Physics 2 Summer 2015
Higher Tier

Question Number								
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	1	(a)	(i)		2	Uranium [nucleus] / it absorbs neutron[s] (1) splits into 2 [smaller] nuclei and neutrons [are released] (1)	Atoms Neutron capture Named elements		Force of impact shatters nucleus. Don't accept collides.
			(ii)		2	Slows down the neutrons (1) **so** they can be absorbed / captured by uranium [nuclei] (1) **The 2nd mark can only be awarded if it is linked to the 1st mark.**	For 2nd mark: Split uranium nuclei **or** they cause fission of uranium **or** the reaction of uranium		
			(iii)		2	Fewer or no neutrons absorbed (1) **so** increase [in rate of] fission [of uranium nuclei] (1) **The 2nd mark can only be awarded if it is linked to the 1st mark.**	For 1st mark: So more neutrons available for fission		Taken out / removed / more energy released
		(b)	(i)		3	Ticks in the 2nd, 3rd and 4th boxes A nucleus of U-230 least number of neutrons (1) ✓ A nucleus of U-235 contains 143 neutrons (1) ✓ A nucleus of U-234 contains 92 protons (1) ✓			Extra tick attracts -1
			(ii)		2	234 (1) $^{234}_{92}U$ (1) as shown here			
		Total Mark			11				

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
	2	(a)	(i)		2	**No credit is given for just naming the radioisotope** **Astatine** Alpha particles highly ionising **or** easily absorbed [by cancer cells] **or** would not penetrate beyond the tumour [to affect healthy cells] (1) It decays [to a safe level] quickly or equivalent (1) **Alternative solution:** **Tellurium** Beta penetrates all of the tumour (1) It decays [to a safe level] quickly or equivalent (1)	Alpha is not able to spread far [The source] won't last long in the body		**Answers for any other radioisotope** Attacks / kills the cancer cells the best. It is highly ionising. Any statement implying that it leaves the body quickly / the half-life is short.
			(ii)		2	**Cobalt / Caesium** Beta / gamma will penetrate the packaging/box **or** kills bacteria (1) It won't need replacing for a long time / it lasts a long time (1)			It has a long half-life
		(b)	(i)		1	5			
			(ii)		2	288 – 144 – 72 – 36 – 18 - 9 Process of halving from 288 (1) 5 times to arrive at 9 (1) **ecf**	Answer only of 9 **gets 2 marks**		An incorrect answer with no workings shown e.g. 18 except for 4 half-lives in (b)(i) which gets 2 marks
		Total Mark			7				

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
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	3				6	**Indicative content:** If the vehicle is travelling faster then the thinking distance is increased and the braking distance is also increased. This means that the overall stopping distance is greater (or the converse for a vehicle travelling more slowly). If the brakes are worn (or poor road surface conditions) the thinking distance is unaffected but the braking distance is increased. This again leads to an increased stopping distance (or the converse for new brakes). If the driver has drunk alcohol or is tired the reaction time is bigger and so the thinking distance is greater. Although the braking distance is unaffected the overall stopping distance is greater. **5-6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.			
		Total Mark			6				

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
	4		(i)		2	Repeat <u>the</u> experiment / gather more data (1) and if the current values or results are <u>close to the first set</u> of readings [the results are repeatable] (1) **The 2nd mark can only be awarded if it is linked to the 1st mark.**	Or opposite comment		
			(ii)		3	As the length doubles the current is halved (1) V is constant (1) so the resistance doubles (1) **Alternative solution:** For a length of e.g. 10 cm, R = 2 Ω and for a length of e.g. 30 cm, R = 6 Ω (2) therefore tripling l, triples R (1) **For 2 marks, the first and third statements need to be linked**	When the length doubles the current is halved (1) since resistance is inversely proportional to current this agrees with the statement (1)		As length increases, current decreases so resistance increases
			(iii)		3	Points plotted within ± ½ small square division (2) (-1 mark for each incorrect plot to a maximum of 2 marks) Curved line of best fit ± one small square division of each point within the range 20 - 75 cm (1)			Line joined dot to dot, whispy lines, double lines
			(iv)		2	Award 2 marks for <u>inversely</u> proportional Award 1 mark for as the length increases current decreases	If length doubles, current is halved **gets 2 marks** Decreases at a decreasing rate **gets 1 mark**		Directly proportional. In a non-linear way for the 2nd mark

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			(v)		4	0.2 A identified from the graph (1) will be dependent on their graph line $R = \frac{V}{I} = \frac{1.8}{0.2}$ = 9 [Ω] (1) **ecf** on 0.2 A So $\frac{9}{45}$ = 0.2 Ω/cm (1) **ecf** on 9 [Ω] Yes or No must be consistent with their answer (1) **Alternative solution:** V = 0.2 (1) × 0.2 = 0.04 V cm^{-1} (1) 0.04 × 45 cm = 1.8 V (1) So correct V (1) **Alternative solution:** R = 0.2 (1) × 45 = 9 Ω (1) $I = \frac{V}{R} = \frac{1.8}{9}$ = 0.2 A (1) So correct value for I (1)	0.2 A identified from the graph (1) will be dependent on their graph line Resistance = 0.2 × 45 = 9 Ω (1) $V = IR$ = 0.2 × 9 = 1.8 V (1) Yes because that was the voltage used (1)		$V = IR$ = 0.2 × 45 = 9 Ω
		Total Mark			14				

Question Number									
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	5	(a)	(i)		2	$P = VI$ = 120 × 5 (1) = 600 [W] (1)			
			(ii)		1	9 000 [J]	9 if k placed before J		9 kJ if given J not crossed out
			(iii)		2	GPE = mgh = 50 × 10 × 14 (1) = 7 000 [J] (1)			
			(iv)		1	Lost as heat / due to friction / energy to lift blocks and hook			Lost to atmosphere / energy wasted / energy lost / air resistance
		(b)	(i)		2	50 (1) × 10 = 500 [N] (1)	$F = \frac{W}{d}$ $= \frac{7\,000(1)}{14}$ = 500 [N] (1)		$\frac{9\,000}{14}$ Substitution of 50 into the PE equation
			(ii)		2	Resultant / unbalanced force (1) so velocity increases / object accelerates (1) **The 2nd mark can only be awarded if it is linked to the 1st mark.**			Statements of Newton's laws Reference to air resistance
			(iii)		3	Change in GPE = gain in KE (1) KE = ½ mv^2 => v^2 = $\frac{2\text{KE}}{m}$ (1 rearranged) **ecf** from (a)(iii) $\frac{2 \times 7\,000}{50}$ = 280 [m^2/s^2] => v = 16.7 [m/s] (1)	Answer of 17 [m/s]		7 000 substituted into any equation other than an energy one
		Total Mark			13				

Question Number								
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	6	(a)			3	Area: (½ × (60 × 30)) + (60 × 35) + (½ × (60 × 15)) So: (900 + 450) (1) - triangles + 2 100 (1) - rectangle = 3 450 [m] (1) **Alternative solution:** Area of a trapezium = ½ × (80 + 35) (1) × 60 (1) = 3 450 [m] (1)			
		(b)			6	**Indicative content:** In the first 30 s there is a resultant force acting in the forward direction which makes the passenger accelerate. Calculations to show the acceleration is 2 m/s^2 and the force is 140 N. Between 30 and 65 s the speed is constant so the resultant force is zero. For the last 15 s the there is a resultant force opposite/backward causing the passenger to decelerate to zero. Calculations to show the deceleration is 4 m/s^2 so the force is 280 N. **5-6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.			
		Total Mark			9				