	121.45
0.0285	1.00941	0.9295	121.01	1.00833	0.8583	121.13
0.0365	1.01253	0.9377	120.73	1.01103	0.8688	120.86
	308.15 K			313.15 K		
0.0065	0.99849	0.7484	122.49	0.99735	0.6754	122.60
0.0105	0.99996	0.7538	122.19	0.99880	0.6811	122.31
0.0155	1.00179	0.7604	121.95	1.00061	0.6883	122.08
0.0215	1.00400	0.7685	121.67	1.00279	0.6969	121.81
0.0285	1.00657	0.7778	121.35	1.00532	0.7069	121.49
0.0365	1.00960	0.7885	121.08	1.00812	0.7184	121.22

Table-V : Concentration (C), Density (ρ),Viscosity (η) and Apparent Molar Volume(ϕ_v)of$KClO_3$ in 0.3% and 0.4% KNO_3 at Various Temperatures.

C (mol/dm^3)	ρ g.cm^{-3}	η cp	ϕ_v cm^3.mol^{-1}	ρ g.cm^{-3}	η cp	ϕ_v cm^3.mol^{-1}
	$KClO_3$ in 0.3% KNO_3					
	298.15 K			303.15 K		
0.0065	1.00272	0.9122	121.78	1.00151	0.8330	121.92
0.0105	1.00429	0.9167	121.52	1.00295	0.8372	121.67
0.0155	1.00621	0.9222	121.28	1.00484	0.8425	121.43
0.0215	1.00853	0.9289	121.01	1.00717	0.8489	121.15
0.0285	1.01124	0.9367	120.73	1.00983	0.8563	120.89
0.0365	1.01453	0.9456	120.41	1.01296	0.8648	120.59
	308.15 K			313.15 K		
0.0065	1.00023	0.7543	122.09	0.99870	0.6750	122.23
0.0105	1.00171	0.7592	121.81	1.00019	0.6818	122.01
0.0155	1.00365	0.7653	121.60	1.00202	0.6902	121.77
0.0215	1.00587	0.7726	121.36	1.00427	0.7004	121.51
0.0285	1.00858	0.7812	121.04	1.00696	0.7123	121.24

0.0365	1.01140	0.7910	120.76	1.00998	0.7258	120.93
	KClO3 in 0.4% KNO3					
	298.15 K			303.15 K		
0.0065	1.00427	0.9166	121.38	1.00281	0.8378	121.57
0.0105	1.00584	0.9218	121.18	1.00437	0.8426	121.37
0.0155	1.00781	0.9283	120.94	1.00639	0.8486	121.18
0.0215	1.01020	0.9361	120.72	1.00874	0.8557	120.94
0.0285	1.01296	0.9452	120.44	1.01155	0.8641	120.63
0.0365	1.01612	0.9556	120.16	1.01461	0.8736	120.34
	308.15 K			313.15 K		
0.0065	1.00136	0.7575	121.80	0.99986	0.6819	121.97
0.0105	1.00290	0.7622	121.55	1.00145	0.6888	121.73
0.0155	1.00487	0.7680	121.37	1.00342	0.6975	121.56
0.0215	1.00722	0.7750	121.13	1.00575	0.7079	121.31
0.0285	1.01001	0.7832	120.82	1.00851	0.7200	121.04
0.0365	1.01313	0.7925	120.56	1.01172	0.7339	120.83

TableVI

Concentration (C), Density (ρ),Viscosity (η) and Apparent molar Volume(ϕ_v)of $KClO_3$ in 0.1% and 0.2% NH_4NO_3at various Temperatures.

C (mol/dm^3)	ρ g.cm^{-3}	η cp	ϕ_v cm^3.mol^{-1}	ρ g.cm^{-3}	η cp	ϕ_v cm^3.mol^{-1}
	$KClO_3$ in 0.1% NH_4NO_3					
	298.15 K			**303.15 K**		
0.0065	0.99936	0.9017	122.24	0.99796	0.8221	122.41
0.0105	1.00092	0.9057	122.03	0.99937	0.8268	122.23
0.0155	1.00257	0.9107	121.81	1.00103	0.8327	122.00
0.0215	1.00469	0.9167	121.54	1.00314	0.8397	121.74
0.0285	1.00722	0.9237	121.267	1.00566	0.8479	121.46
0.0365	1.01005	0.9317	120.93	1.00849	0.8573	121.12
	308.15 K			**313.15 K**		
0.0065	0.99642	0.7438	122.76	0.99488	0.6632	122.87
0.0105	0.99783	0.7481	122.52	0.99615	0.6689	122.63
0.0155	0.99950	0.7535	122.28	0.99797	0.6762	122.40
0.0215	1.00173	0.7599	121.98	1.00018	0.6848	122.12
0.0285	1.00425	0.7675	121.66	1.00284	0.6949	121.79
0.0365	1.00708	0.7761	121.31	1.00567	0.7065	121.45
	$KClO_3$ in 0.2% NH_4NO_3					
	298.15 K			**303.15 K**		
0.0065	1.00065	0.9042	122.12	0.99925	0.8238	122.29
0.0105	1.00204	0.9082	121.93	1.00049	0.8284	122.13
0.0155	1.00381	0.9132	121.70	1.00225	0.8340	121.90
0.0215	1.00590	0.9191	121.44	1.00435	0.8408	121.64
0.0285	1.00841	0.9261	121.14	1.00685	0.8487	121.33
0.0365	1.01121	0.9341	120.79	1.00965	0.8577	120.99
	308.15 K			**313.15 K**		
0.0065	0.99771	0.7416	122.474	0.99617	0.6658	122.76
0.0105	0.99909	0.7467	122.290	0.99754	0.6724	122.48
0.0155	1.00084	0.7530	122.065	0.99929	0.6805	122.26
0.0215	1.00294	0.7607	121.803	1.00140	0.6903	121.99
0.0285	1.00544	0.7696	121.495	1.00403	0.7018	121.66
0.0365	1.00823	0.7798	121.155	1.00682	0.7148	121.38

Table-VII

Concentration (C), Density (ρ),Viscosity (η) and Apparent molar Volume(ϕ_v)of $KClO_3$ in 0.3% and 0.4% NH_4NO_3at various Temperatures.

C (mol/dm^3)	ρ g.cm^{-3}	η cp	ϕ_v cm^3.mol^{-1}	ρ g.cm^{-3}	η cp	ϕ_v cm^3.mol^{-1}
	$KClO_3$ in 0.3% NH_4NO_3					
	298.15 K			**303.15 K**		
0.0065	1.00193	0.9084	121.83	1.00052	0.8275	121.99
0.0105	1.00332	0.9122	121.65	1.00191	0.8317	121.82
0.0155	1.00506	0.9169	121.44	1.00364	0.8371	121.64
0.0215	1.00712	0.9225	121.21	1.00556	0.8435	121.41
0.0285	1.00956	0.9291	120.96	1.00800	0.8510	121.15
0.0365	1.01229	0.9366	120.74	1.01073	0.8596	120.94
	308.15 K			**313.15 K**		
0.0065	0.99898	0.7469	122.25	0.99758	0.6703	122.42
0.0105	1.00035	0.7511	122.01	0.99880	0.6769	122.20
0.0155	1.00208	0.7563	121.83	1.00053	0.6851	122.00
0.0215	1.00401	0.7625	121.54	1.00246	0.6949	121.74
0.0285	1.00659	0.7698	121.32	1.00518	0.7064	121.48
0.0365	1.00931	0.7782	121.10	1.00790	0.7195	121.25
	$KClO_3$ in 0.4% NH_4NO_3					
	298.15 K			**303.15 K**		
0.0065	1.00322	0.9132	121.58	1.00180	0.8311	121.76
0.0105	1.00458	0.9169	121.38	1.00316	0.8351	121.55
0.0155	1.00630	0.9217	121.18	1.00488	0.8401	121.35
0.0215	1.00832	0.9274	120.96	1.00676	0.8460	121.13
0.0285	1.01064	0.9341	120.75	1.00908	0.8529	120.91
0.0365	1.01337	0.9417	120.51	1.01180	0.8609	120.67
	308.15 K			**313.15 K**		
0.0065	1.00039	0.7512	121.91	0.99898	0.6756	122.03
0.0105	1.00175	0.7560	121.71	1.00020	0.6812	121.88
0.0155	1.00332	0.7621	121.51	1.00177	0.6883	121.70
0.0215	1.00521	0.7694	121.32	1.00366	0.6969	121.51
0.0285	1.00767	0.7779	121.10	1.00625	0.7068	121.31
0.0365	1.01038	0.7876	120.89	1.00897	0.7182	121.12

Table-VII: ϕ_v^0 ($cm^3.mol^{-1}$), s_v ($cm^3.mol^{-3/2}.L^{1/2}$), A($dm^{3/2}.mol^{-1/2}$) and B($dm^3.mol^{-1}$) Parametersof $KClO_3$ in Water and Different Composition of KCl at Different Temperatures.

Temp. (K)	Water	0.1% KCl	0.2 % KCl	0.3 % KCl	0.4% KCl
	ϕ_v^0 /($cm^3.mol^{-1}$)				
298.15	123.3	123.2	123	122.5	122.1
303.15	123.2	123.6	123.2	122.7	122.2
308.15	123.9	123.6	123.4	122.9	122.5
310.15	123.3	123.9	123.6	123	122.8
	s_v /($cm^3.mol^{3/2}L^{1/2}$)				
298.15	-10.2	-11.17	-10	-7.29	-5.43
303.15	-8.86	-11.71	-10.49	-7.64	-5.27
308.15	-10.92	-11.28	-10.53	-7.62	-5.69
310.15	-10.2	-11.74	-10.49	7.34	-6.82
	A/($dm^{3/2}mol^{-1/2}$)				
298.15	-0.01	0.02	0.02	0.01	0.02
303.15	-0.04	0.01	0.04	-0.02	0.06
308.15	-0.05	-0.01	0.01	0.03	-0.01
310.15	-0.03	0.05	-0.01	-0.09	0.03
	B/ ($dm^3.mol^{-1}$)				
298.15	0.32	0.14	0.23	0.37	0.37
303.15	1.09	0.8	0.6	0.81	0.68
308.15	2.01	1.39	1.18	0.13	1.26
310.15	1.32	0.54	1.32	1.55	1.55

Table-IX : ϕ_v^0 ($cm^3.mol^{-1}$), s_v ($cm^3.mol^{-3/2}.L^{1/2}$), A($dm^{3/2}.mol^{-1/2}$) and B($dm^3.mol^{-1}$) of $KClO_3$ in Different Composition of KNO_3 at Different Temperatures.

Temp. (K)	0.1% KNO_3	0.2% KNO_3	0.3% KNO_3	0.4 % KNO_3
	ϕ_v^0 /($cm^3.mol^{-1}$)			
298.15	123.20	123.10	122.70	122.30
303.15	123.30	123.20	122.80	122.50
308.15	123.50	123.50	122.90	122.70
310.15	123.70	123.60	123.10	122.80
	s_v /($cm^3.mol^{3/2}L^{1/2}$)			
298.15	-11.84	-12.36	-12.06	-11.06
303.15	-11.74	-12.27	-11.54	-11.08
308.15	-11.88	-12.70	-11.12	-11.19
310.15	-11.81	-12.44	-11.36	-10.51
	A /($dm^{3/2}.mol^{-1/2}$)			
298.15	-0.01	-0.02	-0.01	-0.02
303.15	0.01	-0.01	0.03	0.05
308.15	-0.02	-0.06	0.01	0.02
310.15	-0.02	-0.09	-0.19	-0.10
	B /($dm^3.mol^{-1}$)			
298.15	1.22	1.21	1.25	1.49
303.15	1.24	1.64	1.16	1.24
308.15	1.62	2.04	1.59	1.48
310.15	1.99	2.49	3.20	2.91

Table-X : ϕ_v^0 ($cm^3.mol^{-1}$), s_v ($cm^3.mol^{-3/2}.L^{1/2}$), A($dm^{3/2}mol^{-1/2}$) and B($dm^3.mol^{-1}$) of $KClO_3$ Five Different Concentration of NH_4NO_3 at Different Temperatures.

Temp. (K)	0.1% NH_4NO_3	0.2% NH_4NO_3	0.3% NH_4NO_3	0.4% NH_4NO_3
	ϕ_v^0 /($cm^3.mol^{-1}$)			
298.15	123.20	123.10	122.60	122.30
303.15	123.40	123.30	122.80	122.50
308.15	123.80	123.50	123.10	122.60
310.15	123.80	123.70	123.30	122.70
	s_v /($cm^3.mol^{3/2}L^{1/2}$)			
298.15	-11.78	-11.93	-10.25	-9.62
303.15	-11.70	-11.84	-9.73	-9.77
308.15	-13.04	-11.95	-10.55	-9.17
310.15	-12.20	-12.18	-10.70	-8.32
	A /($dm^{3/2}mol^{-1/2}$)			
298.15	-0.01	-0.03	-0.02	-0.01
303.15	0.02	-0.02	-0.01	-0.01
308.15	0.05	-0.09	-0.01	-0.01
310.15	-0.03	-0.09	-0.08	-0.01
	B /($dm^3.mol^{-1}$)			
298.15	1.13	1.24	1.13	1.09
303.15	1.36	1.44	1.35	1.22
308.15	1.26	2.08	1.44	1.65
310.15	2.32	2.83	2.77	2.17