7. *Densities of n-Propyl- and Isobutyl-alcohols at Low Temperatures.*¹⁾

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The densities of n-propyl- and isobutyl-alcohols at low temperatures were determined with a sealed pycnometer. The bulb has the capacity of about 20 c.c., and the capillary tube has the length of about 80 cm. and the radius of about 1 mm. When the sample has been distilled into the pycnometer in the vacuum system, the pycnometer is sealed off, and then the bulb part is put in the cryostat regulated within 0.1°, while the capillary part is surrounded with the water jacket at 25°C. The height of the liquid meniscus in the capillary tube is read with a vertical cathetometer. The calibration of the pycnometer is done with mercury.

The calculation is done by the following formula,

$$D = \frac{D_0 + \frac{\Delta v D_{25}}{v_0}}{1 + \alpha t}$$

where α is the cubical expansion coefficient of the glass used in the pycnometer, v_0 the volume of the liquid at 0°C., D_0 and D_{25} the densities of the liquid at 0° and 25°C., and Δv the difference of the volumes of liquid at 0° and t° . For the values of D_0 and D_{25} , the followings are used.

n-propyl-alcohol :	$D_0 = 0.81923$, ²⁾	$D_{25} = 0.7999$ ³⁾
isobutyl -alcohol :	$D_0 = 0.81698$, ⁴⁾	$D_{25} = 0.79801$ ⁵⁾

The results are tabulated in Tables 1 and 2, together with the empirical equations expressing the density-temperature relations.

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1) The details of the experiments will be published in J. Chem. Soc. Japan.

2) Young: J. Chem. Soc., 81, 725 (1902).

3) Turner: J. Chem. Soc., 105, 1656 (1914).

4) Young: Beilstein, 4 ed. Bd. 1, p. 374.

5) Brunel and Crenohaw: J. Am. Chem. Soc., 43, 574 (1921).

Table 1. Densities of n-Propyl-alcohol.

Temp. $t^{\circ}\text{C.}$	Density	
	Observed	Calculated
-24.7	0.8371	0.8368
-44.3	0.8523	0.8518
-53.9	0.8600	0.8596
-74.2	0.8770	0.8768
-84.0	0.8851	0.8855
-95.3	0.8950	0.8949
-104.3	0.9037	0.9041
-112.0	0.9104	0.9115

$$D = 0.8193 - 0.00006749 t + 0.000001351 t^2$$

Table 2. Densities of Isobutyl-alcohol.

Temp. $t^{\circ}\text{C.}$	Density	
	Observed	Calculated
-14.7	0.8275	0.8275
-18.2	0.8300	0.8300
-30.6	0.8393	0.8391
-41.0	0.8475	0.8473
-49.9	0.8539	0.8538
-59.5	0.8614	0.8612
-69.0	0.8690	0.8688
-80.7	0.8784	0.8783
-89.5	0.8855	0.8855
-99.3	0.8936	0.8944
-110.8	0.9039	0.9039

$$D = 0.8169 - 0.0007055 t + 0.000000684 t^2$$