ETH zürich | Physikalisches Praktikum der ETH Zürich | Physics Lab

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09 - absolute Zero

Calibration of the pressure sensor

Calibration point at ambient pressure

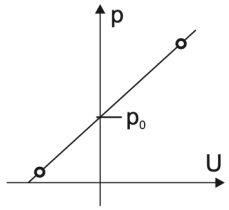
(uncorrected barometer reading)	(temperature at barometer)	(corrected barometer reading)
p_L= 718,7 mm Hg (t_L)	air temp t_L= 24 °C	p_L= 718,7 − 3,11 = 715,59 Torr = mmHg
p_L= 95818,8 Pa	U_L= 97,45 mV	

Calibration point at low pressure

p_t= 0,1 ± 0,1 mbar	p_t= 13,3322 Pa	U_t= −37,65 mV

Sensor characteristics: $p = p_0 + CU$:

p_0= 26712,641 Pa	C= 709,145 Pa/V



Determination of the absolute zero

At the temperature of boiling water

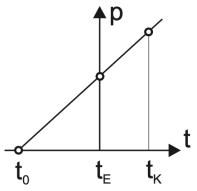
t_K= 98,323 °C	U_K= 95,64 mV	p_K= 95'535,24 ~~mbar~~ Pa

At the temperature of ice water

t_E= 0,00 °C	U_E= 60,78 mV	p_E= 69'814,46 ~~mbar~~ Pa

Approximation for the temperature of the absolute zero:

$t'_0 = -\frac{p_E}{p_K - p_E} t_K = -277,68$ °C



Volume of the empty space / volume of the glass bulb: $V_s/V = \varepsilon = 1 \cdot 10^{-3}$
Cubic expansion coefficient of glass: $\gamma) 1,0 \cdot 10^{-5} °C^{-1}$

a= −24'838,5 Pa	b= −6'158'843,2 Pa·°C	c= 164'746'808,6 Pa·(°C)²

Absolute zero of temperature:

t_0 = −272,31 °C

Determination of the temperature of liquid nitrogen

U_{LN2}= −9,97 mV	p_{LN2}= 19'635,37 Pa	t'_{LN2} = −198,58 °C
corr. coeff A= 256,54 Pa/°C	t_{LN2} = 195,92 °C	