Mark Scheme (Final)

Summer 2017

Pearson Edexcel GCSE

In Physics (5PH2F 01) Paper 01

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question number	Answer	Acceptable answers	Marks
1 (a) (i)	☒ **A** velocity **The only correct answer is A** **B** is not correct because mass is a scalar quantity **C** is not correct because KE is a scalar quantity **D** is not correct because distance is a scalar quantity		**(1)**

Question number	Answer	Acceptable answers	Marks
1 (a) (ii)	substitution 70.0 x 2.4 (1) evaluation 168 (N) (1)	award full marks for correct answer with no working 170 (N) accept power of 10 error for 1 mark e.g. 16.8 or 17 (N) do not accept 70 x 2.4^2	**(2)**

Question number	Answer	Acceptable answers	Marks
1 (b) (i)	☒ **B** **The only correct answer is b** **A** is not correct because the cyclist is accelerating **C** is not correct because the cyclist is decelerating **D** is not correct because the cyclist is decelerating		**(1)**

Question number	Answer	Acceptable answers	Marks
1 (b) (ii)	substitution 12(.0) ÷ 4(.0) (1) evaluation 3.0 (m/s^2) (1)	award full marks for correct answer with no working accept any correct substitution from line e.g. 15(.0) ÷ 5(.0) or 18 /6 OR any numbers that lead to an answer in the range 2.8 to 3.1 3 (m/s^2) allow BOTH marks for an answer in the range 2.8 to 3.1 (m/s^2) allow 1 mark for an answer in the range 2.5 to 2.79 (m/s^2) OR 3.11 to 3.5 (m/s^2) allow 1 mark for (acceleration =) gradient of line/graph ignore change in velocity/time taken as this is on formula sheet	**(2)**

Question number	Answer	Acceptable answers	Marks
1 (c)	150 (N) (1) (towards the) left (1)	 (in the) direction of the 400 (N) force accept an arrow to the left anywhere in the response ←	**(2)**

Total for question 1 = 8 marks

<table>
<tr><th>Question number</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2 (a)</td><td>
<table>
<tr><th>particle name</th><th>charge</th><th>mass (mass unit)</th></tr>
<tr><td>(proton)</td><td>(+1)(positive)</td><td>(1)</td></tr>
<tr><td>(neutron)</td><td>0 or zero or none or neutral</td><td>1</td></tr>
<tr><td>electron</td><td>-1 or negative</td><td>(1/1836)</td></tr>
</table>
1 mark for each correct column
</td><td>(3)</td></tr>
</table>

Question number	Answer	Acceptable answers	Marks
2 (b) (i)	A description of a demonstration of electrostatic charge to include: a description of the scenario (1) a description of the expected outcome (1)	typical responses bring the rod near to: some (small) pieces of paper/ rod/object with same charge/ head or arm/ (uncharged stream of) water from a tap (pieces of) paper are {attracted/move} (to the rod)/ rod/object repel (one another) /hairs stand up or attracted/ water attracted or moves towards rod accept other valid scenarios and outcomes allow idea of attracting an oppositely charged object e.g. the cloth for 1 mark ignore see if it gives a shock to someone/earth it/touch it to some metal	**(2)**

Question number	Answer	Acceptable answers	Marks
2 (b) (ii)	☒ **B** an equal negative charge **The only correct answer is B** **A** is not correct because the charge is opposite to that on the rod **C** is not correct because the charge must be the same size **D** is not correct because the charge must be the same size		**(1)**

Question number	Answer	Acceptable answers	Marks
2 (b) (iii)	An explanation linking: {electron(s)/negative charge(s)} have moved (1) from the rod/to the cloth (1)	no marks if the answer refers to {positive charge(s)/positive electron(s)/proton(s)} moving accept cloth rubs off electrons for both marks accept rod loses electrons for both marks	**(2)**

Total for question 2 = 8 marks

Question number	Answer	Acceptable answers	Marks
3 (a) (i)	73 (m) (1)		**(1)**

Question number	Answer	Acceptable answers	Marks
3 (a) (ii)	Any one from: driving {too long/without a rest} or taking drugs/(prescribed) medication /alcohol/depressants or tiredness or distractions or using mobile phone (1)	 accept old age/illness ignore stimulants e.g. caffeine/coffee	**(1)**

Question number	Answer	Acceptable answers	Marks
3 (a) (iii)	Any one from: increasing speed (of car) poor/worn/faulty brakes carrying heavy load/increased weight or mass worn tyres/poor tread (depth) idea of decreasing contact with road surface eg mud/ice/water/rain (1)	 accept reduced braking force question asks for a factor that increases braking distance so ignore vague statements i.e. road conditions or weather or speed or weight or mass	**(1)**

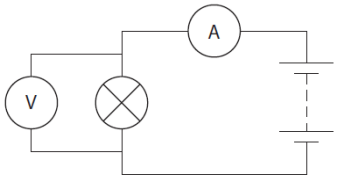
Question number	Answer	Acceptable answers	Marks
3 (b)	☒ **B** increasing the time a resultant force acts on the driver **The only correct answer is B** **A** is not correct because airbags do not alter the KE of the car **C** is not correct because airbags have no effect on thinking time **D** is not correct because airbags decrease the rate of change of momentum of the driver		**(1)**

Question number	Answer	Acceptable answers	Marks
3 (c)	substitution 14 500 x 5.0 (1) evaluation 73 000 (J) (1)	award full marks for correct answer with no working 72 500 (J) or 72.5 kJ or 73 kJ accept power of 10 error for 1 mark e.g. 725 or 73 (J)	**(2)**

Question number	Answer	Acceptable answers	Marks
3 (d)	substitution 800 000 ÷ 12.5 (1) evaluation 64 000 (W) (1)	award full marks for correct answer with no working 64 kW accept power of 10 error for 1 mark e.g. 6400 (W)	**(2)**

Question number	Answer	Acceptable answers	Marks
3 (e)	substitution ½ x 1600 x 30^2 (1) evaluation 720 000 (J) (1)	award full marks for correct answer with no working ½ x 1600 x 900 or 800 x 900 accept 30 m/s^2 as 30^2 72 x 10^4 (J) 720 <u>kJ</u> accept power of 10 error for 1 mark e.g. 720 (J)	**(2)**

Total for question 3 = 10 marks

Question number	Answer	Acceptable answers	Marks
4 (a)	☒ **B**  **The only correct answer is B** ***A*** *is not correct because voltmeter cannot be connected in series with lamp* ***C*** *is not correct because voltmeter cannot be connected in series with cell* ***D*** *is not correct because ammeter cannot be connected in parallel with lamp*		**(1)**

Question number	Answer	Acceptable answers	Marks
4 (b) (i)	Conversion of time to correct unit: 240 (s) (1) substitution 0.8 x 240 (1) evaluation 192 (C) (1)	award full marks for correct answer with no working 0.8 x 4 gains 1 mark for sub of their time into correct eq'n 190 (C) or 1.9 x 10^2 (C) 3.2 (C) gains 2 marks (only mistake is not converting time to seconds) accept power of 10 error for 2 marks e.g. 19.2 (C) accept power of 10 error and time error for 1 mark e.g. 320 or 32 or .32 if no other mark scored correct attempt anywhere at converting minutes to seconds scores 1 mark e.g. 240 4 x 60 3.2 x 60	**(3)**

Question number	Answer	Acceptable answers	Marks
4 (b) (ii)	Substitution 3 x 0.8 (1) Evaluation 2.4 (W) (1)	award full marks for correct answer with no working accept power of 10 error for 1 mark e.g. 24 (W)	**(2)**

Question number	Answer	Acceptable answers	Marks
4 (c)	the resistance (of the second lamp)/it is more (than the resistance of the first lamp) (1)	higher/bigger/increases(resistance) condone stronger reverse argument clearly stated e.g. the resistance of the first lamp is lower it is 5(.0) Ω compared to 3.75 Ω ignore references to current or power (in/of the lamps)/spurious calculations	**(1)**

Question number	Answer	Acceptable answers	Marks
4 (d)	☒ **C** 1.4 A **The only correct answer is C** ***A*** *is not correct because 0.2 A is the difference in currents* ***B*** *is not correct because 0.7 A is the average of the currents* ***D*** *is not correct because the sum of the currents is 1.4 A*		**(1)**

Question number	Answer	Acceptable answers	Marks
4 (e)	An explanation linking: the current will increase (1) (because) the resistance (of the LDR) will decrease (1)	 it is increased/bigger/higher condone stronger accept higher (rate of) flow of charge ignore references to the LDR changing light to energy ignore references to change in speed of the current ignore lamps get brighter/lighter	**(2)**

Total for question 4= 10 marks

Question number	Answer	Acceptable answers	Marks
5 (a)	92 (protons) 143 (neutrons)		**(2)**

Question number	Answer	Acceptable answers	Marks
5 (b)(i)	<table><tr><th>information about radiation</th><th>tick (✓)</th></tr><tr><td>is an electron</td><td></td></tr><tr><td>is electromagnetic radiation</td><td></td></tr><tr><td>is two protons and two neutrons</td><td>✓</td></tr><tr><td>has a positive charge</td><td>✓</td></tr><tr><td>has a negative charge</td><td></td></tr><tr><td>has no charge</td><td></td></tr></table>	accept any clear indication of correct response e.g. crosses in 3rd and 4th boxes if more than two rows are ticked deduct one mark for each extra row.	**(2)**

Question number	Answer	Acceptable answers	Marks
5 (b)(ii)	A description including: (alpha particles) strongly ionising (1) (alpha particles) weakly penetrating/ short range (1)	many ions or many ion pairs produced (in short distance/few cm) accept most/very ionising or more ionising than beta AND gamma ignore good ioniser accept not very penetrating stopped by (a thin sheet of) paper/skin least penetrating/can't travel as far as beta AND gamma/doesn't penetrate as much as beta AND gamma (can only) travel (through) a few cm of air	**(2)**

Question Number		Indicative Content	Mark
***5 c QWC**	**exp**	A description to include some of the following points • (slow moving) neutron fired at/collides with U-235 nucleus • U-235 nucleus absorbs (slow moving) neutron • U-235 nucleus becomes unstable • nucleus splits • producing 2 daughter nuclei (eg barium and krypton) • and releasing 2 or 3 neutrons • these neutrons can go on to cause further fissions • initiating a chain reaction • the products of nuclear fission are radioactive • nuclear fusion is the creation of a larger nucleus/helium nucleus • from smaller nuclei • such as (isotopes of) hydrogen nuclei • the products of nuclear fusion are (usually) not radioactive • nuclear fusion reactions require a large amount of energy • to provide the high temperatures (and pressures) needed • to overcome (electrostatic) repulsion of protons Some points may come from higher tier statements	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• A limited description of either fission or fusion which gives one or more limited statements/fact about fission and/or fusion reactions e.g. in fission a U-235 atom splits e.g. in fusion two atoms join e.g. in fission atoms split (apart) and in fusion atoms join (together) • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• A simple description giving more than one fact about nuclear fission OR more than one fact about nuclear fusion OR at least one fact about both e.g. in fission a U-235 atom splits into 2 daughter atoms e.g. in fusion two hydrogen atoms fuse/join to make a helium atom e.g. in fusion two small atoms fuse/join to make a bigger atom e.g. In fission a U-235 atom splits but in fusion 2 hydrogen atoms join/fuse • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• A detailed description of giving more than one fact about nuclear fission OR nuclear fusion AND at least one fact about the other e.g. in fission a U-235 nucleus splits into 2 daughter nuclei and in fusion two hydrogen nuclei join/fuse e.g. in fusion two hydrogen nuclei fuse to make a helium nucleus. In fission a U-235 nucleus splits	

		• the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately including nucleus or nuclei • spelling, punctuation and grammar are used with few errors

Total for question 5 = 12 marks

Question number	Answer	Acceptable answers	Marks
6(a)(i)	A suggestion to include one of: (packaging/bandage) not damaged/affected by radiation (1) idea that: (gamma radiation/it) will kill ALL bacteria in/sterilise ALL (the bandage) (1) idea of simplicity of operation e.g. boxes of bandages can pass radioactive source on conveyor belt (1) temperature of dressings unchanged (1)	accept heating could damage or burn or melt the packaging/ bandages/contents/(medical) supplies accept (radiation) kills MORE bacteria accept idea that: heating may NOT kill ALL bacteria in the bandage accept heating would require additional energy ignore it is quicker/easier/ cheaper/more efficient	**(1)**

Question number	Answer	Acceptable answers	Marks
6 (a) (ii)	activity falls by 50% in one half-life (1) 10 years (1)	idea that two half-lives needed activity has halved / ½ (of the sample) has decayed in one half-life/5 years accept half (the sample) remains after one half-life/5 years ignore any halving of mass number (60) or half-life award full marks for correct answer with no working	**(2)**

Question number	Answer	Acceptable answers	Marks
6 (b) (i)	A description to include any **one** of:		
	(increased risk of) cancer (1)	mutate cells/DNA/cause mutations/kills cells accept (cobalt-60) could be absorbed into soil/plants ignore it gives out radiation/is radioactive/is ionising ignore it damages cells/it damages crops	
	radiation burns (1)		
	radiation sickness (1)	radiation poisoning ignore pollution/it makes him ill/kills him/ health problems/damage his health/it's toxic	**(1)**

Question number	Answer	Acceptable answers	Marks
6 (b) (ii)	A suggestion to include any **two** of the following:	Typical suggestions	
	suitable shielding for the workers (1)	(protective) suits/hazmat suit/NBC suit/gloves/wear breathing apparatus/(face) masks/goggles/hood with visor accept special(ised) clothing	
	(replacement) shielding for the source (1)	(put cobalt-60) in a lead-lined or metal {box/container}/replace shield	
	limit (time of) exposure (1)	take it in turns/use exposure meter/badge (to measure exposure)	
	method of remote working (1)	use (long) tongs/robots/drones ignore do not touch it/keep a safe distance	
	control access by public (1)	stop people coming close/cordon off area/evacuate people from (surrounding) area	**(2)**
	decontaminate surroundings (1)	put all the soil into bags/remove soil	

Question Number		Indicative Content	Mark
6 c QWC	*	An explanation to include some of the following points: • radium-223 emits alpha particles • alpha radiation would not penetrate the packaging • radium-223 has a half-life of 11 days • radium-223 would need replacing after a short time • sodium-24 emits gamma • gamma radiation will penetrate the packaging • sodium-24 has a half-life of only 15 hours • sodium-24 would need replacing very frequently • cobalt-60 emits gamma • cobalt-60 has a half-life of 5 years • cobalt 60 would not need replacing very frequently accept references such as cobalt lasts 5 years, radium lasts 11 days and sodium lasts 15 hours as references to appropriate half-lives ignore references to the strength of different types of radiation or how dangerous they are	**(6)**

Level	0	No rewardable content
1	**1 - 2**	• A limited explanation which gives at least one relevant fact about one of the sources e.g. cobalt (-60) emits gamma e.g. radium (-223) emits alpha e.g. sodium (-24) has a half-life of (only) 15 hours e.g. radium lasts for 11 days • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy
2	**3 - 4**	A simple explanation which compares cobalt with either radium or sodium or both OR an explanation which qualifies a fact about half-life or penetrating ability with extra detail e.g. cobalt (-60) has a longer half-life than radium (-223). e.g. cobalt (-60) has the longest half-life (of the three sources) e.g. cobalt lasts longer than sodium and/or radium e.g. radium (-223) emits alpha which is less penetrating than gamma/least penetrating (of the 2 or 3 radiations) e.g. cobalt lasts 5 years so it doesn't need replacing often • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy

3	**5 - 6**	• A detailed explanation which gives more than one comparison of cobalt with either radium or sodium or both OR qualifies a comparison with extra detail OR qualifies more than one fact about half-life or penetration or more than one of each with extra detail e.g. the half-lives of radium (-223) and sodium (-24) are too short. Sodium (-24) also emits gamma radiation e.g. cobalt (-60) has the longest half-life and so it won't need replacing (very) often e.g. radium (-223) emits alpha which, unlike the gamma rays from cobalt, would not penetrate the packaging so it cannot kill the bacteria e.g. cobalt (-60) emits gamma (radiation) which unlike alpha can penetrate packaging and completely kill the bacteria e.g. sodium (-24) has the shortest half-life and would soon decay/its activity would decrease too quickly (to be of any use) e.g. cobalt (-60) lasts 5 years so it doesn't need replacing often and gamma can penetrate the box • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Total for question 6 = 12 marks