Finding Planck's constant using the switch on voltage of LEDs of different colours

For the write up of the assignment you must cover the following points.

- state appropriate aim(s)
- explain the underlying physics of the topic researched
- research the topic by selecting relevant data/information
- process and present relevant data/information
- consider experimental uncertainties
- analyse data/information
- state conclusions
- evaluate their investigation
- present the findings of the research in a report

Of the total of 20 marks available for the assignment, the marking instructions provide 16 marks for skills and 4 marks for knowledge and understanding. The table below shows how these marks are allocated to each of the criteria against which the evidence will be assessed.

The length of the assignment should be between 800 – 1500 words, excluding tables, charts, calculations and references.

Criteria	Mark allocation
Aim(s)	1
Applying knowledge and understanding of physics	4
Selecting information	2
Processing and presenting data/information	4
Uncertainties	1
Analysing data/information	2
Conclusion(s)	1
Evaluation	3
Presentation	2

Suggested structure of assignment

Overall aim of assignment

Underlying physics. p-n junction diodes, depletion barriers with associated potential barrier, forward biasing to break down barrier and allow diode to conduct, energy transition between conduction band and valency band to produce photons of energy equal to band gap. E = hf, energy of photon, QV assumed to be equal to band gap. Different QV for different colours mean different band gaps. Band gap depends on material of LED. (examples). Also details of band theory and doping could be mentioned at beginning. Also see question 12 b)I and ii) from the 2016 higher paper and study the answer closely and what you are expected to know for this topic at higher physics.

Experimental Work in class

Exp 1… Including aim (To find the current-voltage characteristic for reverse and forward biased p-n junction diode) and method but particularly showing data in appropriate format using tables and graphs with labels and headings. Also show random uncertainties and reading uncertainties here. The conclusion is the switch on voltage.

Exp 2… Including aim **(To find switch on voltages for forward biased red, orange, green and blue LEDs)** and method but particularly showing data in appropriate format using tables and graphs with labels and headings. Also show random uncertainties and reading uncertainties here. Convert QV to a value and assume it is equal to the band gap, which is hf. Find the h for all four colours and an average, or, plot QV against f and your gradient is h.

If you do all of the above properly you will successfully cover the analysing mark. You should also include where you found your wavelength data from, and where you got Planck's constant from

Overall Conclusion; According to my results Planck's constant equals ….

Evaluation; How close is your h to the quoted value of h?. , Were your sources robust, was your data reliable and how well you think you carried out the activities (did you repeat your readings on different days, did you take an average of the values?

Presentation; Two references and appropriate headings at all points.