

Question number	Answer	Notes	Marks
8 (a) (i)	idea that star A is closer (to Earth than star C);	allow RA	1
(ii)	star D; (because) it (is the only star that) has a mass (much) larger than the mass of the Sun; (because) it has a much lower value of absolute magnitude;	dependent on 1 <sup>st</sup> mark being awarded dependent on 1 <sup>st</sup> mark being awarded allow lowest value of absolute magnitude 2 marks max. if answer suggests that colour/temperature is relevant	3
(b)	any three from: MP1. (hydrogen) fusion stops (in core); MP2. core collapses; MP3. (which) restarts fusion (in core); MP4. star becomes red <u>supergiant</u> ; MP5. fusion of heavier elements stops (in core); MP6. star explodes (as supernova);	allow runs out of hydrogen allow core contracts allow idea that fusion of heavier elements starts allow super red giant  allow planetary nebula formed	3
(c) (i)	evaluation of change of wavelength; <b>substitution into <math>\Delta\lambda/\lambda = v/c</math>;</b> rearrangement; evaluation of speed;  e.g. $\Delta\lambda = (7.780 - 7.774) = 6 \times 10^{-10} \text{ (m)}$ $6 \times 10^{-10} / 7.774 \times 10^{-7} = v / 3.0 \times 10^8$ $v = 6 \times 10^{-10} / 7.774 \times 10^{-7} \times 3.0 \times 10^8$ (v =) $2.315 \times 10^5 \text{ (m/s)}$	<b>-1 if <math>7.780 \times 10^{-7}</math> used as <math>\lambda</math></b>  $2.314 \times 10^5 \text{ (m/s)}$ gets 3 marks only  allow $2.3 \times 10^5$	4
(ii)	MP1. nearby galaxies show smaller {red-shift / change in wavelength}; MP2. nearby galaxies are travelling slower than further galaxies; MP3. (all light red-shifted) suggests universe is expanding; MP4. suggesting universe was once at a single point;	allow RA  allow RA  allow (all) galaxies are moving away from each other	4

Total for Question 8 = 15 marks