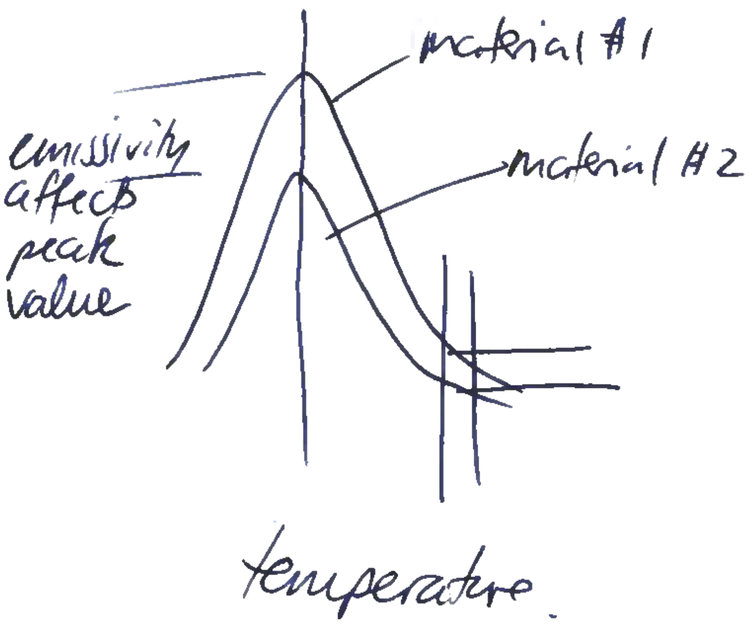
b)

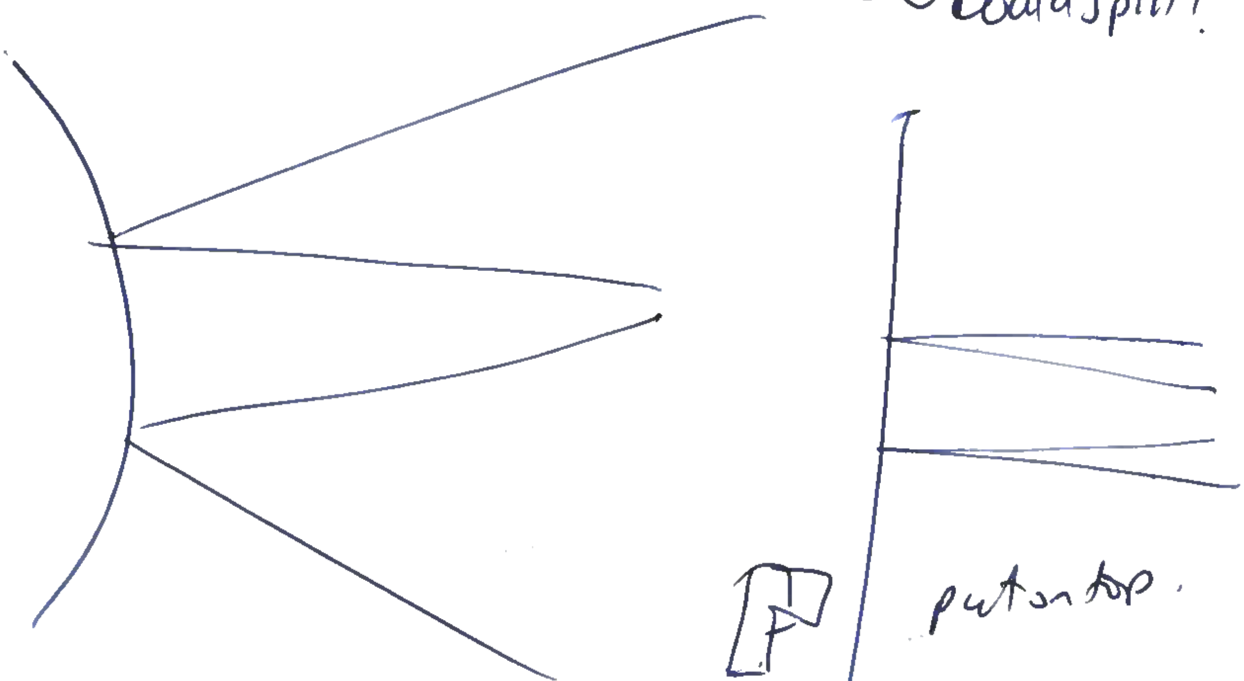
~ 1/2

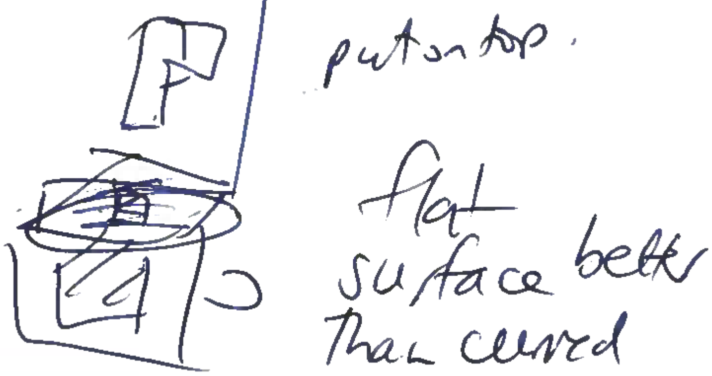
planck's constant

black body radiation.

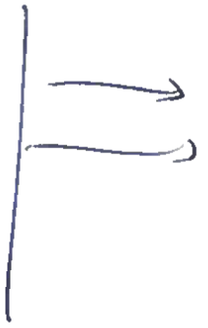
~~[illegible]~~ emission spectrum from the sun.



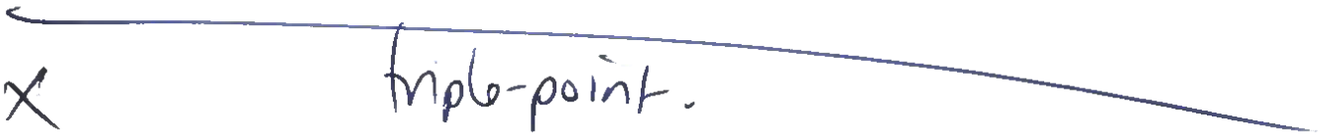




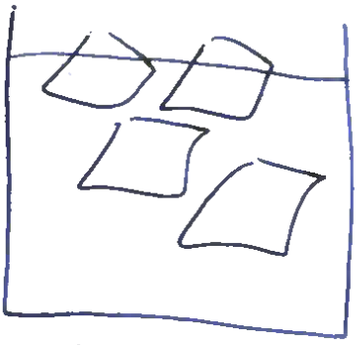
IR:



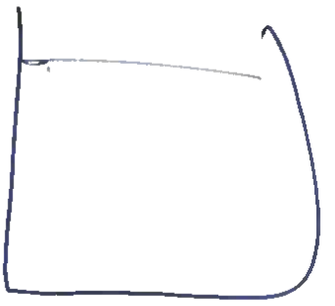
emissivity (varies with material)



triple-point.



ice water.



boiling water
(@ sea level!)

(health & safety!)

between

insulation 11" sensor & water.

Results from Data Analysis

① For 1V, 2V, 3V, 4V, 5V

mean value of Measured Vref − Vcurrent = increase by Vs

[0.8473, 0.8538, 0.8615, 0.8617, 0.8685]

In Amp [~~0.0614~~ 8.0307, 0.1487, 0.1521, 0.1502, 0.1478] Improved

(1, 2, 3, 4, 5)

② for Measured Vref − Vcurrent at 10mV ~ 485mV set ~~for~~ ref

around 0.8mV

result on 1V close to 8A cannot go up test again

In Amp perform better at Measured Vref − Vcurrent through all current range

~ ~~0.15mV~~ difference

0.15mV => 0.8mV/6

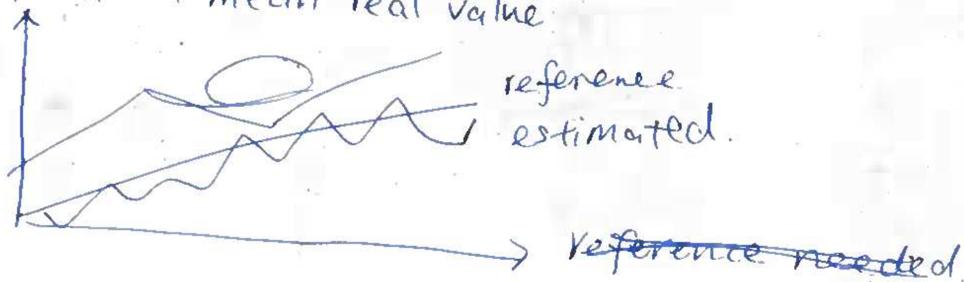
Improved resolution — Improved.

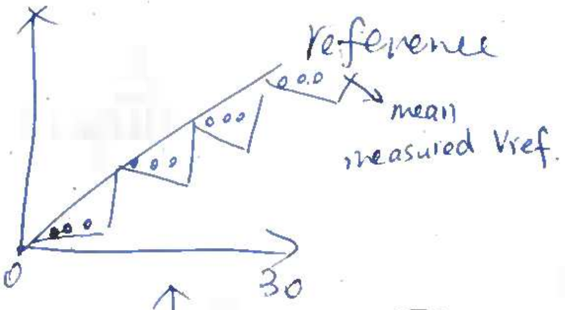
1V 2V 3V 4V mean

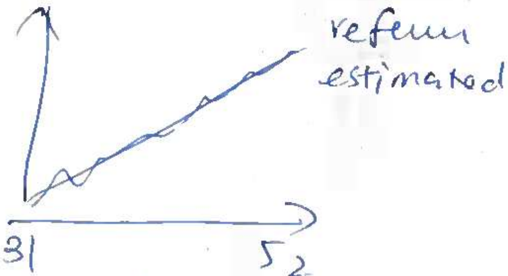
10mV ~ 485mV → at 22mV after this difference increase from ~~0.75 to 0~~, average 0.7 to 0.8

③ Reference needed vs estimated vs real measure

estimated + mean real value







In Amp Much better

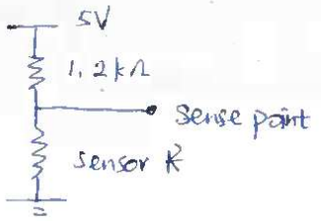
InAmps Much Better

④

Gary Ellard
Gary Ellard

2022/07/22

Temp Sensor F 0.15(A) — Normal Resistance 1kΩ



$\Rightarrow R = R_0 * (1 + a \times T + b \times T^2)$ for $T \geq 0^\circ C$

$R = R_0 \times [1 + a \times T + b \times T^2 + c(T - 10^\circ C) \times T^3]$ For $T < 0^\circ C$

Only concern $T > 0^\circ C$ situation

$V_{sense} = \frac{R}{1.2k + R} \times 5 \Rightarrow \frac{V}{5}(1.2k + R) = R$

$\frac{V}{5} \cdot 1.2k + \frac{V}{5}R = R$

$\frac{V}{5} \times 1.2k = (1 - \frac{V}{5})R$

$R = \frac{\frac{V \times 1.2k}{5}}{(1 - \frac{V}{5})}$

$V(1.2k + R) = 5R$

$V \times 1.2k = (5 - V)R$

$R = \frac{1.2k \cdot V}{5 - V}$

$R = 1k \times (1 + a \times T + b \times T^2)$

$\frac{R}{1k} = 1 + a \times T + b \times T^2$

$b \times T^2 + a \times T + 1 - \frac{R}{1k} = 0$

$V = 2361.6mV$

$R = \frac{1.2k \times V}{5 - V}$

$= \frac{1.2k \times 2.3616}{5 - 2.3616}$

$\approx 1074.1\Omega$

$C = T - 273.15$

$T = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$= \frac{-a \pm \sqrt{a^2 - 4b \times (1 - \frac{R}{1k})}}{2b}$

$T = \frac{-3.9083 \times 10^{-3} \pm \sqrt{(3.9083)^2 \times 10^{-6} - 4 \times (-5.775 \times 10^{-7})(1 - 1.0741)}}{2 \times (-5.775 \times 10^{-7})}$

$T = \frac{-a \pm \sqrt{a^2 - 4b(1 - R)}}{2b}$ kΩ

if ± ⇒ + $T = 19.0457$

if ± ⇒ − $T = 6777.9$ too big

$a = 3.9083E-03$

$b = -5775E-07$

$c = -4.183E-12$

$T = \frac{-3.9083 \times 10^{-3} + \sqrt{(3.9083 \times 10^{-3})^2 + 4 \times 5.775 \times 10^{-7} \times (1 - 1.0741)}}{-2 \times 5.775 \times 10^{-7}}$

$= \frac{3.9083 \times 10^{-3} - \sqrt{(3.9083 \times 10^{-3})^2 + 4 \times 5.775 \times 10^{-7}(1 - 1.0741)}}{2 \times 5.775 \times 10^{-7}}$

$T = -3.9083 \times 10^{-3} \pm \sqrt{(3.9083)^2 \times 10^{-6} - 4 \times (-5775 \times 10^{-7}) \times (1 - R)}$

$2 \times (-5775E-07)$

Toutch it by hand. (37°C probably)

Skin temp may lower

$V_{sense} = 2380.8\ mV$

$$R = \frac{1.2k \times 2.3808\ V}{5 - 2.3808}$$

$$= \frac{2856.96}{2.6192}$$

$$= 1090.776\ \Omega$$

$$= 1090.8\ \Omega$$

$$T = \frac{-3.9083 \times 10^{-3} + \sqrt{(3.9083 \times 10^{-3})^2 + 4 \times 5.775 \times 10^{-7} \times (1 - 1.0908}}{-2 \times 5.775 \times 10^{-7}}$$

$T \approx 23.4°C$ skin temp