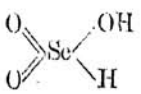
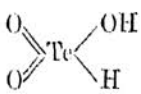
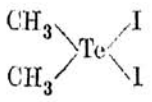
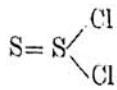
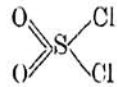
Molecular Structure of Some of the Selenium and Tellurium Compounds

PAULING,[1] Van Vleck,[2] Slater[3] and Angus[4] have shown that the diamagnetic susceptibility of an ion is given by $\chi_A = -\frac{e^2 z}{6mc^2} \sum \overline{r^2}$, where $\sum \overline{r^2}$ depends upon the valency state of the ion. The validity of this expression has been verified by Farquharson,[5] Gray and Cruickshank,[6] Clow[7] and Bhatnagar and co-workers.[8]

Varadachari and Subramaniam[9] and Nevgi[10] have determined the susceptibilities of a number of sulphur compounds and using Kido's values for the ionic susceptibility of sulphur in different valency states, have assigned suitable valencies to sulphur in these compounds. We have measured the magnetic susceptibilities of about a dozen compounds of selenium and tellurium by the modified form of Gouy's Balance and have calculated the theoretical values of selenium and tellurium in different valency states using Slater's and Angus's methods for the calculation of $\sum \overline{r^2}$. The calculated and observed values for some of these compounds are shown in Table I.

Incidentally we have calculated the values of $\sum \overline{r^2}$ according to Slater's and Angus's methods and hence the ionic susceptibilities, for sulphur in different valency states and have used them to calculate the susceptibilities of the sulphur compounds studied by Varadachari and Subramaniam and Nevgi. Table I shows that the values thus calculated for S_2Cl_2 and SO_2Cl_2 agree closely with those experimentally found by Varadachari and Subramaniam and Nevgi, respectively.

TABLE I

Compound	Correct constitution	$-\chi_a \times 10^6$ & $\chi_m \times 10^6$ observed by the authors	$\chi_a \times 10^6$ & $\chi_m \times 10^6$ calculated by Slater's method	$\chi_a \times 10^6$ & $\chi_m \times 10^6$ calculated by Angus's method
Se_2Br_2 ..	Br–Se–Se–Br	(χ_a) 0·3544	0·3479	0·3400
		(χ_m) 112·6	110·72	108·18
H_2SeO_3 ..		(χ_a) 0·3515	0·3470	0·3465
		(χ_m) 45·41	44·84	44·77
H_2TeO_3 ..		(χ_a) 0·1966	0·1978	0·1972
		(χ_m) 34·89	35·12	35·00
$(CH_3)_2TeI_2$ ..		(χ_a) 0·3535	0·3547	0·3542
		(χ_m) 145·40	145·85	145·71
S_2Cl_2 ..		(χ_a) 0·461 [9]	0·4613	0·4523
		(χ_m) 62·2 [9]	62·272	61·05
		(χ_a) 0·405 [10]		
		(χ_m) 54·7 [10]		
SO_2Cl_2 ..		(χ_a) 0·365 [9]	0·3891	0·3884
		(χ_m) 49·3 [9]	52·517	52·422
		(χ_a) 0·397 [10]		
		(χ_m) 53·6 [10]		
		(χ_a) 0·402 (Kido)		
		(χ_m) 54·6 (Kido)		

A full account of the work is being sent for publication elsewhere. Authors are thankful to Dr. S. S. Bhatnagar for suggestion and criticisms.

MATA PRASAD.
S. S. DHARMATTI.

Chemical Laboratories,
Royal Institute of Science,
Bombay,
April 2, 1940.

[1] Pauling, *P. R. S.*, 1927, **114** A, 181.

[2] Van Vleck, *Phys. Rev.*, 1928, **31**, 587.

[3] Slater, *ibid.*, 1930, **36**, 57.

[4] Angus, *P. R. S.*, 1932, **136** A, 569.

[5] Farquharson, *Phil. Mag.*, 1932, **14**, 1003.

[6] Gray and Cruickshank, *Trans. Farad. Soc.*, 1935, **32**, 1491.

[7] Clow, *ibid.*, 1937, **33**, 381.

[8] Bhatnagar, *Curr. Sci.*, 1935, **4**, 153, 234; *J. Ind. Chem. Soc.*, 1935, **12**, 799; *J. C. S.*, 1936, **13**, 278; *ibid.*, 1938, 1428; *Proc. Ind. Acad. Sci.*, 1939, **10**, 150.

[9] Varadachari and Subramaniam, *Proc. Ind. Acad. Sci.*, 1936, **3A**, 428.

[10] Nevgi, *J. Univ. Bombay*, 1938, **7**, 82.