Name of the Student:_____
Max. Marks : 19 Marks **Time : 19 Minutes**

Q1.

The red shift of a galaxy's spectrum can be used to determine its velocity, relative to the Earth.

(a) The wavelength of the hydrogen alpha line in the spectrum of the galaxy NGC 1357 is 660.86 nm. The wavelength of the same line from a laboratory based source is 656.28 nm. Calculate the velocity of galaxy NGC 1357.

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_____

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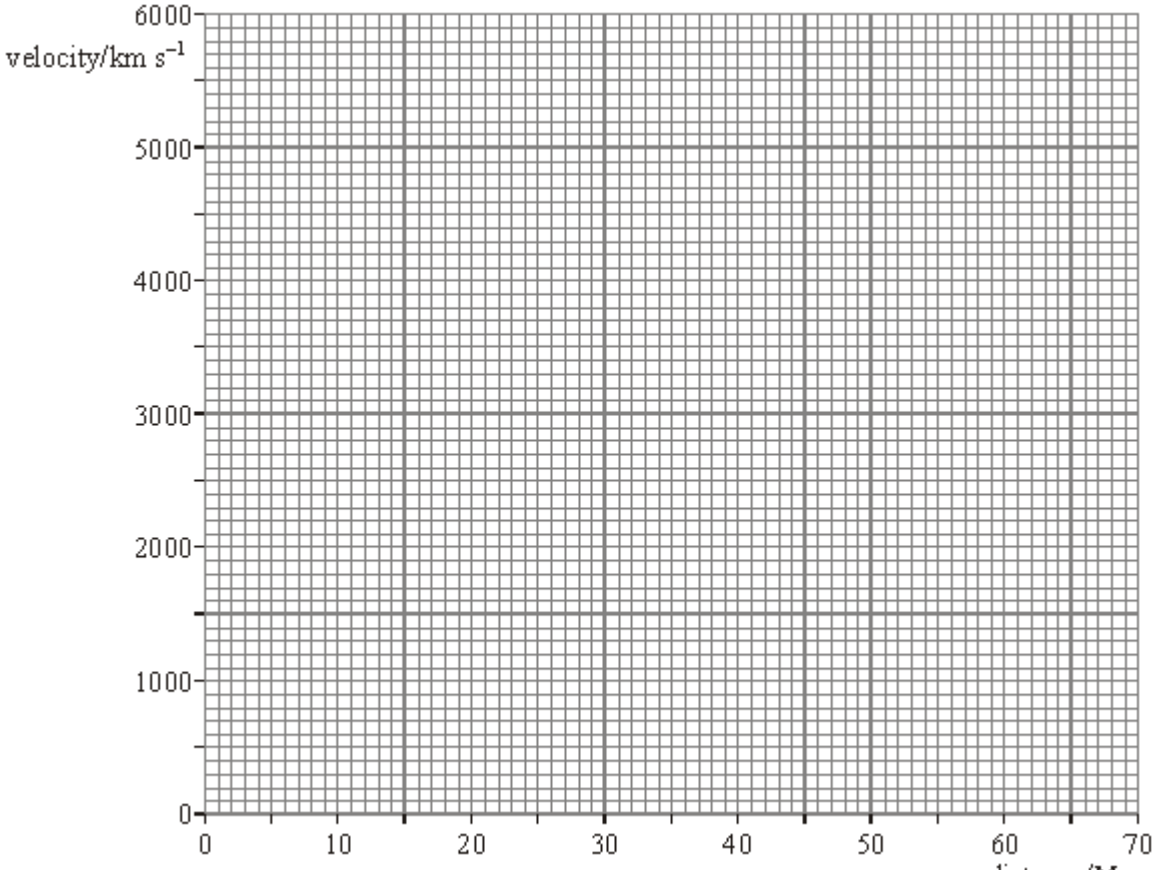
_____

(2)

(b) Use the value obtained in part (a) to complete the table. Plot a graph of the data in the table below and use the graph to determine a value for the Hubble constant.

galaxy	velocity/km s^{-1}	distance/Mpc
NGC 1357		28
NGC 1832	2000	31
NGC 5548	5270	67
NGC 7469	4470	65



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(3)

(Total 5 marks)

Q2.

(a) Draw a ray diagram for an astronomical refracting telescope in normal adjustment. Your diagram should show the paths of three non-axial rays through both lenses.
Label the principal foci of the two lenses.

(3)

(b) **Figure 1** shows an astronomical telescope made from two cardboard tubes of slightly different diameter, two convex lenses of focal lengths 0.10 m and 0.50 m respectively and some modelling clay.

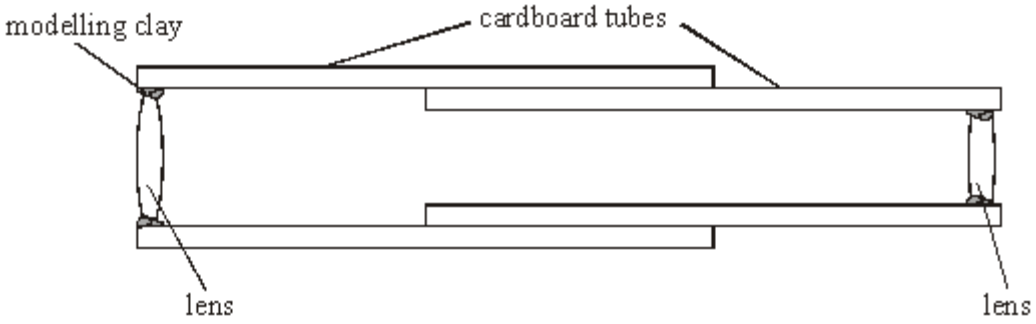

Figure 1

(i) Calculate the distance between the two lenses when the telescope is in normal adjustment.

_____

(ii) The Moon is 380 000 km from the Earth and has a diameter of 3 500 km. Calculate the angle subtended by the image of the full Moon when viewed through the telescope.

_____

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(iii) The telescope suffers from chromatic aberration. Describe how this affects the appearance of the image.

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(4)

(Total 7 marks)

Q3.

Figure 1 shows the black body radiation curves for three stars, labelled P, Q and R.

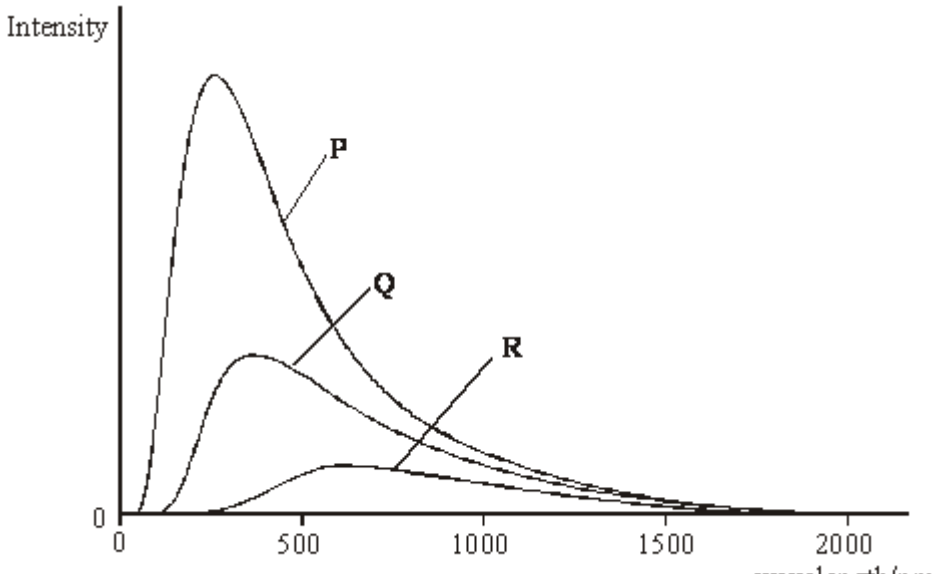

Figure 1

(a) (i) State and explain, without calculation, which one of the three stars is the hottest.

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(ii) Calculate the black body temperature of the hottest star.

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_____

(3)

(b) More detailed analysis of the hottest star's spectrum revealed the presence of Hydrogen Balmer absorption lines.

(i) For which two spectral classes are these lines the prominent feature?

_____

(ii) Describe how these absorption lines are produced in the spectrum of a star.

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(4)

(Total 7 marks)