Name of the Student:_____
Max. Marks : 16 Marks **Time : 16 Minutes**

Q1.

The table gives data about the supergiant star Melnick 34 and the Sun.

Name	Radius / m	Surface temperature / K
Melnick 34	1.4×10^{10}	53 000
Sun	7.0×10^{8}	5 700

(a) Calculate $\frac{\text{power output of Melnick 34}}{\text{power output of the Sun}}$.

answer = _____

(2)

(b) Discuss why the evolution of a supergiant star in the local part of our galaxy could be dangerous for life on Earth.

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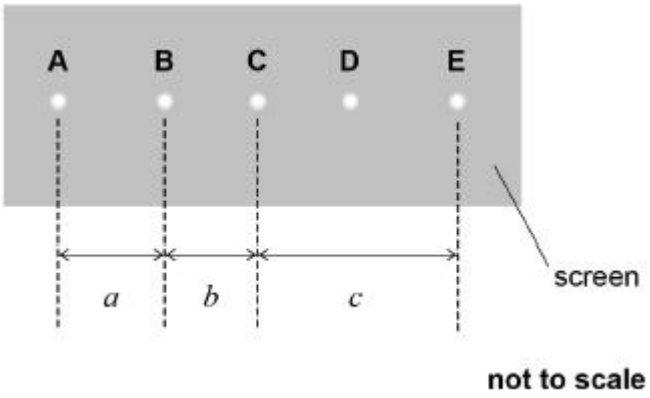
(2)
(Total 4 marks)

Q2.

This question is about the measurement of the wavelength of laser light.
The light is shone onto a diffraction grating at normal incidence.
The light transmitted by the diffraction grating produces five spots on a screen. These spots are labelled **A** to **E** in **Figure 1**.

Figure 1



A student uses a metre ruler with 1 mm divisions to take readings. He uses these readings to obtain measurements a, b and c, the distances between centres of the spots as shown in **Figure 1**.
Table 1 shows his measurements and his estimated uncertainties.

Table 1

Measurement	Distance / mm	Uncertainty / mm
a	289	2
b	255	2
c	544	2

(a) Explain why the student's estimated uncertainty in measurement a is greater than the smallest division on the metre ruler.
You should refer to the readings taken by the student in obtaining this measurement.

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(2)

(b) The distance between the centres of spots **A** and **C** and the distance between the centres of spots **C** and **E** are equal.

That is:

$$a + b = c$$

Calculate the percentage uncertainty in the sum of a and b.

percentage uncertainty = _____

(2)

(c) Discuss why the experimental measurements lead to a different percentage uncertainty in c compared to that in $a + b$.

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(2)

(d) Eye protection should be used to prevent eye damage when using a laser.

Describe **one** other safety measure to minimise the risk of eye damage when using a laser in the laboratory.

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(1)

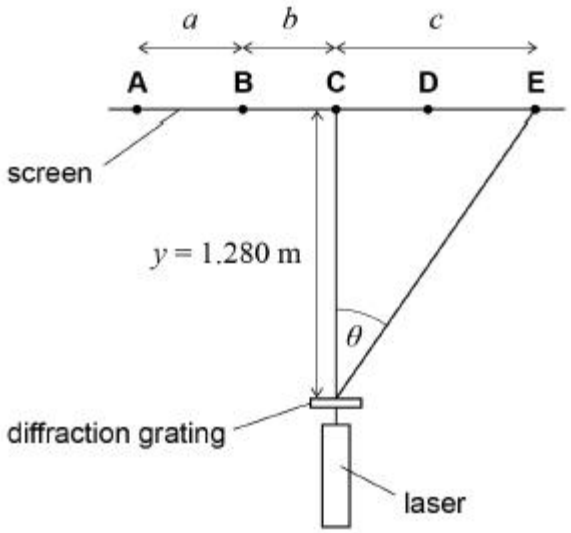
(e) **Figure 2** shows the experimental arrangement with y, the perpendicular distance between the diffraction grating and the screen, equal to 1.280 m.
Table 2 shows some of the data from **Table 1**.

Table 2

Measurement	Distance / mm
a	289
b	255

c	544

Figure 2



Calculate the angle θ shown on **Figure 2**.

θ = _____ degrees

(1)

(f) Spot **E** is the second-order maximum.
The diffraction grating has 3.00×10^5 lines per metre.

Calculate the wavelength of the laser light.

wavelength = _____ m

(1)

(g) The student plans to repeat the experiment using the same diffraction grating and laser.

State and explain **one** way the student can change the experimental arrangement to reduce the percentage uncertainty in the measurement of the wavelength.

Assume the percentage uncertainty in sin θ is the sum of the percentage uncertainties in y and c.

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(2)
(Total 12 marks)