of the integral can be put equal to zero. For $(V - \frac{Ze}{r})$ at small r, we can write its equal, $\left[d\,(Vr)/dr\right]_{r=0}$. Changing then to the coordinates β and s, we find

$$E_{pot} = -ZkT\int_0^{\sqrt{2\beta}} (\beta - \tfrac{1}{4})\, w^3\, I_{1/2}\,(2\beta/w^2)\, dw. \qquad (22)$$

The integral is obtained numerically from the data of the solution.

The kinetic energy of each electron of momentum p is $p^2/2m$. Multiplying by the desntiy of electrons with integrating over all space, we find for the kinetic energy of all electrons

$$E_{kin} = \int_0^a 4\pi r^2\, dr \int_0^\infty \frac{p^2/2m \cdot 2 \cdot 4\pi p^2\, dp/h^3}{\left[\exp\left(\frac{p^2/2m - eV}{kT} + \eta\right) + 1\right]} \qquad (23)$$

This expression can be simplified by a rather long sequence of operations. If one integrates by parts first by r, and then again by p, and then uses Eq. (14) to replace one of the integrals on p one can show finally that

$$E_{kin} = \frac{16\pi^2}{h^3 m}\,\frac{a^3}{3} \cdot \int_0^\infty \frac{p^4\, dp}{\left[\exp\left(\frac{p^2/2m - eVa}{kT} + \eta\right) + 1\right]} \qquad (24)$$

where V_a is the value of the potential at the surface of the atom r = a. The integral is, of course, proportional to $I_{3/2}\left(\frac{eV_a}{kT} - \eta\right)$ (see Eq. (15a)).

We next compute the pressure. Since there is no field at r = a, all of the momentum carried across this surface (which in one second per cm^2 is P, the pressure) must be carried by electrons crossing this surface. This is the reason why computing the pressure at r = a is particularly simple. At this point pressure simply appears as the pressure of a free electron gas.