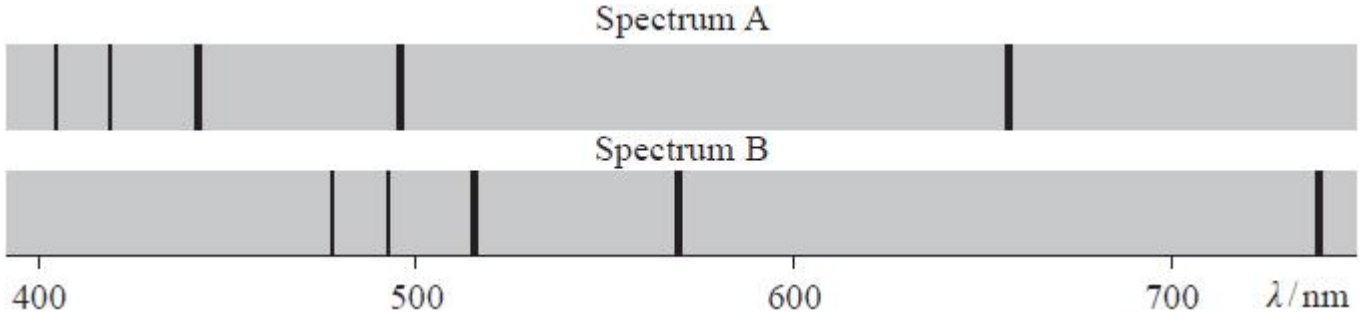
Practice Question Set For A-Level
Subject : Physics
Paper-2 Topic : 10_Space

Name of the Student:_____
Max. Marks : 21 Marks **Time : 21 Minutes**

Q1.

The diagram shows the spectra produced by two stars. Spectrum A is produced from the light from the Sun and spectrum B is produced from the light from a distant star.



The dark lines are produced when light from the core of the star is absorbed by hydrogen atoms in the outer regions of the star. Light is then re-radiated, but in all directions, giving rise to the dark lines in the spectrum.

Explain why the long wavelength lines are shifted by a greater amount than the short wavelength lines.

(2)

.....

.....

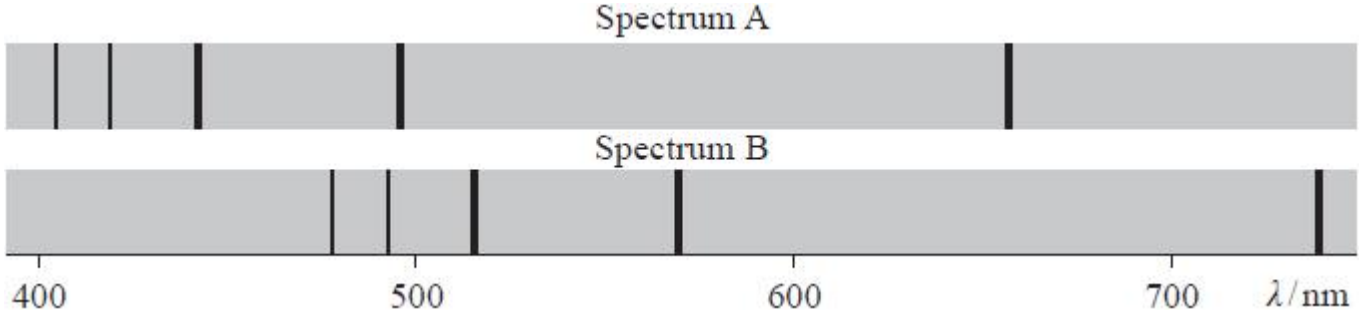
.....

.....

(Total for question = 2 marks)

Q2.

The diagram shows the spectra produced by two stars. Spectrum A is produced from the light from the Sun and spectrum B is produced from the light from a distant star.



The dark lines are produced when light from the core of the star is absorbed by hydrogen atoms in the outer

regions of the star. Light is then re-radiated, but in all directions, giving rise to the dark lines in the spectrum.

One of the lines in the hydrogen spectrum occurs at a wavelength of 656 nm in the laboratory.

Explain what conclusion can be made from the shift in wavelength of this line in spectrum B. Your answer should include a calculation.

(4)

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 4 marks)

Q3.

The photograph below was taken by the James Webb Space Telescope (JWST) and shows a group of galaxies that formed shortly after the big bang, about 13×10^9 years ago.

(Source: © NASA, ESA, CSA, STScI)

(i) Derive the equation $T = 1/H_0$ where T is the age of the universe.

(1)

(ii) State **one** assumption made in your derivation.

(1)

.....

.....

(iii) The parsec (pc) is a unit used for astronomical distances. 1 pc is 3.1×10^{16} m.

The accepted range for the Hubble constant H_0 is (60–80) km s^{-1} Mpc^{-1}.
Deduce whether the observation by the JWST leads to a value of H_0 within the accepted range.
1 year = 3.16×10^7 s

(3)

.....

.....

.....

.....

.....

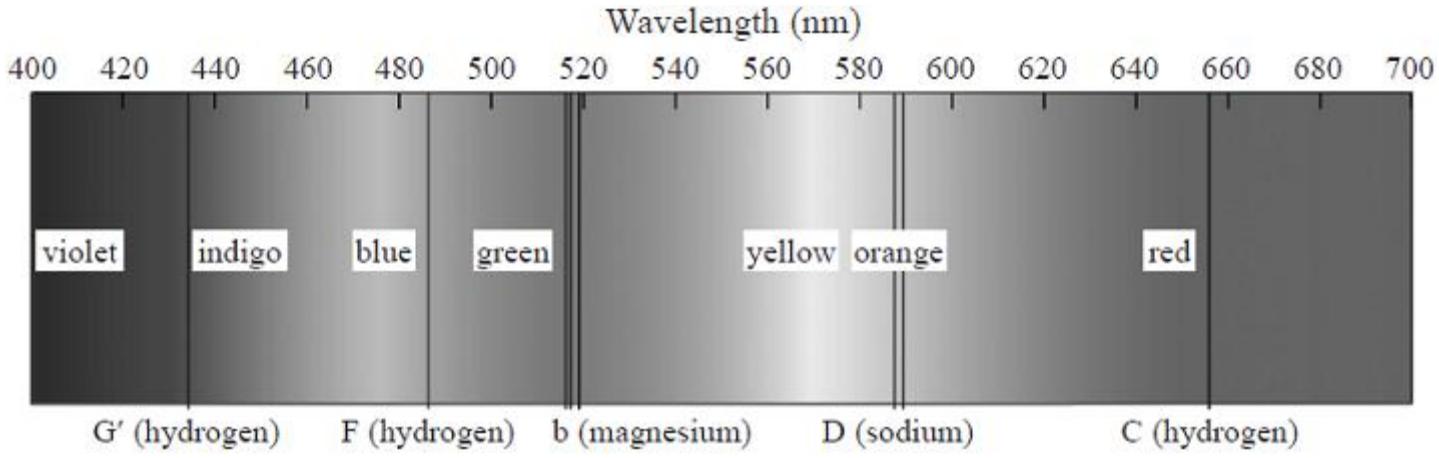
.....

(Total for question = 5 marks)

Q4.

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)

.....

.....

.....

.....

.....

.....

.....

.....

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

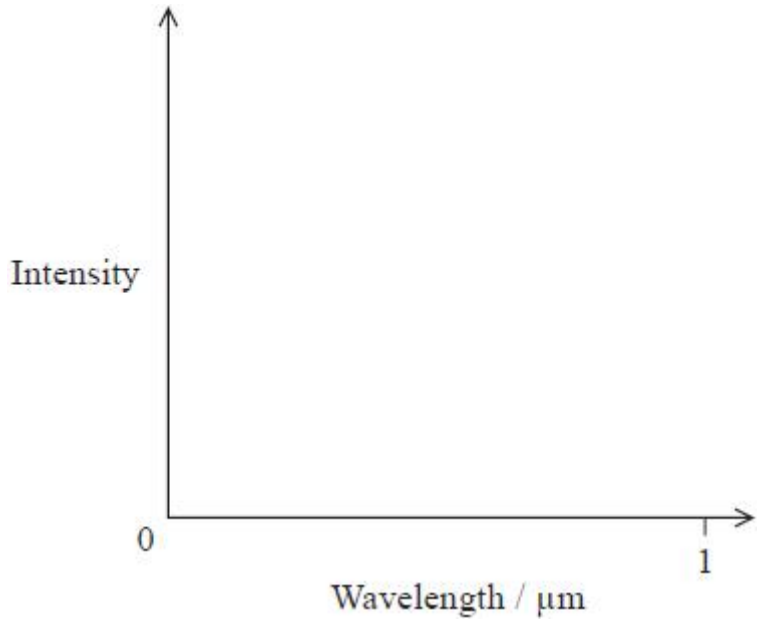
On the axes below, sketch a graph of the intensity of radiation against the wavelength of that radiation for this star.

(4)

.....

.....

.....



(iii) This star is a main sequence star.

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

(2)

.....

.....

.....

.....

(Total for question = 10 marks)