

commonly needed for analysis. With a paper in which all the readings are the same (say, R, 70; G, 70; B, 70) we can say that the paper contains 70 per cent. white, and $100 - 70 = 30$ per cent. theoretical black; it is then a rather light grey. In a paper giving different readings for the three colours another fact is needed. The total brightness or luminosity of white light is due mainly to the green part of the spectrum. Hence in determining the real luminosity of a coloured sample it is necessary to multiply the percentage of each colour present by an appropriate factor to determine the proportion of the total luminosity supplied by each, and then add these products. This sum, the luminosity, subtracted from 100, gives the theoretical percentage of black in the colour. The proportional factors for the three primary colours have been determined, and are as follows: 0.19 for red, 0.71 for green, and 0.10 for purple-blue. To find the partial luminosity due to any secondary colour it is simply necessary to multiply the amount of each primary colour in it by the proper luminosity factor and add the results. To illustrate the treatment with a coloured paper, we may take one with the following readings:—

	Red.	Green.	Blue.	
	85	75	60	
Deduct	60	+ 60	+ 60	= 60 white.
Leaving	25	15	0	
and	15	+ 15		= 15 yellow
Leaving	10	0		so finally
	10		+ 10	= 10 orange
	0		5	= 5 yellow.

when all the primary colours have been used.

To determine the luminosity:—

$$60 \times 0.19 + 60 \times 0.71 + 60 \times 0.10 = 60 \text{ from white}$$

$$20 \times 0.19 + 10 \times 0.71 = 10.9 \text{ from orange}$$

(since orange contains a double proportion of red)

$$5 \times 0.19 + 5 \times 0.71 = 4.5 \text{ from yellow}$$

and as a check,—

$$85 \times 0.19 + 75 \times 0.71 + 60 \times 0.10 = 75.4 \text{ total luminosity}$$

and from the last value we find $100 - 75.4 = 24.6$ theoretical black.

Thus our sample has 60 parts white, a primary hue of orange, and a secondary hue of yellow (primary and secondary on the basis of actual amounts present), with luminosities of 60, 10.9, and 4.5; this is a rather strong tint of orange. The black serves to darken or deaden the colours.

In this way a rough mental image of colour can readily be formed, even without computation. The lowest of the three readings obtained determines the amount of white; the highest, the primary hue; and the relative values show the strength or saturation of that hue.

APPENDIX V.—METHODS OF ANALYSIS OF SULPHITE ACID AND LIQUOR.

METHOD OF ANALYSIS OF SULPHITE ACID AND LIQUOR.

Total SO₂.

A 2 c.c. sample of acid is diluted to 150 c.c. with H₂O in a 500 c.c. Erlenmeyer flask. Starch indicator is added, and the sample is titrated with N/16 iodine solution. 1 c.c. N/16 iodine is equivalent to $\frac{1}{10}$ per cent. total SO₂.

Free SO₂.

Two cubic centimetres of the acid is diluted to 150 c.c. in an Erlenmeyer flask. Phenolphthalein is added, and the solution is titrated with 1 c.c. N/16 NaOH solution to a faint permanent pink. 1 cc. N/16 NaOH is equivalent to $\frac{1}{10}$ per cent. free SO₂.

Combined SO₂.

The per cent. SO₂ present as combined SO₂ (in the form of CaSO₃) is obtained by the difference between the per cent. total and per cent. free SO₂.

SANDER METHOD FOR ANALYSIS OF ACID AND LIQUOR.

A 2 c.c sample is diluted to 75 c.c. with water in a 500 c.c. Erlenmeyer flask. Methyl orange or bromphenol blue is added, and the solution titrated to neutrality with N/8 NaOH solution. An excess of saturated mercuric-chloride solution is added, and the solution again titrated to neutrality.

Total SO₂.

The second titration $\times 0.4$ gives the per cent. total SO₂.

Combined SO₂.

The difference between the second and first titration $\times 0.2$ gives the per cent. combined SO₂.