Name of the Student:_____
Max. Marks : 26 Marks **Time : 26 Minutes**

Mark Schemes

Q1.

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

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

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

$= 1.6 \times 10^{4}$ 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) $P = \sigma A T^4$

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

$= 1.1 \times 10^{15}$ 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.

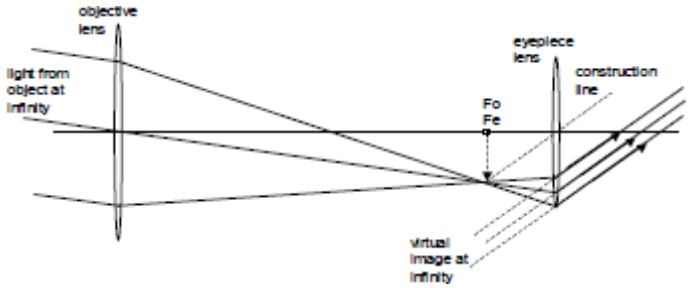
2

[8]

Q2.

(a) Both focal points labelled, on the principal axis, and coincide, with fo>fe ✓
Three <u>off-axis</u> rays through objective lens correct ✓
Three rays through eyepiece correct, parallel to a construction line. ✓

Accept point or length labelled. Allow single point F.
Ignore labels outside the space between the two lenses.
Rays must be off-axis to get the second mark.
Construction line does not need to be drawn.
If only 2 rays drawn, or there is no principal axis, max 2.



3

(b) (i) Using
$f_o + f_e = 21$
$f_o / f_e = 210$ ✓

Evidence of both equations needed for the mark.

Gives
$211\ f_e = 21$
$f_e = 21 / 211 = 0.10$ m
and $f_o = 21$ m (20.9) ✓

Alternative: $f_o = 4410 / 211 = 0.10$ m
If 210 used rather than 211 in substitution, max 1.
If the correct answer is obtained by inspection, max 1.

2

(ii) Large diameter allows fainter objects to be viewed,
(as the collecting power is proportional to d^2) ✓
Larger diameter allows better resolution (as smallest resolvable angle is proportional to 1 / d)✓

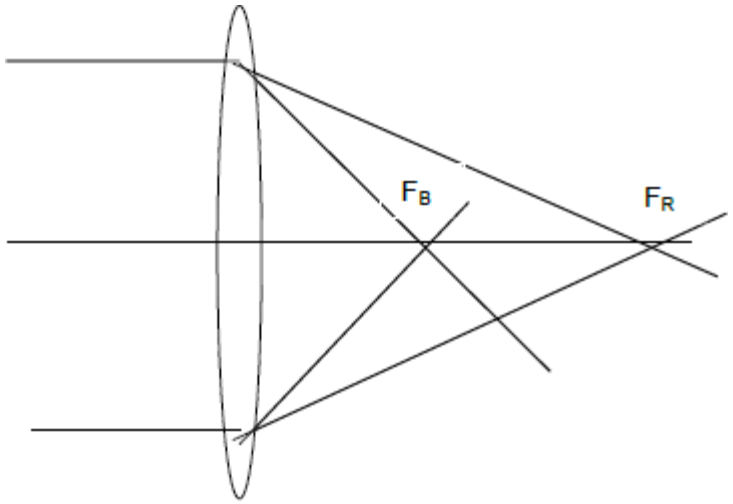
Allow: more light, better collecting power, brighter image, able to see more distant objects (not just further).
Allow references to more detail or clearer images for this mark.
Ignore references to magnification or field of vision.

2

(c) Diagram showing two focal points with blue focal point closer to lens than red focal point.

Colours must be labelled. Allow wavelengths or frequencies if correct way round.
Rays need to be focused.
Allow 1 ray for each colour if principal axis drawn and foci labelled.

If other colours included, they must be correct.
Allow violet for blue.
Incident rays do not need to be parallel to the principal axis.



1

[8]

Q3.

(a) Apparent magnitude at a distance of 10pc

Allow "brightness".
Do not allow luminosity or magnitude.

1

(b) Absolute magnitude from 15 to -10
Temperature from 50 000K to 2500K

Allow 15 to -15.
Allow 50 000 to 3500 K.

2

(c) (i) S at 5700 K and abs mag 5

The position of S should be consistent with the scales on the axes.
Allow ce on scale.
Allow 6000 for T.
If labels not present, or if only correct extreme values on scale, S should be to the right of and below the centre.

1

(ii) W at same abs mag as S, but further to left

Judgements on ii – iv should be based on the position of S. If S is not labelled, it should be based on where S should be.

1

(iii) X at same temperature as S but greater absolute magnitude

1

(iv) Y at same abs mag or above S, on the right hand side of the diagram

1

(d) Similar power output ✓
but is hotter ✓
Ref to $P = \sigma AT^4$ hence W must have smaller diameter than the Sun ✓

Allow luminosity for Power.

Answer must be supported to get the mark.

[10]