CHAPTER 7

CONCLUSIONS.

The results obtained in the present investigation will now be briefly summarised and the corelations between the various states of the molecules of the group will be established.

The vibrational constants of the various systems reported earlier and those obtained in the present investigation are collected in tables (27), (28) and (29). The latter are marked with an asterisk. The following facts are easily established. :-

(i) The corresponding systems for chloride, bromide, and iodide occur progressively towards longer wavelengths. Further the vibrational frequencies for the corresponding systems decrease

with the increase in the molecular weight of the molecule.

(ii)   All the B-systems for the three halides are similar in appearance, their region of occurr$\overset{ie}{\underset{\wedge}{a}}$nce and degradation. The evidence presented here indicated that they belong to a $B^2\Sigma \to X^2\Sigma$ transition.

(iii)   The diffuse bands in the red region are similar for all the molecules, the diffuseness decreasing with the increase in the weight of the molecules. The molecules CdBr and CdCl show more diffuseness in comparison with the molecule CdI and this fact may be accounted as due to the large number of isotopic constituents for the first two mentioned molecules. Even though the experimental evidence is not enough for establishing the transition, it definitely indicates the possibility of a new state having an energy lower than that of B-state. Detailed investigation of these systems under better dispersion and improved experimental conditions is under plan.

(iv)   Excluding the Cornell system of CdCl a similarity between the E - systems of CdBr and CdI has been established. Since the E - system of CdI

consists of sharp and intense bands and that of CdBr slightly diffuse and less intense bands, the corresponding system for CdCl, if at all it can be observed, should be sought for in the region of the observed continuum between $\lambda\lambda$ 2327-2600 A.U. The present author could not observe these bands in E and D' systems for CdCl molecule because of the inappropriate experimental conditions.

The same remarks will then be applicable to the D' systems of the three molecules and such a system for CdCl molecule should be nearer to the continuum at λ 2550 A.U. In the case of C and D systems the above observations have close correspondence, so far as the intensity and sharpness of the bands is concerned. If Howell's suggestion for the transition of E system of CdI molecule being due to $^2\Pi\rightarrow{}^2\Sigma$ state, the present observations indicate that the transitions for D' and E systems are $^2\Sigma\rightarrow{}^2\Sigma$ and $^2\Pi\rightarrow{}^2\Sigma$ respectively.

(v)   The present study supports the earlier work on Cornell's system in case of CdCl. However in the case of CdBr and CdI molecules such a system is not yet observed. The reasons are not yet clearly understood.

(vi)   The comparison of these states with the corresponding states of halides of zinc and mercury is best shown in fig. (5). The atomic states ^1P and ^3P of the corresponding atoms are also shown in the same figure. It is evident that for iodides fairly good correspondence could be established but the data is not enough for the chlorides and bromides, which may enable one to arrive at definite conclusions. More work on these molecules is therefore desired.
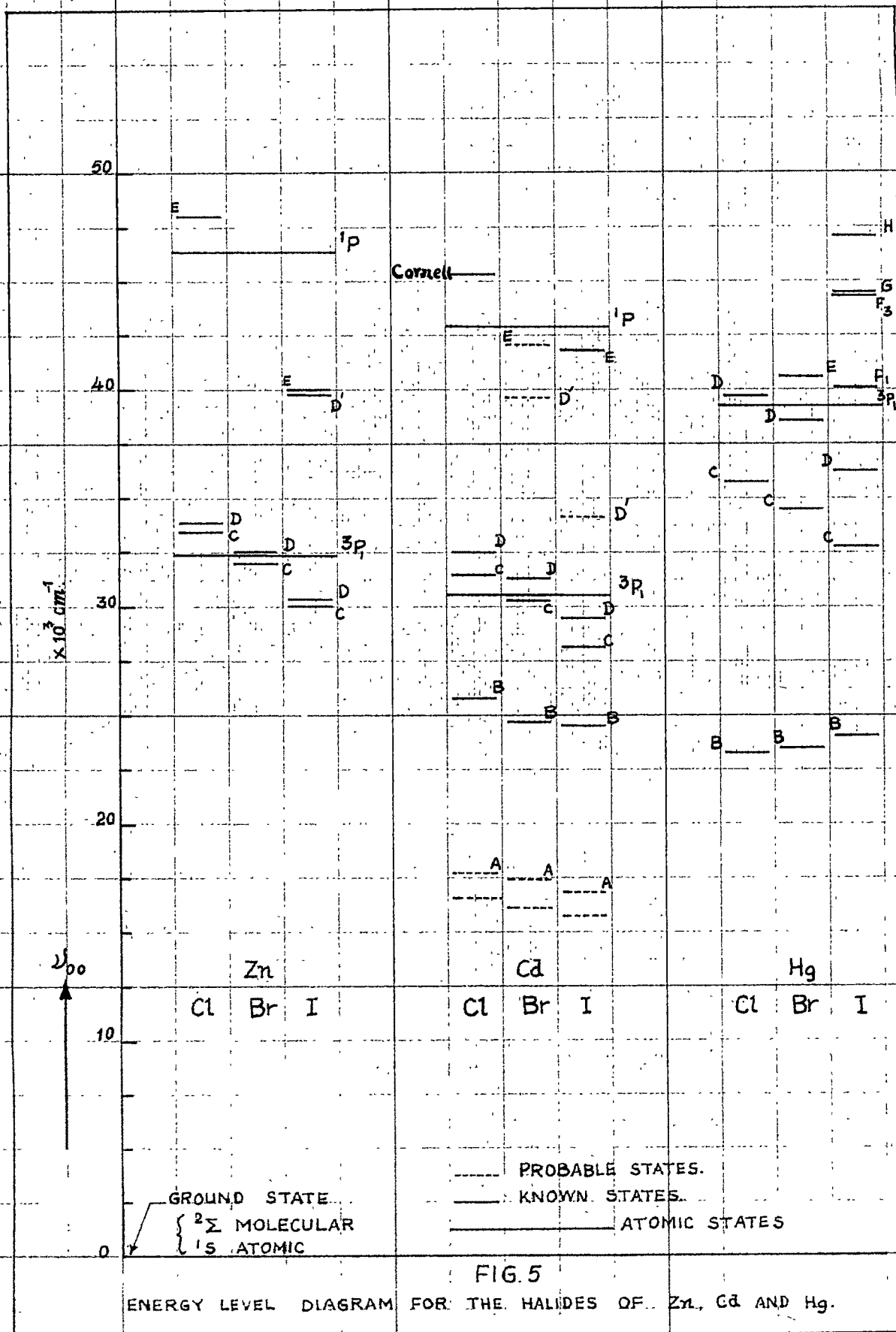
FIG. 5

ENERGY LEVEL DIAGRAM FOR THE HALIDES OF Zn, Cd AND Hg.

TABLE 27

VIBRATIONAL CONSTANTS OF CdCl MOLECULE

State	ν_{oo}	ω_e cm^{-1}	$\omega_e x_e$ cm^{-1}	Probable transition	Degradation	λMax.	Region in Å
E	45366.8	264.0	7.5	$E^2\Sigma - X^2\Sigma$	Red	2205	2181-2240
*D'	-	-	-		Continuum	2550	2327-2600
D	32536	(399.0)	(1.5)	$D^2\Pi_{3/2} - X^2\Sigma$	Violet	3073	3012-3105
C	31518	(399.0)	(1.5)	$C^2\Pi_{1/2} - X^2\Sigma$	Violet	3172	3142-3172
*B	25921	153.5	3.75	$B^2\Sigma - X^2\Sigma$	Red	4484	3700-4900
*A	-	134.0	3.00	-	Red	5726 6400	5050-6500
X		330.5	1.20				

* Data from the present investigation.

TABLE 28

VIBRATIONAL CONSTANTS OF CdBr MOLECULE

State	ν_{oo}	ω_e cm^{-1}	$\omega_e x_e$ cm^{-1}	Probable transition	Degradation	λMax.	Region in Å
*E		~129	~3.0	—	Red	2450	2351-2458
*D'		~170	~1.0	—	Red	2508	2472-2547
D	31470.5	254.5	0.75	$D\,^2\Pi_{3/2} \rightarrow X\,^2\Sigma$	Violet	3176	3123-3247
*C	30312	254.0	0.50	$C\,^2\Pi_{1/2} \rightarrow X\,^2\Sigma$	Violet	3298	3298-3324
*B	24760	105.4	1.70	$B\,^2\Sigma \rightarrow X\,^2\Sigma$	Red	4441	3900-4900
*A		106.0	1.50	—	Red	5700 6400	5100-6400
X		230.0	0.50				

* Data from the present investigation.

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TABLE 29

VIBRATIONAL CONSTANTS OF CdI MOLECULE

State	ν_{00}	ω_e cm^{-1}	$\omega_e\chi_e$ cm^{-1}	Probable transition	Degradation	λMax.	Region in Å
*E	41984	107.67	1.33	—	Red	2472	2360-2600
*D'		~104.0	~0.5	—	Red	2923	2890-2984
D	29539	196.6	0.70	$D\,^2\Pi_{3/2} \rightarrow X\,^2\Sigma$	Violet	3384	3288-3517
C	28233 / 28232	(197) / 181.60*	(0.7) / 0.55*	$C\,^2\Pi_{1/2} \rightarrow X\,^2\Sigma$	Violet	3541	3540-3600
*B	24542	77.7	1.45	$B\,^2\Sigma \rightarrow X\,^2\Sigma$	Red	4400	3850-4868
*A		51.0	1.0	—	Red	5890 / 6320	5100-6370
X		178.5	0.625				

* Data from the present investigation.