

TABLE I
Absolute dH-vA Frequencies in 10^8 G

Specimen	F Measured	Orientation correction	F_0	Mean, F_0	Pulsed field, F_0	Lattice const., ^e F_0
K-P1	1.8245	+0.04%	1.8252	1.824 ± 0.002	1.826 ± 0.004 ^a (1.8246 ± 0.0006) ^b	1.832
K-P3	1.8237	-0.04%	1.8230			
K-P4	1.8236	+0.007%	1.8237			
Rb-P1	1.6025 (poor)	-0.23%	1.5988	1.603 ± 0.003	1.601 ± 0.008 ^c	1.603
Rb-P2	1.6036	+0.14%	1.6058			
Cs-P1	1.3589	+0.37%	1.3638	1.365 ± 0.002	1.366 ± 0.003 ^d	1.368
Cs-P2	1.3572	+0.62%	1.3657			

^aOkumura and Templeton (unpublished).

^bThomas and Turner.¹⁰ Measured in a superconducting solenoid with simultaneous NMR calibration.

^cOkumura and Templeton,¹¹ after correction for calibration error (periods to be multiplied by 1.025) and orientation.

^dOkumura and Templeton.⁴

^eBarrett.¹⁷

TABLE II
Compressibilities in 10^{-2} kbar⁻¹

Specimen	Measured $(dA/A)/dP$	Mean "area" compressibility	Equivalent volume compressibility
K-P1	1.722	1.71 ₈ ± 0.008	2.57 ₇ ± 0.013
K-P3	1.721		
K-P4	1.711		
Rb-P1	2.097 (poor)	2.11 ₀ ± 0.01	3.16 ₄ ± 0.015
Rb-P2	2.110		
Cs-P1	2.691	2.68 ₀ ± 0.013	4.02 ₀ ± 0.02
Cs-P2	2.668		

TABLE III
Atomic Volumes and Bulk Moduli

Material	V_0 (cm ³) (present work)	V_0 (cm ³) (p-v-t, lattice const.)	B_0 (kbar) (present work)	B_0 (kbar) (p-v-t, u-s) ^a	B_0V_0 (× 10 ⁵ J/mole) (present work)	B_0V_0 (× 10 ⁵ J/mole) (p-v-t) ^b
K	43.2 ₄	43.3, 42.96	38.8 ± 0.2	37.0, 36.6	1.68	1.60
Rb	52.4 ₇	53.0, 52.46	31.6 ± 0.15	29, 30.6	1.66	1.54
Cs	66.7 ₅	66.5, 66.52	24.9 ± 0.13	21.5, 23.1	1.66	1.43

^aPressure-volume-temperature, ultrasonic. As quoted by Anderson *et al.*⁶

^bN.B. The p-v-t value of B_0V_0 for Na is 1.68×10^5 J/mole.

high-pressure piston displacement techniques; we also make comparison for B_0 with values derived from ultrasonic measurements of elastic constants and for V_0 with values corresponding to lattice constant data. The values of the product B_0V_0 are also included and compared with the values of this "characteristic energy" from pressure-volume-temperature (p-v-t) measurements as summarized by Anderson *et al.*⁶

The values of F_0 differ very little from those determined by pulsed field measurements, which suggests that "negative pressure" effects, previously put forward as a possible source of anomalously low values of F_0 in enclosed samples, are not in fact important. It is probable, as Shoenberg and Stiles³ suggest, that stresses caused by thermal contraction in the earlier experiments were relieved by plastic flow. The evidence for and against the existence of a "charge density wave" ground state in the alkali metals^{15,16} has been discussed by Thomas and Turner¹⁰ with reference to potassium; the present results certainly offer no support for the theory, which would require that observed values of F_0 should be significantly lower than those calculated from lattice constant measurements. It is now believed that the apparent discrepancy in the case of potassium arises from an error in Barrett's¹⁷ lattice constant figure. The discrepancy corresponds to an error of about -0.2% in lattice constant, which could easily be accounted for by the 0.5% Na in Barrett's potassium.

The comparisons in Table III show that, although there is substantial agreement on the values of V_0 , our values of B_0 appear to be systematically larger than those given by the piston (p-v-t) method. It is perhaps significant that the largest difference is in Cs, where our figure for B_0 is 16% higher, and also perhaps that our values for B_0V_0 in K, Rb, and Cs are essentially equal to the value of 1.68 J/mole given by the p-v-t method for Na. The total pressure range involved in our measurements is 25 bar; we believe our figures to be accurate to better than 0.5% . The p-v-t figures are quoted to 1% ; however, the pressure range involved is 20 kilobar, and indeed the limiting accuracy at low temperatures is about 100 bar. One might query the use of a piston technique in measuring compressibility, since this requires appreciable plastic flow of the compressed metal if its cubic structure is to be maintained. However, the measurements have usually been made on at least two samples of differing length-diameter ratios that should presumably show up any systematic departures from true hydrostatic conditions.

We must conclude then at present that there is a real difference between the differential compressibility (i.e., that measured at essentially constant volume) and compressibility measured under conditions involving appreciable volume change. The fact that the compressibility apparently *increases* with increasing pressure argues a degree of instability in the body-centered cubic structure that is most marked in cesium. Such an instability seems not unlikely since at ~ 22 kbar, after being compressed by some 40% , Cs I transforms to the close-packed cubic Cs II. Though no such transformation occurs in Rb or K, the tendency may well exist, appearing as a departure from linearity in the compressibility.