

10 (a) State Hubble’s law.

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..... [2]

(b) A star in a distant galaxy emits radiation that has a maximum intensity of emission at a wavelength of  $4.62 \times 10^{-7}$  m.

Observations of the galaxy made on the Earth detect the maximum intensity of emission from the star at a wavelength of  $4.91 \times 10^{-7}$  m.

(i) Explain why the observed wavelength and the emitted wavelength have different values.

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..... [2]

(ii) Calculate the speed of the star relative to the Earth.

speed = .....  $\text{ms}^{-1}$  [2]

(iii) The wavelength of maximum intensity of emission is used to determine a value for the surface temperature of the star.

Explain how the temperature determined using the observed wavelength compares with the true value of temperature determined using the emitted wavelength.

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..... [2]

(c) A value for the Hubble constant is  $2.3 \times 10^{-18} \text{ s}^{-1}$ .

Use your answer in (b)(ii) to determine the distance of the star in (b) from the Earth.

distance = ..... m [2]

[Total: 10]