Name of the Student:_____
Max. Marks : 24 Marks **Time : 24 Minutes**

Q1.

(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) An early form of this telescope was built by Johannes Hevelius. It was 3.7 m long and had an angular magnification of 50. Hevelius used it to help produce one of the earliest maps of the Moon's surface.

(i) Calculate the focal lengths of the objective lens and eyepiece lens in an astronomical telescope of length 3.7 m and angular magnification 50.

focal length of objective lens = _____ m

focal length of eyepiece lens = _____ m

(2)

(ii) The Triesnecker Crater on the Moon has a diameter of 23 km. Calculate the angle subtended by the image of this crater when viewed through a telescope of angular magnification 50 on the Earth.

distance from Earth to Moon = 3.8×10^5 km

angle = _____ rad

(2)

(c) Early refracting telescopes suffered significantly from chromatic aberration. Draw a diagram to show how a single converging lens produces chromatic aberration.

(2)

(Total 9 marks)

Q2.

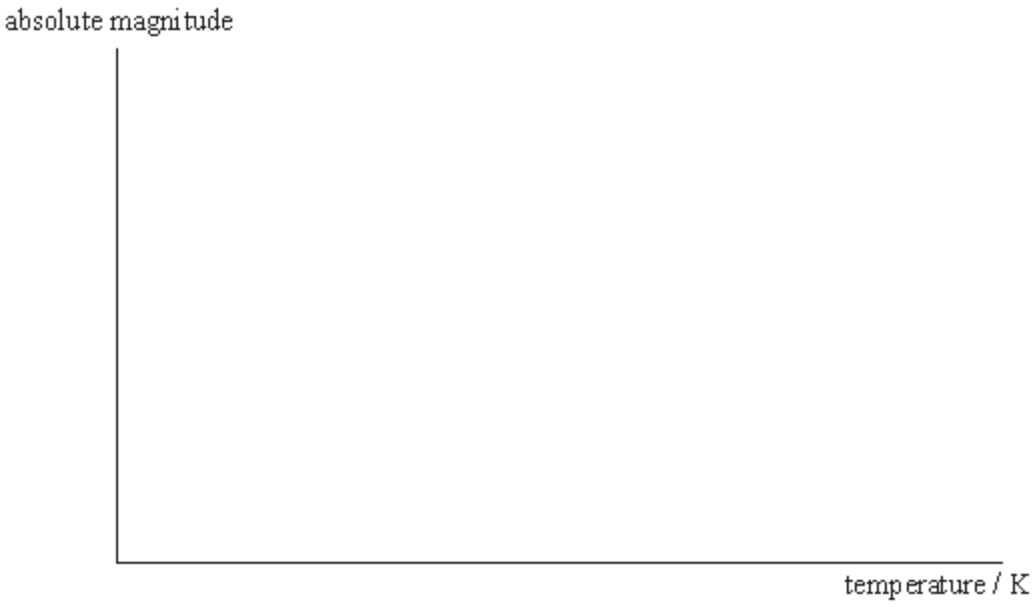
(a) Define the *absolute magnitude* of a star.

_____

_____

(1)

(b) The figure below shows the axes of a Hertzsprung-Russell (H-R) diagram.



(i) On each axis indicate a suitable range of values.

(ii) Label with an S the current position of the Sun on the H-R diagram.

(iii) Label the positions of the following stars on the H-R diagram:

(1) star W, which is significantly hotter and brighter than the Sun,

(2) star X, which is significantly cooler and larger than the Sun,

(3) star Y, which is the same size as the Sun, but significantly cooler,

(4) star Z, which is much smaller than the Sun, and has molecular bands as an important feature in its spectrum.

(7)
(Total 8 marks)

Q3.

(a) The table summarises the properties of five of the stars in the constellation of Cassiopeia.

name	absolute magnitude	apparent magnitude	spectral class
Achird	4.6	3.5	G
Chaph	1.9	2.3	F
Ruchbah	0.24	2.7	A
Segin	–2.4	3.4	B
Shedir	–0.9	2.2	K

Explaining your answer in each case, state which star

(i) is the hottest,

_____

_____

_____

(ii) is likely to appear orange in colour,

_____

_____

_____

(iii) appears the brightest from Earth,

_____

_____

_____

(iv) is less than 10 pc away from the Earth.

_____

_____

_____

(4)

(b) The constellation Cassiopeia contains another star with an apparent magnitude of 2.2, absolute magnitude of –4.6 and a surface temperature of 12 000 K. Calculate, for this star,

(i) its distance from the Earth,

_____

_____

_____

(ii) the peak wavelength in its black body radiation curve.

_____

_____

_____

(3)

(Total 7 marks)