

Let us now evaluate $-\frac{d\Psi_2}{dV}$. According to Kar-Mazumdar

$$A_s \psi_s = \pm \ln \left(1 \mp e^{\frac{\psi - u_s}{KT}} \right) \dots \dots (4)$$

From (2) and (4)

$$\begin{aligned} P_{(\text{cell})} &= -\frac{d\Psi_2}{dV} \\ &= \mp \frac{KT}{V} \sum_s \left\{ A_s \ln \left(1 \mp e^{\frac{\psi - u_s}{KT}} \right) \right. \\ &\quad \left. \pm A'_s \left/ \left(e^{-\frac{\psi + u_s}{KT}} \mp 1 \right) \right. \right\} \dots (5) \end{aligned}$$

On substituting the usual value of A_s and on integrating the right hand side of (5) we get

$$P_{(\text{cell})} = \frac{NKT}{V} \left\{ \frac{F_{3/2}(\psi/KT)}{F_{1/2}(\psi/KT)} - 1 \right\} \dots (6)$$

So the total pressure P is given by

$$P = P_{(\text{mol})} + P_{(\text{cell})} = \frac{NKT}{V} \frac{F_{3/2}(\psi/KT)}{F_{1/2}(\psi/KT)} (7)$$

This is the well-known equation of state in the new statistics.

In the case of radiation $A_s = \frac{8\pi V \nu_s^2}{c^3} d\nu_s$, $u_s = h\nu_s$ and $\psi = 0$ so that $\Psi_1 = 0$, so we have as in equation (5)

$$\begin{aligned} P_{(\text{Rad})} &= -\frac{d\Psi_2}{dV} \\ &= -\frac{8\pi KT}{c^3} \left(\frac{KT}{h} \right)^3 \\ &\quad \times \int_0^\infty \ln \left(1 - e^{-\frac{h\nu_s}{KT}} \right) \left(\frac{h\nu_s}{KT} \right) \cdot d \left(\frac{h\nu_s}{KT} \right) \\ &= \frac{8\pi KT}{c^3} \left(\frac{KT}{h} \right)^3 \times \frac{1}{3} \int_0^\infty \frac{x^3 dx}{e^x - 1} \\ &= \frac{1}{3} \epsilon \text{ (Planck)} \end{aligned}$$

Thus the above discussion strongly supports the idea of the free energy of cells.

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32-Electron System of Selenium.

IN the second* of a series of papers dealing with the investigations on the successive

* Investigations on the Spectrum of Se., Part II, Badami and K. R. Rao. *Proc. Roy. Soc.* (in press).

spectra of Selenium, it was shown that 32-electron system of Selenium consists of triplets and singlets and all the terms corresponding to the deepest 4p state and the higher 5s, 4d, 5p and sp^3 states were discovered. Further investigation of the spectrum has revealed about twenty new levels assignable to the doubly-ionised atom and arising from the still higher 6s, 5d configurations. For the first time in spectra of the type under consideration, some terms are also found belonging to the 4f state of the valence electron.

The differences $4p \ ^3P_0 - ms \ ^3P_2$ are found regularly to tend, in conformity with theoretical prediction, towards the difference $4p \ ^2P_{3/2} - ^2P_{1/2} = 4376 \text{ cms.}^{-1}$ of the next higher ion -Se IV.†

Full details of the investigation will be shortly published elsewhere.

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Occurrence of Free Tyrosine in the Lac Insect (*Lakshadia mysorensis*).

WHILE investigating the nitrogenous constituents from the body fluids of the lac insect, tyrosine was found to be present free, in the water soluble portion to the extent of nearly 2.5 per cent calculated on the total water soluble nitrogen. The scarlet-red, aqueous extract of the insects, is first treated carefully with the requisite amount of barium hydroxide to remove the colouring matter. The clear light-coloured filtrate is, then, treated with phosphotungstic acid which precipitates out the more complex nitrogenous bodies. On concentrating the filtrate, characteristic crystals of tyrosine separate out.

Tyrosine has been found to occur in aqueous extracts of the earthworm, in the salivary glands of cephalopods, and in the blood of the silkworm. The febrifugal property possessed by the water extract of the earthworm is attributed to the tyrosine present in the extract. The reputed anti-

† Investigations on the Spectrum of Se., Part I, K. R. Rao and Badami. *Proc. Roy. Soc. A.*, **131**, 154 (1931).

pyretic quality of the aqueous decoction of the lac insect may similarly be due to its tyrosine content.

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Action of Light on the Vapour of
Tin Dihalides.

THE absorption spectra of Tin dihalides which I have been investigating for some time past have revealed certain unusual features which cannot be reconciled with the well-known theory of Franck. The absorption has been found to consist of several patches followed by transmitted regions. The details are given below. There is no sign of band absorption.

TABLE 1.

Substance	Long wavelength limit First cut ν_1		Long wavelength limit Second cut ν_2		Long wavelength limit Third cut ν_3	
	Angstrom units	Kilocalories	Angstrom units	Kilocalories	Angstrom units	Kilocalories
Tin dichloride	4480	69.8	3712	76.6	2858	99.6
Tin dibromide	4517	62.9	3967	71.7	3274	86.9
Tin diiodide	6400	44

The values of the atomic heat of formation of SnBr_2 and SnI_2 are approximate, as the heats of sublimation for these salts have been extrapolated. It is seen that the energies corresponding to the three cuts bear the same ratio to the atomic heat of formation in the case of each of the salts. The correspondence is shown in table below.

TABLE 2.

Substance	Atomic heat of formation of the substance in kilocalories R	$\frac{\nu_1}{R}$	$\frac{\nu_2}{R}$	$\frac{\nu_3}{R}$
Tin dichloride ..	176	0.39	0.43	0.57
Tin dibromide ..	158	0.39	0.45	0.56
Tin diiodide ..	73.5	0.60

Such a correspondence has been already found by Dr. S. C. Deb* in the case of halides of Aluminium.

Of a far greater interest are the intensity conditions of the various retransmissions, the sharpness of the cuts, and the unsymmetrical widening of the absorption regions as the density of the vapour and its temperature are varied. The following explanation is made disregarding the energy considerations.

* Deb. Absorption Spectra of some Trihalides. *Bull. Acad. Sc., U.P.* Vol. 1.

It may be modified when I have micro-photographed the spectrum.

The first cut can be explained as marking the photo dissociation of SnCl_2 into SnCl and Cl . The SnCl molecule is in the state $^2\Pi_{1/2}$ which has been postulated by Mulliken† in explaining the band systems obtained by Jevons.‡ Those bands were attributed to SnCl . The second cut can be explained as marking the photodissociation of SnCl_2 into Cl and SnCl in the $^2\Pi_{3/2}$ state. The difference between these two cuts is 2385 cms.^{-1} , the difference between the 0-0 bands in the band systems of SnCl is 2360 cms.^{-1} marking the difference between the $^2\Pi_{1/2}$ and $^2\Pi_{3/2}$ states. The agreement between the difference of the two cuts and of the two states of SnCl molecule is very good.

We are not so sure about the interpretation of the third cut and possibly a fourth cut. The following explanation is offered only tentatively. The cut corresponds to the dissociation of SnCl ($^2\Pi_{3/2}$) into Sn and Cl . If its heat of dissociation be R' , and the energy corresponding to the second cut be W , then

$$R' = R - W = 99.9 \text{ K cal.}$$

The experimental value is 99.6 K cal. , which is an excellent agreement.

† Mulliken. *Phy. Rev.*, 28, 497, 1926.

‡ Jevons. *Proc. Roy. Soc., A.* Vol. 110, p. 365.