Name of the Student:_____
Max. Marks : 18 Marks **Time : 18 Minutes**

Mark Schemes

Q1.

(a) (i) largest distance = 2.57 + 1 = 3.57 AU ✓

$3.57 \text{ AU} = 3.57 \times 1.5 \times 10^{11}\text{m}$

$= 5.36 \times 10^{11}\text{(m)}$ ✓

The first mark is for the correct distance in AU.
The second mark is for the correct conversion to metres. Allow c.e.

2

(ii) angle = s / r

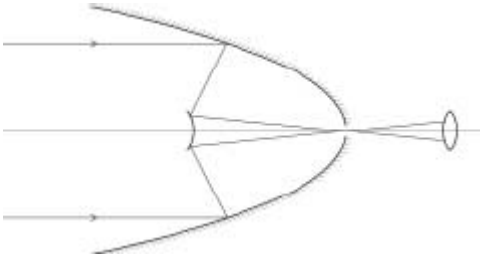
$= 5.4 \times 10^{5} / 1.73 \times 10^{11}$ ✓

$= 3.12 \times 10^{-6}$ (rad) ✓

Working needs to be shown for the first mark.
At least two sf needed for final mark.

2

(b) (i) mirrors correct ✓
primary concave, secondary convex. No shading needed
primary mirror should be continuous i.e. not two mirrors
if no hole, evidence can be given by rays passing through
rays correct ✓
rays must cross after the secondary mirror



The lens does not need to be included.

2

(ii) angular resolution = λ / D $D = 1 \times 10^{-6} / 3.3 \times 10^{-7}$ ✓

D = 3.0 m 2 sf needed ✓

Allow use of factor of 1.22.
Allow 1 sf if justified by discussion of approximate nature of calculation.

2

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(c) minimum angular resolution is better / smaller than the size of the asteroid ✓

The first mark is for qualitative comparison.

details of about 1/10 the angular size of Vesta / 50km can be seen ✓

the second for the quantitative analysis.

2

[10]

Q2.

(a) (i) $\lambda_{max} T = 0.0029$

$$\lambda_{max} = 180 \times 10^{-9} \text{ m} \checkmark$$

$T = 0.0029 / 180 \times 10^{-9}$

$= 1.6 \times 10^{4}$ K ✓

Allow range for wavelength.

170nm to 190nm correct.

150nm to 200nm incorrect but treat as a.e.

Anything else treat as PE –first two marks not awarded.

Allow kelvin for unit. But not degrees kelvin.

3

(ii) $P = \sigma A T^4$

$A = P / \sigma T^4 = 4.2 \times 10^{24} / (5.67 \times 10^{-8} \times (1.6 \times 10^{4})^4)$ ✓

$= 1.1 \times 10^{15} \text{ m}^2$

$r = \sqrt{(A / 4\pi)} = 9.5 \times 10^{6}$ m ✓

Allow c.e. for T from ai.

If formula wrong treat as PE – no marks awarded. Note: this is true if the incorrect equation for A is used within the power equation.

2

(b) (i) dwarf ticked

1

(ii) it has a high temperature ✓

Allow low power output for small.

Allow high power output for large.

but is relatively small, so it will have a low absolute magnitude ✓

Marks can be awarded for ruling out other two.

(this puts it into the bottom left region of the HR diagram)

If white dwarf not ticked in bi :–

Giant stars – cool and big.

Main sequence – either cool and small or hot and big for 2 marks.

Or 'middling temperature and size for 1 mark.

2

[8]

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