**Governor Stirling Senior High School**

**2019 Year 12 Physics**

**Task 8A: Experiment**

**Practical Test WAVES AND QUANTA**

**Part A: DETERMINING PLANCK’S CONSTANT**

**Marks: /20**

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Teacher: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Background:**

In this experiment, the voltage is carefully measured that causes 2 micro amps to flow through each selected LED. Voltage across the LED’s is changed until a current of 2uA flows. At this very low current, the LEDs are JUST at the point of conduction. Hence the voltage measured is very close to the threshold voltage: the voltage to completely stop the electron flow. The threshold voltage is a measurement of the energy level of the most excited electrons (the emission energy, Eg) and is related to the frequency of photons emitted**.**

**Eg = eVth = hf**

**Equipment:**

Planck’s Constant kit, 2x multimeters, 12V power supply, leads.

**Procedure:**

The following circuit has been set up for you:

**A**



**9-12 V**

**V**

1. Set the power supply voltage between 9 and 12 Volts DC.

2. Set the digital meter connected to the “A” terminals to a DC range of about 200uA.

3. Set the digital meter connected to the “V” terminals to a DC range of about 20 volts.

4. Set the rotary LED selector switch to select the 465 nanometre wavelength LED.

5. Starting at the “min” position, increase the voltage applied to the LED until the current

through the LED reads 2uA on the digital meter set to micro amps.

6. At 2uA through the LED, note and record the voltage applied to the LED by reading the digital meter set to volts.

7. Repeat steps from 4 to 6 after selecting the next LED.

Operation: (2 marks)

|  |  |  |
| --- | --- | --- |
| Vth | (Read from the dial) | Frequency (f) |
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|  |  |  |
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|  |  |  |

Table: (2 marks)

8. When all 7 LEDs have been documented, PLOT THE GRAPH of frequency of the light from the LED (X axis) against the voltage applied (Y axis).

(GRAPH PAPER IS SUPPLIED). (4 marks)

9. Draw a line of best fit. (1 mark)

10. Calculate the gradient showing clearly on the graph where you have taken the points.

(3 marks)

11. Use the gradient to calculate h. (4 marks)

12. List where sources of random and systematic errors may occur when conducting the above experiment: (3 marks)

RANDOM: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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SYSTEMATIC: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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13. Identify one method which would help to minimise the errors. (1 mark)

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