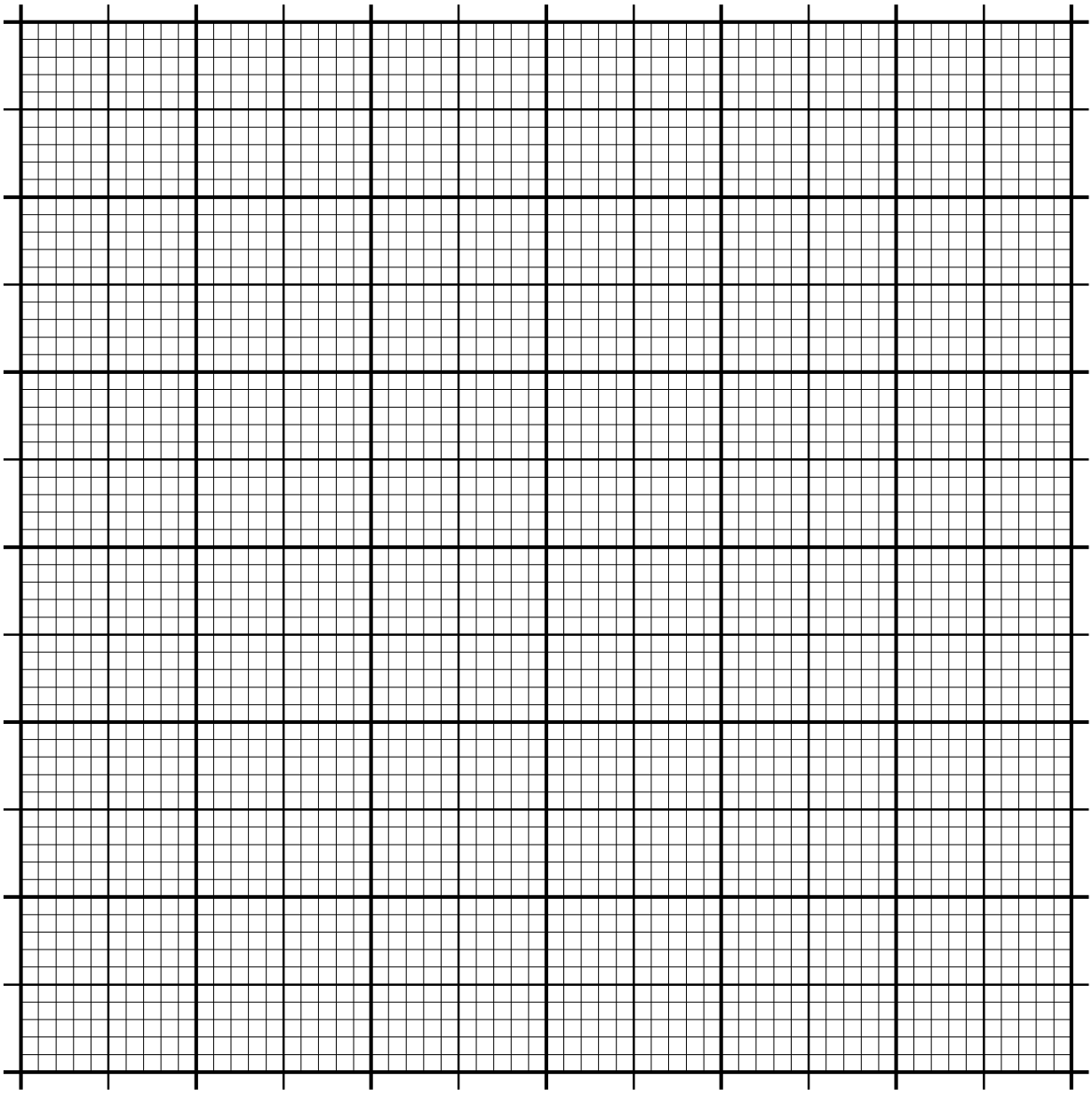
Part B **<u>Calibration of the emission spectrum of helium</u>**
(Completed as an individual.)

AIM: To use the emission spectrum of mercury to calibrate the emission spectrum of helium.

PROCESSING OF RESULTS:

1. For the mercury vapour data, plot a graph of ***λ (nm)*** on the y-axis against ***average x (cm)*** on the x-axis.
Draw the line of best fit. **[5 marks]**



2. (a) Determine the gradient of the graph. Show your working clearly. **[3 marks]**

(b) Write the equation of the line of best fit. **[2 marks]**

……..

(c) Use the answers to Q 2 to calculate the wavelengths of the visible part of the helium spectrum and ***record these in Table 2***.

Show your working of ***ONE*** of the calculations in the space below. **[3 marks]**

Working:

QUESTIONS

1. Measurement of the position ***x*** of the mercury vapour emission lines was repeated for each of the yellow, green and violet lines by ***two*** different students.

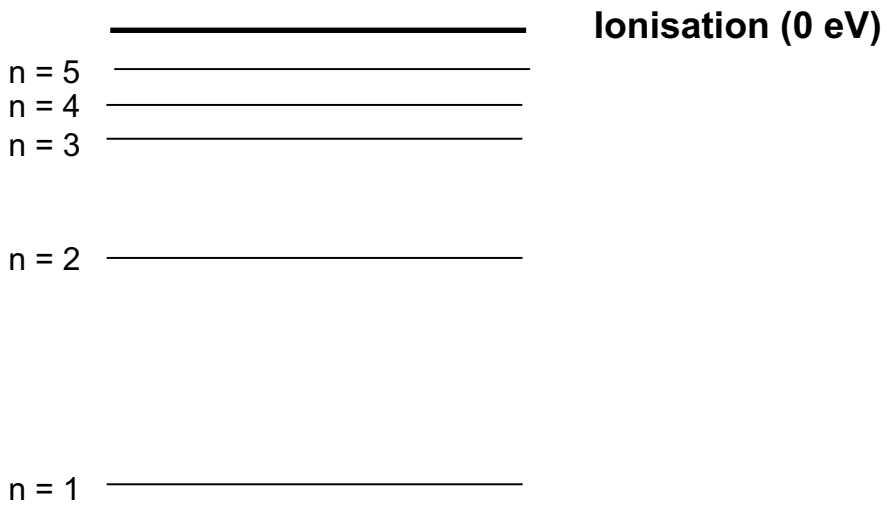
   (a) Why was the measurement repeated? **[1 mark]**

   (b) Why was the measurement repeated by two different students? **[2 marks]**

   (c) Suggest another method that could be used to repeat the measurement.
   [Hint: Consider page 1.] **[2 marks]**

2. What would be the effect on the position ***x*** of the mercury vapour emission lines if the diffraction grating was placed 100 cm from the lamp instead of 75 cm from the lamp? Explain. **[2 marks]**

3. The diagram below shows some of the possible electron energy levels in a hydrogen atom. The ionisation energy is 13.6 eV.



(a) Explain what is meant by ionisation energy? **[1 mark]**

(b) Indicate on the diagram where the electron would be if it were in "the ground state". **[1 mark]**

(c) Light from a hydrogen discharge tube consists of a *line emission spectrum.* Explain how line emission spectra are produced.

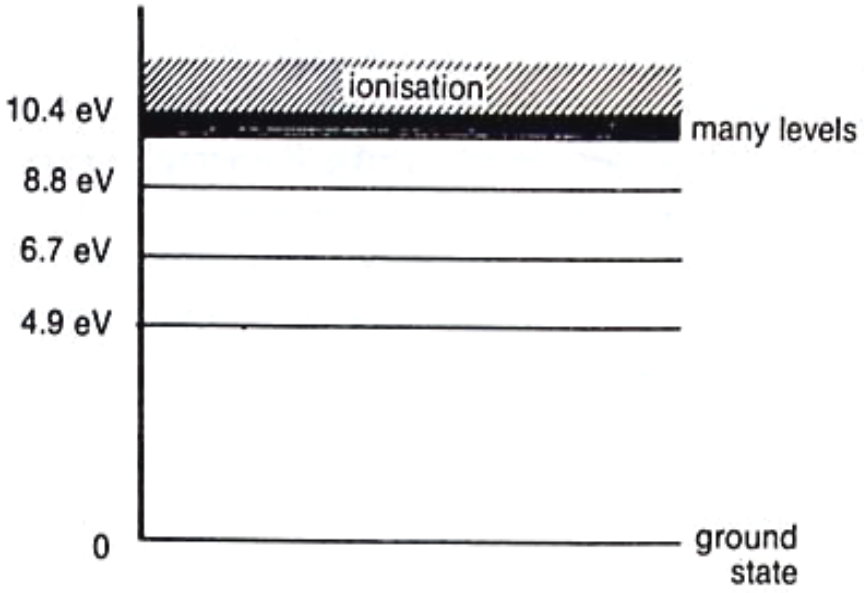
[3 marks]

(d) The only emission spectra which occur in the visible region are those involved with transitions to level 2.

Draw an arrow on the diagram to represent the transition for the longest wavelength photon emitted in the visible region. Calculate the energy difference in joules, for this transition if the longest wavelength of these in the visible region has a wavelength of 655 nm.

[3 marks]

4. The diagram below shows some of the energy levels inside a mercury atom. Assume the 10.4 ev is for the fourth energy level above groundstate and is below the ionisation energy.



How many lines would you expect this atom to show in its:

(a) absorption spectrum **[1 mark]**

(b) emission spectrum **[1 mark]**