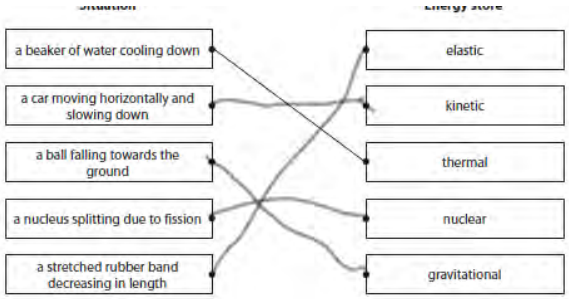
Question number	Answer	Notes	Marks
1 (a)		-1 for each additional line	4
(b) (i)	A - electrical;		1
(ii)	B - light radiation;		1

(Total for Question 1 = 6 marks)

Question number	Answer	Notes	Marks
4 (a)	idea that not doing so means impossible to tell what change caused the change in the dependent;	allow idea of a 'fair test' ignore references to accuracy, reliability	1
(b) (i)	straight line; (line) does not go through origin;	condone linear	2
(ii)	given line extrapolated to x-axis; -300 °C;	accept in range –320 to -280 degrees C	2
(iii)	any THREE from: MP1 (increase in temperature) increases speed/KE; MP2 collisions between walls and particles more frequent/eq; MP3 idea collisions between walls and particles are harder; MP4 idea that force (between wall and particle) is increased; MP5 P=F/A so increased force means increased pressure for same area.		3
(c) (i)	conversion of both temperatures to kelvin scale; substitution; rearrangement; evaluation; e.g. 35 °C and 340 °C→ 308 and 613 K 112 (kPa)/308 = P / 613 P = 613 × 112 / 308 P = 220 (kPa)	-1 for POT error accept 222.909… accept 1088 (kPa) for 2 marks (no conversion of temperature)	4
(ii)	number of {particles/moles/mass/molecules} of gas	accept type of gas	1

(Total for Question 4 = 13 marks)

Question number	Answer	Notes	Marks
5 (a)	any attempt at finding the area/ "area = distance" stated; area of triangle = ½ x 4.3 x 0.2 (= 0.43 m); area of rectangle = 4.3 x 0.2 (= 0.86 m); distance = 1.29 (m) ;	 accept area of trapezium = ½ x 4.3 x (0.2 + 0.4) for MP2 and MP3. count squares; area of 1 square = 0.001 (m); distance = 1.29 (m)	4

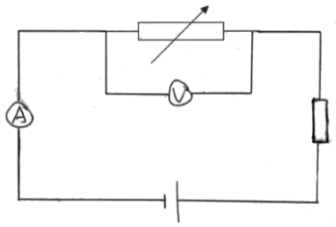
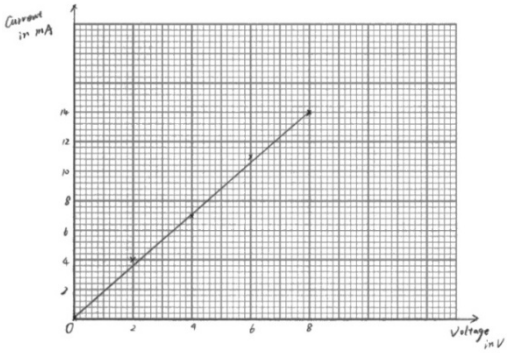
(b) (i)	idea that acceleration = gradient;
	gradient = (-)4.3 / 0.05;
	acceleration = (-) 86 (m/s^2);
		
		-1 for POT error
			3

(ii)	(resultant) force = mass x acceleration / F = ma		1
(iii)	substitution; evaluation; eg F = 0.13 x 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
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)

Question number	Answer	Notes	Marks
12 (a) (i)	correct symbol for resistor; correct symbol for cell; correct symbol for ammeter; circuit is complete series circuit;  	reject extra components allow ECF for missing/incorrect symbols	4
(ii)	voltmeter symbol is correct and in parallel with any component; voltmeter is in parallel with variable resistor;		2
(b)	any FOUR from: stretchy resistor increases in resistance (when mass increased); total resistance increases; I = V/R; current in circuit less; voltage across fixed resistor decreases; so voltage across stretchy resistor increases; as total voltage is constant/voltage of cell constant;	reject V=IR or I=V/R with assumption of constant current	4
(c) (i)	voltage;	allow 'V'	1
(ii)	suitable linear scale chosen (>50% of grid used); axes labelled with quantities and unit; all plotting correct to nearest half square;  	ignore orientation	3
(iii)	correct best fit line judged by eye;		1

(Total for Question 12 = 15 marks)