

Name of the Student: _____

Max. Marks : 26 Marks

Time : 26 Minutes

Mark Schemes

Q1.

- (a) (i) P has the lowest peak wavelength (λ_{max}) **(1)**
 (since) $\lambda_{max}T = \text{constant}$, lowest λ_{max} means highest T **(1)**
 [or P has highest peak intensity **(1)**
 intensity is power per unit area, or ref to Stefan's law **(1)**]
- (ii) $\lambda_{max} = 300 \times 10^{-9}(\text{m})$ **(1)**
 (use of $\lambda_{max}T = 0.0029$ gives) $T = 9.7 \times 10^3\text{K}$ **(1)** ($9.67 \times 10^3 \text{ K}$)
- (b) (i) A and B **(1)**
- (ii) light from the star passes through the atmosphere of the star **(1)**
 which contains hydrogen with electrons in $n = 2$ state **(1)**
 electrons in this state absorb certain energies and (hence) frequencies of light **(1)**
 the light is re-emitted in all directions, so that the intensity of these frequencies is reduced in any given direction, resulting in absorption lines **(1)**

max 3

max 4

[7]

Q2.

- (a) (i) main sequence correct **(1)**
 Giants and Dwarfs correct **(1)**
 OBAFGKM **(1)**
- (ii) X at G, 5 **(1)**
 line up to Red Giant, down to White Dwarf **(1)**
- (b) (i) temperature and colour [or reference to correct spectral line] **(1)**
- (ii) $\frac{330}{3.26} = 100 (\text{pc})$ **(1)**
- (iii) $m - M = 5 \log \frac{d}{10}$ gives $m - M = 5$ **(1)**
 $M = -2.1$ **(1)**
 (allow C.E. for value of d from (ii))

max 4

(iv) Matar is brighter (but at same temperature) **(1)**

(since $P = \sigma AT^4$), Matar must have larger A, therefore larger **(1)**

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[10]

Q3.

(a) (i) correct shape of graph (steeper on left of peak) **(1)**

(ii) region to left of peak **(1)**

(iii) ozone **(1)**

(iv) lower temperature, shifts peak ($\lambda_{\max}$) to longer wavelengths **(1)** $\lambda_{\max}T = \text{constant}$ **(1)**

max 4

(b) (i) (use of $f = \frac{c}{\lambda}$ gives) $f \left(= \frac{3 \times 10^8}{2.7} \right)_8 \text{ Hz,}$

(in range) **(1)**

(ii) (double) Doppler **(1)**

(iii) (reflection off moving object gives double Doppler),
frequency shift = 150 Hz

$$v = \frac{150 \times 3 \times 10^8}{1.1 \times 10^8} \quad \mathbf{(1)}$$

(allow C.E. for shift = 300 Hz)

= $4.1 \times 10^2 \text{ m s}^{-1}$ (towards each other) **(1)**

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[9]