Name of the Student:_____
Max. Marks : 17 Marks **Time : 17 Minutes**

Mark Schemes

Q1.

(a) (i) the brightness of a star as it would appear from a distance of 10 pc ✓

1

(ii) Betelgeuse

Bellatrix is actually a lot brighter than Betelgeuse (the absolute magnitude is a lot more negative), but only appears to be a bit brighter (the apparent magnitude is only a little smaller) so Betelgeuse must be closer ✓

1

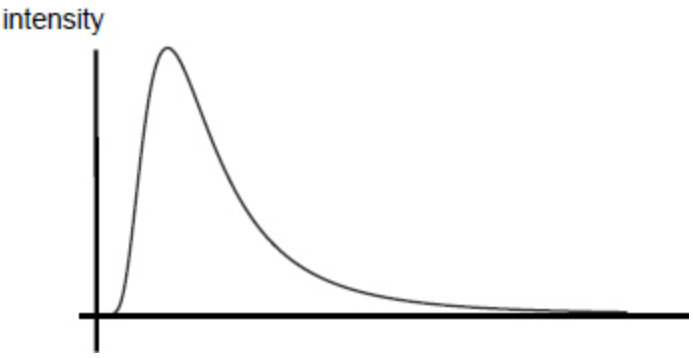
(b) (i) use of $\lambda_{max} T = 0.0029$

gives $\lambda_{max} = 0.0029/22\,000$ ✓

$= 1.32 \times 10^{-7}$ (m) ✓

2

(ii)



steeper LHS than RHS ✓

intensity goes towards zero as the wavelength goes to end of axis ✓

wavelength scale with peak near 130 nm ✓

3

(c) (i) B ✓

1

(ii) helium ✓

1

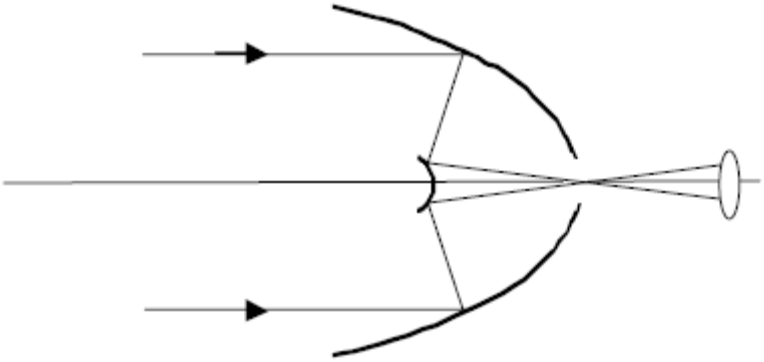
(iii) temperature too low (for atmosphere of Betelgeuse to have hydrogen in n=2 state) ✓

1

[10]

Q2.

(a)



mirrors correct – concave primary and convex secondary ✓

both rays correct to eyepiece ✓

2

(b) (i)

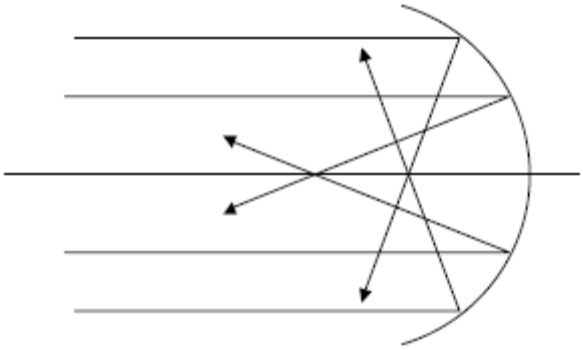


diagram to show two pairs of parallel rays being brought to a focus, those further from the axis being focused closer to the mirror ✓

1

(ii) (use of $\theta = /\lambda/D$)

to give $\theta = 630 \times 10^{-9}/0.15 = 4.2 \times 10^{-6}$ ✓

rad ✓

2

(iii) use of $s = r\theta$

to give $\theta = 4.8 \times 10^{3}/1.4 \times 10^{9} = 3.43 \times 10^{-6}$ ✓

(rad) ✓

claim unlikely to be valid as this angle is smaller than the minimum angular separation calculated in (ii) ✓

2

[7]