A comparison of our results with the theoretical calculations of others who used hydrogen-like wave functions shows that our quasiclassical radial functions give much better agreement with experiment. lines as calculated by the use of hydrogen-like functions are 50: 100: 34: 12 for all atoms, which does not agree with experiment.

In conclusion I must express my gratitude to B. T. Geilikman, who directed this work.

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256

Magnetic Properties of Oxides of Manganese at Temperatures from 20 to 300° K

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IN CONNECTION with the anomaly in the magnetic properties of manganese carbonate below 31° K, discovered by the authors[1], it was deemed of interest to study the magnetic properties of oxides of manganese at low temperatures. These were the most probable impurities in the preparations studied. The magnetic properties of manganese monoxide (MnO) and of manganese dioxide (MnO_2) have been studied in detail by a number of authors[2]. Both compounds become antiferromagnetic at temperatures 122° K (MnO) and 84°K (MnO_2).

Measurements of the magnetic susceptibility of Mn_2O_3 and Mn_3O_4 were carried out on natural samples of these compounds in the temperature range 20 to 300° K. The measurements were made on the same samples of hausmannite (Mn_3O_4) and of braunite (Mn_2O_3) for which a physico-chemical analysis had earlier been made by Rode[3]. In Rode's judgment, the composition of these samples was quite close to stoichiometric.

The results of the measurements of the magnetic susceptibility of hausmannite (Mn_3O_4), in the temperature range 43 to 300° K, are presented in Fig. 1 as a plot of $1/\chi$ *vs.* T (curve 1). Below 42.5° K, hausmannite exhibits characteristic ferromagnetic properties. In Fig. 2 is drawn a curve showing the dependence of the magnetic moment M on the field H for 20.4° K. Hausmannite has the structure of a spinel elongated in the [001] direction[4]. Therefore it is natural to suppose that hausmannite, like the ferrites, is antiferromagnetic with an uncompensated moment. The ordering temperature is $T_C = 42.5°$ K.

The temperature dependence of the inverse magnetic susceptibility in the paramagnetic range agrees qualitatively with the formula proposed by Néel[5] for such substances,

$$1/\chi = \frac{T}{C_{\text{mol}}} + \frac{1}{\chi_0} - \frac{s}{(T-\Theta)}. \tag{1}$$

Curve 2 of Fig. 1 corresponds to formula (1) with the following values of the constants:

$$C_{\text{mol}} = C\,(\text{Mn}^{++}) + 2C\,(\text{Mn}^{+++}) = 10{,}4;$$

$$1/\chi_0 = 91{,}3;\ s = 3480,\ \Theta = 31{,}1.$$

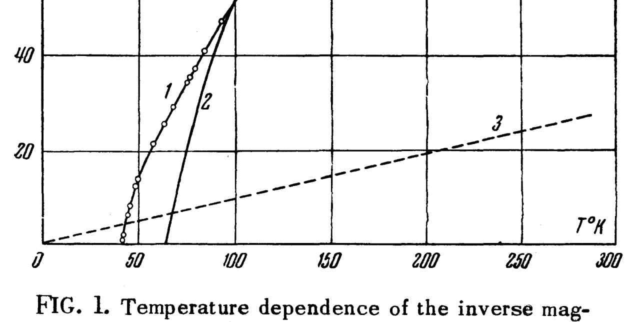

FIG. 1. Temperature dependence of the inverse magnetic susceptibility (molar) of hausmannite (Mn_3O_4). 1—experimental curve; 2—Néel's formula; 3—*Curie's law.*

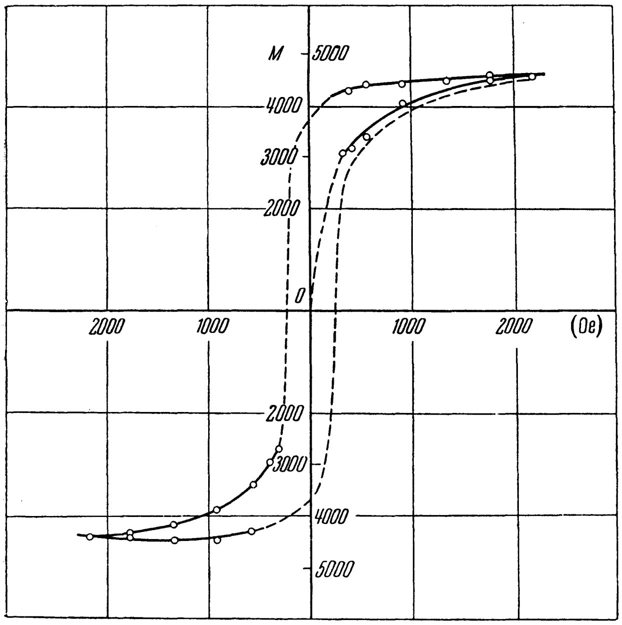

FIG. 2. Dependence of the magnetic moment (molar) of hausmannite on the field (T = 20.4° K).

For comparison, Curve 3 has been drawn in Fig. 1; it corresponds to Curie's law with the constant C_{mol} given above.

Figure 3 shows the curve obtained by us for the temperature dependence of the inverse magnetic susceptibility of braunite (Mn_2O_3). Braunite remains paramagnetic over the whole range of temperatures studied. Below 120° K we observe an anomalous behavior of the susceptibility. The reason for this anomaly is not clear. It may be due to insufficient purity of the sample.

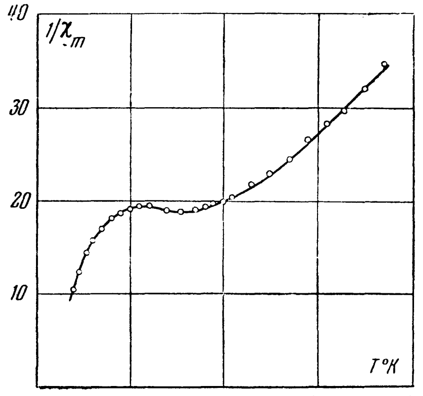

FIG. 3. Temperature dependence of the inverse magnetic susceptibility of braunite (Mn_2O_3).

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257

Visual Observation of the Stratification of Solutions of He^3-He^4

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AS WALTERS AND FAIRBANK[1] have recently pointed out, solutions of He^3-He^4 at temperatures below 0.8° K separate into two phases with different concentrations of He^3. Making use of the nuclear resonance technique, these authors carried out measurements of the phase diagram of solutions of He^3-He^4 in the temperature range 0.25–0.85° K.

We have set up experiments on the visual observation of the stratification of solutions of He^3-He To obtain the low temperatures, we pumped vapors of He^3 which were condensed in a small transparent Dewar of volume of about 3 cm³ (Fig. 1).

A glass ampoule *b* with a volume of about 200 mm³ (diameter of the ampoule 3.5 mm, height 20 mm) was placed inside the Dewar *a*. The ampoule was joined by the copper link *c* to a thin steel capillary *d*, of internal diameter 0.5 mm, which led out of the Dewar.

The gaseous mixture He^3-He^4 along the capillary was condensed in the ampoule so that the meniscus between the liquid and the vapor remained below the copper connection. A mixture of 51.1% He^3-He^4 concentration was used in the experiment. Condensation took place at 1.1° K. At this temperature, the solution was a homogeneous transparent liquid.

Under a slow decrease of temperature, the solu-