

DETERMINATION OF THE RATIO OF SPECIFIC HEATS OF A GAS BY METHOD OF CLEMENT AND DESORMES

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The value of k was determined for CO_2 by several trials, and the average of the results taken. A light grade of motor lubricating oil was used in the manometer to indicate pressures. The density (specific gravity) of the oil was determined by laboratory tests to be 0.8566; mercury, therefore, being 15.87 times as heavy as the oil. The differences of level of the manometer were calculated in terms of mercury to find p_1 , and p_3 , by dividing the difference of level of the manometer in centimeters by 15.87.

The values for k as determined by the exact formula and the approximate formula are given in the table with a sample calculation of each type. Trials were made over a period of two days giving a different value for p_2 .

p ₂ barometer reading	b ₁	b ₂	p ₁ (p ₂ +b ₁)	p ₃ (p ₂ +b ₃)	k from approx. formula	k calculated from exact equation
76.7 cm.	17.2 cm.	3.9 cm.	77.783	76.945	1.293	1.293
76.7 cm.	12.6 cm.	2.8 cm.	77.494	76.876	1.2859	1.2919
76.98 cm.	9.4 cm.	2.2 cm.	77.572	77.119	1.3055	1.3070
76.98 cm.	12.2 cm.	2.8 cm.	77.748	77.156	1.2978	1.2982
76.98 cm.	18.4 cm.	4.2 cm.	78.139	77.245	1.2958	1.2980
76.93 cm.	14.6 cm.	3.4 cm.	77.900	77.194	1.3035	1.3030

General Average for k 1.2968

Percent of error 0.18%

Calculations: (exact formula)

$$\begin{aligned}
 k &= \frac{\log(p_2 + b_1) - \log p_2}{\log(p_2 + b_1) - \log(p_2 + b_3)} \\
 &= \frac{\log 77.494 - \log 76.7}{\log 77.494 - \log 76.876} \\
 &= \frac{1.88927 - 1.88480}{1.88927 - 1.88579} = \frac{.00447}{.00346} = 1.2919
 \end{aligned}$$

(Approximate formula)

$$k = \frac{b_1}{b_1 - b_2} = \frac{12.6}{12.6 - 2.8} = \frac{12.6}{9.8} = 1.2859$$