Practice Question Set For A-Level
Subject : Physics
Paper-2 Topic : 5_Waves

Name of the Student:_____
Max. Marks : 22 Marks **Time : 22 Minutes**

Q1.

Barnard's star is a red dwarf star in the vicinity of the Sun. The wavelength of a line in the spectrum of light emitted from Barnard's star is measured to be 656.0 nm. The same light produced by a source in a laboratory has a wavelength of 656.2 nm.

A diffraction grating can be used to analyse the radiation emitted by a variety of sources.

(i) A diffraction grating of known grating spacing is used in a school laboratory to analyse the light emitted by a laser.

Describe how the diffraction grating is used and the measurements that should be taken.

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(ii) A diffraction grating with grating spacing of 2.2×10^{-6} m is used to determine the difference in wavelength for the spectral line emitted by Barnard's star.

Comment on the suitability of using a diffraction grating with this spacing. You should include appropriate calculations.

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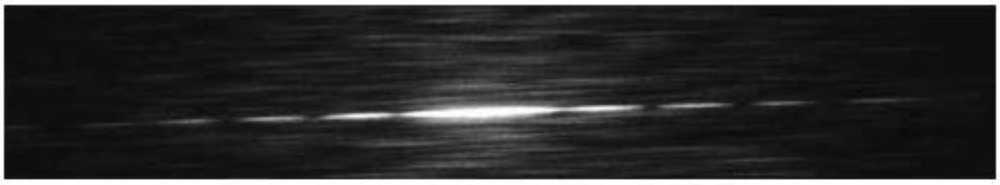
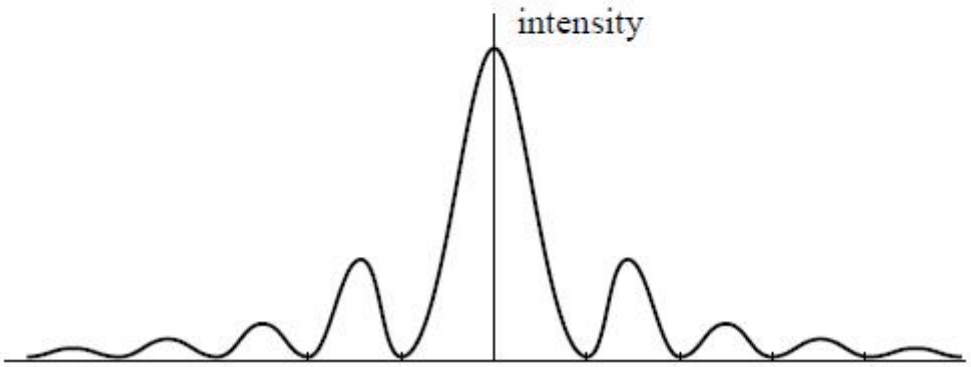
(Total for question = 7 marks)

Q2.

A student obtains the following diffraction pattern on a wall by shining a red laser beam through a single narrow slit.

The corresponding graph of intensity against position is shown below.





(a) Explain how the diffraction pattern is created.

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(b) Explain how the pattern would differ if green laser light were used instead of red laser light.

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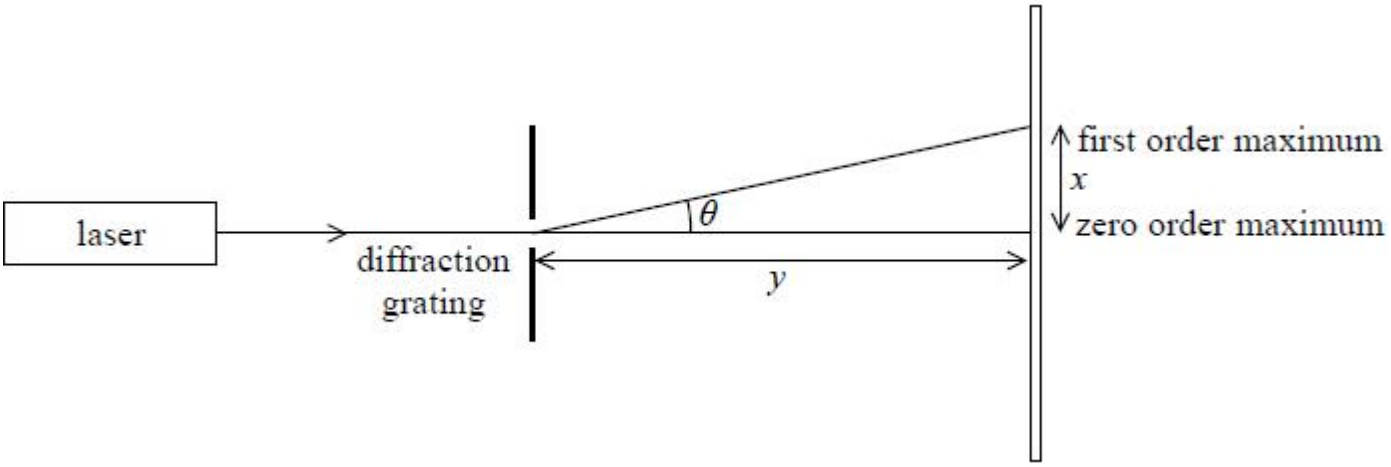
(c) A student replaces the single slit with a diffraction grating and obtains the pattern shown in the photograph.

The photograph shows the zero order maximum and the first and second orders on either side.
The student takes measurements to determine the grating spacing.



The student measures x, the distance between the zero order maximum and the first order maximum, and y, the distance between the slit and the screen.

x = 23 cm
y = 1.5 m
Number of lines per millimetre = 300

Calculate the wavelength of light from the laser.

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Wavelength = ...

(Total for question = 9 marks)

Q3.

The diffraction of light provides evidence for the wave theory of light.

A student carried out an investigation to determine the wavelength of the light emitted from a laser pen.

He shone the light from the laser pen so that it was incident perpendicularly on a diffraction grating. The diffraction grating had 200 lines per mm. He observed the diffraction pattern on a screen 3.00 m away from the grating. The pattern consisted of a series of bright dots.

(i) Give a reason why a laser is a suitable source of light to produce a diffraction pattern.

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(ii) The student measured a distance of 102 cm between the central maximum and the centre of a third order maximum.

The table shows the range of wavelengths for each colour of the visible spectrum.

Colour	Range of wavelength / nm
violet	380 – 450
blue	450 – 495
green	495 – 570
yellow	570 – 590
orange	590 – 620
red	620 – 750

Deduce the colour of the light emitted from the laser pen.

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(Total for question = 6 marks)