GCSE Science - Physics 2

Marking Scheme - Summer 2014

HIGHER TIER

Question				Marking details	Marks
1.	(a)	(i)		0.8 [s]	1
		(ii)		3.2 [s] (allow **ecf** from (i)) If answer is 3.2 in (i) then **don't accept** 0.8 as **ecf** in this part.	1
		(iii)		subs $\frac{15}{3.2(\text{ecf})}$ (1) = 4.69 or 4.7 or 4.6875 [m/s^2] (1) Ignore the signs. **Don't accept** 4.68 or 4.687. A common **ecf** is $\frac{15}{4.2}$ = 3.57 or 3.6	2
		(iv)		Horizontal line would be longer (1) because the reaction (or thinking) time (or distance) would be longer / would travel further [at constant speed] / slower reactions (1) **Don't accept** slower reaction time **To award both marks both statements must be linked.**	2
		(v)		Less steep graph / sloping line is longer (1) because braking distance (or time) increases / takes longer to stop / smaller deceleration / less friction or grip (1) **Don't accept** not as fast to mean a greater braking distance. **Accept** slippery road. **To award both marks both statements must be linked.**	2
	(b)	(i)		250 **and** 24 from graph (1) subs 250 × 24 (1) = 6 000 [J] (1)	3
		(ii)		6 000 [J] (**ecf**)	1
				Question total	**[12]**

Question				Marking details	Marks
2.	(a)	(i)		38 (1) 2 (1)	2
		(ii)		Neutrons produced [go on to] cause more reactions **or** collisions **or** bombards (1), number of neutrons doubles (accept increase / multiply / triple) [each time] (1) Treat reference to fast neutrons as neutral. N.B. reference to 3 neutrons could arise from the equation above. **To award both marks both statements must be linked.**	2
	(b)			They contain same number of protons / 1 proton (1) but different number of neutrons / 1 neutron and the other has 2 neutrons (1) Reference to electrons loses 1 mark. **Don't accept** nucleons / mass number / atomic number	2
	(c)			**Indicative content:** In fission a heavy element such as [U 235] absorbs a neutron and splits into lighter nuclei [releasing energy]. In fusion, light elements [such as hydrogen isotopes] collide [in high energy collisions and join together] to produce a heavier element, [also releasing energy]. The main problem with nuclear fission is that it produces waste products which are highly radioactive for a long time. The main problem with nuclear fusion is that it requires very high temperatures and pressures which need lots of energy so it is not yet easily contained. **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	**[12]**

Question				Marking details	Marks
3.	(a)	(i)		Emits an electron	1
		(ii)		It is the time taken to halve / it takes 5 720 years to halve(1) the number of C-14 nuclei (or atoms) / the mass (or amount) of C-14 / the activity / count rate (1) Treat radioactivity as neutral.	2
	(b)			$^{14}_{7}N$ (2) $^{0}_{-1}e$ (1) beware of missing minus sign	3
	(c)	(i)		It takes 4 half-lives (1) so time = 4 × 5 720 = 22 880 [years] (1)	2
		(ii)		100 years is only a [small] fraction or $\frac{1}{57}$ of a half-life (1) so difference in C-14 readings will be small / won't have decayed by very much (1) **To award both marks both statements must be linked.**	2
				Question total	**[10]**
4.	(a)			Initially weight is greater than air resistance [so he accelerates] (1) as he goes faster air resistance increases (1) eventually the forces balance (1) **To award all 3 marks the third statement written down must be linked to one of the previous two statements.**	3
	(b)	(i)		Change in momentum = 118 × 373 (1) = 44 014 [kg m/s] (1)	2
		(ii)		Resultant force = $\frac{44014}{42}$ (1) = 1 048 [N] (1) **ecf** from (i) OR use of $F = ma$ = 118 × 8.9 (1) = 1 050 [N] (1)	2
		(iii)		W = 118 × 10 = 1 180 N (1) Air resistance = W – resultant force or 1 180 – 1 048 (1) = 132 [N] (1) **ecf** from (ii) & on weight N.B. **Answer mark awarded only** if correct sign present e.g. 118 – 1 048 (1) = - 930 [N]	3
	(c)			Air resistance force small (1) because in contact with small number of air particles [per second] / so need to go very quickly for air resistance to balance weight / so need to go very quickly to reach terminal velocity (1) **To award both marks both statements must be linked.**	2
				Question total	**[12]**

Question				Marking details	Marks
5.	(a)			**Indicative content:** Diagram showing the lamp connected in series with an ammeter, a variable power supply **or** a power supply with a variable resistor. A voltmeter is connected in parallel across the lamp. A pair of readings is taken from the ammeter and voltmeter. The variable resistor is adjusted [to vary the voltage across the lamp] and another pair of readings is taken. This is repeated. Results are plotted on a graph and the variation in resistance can be determined by how the slope changes **OR** the resistance of the lamp is calculated for each set of readings by using $V=IR$. **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
	(b)	(i)		Scales (at least ½ of each axis used) (1) plots (allow ± ½ small square division) (1) smooth curve allow ± ½ small square division (1) allow straight line between 0 and 2 and between 2 and 6 but expect a curve between 6 and 10. **Don't allow** wispy, wobbly, thick lines	3
		(ii)		Current from their graph (i.e. 1.6 A) (1), substitution (1), answer = 3.1 [Ω] (1) **ecf**	3
		(iii)		R must be increasing (1) Graph becomes less steep / as voltage increases, current increases less and less / an alternative method would be calculating another value of R (1) **To award both marks both statements must be linked.**	2
				Question total	**[14]**
				Higher tier paper total	**[60]**