Question number	Answer	Notes	Marks
4 (a) (i)	momentum = mass × velocity;	all standard symbols and rearrangements e.g. m = p / v ignore m, M for momentum	1
(ii)	substitution; rearrangement; evaluation to 2 or more s.f.; e.g. 1100 = mass × 14 mass = 1100 / 14 (mass =) 79 (kg)	 answer of 78 (kg) gets 2 marks only allow 78.6, 78.57… condone 78.5	3
(b)	substitution into F = Δp / t; rearrangement; evaluation; e.g. 15 000 = 1100 / t t = 1100 / 15 000 (t =) 0.073 (s)	ignore not converting kN to N allow use of Δp = (80 × 14 =) 1120 −1 for POT error allow 0.07, 0.0733…, 0.075, 0.0746…	3
(c)	idea that airbag increases the (collision) time; reduces the rate of change of momentum;	 condone slows down change of momentum allow reduces acceleration allow use of equation AND statement that change in momentum is constant (which reduces the force)	2

Total for Question 4 = 9 marks

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 1st mark being awarded dependent on 1st 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 supergiant; 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; substitution into $\Delta\lambda/\lambda = v/c$; rearrangement; evaluation of speed; e.g. $\Delta\lambda = (7.780\text{-}7.774) = 6 \times 10^{-10}$ (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 =) 2.315×10^{5} (m/s)	 −1 if 7.780×10^{-7} used as λ 2.314×10^{5} (m/s) gets 3 marks only allow 2.3×10^{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