

Name of the Student: _____

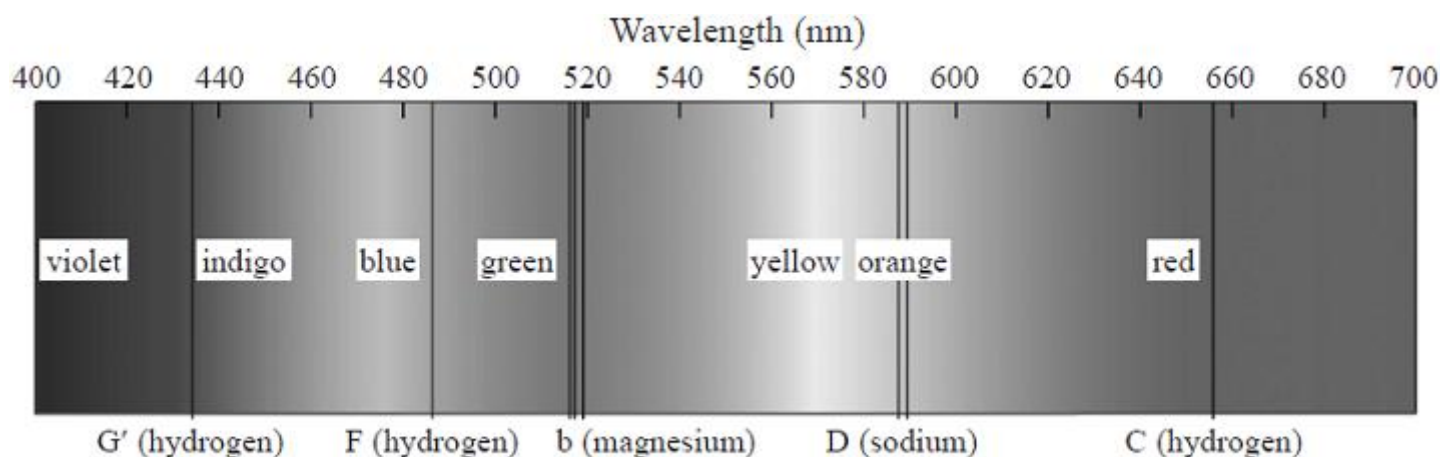
Max. Marks : 22 Marks

Time : 22 Minutes

Q1.

Scientists can analyse light from stars that has passed through a diffraction grating.

A spectrum of the visible light emitted by a particular star is shown.



(Source: © Universal Images Group North America LLC/Alamy Stock Photo)

(i) Light interacts with atoms as it passes through the atmosphere of the star.

Explain how this leads to the formation of the dark lines within the spectrum.

(4)

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(ii) The surface temperature of the star is 5800 K.

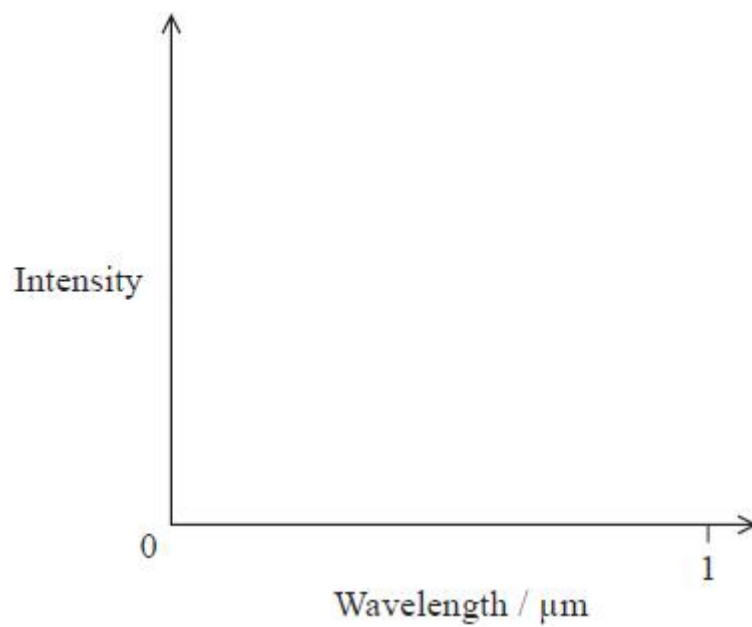
On the axes below, sketch a graph of the intensity of radiation against the wavelength of that radiation for this star.

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(iii) This star is a main sequence star.

Explain why main sequence stars do not collapse due to gravitational forces.

(2)

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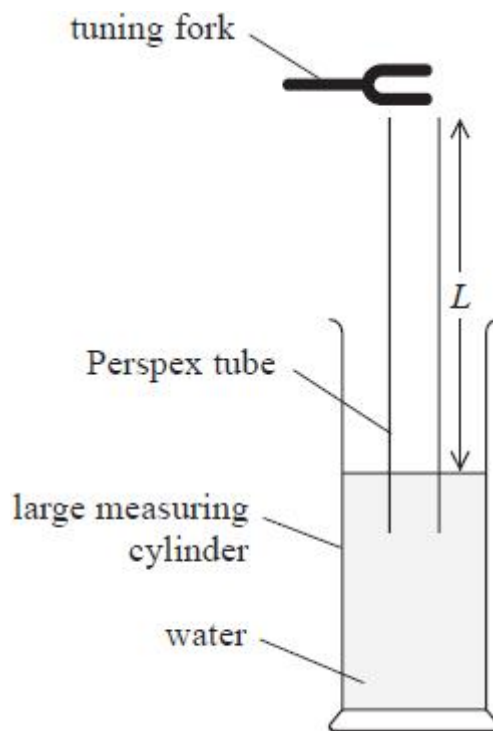
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(Total for question = 10 marks)

Q2.

The speed of sound in air can be determined by creating a standing wave in a column of air. The diagram shows a tuning fork just above the open end of a tube.



The tuning fork produces a sound wave of known frequency f . Several tuning forks are available, each with a different frequency.

A student adjusted the length L of the air column. A loud sound was heard when a standing wave was produced. A node was formed at the water surface, and an antinode was formed at the open end of the tube.

The student used values of L and f to determine a value for the speed of sound.

Describe a graphical method that the student could have used to determine a value for the speed of sound.

(3)

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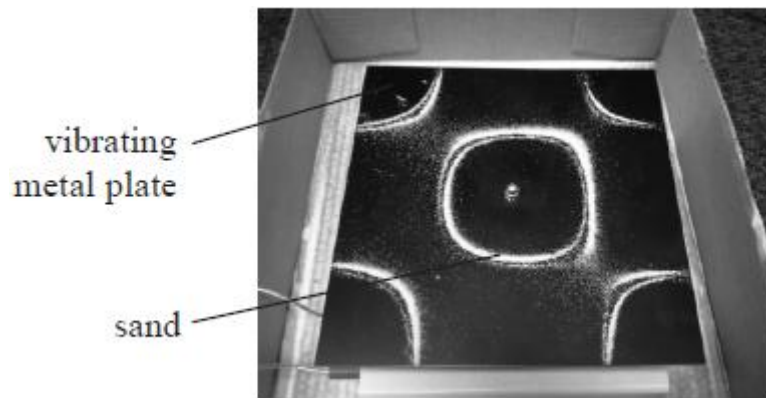
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(Total for question = 3 marks)

Q3.

Rosslyn Chapel is a 15th century chapel in Scotland. Inside the chapel, small sandstone cubes protrude from a number of arches. It has been suggested that carvings on these cubes bear a resemblance to standing wave patterns that can be produced on a vibrating metal plate.

A metal plate is made to vibrate and sand is scattered evenly across its surface. At a certain frequency the sand moves to produce the standing wave pattern shown below.



(Source: <https://skullsinthestars.com/2013/05/02/physics-demonstrations-chladni-patterns/#jpcarousel-7353>)

Explain why the sand moves to different positions when a standing wave is formed on the plate.

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(Total for question = 3 marks)

Q4.

The photograph shows a guitar. The strings of the guitar are at the same tension.



When a string is plucked, a standing wave is set up on the string.

* Explain how a standing wave is set up on a string.

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(Total for question = 6 marks)