(unit, erg. cm.$^{-2}$ deg.$^{-1}$ sec.$^{-1}$)

T_0	Pressure	$\sigma+K/4T_0^3 S$	
		Non-lined vessel	Silver-lined vessel
15°C	76 cm. Hg	7.3×10^{-5}	6.91×10^{-5}
	10^{-3} mm. Hg	4.5 〃	1.45 〃
	10^{-4} mm. Hg	4.1 〃	0.58 〃
30°C	76 cm. Hg	5.9×10^{-5}	3.56×10^{-5}
	10^{-3} mm. Hg	3.9 〃	1.42 〃
	10^{-4} mm. Hg	3.6 〃	0.48 〃

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3. Portable Radiation Detector Instrument.

Sakae Shimizu and *Osamu Horibe.*

A lightweight portable radiation dector instrument convenient for field work and the detection of missing Ra-needles, is constructed. This instrument is composed of three parts, i. e., G-M tube, amplifier and high voltage supply.

The G-M tube of end-window type, having a thin mica window of about 3 mg/cm^2 in thickness, is composed of a lead cathode 2 cm thick, with the inside diameter of 2 cm and the effective length of 3 cm. It is filled with argon of 9 cm Hg mixed by ethyl alcohol of 1 cm Hg. This G-M counter is capable of detecting β-rays as well as γ- and X-radiation, and furthermore, because of its fairly thick lead wall, its sensitivity to γ- and X-radiation shows considerable directionality which is frequently necessary in practical use. The G-M counter is closed entirely in Bakelite envelope and connected to amplifier and high voltage supply with sealed wires.

Two miniature pentodes are used for amplifiers. 1L4 and 3S4, which are operated by small dry batteries of 96 v and 1.5 v respectively and provided with a 3 inch magnetic speaker. The whole amplifier set is housed in a small aluminum box which measures only 13×17×7 cm and weighs 1.4 Kg. An earphone tip jack is also provided with.

As the high voltage supply for G-M tube normal circuit is used with a rectifier tube KX-142 and is operated by A. C. 110 v. Arbitrary D. C. voltage between 0 and 2000 is easily obtained by rotating a slidac inserted in the primary circuit of a 2000 v transformer.

In order to reduce as less as possible the fluctuation of high voltage due to that of A. C. 110 v, a condenser of a few μF is fixed in series in the primary cuicuit of the slidac. Whole set is mounted in an aluminium box which measures only

20×13×22 cm. We are now working further in construction of a more compact and lightweight high valtage supply which will be operated by small dry battery.

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4. Quantum Mechanical Calculation on the Bond Moment.

Pauling's Formula about Electronegativity.

Nishio Hirai.

The bond moments of diatomic (F. T. Wall: J. A. C. S. **61**, 1051 (1939)) and polyatomic (T. Ri and N. Muroyama: Proc. Imp. Acad., **20**, 93 (1944); Rev. Phys. Chem. Japan, **18**, 24 (1944)) molecules were calculated by the resonance theory and given as follow,

$$\mu_{AB}=i^2er_{AB},\quad 1/i^2=1+(E^0_{AB}-E_i)/E' \qquad (1)$$

Here we will make clear the relation between μ and the difference in electronegativity of two atoms. When the bound is completely homopolar, its energy and Hamiltonian are

$$E^0_{AB}=\frac{1}{2}(E_{AA}+B_{BB}),\quad H^0_{AB}=\frac{1}{2}(H_{AA}+H_{BB}) \qquad (2)$$

The difference in the effective nuclear charges is $\triangle Z$ and its effect can be considered as a perturbation to the complete homopolar bond, then

$$H_{AB}=H^0_{AB}+H',\quad H'=\frac{\triangle Z^2e^2}{2r_{AB}}-\frac{\triangle Ze^2}{2r_{AB}}\left(\frac{1}{r_{A2}}-\frac{1}{r_{B1}}\right) \qquad (3)$$

can be derived from (2), and corresponding to this perturbation

$$\psi_{AB}=\psi^0_{AB}+\psi',\quad E_{AB}=E^0_{AB}+E',\quad \psi'=iA(1)\ A(2) \qquad (4)$$

If we put $W_A=Z_Ae^2/2r_A\sim 110x_A$ for the atoms $r_{AB}\simeq r_A+r_B\doteqdot 2A$, the additional ionic resonance energy

$$E'=\iint\psi^0_{AB}H'\psi^0_{AB}d\tau_1d\tau_2\simeq\frac{\triangle Z^2e^2}{r_{AB}}=23\,(x_A-x_B)^2 \qquad (5)$$

As for the amount of ionic charactor

$$i^2=H'^2_{0i}/(E^0_{AB}-E_i)^2=\triangle Z^2e^4J^2/2(E^0_{AB}-E_i)^2=\frac{1}{4}(x_A\ \ x_B)^2 \qquad (6)$$

If we put $J=\int A(1)\ B(1)\frac{1}{r_{A1}}d\tau_1\doteqdot L/r_{AB}$ where we assume L is 0.65, the value of hydrogen-like wave function $1S$ and $2S$ at about $r_{AB}\doteqdot 2A$, and $E^0_{AB}-E_i\cong 90$ Kcal/mol (7) when $\triangle Z$ is small.

We can get (6) as the first term of Taylor expantion of (1) in x_A-x_B from (5) and (7).

Equation (5) and (6) are the empirical formulas which are given by L. Pauling in "The Nature of the Chemical Bond." 60, 69 (1940).