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.

Analysing the light from a star allows elements present in its outer atmosphere to be identified because each element produces a distinctive set of spectral lines.

*(a) Describe how a spectral line is produced by a hot gas, explaining why a particular element can only give rise to particular frequencies.

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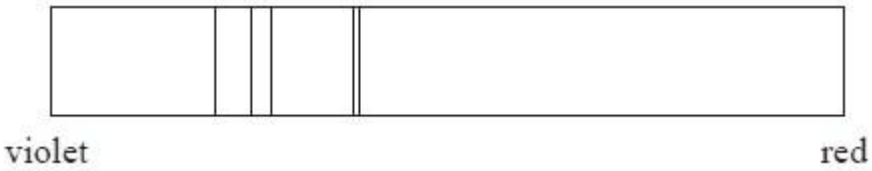
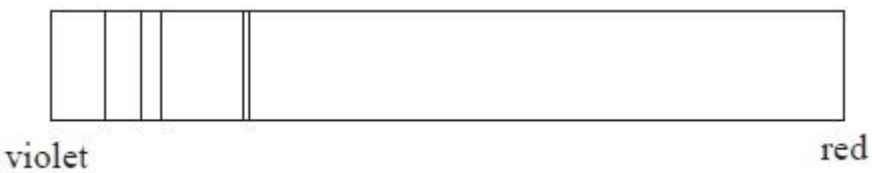
(b) The diagram shows the spectral lines produced by a particular element when observed in a laboratory.



The diagram below shows the spectral lines obtained by analysing the light from a star. This shows the same pattern of lines, but in a different part of the spectrum.



Name this effect and explain what may be deduced about the motion of this star relative to the Earth.

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(c) Suggest what the phenomena in parts (a) and (b) imply about the nature of light.

(1)

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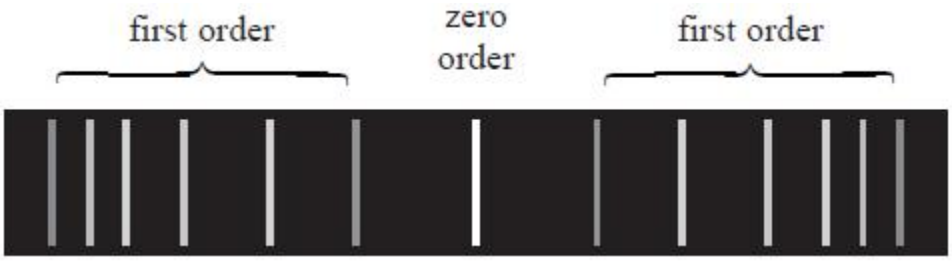
(Total for Question = 10 marks)

Q2.

In a spectrometer, light from a tube of hot gas is passed through a diffraction grating.

The diagram shows the zero order and the first order maxima for the line spectrum produced.



(a) The spectrometer measures the angles between the different lines and the zero order. One of the lines has a wavelength of 650 nm and is observed, in the first order spectrum, at an angle of 19.9° from the zero order.

Calculate the number of lines per metre of the diffraction grating.

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Number of lines per metre = ...

(b) Explain one precaution that could be taken to ensure the accuracy of the measurement of the angle.

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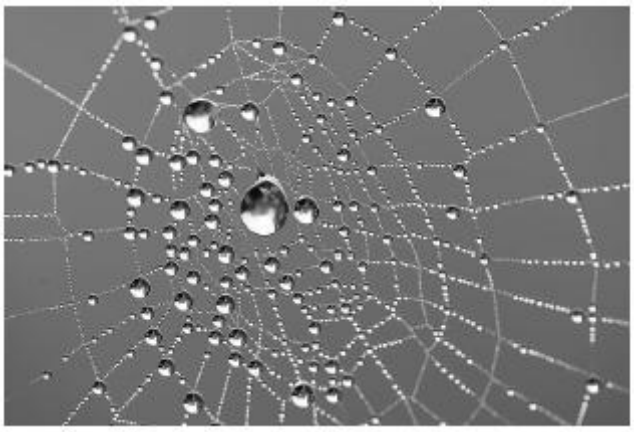
(Total for Question = 5 marks)

Q3.

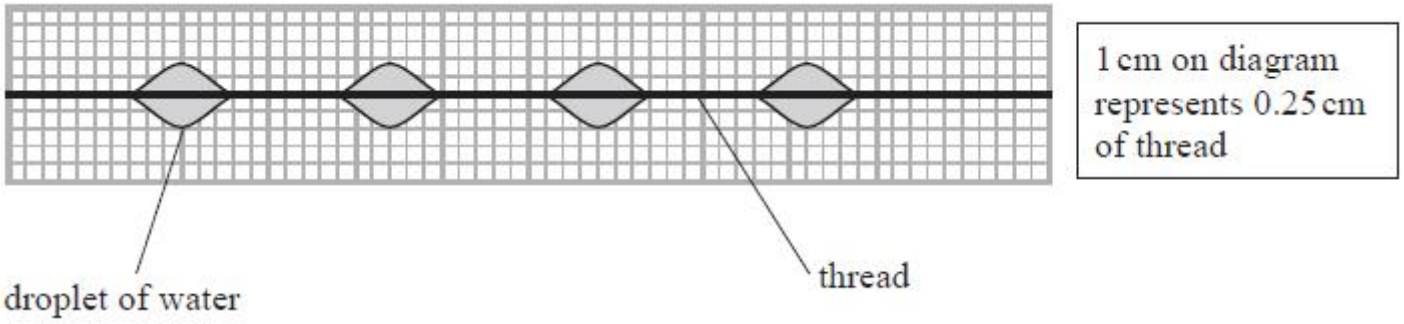
The photograph shows part of a spider's web where water droplets have collected at certain points. The web is made from spider silk which is made by the spider.



Spiders are almost completely dependent on vibrations transmitted through their web for receiving information about the location of trapped insects. When the threads are disturbed by the insects, progressive waves are transmitted along sections of the silk.

It has been suggested that the droplets of water collect at certain points on the web because stationary waves are formed.

The diagram shows water droplets on a single thread of spider silk when the frequency of waves is 7.9 Hz.



Further measurements are taken to test whether the observations are consistent with the presence of stationary waves in the threads.

diameter of the thread = 3.6×10^{-6} m

mass per unit length of the thread = 1.32×10^{-8} kg m^{-1}

Young modulus of spider silk = 1.2×10^{9} N m^{-2}

strain in the thread = 9.7×10^{-9}

Determine, by considering wave speed, whether the measurements are consistent with this suggestion.

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(Total for Question = 7 marks)