more or less in the same position in coumarin.

A detailed discussion of the results in relation to the molecular structure of coumarin and to the pyrone ring will be shortly published elsewhere.

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The Spectra of Iodine V and I. VI.

THE spectrum of a highly condensed discharge through the vapour of iodine contained in very narrow capillary tubes has been photographed on Ilford special rapid plates by using a Quartz Littrow Spectrograph. A half-kilowatt transformer yielding about 30,000 volts in the secondary, was made use of and an auxiliary spark gap of length about a centimetre and a condensing capacity of 0·07 microfarads helped to increase the excitation.

The spectrum thus obtained contained many lines, which could be very easily suppressed by including a small series inductance in the exciting circuit, and could thus be assigned to the higher spark spectra of iodine. An examination of the data thus obtained revealed a prominent pair apparently due to I V in the region λ 3200–λ 2400. Use is also made of the list of Iodine lines recently published by Bloch and others.[1] Several lines, which included the characteristic regularities expected of the spectrum of I V could be selected and a term scheme developed, corresponding to that of Te IV[2] elucidated by Rao. The intervals $5p^2\ {}^2D_{1\frac{1}{2}}$–$^2D_{2\frac{1}{2}}$ and $5p^2\ {}^2P_{\frac{1}{2}}$–$^2P_{1\frac{1}{2}}$ were found to be 3073^{-1} cm. and 3328^{-1} cm. respectively. Many of the expected terms due to 5p, 6p; $5p^2$, 5d and 6s configurations were identified. The largest term $5p\ {}^2P_{\frac{1}{2}}$ yielded an ionisation potential of 31·6 volts for I V.

An investigation of the regularities to be expected in the lines of I VI was also undertaken in order to enable a useful classification of the lines due to Prof. Bloch referred to above. The very important intervals $5p\ {}^3P_0$–$^3P_1$ and $5p\ {}^3P_1$–$^3P_2$ are 3595 and 10430 wavenumbers respectively. As many as thirteen terms due to I VI could be identified. Further investigation of the spectrum of iodine is in progress and the results will be communicated shortly.

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[1] *Jour. de Phy. et Radium*, 1937, **8**, No. 9.
[2] *Proc. Roy. Soc.*, 1931, A, **133**, 220.

The Third Spark Spectrum of Krypton Kr. IV.

HIGHLY condensed discharges through Krypton gas at various pressures were photographed by using a large Quartz Littrow Spectrograph. Adopting the usual methods of varying the intensities of excitation, such as the variation of the capacity, inductance and length of the auxiliary series spark gap, the lines due to Kr IV were easily identified.

Following the analysis of Se II,[1] and Br III,[2] carried out in these laboratories the fundamental multiplets, 5s ^4P–5p ^4D, and 5s ^4P–5p ^4P in Kr IV were located. These led to the evaluation of the 5s, 5p and a number of the md terms. The difference $5p\ {}^4P_{1\frac{1}{2}}$–$^4P_{2\frac{1}{2}}$ is $348\cdot1$ cm.$^{-1}$. A few of the important lines are,

5s $^4P_{2\frac{1}{2}}$–5p	$^4D_{3\frac{1}{2}}$	38310 cm.$^{-1}$
$^4P_{1\frac{1}{2}}$–	$^4D_{2\frac{1}{2}}$	38225 ,,
$^4P_{\frac{1}{2}}$ –	$^4D_{1\frac{1}{2}}$	38146 ,,

Full details of the analysis will be published shortly.

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[1] *Proc. Roy. Soc.*, 1935, A, **149**, 56.
[2] *Ibid.*, 1937, A, **161**, 38.

Critical Temperatures of Liquids.

USING the surface tension measurements of Ramsay and Shields (1893), it has been shown that the calculated critical temperatures of liquids agree fairly with those observed.[1] Combining van der Waals' relation (1894) for the variation of surface tension with temperature and Macleod's equation (1923), and neglecting the vapour density in comparison with the density of the liquid, it follows that $\rho_\theta = \rho_0 \left(1 - \frac{\theta}{\theta_c}\right)^{3/10}$, where ρ_θ is the density of the liquid at an absolute

temperature θ, and θ_c the crit cal temperature.[2] This equation leads to the simple result,

$$\theta_c = \theta + \frac{3}{10\alpha_\theta},$$

where α_θ is the coefficient of expansion of the liquid at θ. If Sugden's parachor equation (1923) is combined with Eötvös rule (1886), the above relation could again be deduced. If α_0 be the coefficient of expansion of a liquid at 0 °C., its critical temperature on the Centigrade scale would be given by $\frac{3}{10\alpha_0}$ — a relation dimensionally correct. The values of the critical temperatures thus calculated for a few liquids are compared with the values experimentally obtained in the following table :

Liquid	$\theta_c = 3/10\alpha_0$ °C.	θ_c exptl. °C.
Acetone ..	226.6	235
Amyl Alcohol ..	337.0	307
Methyl Alcohol ..	252.8	240
Bromine ..	289.1	302
Carbon di-sulphide ..	263.1	273
Chloroform ..	271.1	263
Ether ..	198.3	194
Mercury ..	1648	>1550

It is far easier to estimate the critical temperature of a liquid from its coefficient of cubical expansion than from the variation of surface tension with temperature ; it is needless to point out that the former could be more readily determined than the latter.

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[1] J. Newton Friend, *A Text-Book of Physical Chemistry*, 1932, **1**, 264.
[2] *Ibid.*, p. 161.

The Natural Activators of Papain.

CONSIDERABLE interest has centred round the quest for the natural activator of papain and other plant proteases. The identification of the 'zookinase' of liver cathepsin,[1] and the 'phytokinase' of yeast protease[2] with glutathione has rendered probable the assumption that glutathione is the natural activator of papain and other plant catheptic enzymes. Grassman[3] investigated the nature of the activator of papain and came to the conclusion that the activator which gave a strong nitro-prusside test was not glutathione, but a peptide containing cysteine and glutamic acid. The occurrence of glutathione in the milky juice of *Calotropis gigantea* which contains an active proteoclastase[4] has been recorded.

Work on the natural activators of plant proteases is being carried out in this laboratory for some months past. This has led us to the conclusion that the latex of *Carica papaya* contains glutathione which serves as a natural activator of papain. This does not, however, preclude the possibility of other activators being present, such as the peptide isolated by Grassman. The glutathione which we have estimated by applying Woodward's procedure[5] constitutes only a fraction of the total SH-compounds present. Table I gives the concentration of glutathione in 3 samples of the latex. The concentration of total SH-compounds (calculated as glutathione) determined by the iodometric method after correcting for the ascorbic acid that is present, is also given in the table.

TABLE I.

No.	Glutathione mgm. in 100 gm. of latex	Total SH-compounds calculated as glutathione mgm. in 100 gm. of latex
1	120	2460
2	70	1470
3	110	1560

Attempts have been made to isolate glutathione by employing Pirie's method.[6] The characteristic silky white crystals of the cuprous compound of glutathione were isolated from acid solutions, but owing to the limited quantity of latex at our disposal, we have not been able to obtain glutathione in the crystalline form so far, but have only been able to carry out a few identification tests with the product obtained by the decomposition of the cuprous compound. Cysteine, in the free condition, is not present in the latex.

It would thus appear that there are at least two types of SH-compounds present in the latex : (1) glutathione, and (2) the "papainbegleitstoff X" of Grassman. SH-proteins also appear to be present and from the work of Purr[7] it appears probable that such proteins may also serve to activate papain.