A plot of the square root of these frequencies against atomic number gives three nearly parallel straight lines.

The potentials ascribed to the K limits likewise give a straight line. It is interesting to note that the ionization potential of He falls on the K line and that of Ne on the principal L line. The table gives only critical potentials that fall in the region of x-ray limits. It must be emphasized that the experimental errors in "computed L limits" are of the same magnitude as for the observed points.

BUREAU OF STANDARDS.

SECONDARY X-RAYS FROM CRYSTALS.

By G. E. M. JAUNCEY.

Using a Bragg x-ray spectrometer, the crystal was fixed at a certain angle and the ionization chamber was set at a series of angles between an angle A° , which was near zero, and 90° . The slit in front of the ionization chamber subtended an angle of 6° at the center of the table, while the angular width of the beam of primary x-rays incident on the crystal was less than 0.25° . Using the general radiation from an x-ray tube with a tungsten target, it was found that, although the maximum deflection of the electrometer occurred when the angle of the ionization chamber was double that of the crystal, yet the deflection was quite appreciable at other angles of the ionization chamber.

From the curve showing the relation between the intensity at various angles and the angle of the ionization chamber, the value I_s of the total intensity of radiation emitted by the crystal between the angles of A° and 90° in the plane of reflection was calculated. The ratio of I_r to I_s , where I_r is the intensity at the position of reflection, is shown in the following table:

Rocksalt Crystal.

Crystal Angle Degrees.	Angle A Degrees.	I_r/I_s Per Cent. .
7	7	33
10	10	19
15	15	18

From the table it is seen that the reflected radiation constitutes less than one half of the total radiation emitted by the crystal. There is radiation at all angles up to 90° , the regularly reflected radiation being added to that which is radiated at all angles.

Setting the crystal at an angle of 7° and the ionization chamber at 60° , the absorption produced by 3 mm. of aluminium when placed in the primary and then in the secondary beam was determined. In the primary beam the aluminium reduced the intensity to 46 per cent., while in the secondary it

reduced the intensity to 42.5 per cent. There seems, therefore, to be some fluorescent radiation present.

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BRIGHTNESS OF TUNGSTEN.

BY W. E. FORSYTHE.

THE brightness of tungsten in candles per square centimeter has been measured by three different methods for a wide range of temperatures. The first method used was the direct one where the light from a definite length of a filament of a known diameter was measured for a temperature of about 2350° K. and from the values thus obtained the brightness per square centimeter calculated. Values were thus obtained using special 20-mil. tungsten lamps and also special lamps with a ribbon filament several centimeters long, 2 mm. wide and about .01 mm. thick. Values of the brightness for points a few hundred degrees above and below this were obtained in terms of this value by direct comparison. By this method the brightness was measured from 2080° K. to 2600° K.

The second method was to use as a brightness photometer a disappearing filament optical pyrometer having for the monochromatic screen a yellow-green glass whose effective wave-length for the different temperature intervals was very close to the Crova wave-length for the same temperature intervals. This pyrometer was calibrated for brightness from a black body. Since both the Crova wave-length and the effective wave-length of the screen used, as well as the different temperature intervals over which measurements were made were known, it was possible to correct values of brightness obtained to the values that would have been obtained if the Crova wave-length had been used in each case. By this method the brightness was measured from about 1000° K. to about 3400° K.

The third method was by calculation using the following relation involving the brightness of the black body, the color temperature (T_c) and brightness temperature (S) of the tungsten.

$$B_w = B_{BB} \cdot \frac{e^{-\frac{c_2}{\lambda S}}}{e^{-\frac{c_2}{\lambda T_c}}},$$

where B_{BB} is the brightness of a black body at a temperature $T = T_c$. By this method values were obtained for a temperature range from about 1000° K. to the melting point of tungsten. The three methods gave results that agreed well within the experimental error. The values obtained were plotted $\log B_w$ against $\log T$ and from the smooth curve the values given in the table were obtained.