

Question number	Answer	Notes	Marks
1 (a)	A (absolute magnitude); B is incorrect because apparent magnitude is how bright the star appears on Earth, regardless of distance C is incorrect because the H-R diagram requires a specific scalar magnitude D is incorrect because the H-R diagram requires a specific magnitude		1
(b)	P: white dwarfs; Q: main sequence; R: red giants;	reject if more than one given reject if more than one given reject if more than one given	3
(c)	idea of the left-hand side; idea that blue/white stars are hottest / hotter than red/orange stars;	allow 'blue' allow use of letter P to indicate left side ignore 'white' allow white dwarfs are hottest	2

Total for Question 1 = 6 marks

Question number	Answer	Notes	Marks
2 (a)	violet;	reject purple, ultraviolet, UV	1
(b)	idea that UV causes mutations/damage (in cells); (leading to) (skin) cancer/blindness;	allow kills cells/tissue, sunburn, burns skin	2
(c) (i)	speed = frequency \times wavelength;	allow standard symbols and rearrangements e.g. $f = v/\lambda$ allow c, v for speed	1
(ii)	substitution OR rearrangement; evaluation; e.g. $300\,000\,000 = f \times 15$ OR $f = v/\lambda$ (f =) $20\,000\,000$ (Hz)	-1 for POT error accept 20 MHz, 20 million (Hz), 20×10^6 (Hz), $2(.0) \times 10^7$ (Hz)	2

Total for Question 2 = 6 marks

Question number	Answer	Notes	Marks
7 (a)	substitution into $F = (mv - mu) / t$; rearrangement; evaluation; e.g. $2.5 = [0.074 \times 3.0 - (-0.074 \times 0.0)] / \text{time}$ $\text{time} = (0.074 \times 3.0) / 2.5$ $(\text{time} =) 0.089 \text{ (s)}$	0.08 scores 2 marks if supported by valid working allow alternative method using $F=ma$ and $a=(v-u)/t$ allow 0.09, 0.0888 (s) condone 0.088 (s)	3
(b)	magnitude = 4.9 (N); direction = right/opposite to car;	ignore East	2
(c)	any two from: MP1. (crumple zone) increases the time (taken to stop); MP2. same momentum change (as car 2); MP3. smaller acceleration; MP4. reference to formula force = change in momentum/time;	allow same velocity change (as car 2) allow deceleration	2

Total for Question 7 = 7 marks