

Question number	Answer	Notes	Marks
5 (a)	any attempt at finding the area/ "area = distance" stated; area of triangle = $\frac{1}{2} \times 4.3 \times 0.2$ (= 0.43 m); area of rectangle = 4.3×0.2 (= 0.86 m); distance = 1.29 (m) ;	accept area of trapezium = $\frac{1}{2} \times 4.3 \times (0.2 + 0.4)$ for MP2 and MP3. count squares; area of 1 square = 0.001 (m); distance = 1.29 (m)	4
(b) (i)	idea that acceleration = gradient; gradient = $(-)4.3 / 0.05$; acceleration = $(-) 86$ (m/s ²);	-1 for POT error	3
(ii)	(resultant) force = mass x acceleration / $F = ma$		1
(iii)	substitution; evaluation; eg $F = 0.13 \times 86$ $F = 11$ (N)	allow ECF from (i) ignore sign 11.18, 11.2	2
(c)	increases time of collision; any reference to shallower gradient on graph; so acceleration will be smaller (in magnitude);		3

(Total for Question 5 = 13 marks)

Question number	Answer	Notes	Marks
9	<p>Any FIVE from:</p> <p>MP1 reference to Doppler effect;</p> <p>MP2 wavefronts are emitted at constant frequency by buzzer;</p> <p>MP3 wavefronts arrive at student (A) further apart than when they were emitted;</p> <p>MP4 distance between wavefronts is the wavelength;</p> <p>MP5 $\text{speed} = \text{frequency} \times \text{wavelength}$;</p> <p>MP6 speed of waves is constant;</p> <p>MP7 as speed is constant and wavelength has increased, frequency must decrease;</p> <p>MP8 decrease in frequency is experienced as a decrease in pitch;</p>	<p>Allow 'wavelength increases' if MP3 or MP4 not awarded</p>	5

(Total for Question 9 = 5 marks)

Question number	Answer	Notes	Marks
10 (a)	$236 - (97 + 135);$ $x = 4;$	answer of 4 scores 2	2
(b)	(fission) releases neutrons; neutrons can be captured by other uranium nuclei; (these nuclei) then undergo fission;		3
(c)	evidence of halving of 72 (kBq); evidence of four half-lives required; e.g. count rate after 4 half-lives is 4.5 (kBq) evidence that four half-lives is equivalent to 60 million years;		3
(d)	Any FIVE from: MP1 Idea of strong containers; MP2 idea that containers can't rust; MP3 idea that rust-proof containers expensive/difficult to manufacture; MP4 reference to security of waste site; MP5 reference to dilution in sea water; MP6 reference to leakage into water table;	accept idea of a location that prevents rust accept low earthquake risk	5

(Total for Question 10 = 13 marks)