GCSE Science – Physics P2 Mark Scheme

January 2014

FOUNDATION TIER

Question			Marking details	Marks
1.	(a)	(i)	Second box ticked	1
		(ii)	Second box ticked	1
	(b)		Arrow pointing up (can be anywhere)	1
	(c)	(i)	20 – 5 = <u>15</u> [N]	1
		(ii)	$\dfrac{15(\text{ecf})}{0.5}(1) = 30[\text{m/s}^2]$ (1)	2
			Question total	**[6]**
2.			slow neutrons (1) fission (1) moderator (1) neutrons (1) control rods (1)	5
			Question total	**[5]**
3.	(a)	(i)	D	
		(ii)	C	
		(iii)	C	
		(iv)	D	4
	(b)		50 x 70 (1 – substitution) = 3 500 [kg m/s] (1) **ALTERNATIVE:** 55 x 70 = 3 850 **and** 5 x 70 = 350 (1) 3 500 [kg m/s] (1)	2
			Question total	**[6]**

Question			Marking details	Marks
4.	(a)	(i)	$\frac{4}{2}$ (1) = 2 [Ω] (1)	2
		(ii)	2 x 4 (1) = 8 [W] (1)	2
		(iii)	2 [A]	1
	(b)	(i)	Decreases (1) stays the same (1)	2
		(ii)	Increase	1
	(c)		Bulbs can be switched separately / don't go out if one breaks (1) bulbs stay bright [when more added] / same voltage / current doesn't decrease or resistance doesn't increase (1) **OR** converse arguments about series circuits	2
			Question total	**[10]**
5.	(a)		Braking [distance]	1
	(b)	(i)	[Thinking distance] increases with speed (1) in proportion / in a linear manner / uniformly (1)	2
		(ii)	Increase it (no reference to time)	1
		(iii)	Steeper line shown through the origin (accept a curve provided always above the given line)	1
	(c)	(i)	13 [m/s]	1
		(ii)	8 [s] accept 6.8 [s]	1
		(iii)	B (1) because time is short<u>est</u> / area under graph small<u>est</u> / big<u>gest</u> deceleration / steep<u>est</u> line (accept steeper than others) / big<u>gest</u> gradient / stops in <u>only</u> 5 s (1) Neutral – longest or shortest gradient Don't accept – stops at 5 s or steeper rate	2
			Question total	**[9]**

Question				Marking details	Marks
6.		(i)		$a = \frac{(0-15)}{5}$ OR $a = \frac{(15-0)}{5}$ (1 – subs) = -3(1 – ans) [m/s^2] Answer does not require a negative sign.	2
		(ii)	(I)	Mean speed $= \frac{(15+0)}{2} = 7.5$ (1 – subs), (1 – ans) [m/s]	2
			(II)	EITHER: Mean speed would have remained the same (1) because it is the sum of two values that will not have changed (divided by two) (1). OR: The distance taken to stop would have increased but the time taken would have also increased (1) so it is difficult to conclude how the mean speed would have changed. (1) OR: Mean speed would remain the same (1) because distance and time increase. (1) **Either mark can be awarded on its own but only award 2 marks if they are linked.**	2
				Question total	**[6]**
7.	(a)	(i)		[Same] <u>number</u> (accept amount) <u>of protons</u> / <u>53 protons</u> / [same] <u>proton number</u> / Don't accept: same number of protons and electrons or same atomic number or 53 or reference to the mass number being equal to 53.	1
		(ii)		[Different] number of neutrons / nucleons Accept [different] number of protons and neutrons / one has 70 neutrons and the other has 78 neutrons. Don't accept different mass numbers or 123 and 131.	1
	(b)	(i)		[fast moving / high energy] electron (accept slow electron) Don't accept positive electron.	1
		(ii)		$I \rightarrow \,^{131(1)}Xe + \,_{-1(1)}\beta + \gamma$	2
	(c)			Gamma is less ionising (1) so is easily detected outside of the body / penetrates the body or skin well / is less harmful (1). OR because beta would be more ionising (1) so is less penetrating / less likely to get out of the body / more harmful (1). OR Iodine-123 has a shorter half-life [13 hours] (1) so it <u>decays</u> quicker (1) don't accept escapes quicker **Either mark can be awarded on its own but only award 2 marks if they are linked.**	2
	(d)	(i)		Plots (2) allow ± ½ small square division (deduct 1 mark for each incorrect plot) smooth curve (1) allow **ecf** Don't accept double lines /whispy / thick / disjointed / wobbly lines.	3
		(ii)		Lines/points on grid from 12 <u>and</u> 3 to the curve or down to time axis (1) time interval of 16 [days] ± 1 [day] / equal to two half-lives (1). Apply **ecf** for the graph.	2
				Question total	**[12]**

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Question	Marking details	Marks
8.	**Indicative content:** Name of air bag, seat belt, head rest or crumple zone. **Explanation in terms of forces:** The seat belt is slightly stretchy, the air bag is soft and can be pushed in. The front crumple zone is designed to collapse in a head-on collision. They all increase the time taken for the occupant to come to rest in a collision. This reduces the force acting on an occupant since the force acting to stop a person is inversely proportional to the time taken, given that the final speed is zero in all cases. Smaller force implies less chance of an injury. $\{F = \frac{m(v-u)}{t}$ or $a = \frac{(v-u)}{t}\}$ (**For head rest answer only**) It squashes to provide a forward force to prevent recoil of the head. The force of the head rest on the head decelerates its backward motion. **Explanation in terms of energy:** All 3 aspects of car safety increase the distance that the occupant travels before coming to rest. The kinetic energy of the occupant is reduced to zero by work being done on the person. Work is the product of force and distance, so by increasing the stopping distance, the force acting is reduced, resulting in less chance of an injury. (*W=F* x *d)* (**For head rest answer only**) The recoil distance travelled by the head is small, so head rest is strong enough to apply sufficient force to reduce the kinetic energy of the head to zero through its work done. **Explanation in terms of momentum:** All three aspects of car safety increase the time taken to bring the occupant to rest. That means that the rate of change of momentum is reduced, which in turn reduces the force on the occupant ($F = \frac{\Delta p}{t}$) (**For head rest answer only**) Head's momentum is brought to zero in a small time so head rest must be strong enough to do this. **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.	6
	Question total	**[6]**
	FOUNDATION TIER PAPER TOTAL	**[60]**