different frequencies have been found which are given in Table I.

TABLE I

Frequencies observed in the discharge

Discharge Potential in volts	Pressure in mm.	Frequencies in Mc./s.				
5600	0·015	0·236	0·595	0·735	1·625	2·27
2900	0·029	..	0·61	..	1·625	2·25
2000	0·04	..	..	0·735	1·66	2·56
980	0·1	0·236	..	..	1·69	2·45
	Mean	0·236	0·603	0·735	1·65	2·38

An oscillograph was also used to study the voltage oscillations. As a suitable voltage divider to bring out the voltage across the discharge tube to within 450 volts (the highest voltage that can be applied to the oscilloscope input) was not available, direct observations were not possible. An indirect method which can give a qualitative picture of the discharge tube was used. Current oscillations were also studied. The voltage developed across the resistance included is applied to the horizontal plates of the oscilloscope. The patterns on the screen indicate the variations in the current of the discharge tube circuit. The frequencies of the different types of oscillation were measured with the oscilloscope and were found to be nearly the same as that obtained with wavemeter. The frequencies of the striations which are a common feature of the positive column of a glow discharge were found to vary from 40 to 800 cycles.

I am grateful to Dr. B. Dasannacharya for guidance.

Physical Laboratory, M. SAKUNTALA.
Banaras Hindu University,
May 21, 1954.

1. Terman, F. E., *Measurements in Radio Engineering*, p. 117.

CALCULATION OF THE DIPOLE MOMENTS OF TRI-SUBSTITUTED BENZENES

A GENERAL method is worked out for the theoretical calculation of the dipole moments of 1 : 2 : 4-tri-substituted benzenes following the lines of Smallwood and Herzfeld[1] for the di-substituted benzenes. The total moment of a tri-substituted benzene compound comprises of (1) the vector sum of the moments of the primary dipoles, (2) the mutual induction of the three primary dipoles on one another, and (3) the moments induced in the -CH and the -C-C bonds of the hydrocarbon residue by the primary dipoles. A correction is also applied for the dielectric constant of the internuclear space as has been suggested by Le Fevre.[2]

The final equation giving the dipole moment M of the compound is given as

$$M = \sqrt{M_x^2+M_y^2} \qquad (1)$$

where

$$M_x = 2\cdot3652\,\xi_1' + 1\cdot07456\,\eta_1' + 1\cdot3171\,\xi_2' + 0\cdot2809\,\eta_2' + 2\cdot3326\,\xi_3' + 1\cdot01432\,\eta_3'$$

$$M_y = 0\cdot9254\,\xi_1' + 0\cdot7710\,\eta_1' + 0\cdot2809\,\xi_2' + 1\cdot9135\,\eta_2' + 1\cdot0143\,\xi_3' + 0\cdot8454\,\eta_3'$$

ξ's denote the X-components and η's denote the Y-components of the moment as modified by the induced effects.

The values calculated for five compounds for which experimental data are available, are given in Table I.

TABLE I

Compound	$M_{vect.}$	$M_{eq.}$ (1)	M′	$M_{obs.}$
1 : 2 : 4-Trichloro-benzene	1·64	1·24	1·40	1·25[3]
2 : 4-Dinitrochloro-benzene	3·26	3·14	3·19	3·0±0·1[4]; 3·29[3]
2 : 4-Dinitrobromo-benzene	3·26	3·72	3·54	3·1±0·1[4]
2 : 4-Dinitroiodo-benzene	3·31	4·92	4·29	3·4±1[4]
2 : 5-Dichloronitro-benzene	3·75	3·31	3·48	3·45[3]

The first column ($M_{vect.}$) gives the moment in Debye units obtained by the simple method of vectorial addition, the second ($M_{eq.\,(1)}$) gives the value calculated according to Eq. (1) and the third (M′) gives the value when the correction for the dielectric constant of the internuclear space is also incorporated. The difference between $M_{vect.}$ and $M_{eq.\,(1)}$ which gives the induced effect is multiplied by the factor $\frac{\epsilon+2}{3\epsilon} = \frac{4\cdot4}{7\cdot2}$ (ϵ the dielectric constant of the internuclear space being taken as 2.40[2]) to give the actual induced effect. This is added algebraically to $M_{vect.}$ to get the value under the head M′. The last column ($M_{obs.}$) gives the observed value.

Details of the calculation and the discussion of the values will be published elsewhere.

Physics Dept., D. V. G. L. NARASIMHA RAO.
Andhra University,
Waltair,
July 23, 1954.

1. Smallwood and Herzfeld, *J.A.C.S.*, 1930, **52**, 1919.
2. Le Fevre and Le Fevre, *J.C.S.*, 1937, 196.
3. Hassel and Næshagen, *Z. Phys. Chem.*, 1931 **12B**, 79.
4. Lutgert, *Ibid.*, 1932, **17B**, 460.