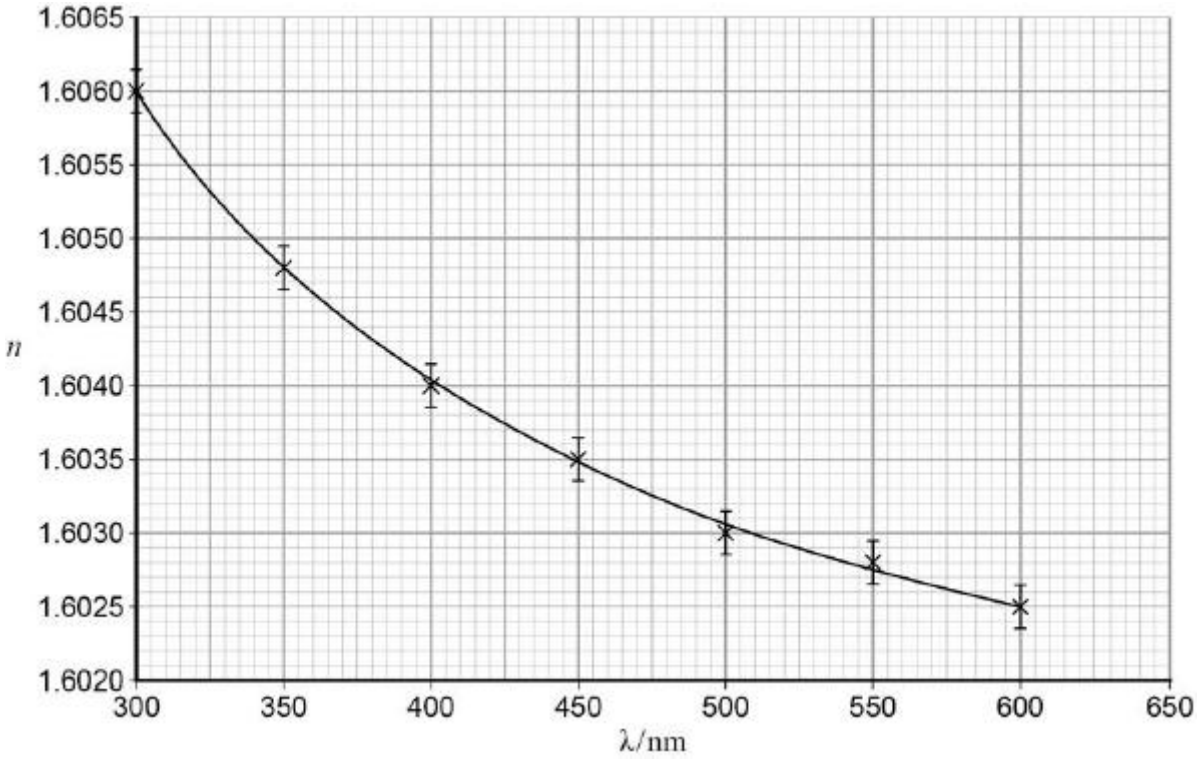
Name of the Student:_____
Max. Marks : 27 Marks **Time : 27 Minutes**

Q1.

Figure 1 shows how the refractive index n of a type of glass varies with the wavelength of light λ passing through the glass. The data for plotting the graph were determined by experiment.

Figure 1



(a) A student says that **Figure 1** resembles that of the decay of radioactive atomic nuclei with time and that it shows half-life behaviour.

Comment on whether the student is correct.

_____

_____

_____

(1)

(b) The dispersion D of glass is defined as the rate of change of its refractive index with wavelength. At a particular wavelength $D = \frac{\Delta n}{\Delta \lambda}$.

Determine D at a wavelength of 400 nm. State an appropriate unit for your answer.

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D _____ unit _____

(3)

(c) It is suggested that the relationship between n and λ is of the form

$$n = a + \frac{b}{\lambda^2}$$

where a and b are constants. The data plotted in **Figure 1** are given in the table below.

λ / nm	n			
300	1.6060			
350	1.6048			
400	1.6040			
450	1.6035			
500	1.6030			
550	1.6028			
600	1.6025			

You are to determine a using a graph of n against $\frac{1}{\lambda^2}$.

.

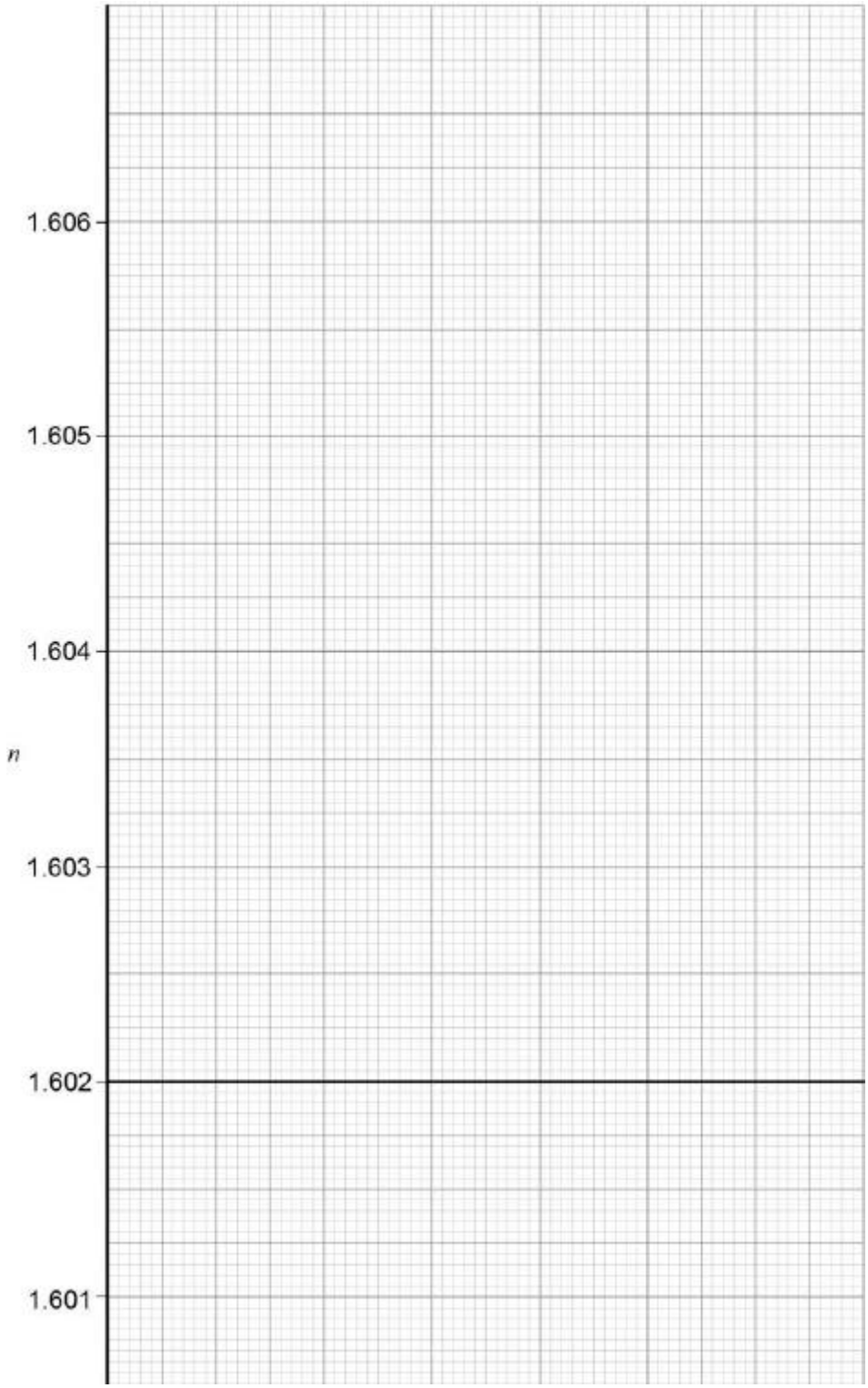
Make any calculations that you need to in order to plot your graph. The columns in the table are for you to use to calculate and tabulate the derived data that you need.
You may not need all the columns.

(3)

(d) Plot your graph on **Figure 2**. The values of n are provided on the y-axis.

Figure 2

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(3)

(e) Use your graph to determine a.

(1)

(f) State the significance of a.

_____

_____

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(1)

(g) Another suggestion for the relationship between n and λ is that

$$n=c\lambda^{d}$$

where c and d are constants.

Explain how d can be determined graphically. Do not attempt to carry out this analysis.

(3)

(Total 15 marks)

Q2.

The Summer Triangle consists of three stars, Altair, Deneb and Vega.
Some of the properties of the three stars are summarised in the table below.

	Altair	**Deneb**	**Vega**
surface temperature / K	7700	8500	9600
apparent magnitude	0.77	1.25	0.03
absolute magnitude	2.21	–8.38	0.60

(a) The three stars belong to the same spectral class.

State and explain which spectral class they belong to.

(2)

(b) Deduce which of the three stars appears brightest.

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_____

_____

_____

(2)

(c) Calculate the distance from Earth to the closest of the three stars.

distance = _____ pc

(3)

(d) Deduce which of the three stars is the largest.

_____

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(e) Calculate the wavelength of the peak in the black body radiation curve of Altair.

wavelength = _____ m

(2)

(Total 12 marks)

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