Name of the Student:_____
Max. Marks : 25 Marks **Time : 25 Minutes**

Mark Schemes

Q1.

(a) Distance at which 1AU ✔ subtends an angle of 1/3600th degree ✔

or

Diagram with 1AU, 1pc and 1/3600th degree labelled ✔

Allow 1 arc second for angle
1AU can be shown as Sun Earth distance
1pc can be either long side

2

(b) They are the same spectral class and therefore have similar temperatures. ✔

No mark for the answer on its own.
First mark for identifying same T

They have the same apparent magnitude, but K is significantly further away, therefore K has a greater power output (P)/ brighter absolute magnitude ✔

Second mark for identifying greater P
Condone greater for brighter
Condone luminosity for absolute magnitude

As $P=\sigma AT^4$

to have a greater power output than R at the same temperature, K must have a greater area, and therefore be bigger. ✔

Third mark for use of Stefan's Law to obtain the answer.

3

(c) Substitution into $\lambda_{max}T = 0.0029$ mK ✔

To give $T = 2.9 \times 10^{-3} / 1.0 \times 10^{-6} = 2.9 \times 10^{3}$ K ✔

Condone power of ten errors in first mark

2

(d) The spectral class is related to the temperature✔

So the star is in spectral class M

Allow ecf from (c) – see spec for table of spectral class and temperature

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And is therefore Rasalgethi ✔

The second mark is for the correct class and therefore star identified

2

(e) Rasalgethi

1

(f) Use of m-M = 5 log (d/10)

To give

3.1 – M = 5 log(2.3) ✔

3.1 – M = 1.8 ✔

First two marks are for the substitution of M, m and unit of d and correct log.

Detect one mark for each error; more than two errors give 0/3

M = 1.3 ✔

Third mark for the correct calculation: allow ecf for up to two errors

3

[13]

Q2.

(a) Principal axis drawn and principal foci shown to coincide on it ✔

three non-axial rays drawn correctly with final virtual image shown ✔

PA needs to be drawn

2

(b) Mirrors do not suffer from chromatic aberration, ✔

Mirrors can be larger and therefore have greater collecting powers ✔

Mirrors can be larger and therefore have smaller minimum angular resolution ✔

Parabolic mirrors with axial rays do not suffer from spherical aberration ✔

4

(c) **The mark scheme gives some guidance as to what statements are expected to be seen in a 1 or 2 mark (L1), 3 or 4 mark (L2) and 5 or 6 mark (L3) answer. Guidance provided in section 3.10 of the *Mark Scheme Instructions* document should be used to assist marking this question.**

L3 5−6 marks	clear description of what is meant by apparent magnitude, with discussion of logarithmic scale; explanation of Hipparcos scale in terms of visibility of stars	The student presents relevant information coherently, employing structure, style and sp&g to render meaning clear. The text is legible.
L2 3−4	Either apparent magnitude or Hipparcos scale discussed in	The student presents relevant information and in a way which

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marks	detail, with other not discussed fully or containing errors	assists the communication of meaning. The text is legible. Sp&g are sufficiently accurate not to obscure meaning.
L1 1−2 marks	Either one discussed fully and other not at all, or both discussed with some errors.	The student presents some relevant information in a simple form. The text is usually legible. Sp&g allow meaning to be derived although errors are sometimes obstructive.
0 marks	Little or no discussion of relevant content.	The student's presentation, spelling, punctuation and grammar seriously obstruct understanding.

(d) **The following statements could be present**

- *apparent magnitude is based on how bright a star appears on the Earth*
- *this depends on how bright a star actually is and how far away it is*
- *larger values of apparent magnitude are given to dimmer stars*
- *the difference of 1 on the apparent magnitude scale is associated with a difference in brightness of a factor of 2.51.*

The Hipparcos scale assumed the brightest stars have a magnitude of 1 and the dimmest a magnitude of 6.
Magnitude 1 stars are 100 times brighter than magnitude 6 stars.

Applying apparent magnitude to the Hipparcos scale means that some stars (the brightest) have a negative apparent magnitude.

6

[12]

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