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Application No: 22BTRAD018

Exp 4-VERIFICATION OF STEFAN'S LAW

Aim: To verify Stefan's law of Black-body radiation by studying the variation power dissipated across the bulb as a function of resistance.

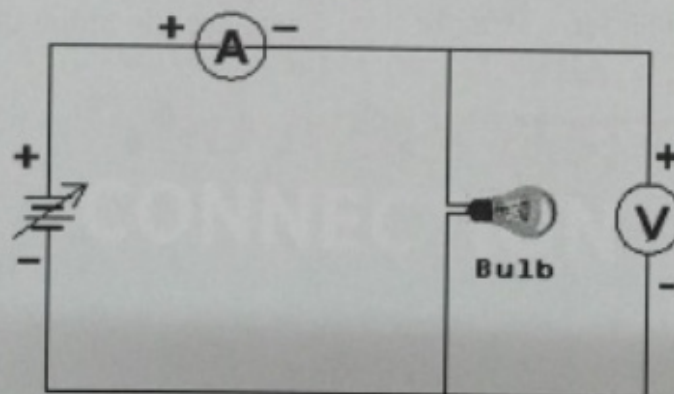**Apparatus**: Electric bulb, variable power supply, voltmeter, and ammeter etc.

Formula: $E = \sigma T^4$

E is the rate of energy emitted from the unit surface area of a Black-Body Wm^{-2}.

σ is Stefan's constant $Wm^{-2}K^{-4}$.

T is the Absolute temperature in K.

Circuit diagram

Procedure:

Connect the circuit as above. Connect the battery, ammeter in series, electric bulb and voltmeter parallel as shown in figure.

Now by using battery, vary the voltages from 0 in steps of 1 Volt and note down the corresponding value of current I from the ammeter in the given table. Calculate log P and log R as given in the table. Plot log P vs log R as shown in the rough graph using excel/python tool.

Trail No.	V volt	I (mA) ampere	$R = \dfrac{V}{I}$ Ω	$P = VI$ watt	$\log_{10} R$	$\log_{10} P$

1	1	5.59×10^{-2}	1.79×10^{1}	5.59×10^{-2}	1.2525881	-1.2525881
2	1.5	6.55×10^{-2}	2.29×10^{1}	9.83×10^{-2}	1.35984	-1.00766
3	2	7.55×10^{-2}	2.65×10^{1}	1.51×10^{-1}	1.42308	-0.8210
4	2.5	8.42×10^{-2}	2.97×10^{1}	2.11×10^{-1}	1.47262	-0.6767
5	3	9.31×10^{-2}	3.22×10^{1}	2.79×10^{-1}	1.50817	-0.5539
6	3.5	1.01×10^{-1}	3.47×10^{1}	3.53×10^{-1}	1.54017	-0.4520
7	4	1.08×10^{-1}	3.69×10^{1}	4.34×10^{-1}	1.56703	-0.3629
8	4.5	1.15×10^{-1}	3.90×10^{1}	5.19×10^{-1}	1.591006	-0.2845
9	5	1.22×10^{-1}	4.10×10^{1}	6.11×10^{-1}	1.612254	-0.21431
10	5.5	1.28×10^{1}	4.31×10^{1}	7.01×10^{-1}	1.63485	-0.15412

Graph

Plot a graph using excel tool taking log R along X- axis and log P along -ve Y-axis. You will get a straight line. Calculate the slope of the graph.
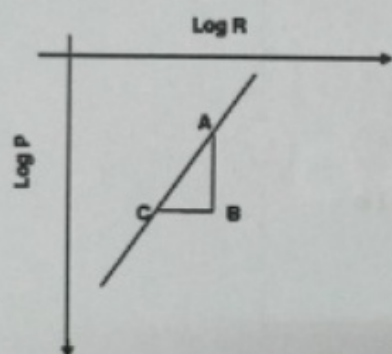
Result:

The slope of the straight line is given by 2.9625378825 and hence the Stefan's law is verified.

Note: Students are directed use excel or python tool for calculations and graph submit the filled (manually) worksheet along with excel/python file to LMS for evaluation.

2