OCR
Oxford Cambridge and RSA

GCSE

Physics A

Unit **A182/02:** Unit 2 – Modules P4, P5, P6 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2016

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

Annotations

Used in the detailed Mark Scheme:

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
(1)	separates marking points
not/reject	answers which are not worthy of credit
ignore	statements which are irrelevant - applies to neutral answers
allow/accept	answers that can be accepted
(words)	words which are not essential to gain credit
words	underlined words must be present in answer to score a mark
ecf	error carried forward
AW/owtte	credit alternative wording / or words to that effect
ORA	or reverse argument

Available in RM Assessor to annotate scripts:

	indicate uncertainty or ambiguity
BOD	benefit of doubt
CON	contradiction
	incorrect response
ECF	error carried forward
	draw attention to particular part of candidate's response
NBOD	no benefit of doubt
R	reject
	correct response

L1 , L2 , L3	draw attention to particular part of candidate's response
^	information omitted

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Subject-specific Marking Instructions

a. Accept any clear, unambiguous response (including mis-spellings of scientific terms if they are *phonetically* correct, but always check the guidance column for exclusions).

b. Crossed out answers should be considered only if no other response has been made. When marking crossed out responses, accept correct answers which are clear and unambiguous.

e.g. for a one-mark question where ticks in the third <u>and</u> fourth boxes are required for the mark:

This would be worth 1 mark.

This would be worth 0 marks.

This would be worth 1 mark.

c. The list principle:
If a list of responses greater than the number requested is given, work through the list from the beginning. Award one mark for each correct response, ignore any neutral response, and deduct one mark for any incorrect response, e.g. one which has an error of science. If the number of incorrect responses is equal to or greater than the number of correct responses, no marks are awarded. A neutral response is correct but irrelevant to the question.

d. Marking method for tick-box questions:

If there is a set of boxes, some of which should be ticked and others left empty, then judge the entire set of boxes.
If there is at least one tick, ignore crosses and other markings. If there are no ticks, accept clear, unambiguous indications, e.g. shading or crosses. Credit should be given according to the instructions given in the guidance column for the question. If more boxes are ticked than there are correct answers, then deduct one mark for each additional tick. Candidates cannot score less than zero marks.

e.g. if a question requires candidates to identify cities in England:

Edinburgh	
Manchester	
Paris	
Southampton	

the second and fourth boxes should have ticks (or other clear indication of choice) and the first and third should be blank (or have indication of choice crossed out).

Edinburgh			✓			✓	✓	✓	✓	
Manchester	✓	×	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	×		✓		✓	✓		✓	
Score:	**2**	**2**	**1**	**1**	**1**	**1**	**0**	**0**	**0**	**NR**

e. For answers marked by levels of response:

i. **Read through the whole answer from start to finish**

ii. **Decide the level** that **best fits** the answer – match the quality of the answer to the closest level descriptor

iii. **To determine the mark within the level**, consider the following:

Descriptor	Award mark
A good match to the level descriptor	The higher mark in the level
Just matches the level descriptor	The lower mark in the level

iv. Use the **L1**, **L2**, **L3** annotations in RM Assessor to show your decision; do not use ticks.

Quality of Written Communication skills assessed in 6-mark extended writing questions include:

- appropriate use of correct scientific terms
- spelling, punctuation and grammar
- developing a structured, persuasive argument
- selecting and using evidence to support an argument
- considering different sides of a debate in a balanced way
- logical sequencing.

Question			Answer	Marks	Guidance
1	(a)	(i)	22 (N)	1	
		(ii)	11 (1); J (1)	2	**allow**: ECF from ai **allow**: j / Nm / joules **do not allow**: n (for N)/ mN
		(iii)	Total energy stays the same / energy is not lost (or gained) (1); (work done by Roy =) heat (wasted) **and** GPE/energy gained by tins (1)	2	**allow**: energy cannot be created or destroyed **allow**: energy is **only** transferred (into other forms) **ignore** sound / KE of Roy
	(b)		GPE =KE / Wh = ½ mv^2 (1); Correct substitution (1); 5.5 (1)	3	**allow**: mgh for Wh **allow**: gh = ½ v^2 Correct substitution also gains first marking point. E.g. 32 x 1.5 = 0.5 x 3.2 x v^2 3.2 x 10 x 1.5 = 0.5 x 3.2 x v^2 10 x 1.5 = 0.5 x v^2 48 = 0.5 x 3.2 x v^2 / 48 = 1.6 v^2 5.5 without working gains 3 marks **allow**: an answer with more than 2 s.f. provided that it rounds to 5.5
			Total	8	

Question			Answer	Marks	Guidance
2	(a)	(i)	12.5 (s)	1	**allow** 12-13
		(ii)	130/20 (1); 6.5 (m/s) (1)	2	6.5 without working gets 2 marks
		(iii)	Speed increases, then decreases and the lorry becomes stationary – tick in top box	1	
	(b)	(i)	(normal) <u>reaction</u>	1	
		(ii)	(Interaction pair act) on different bodies (2); OR these forces are not the same type of force (1); these forces are gravitational and reaction/(normal) contact force (1)	2	**allow** for 1 mark: these forces/they are on same body (OWTTE) **ignore** references to equal and opposite forces
			Total	7	

Question			Answer	Marks	Guidance
3			**[Level 3]** Detailed explanation of cause of collision injury **AND** explains actions of seat belts **and** air bags. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Simple explanation of cause of collision injury **AND** explains action of **either** seat belts **or** of air bags. Detailed explanation of cause of collision injury without action of either seat belt or air bag max 3 marks. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Description of collision **OR** explains action of seat belts **OR** explains action of air bags. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to A*** **Indicative scientific points may include:** **Detailed explanations of cause of collision injury** • Use of work done = force x distance • Use of change of momentum = force x time • Longer time causes smaller force, related to change in momentum **Simple explanation of cause of collision injury** • passenger has momentum in moving car • force from car reduces passenger momentum • passenger injured by force if big enough • Longer time causes smaller force **Description of collision** • passenger stopped/injured by car dashboard/windscreen • car stops suddenly **Seatbelt** • provides force to stop passenger • stretches during collision • increasing time for slowing down passenger • reducing force on passenger • because force = momentum change/time **Airbag** • expands suddenly at collision • provides force to stop passenger • collapses slowly / cushioning • increasing time for slowing down passenger • reducing force on passenger • because force = momentum change/time **Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.**
			Total	**6**	

Question			Answer	Marks	
4			changing current / ac (in primary/input) (1); magnetic field (in core) (1); (magnetic field) is changing (which induces voltage) (1)	3	**if no other mark** awarded **allow** lower voltage output / less turns on secondary (ORA)
			Total	3	

Question			Answer	Marks	
5	(a)	(i)	(Electromagnetic) induction	1	
		(ii)	Idea of opposite relative movement (with the same pole) / Idea of using the other pole (in the same direction)	1	If two changes are given ensure that they don't cancel out eg. 'push S pole into other end' =0
	(b)	(i)	more power / more work done per second / more energy per second / more current / more voltage	1	
		(ii)	C	1	
		(iii)	Iron / cobalt / nickel	1	Not steel **allow** Fe / Co / Ni
			Total	5	

Question			Answer	Marks	Guidance
6	(a)	(i)	Eve	1	
		(ii)	Ben	1	
	(b)	(i)	5 (Ω)	1	
		(ii)	0.5 (V)	1	**allow** $^1/_2$
	(c)	(i)	1.5 (V)	1	**allow** $1^1/_2$
		(ii)	0.2 (A)	1	**allow** $^1/_5$
			Total	6	

Question	Answer	Marks	Guidance
7	**[Level 3]** States and explains the correlation **AND** describes at least two improvements. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** States the correlation **AND** describes two improvements. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** States the correlation **OR** describes two improvements. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grade D/C** **Indicative scientific points may include:** **Correlation:** **Statement of correlation** • resistance decreases with more wires/paths/branches • negative correlation **Explanation of correlation** • more wires gives more paths for current/electrons/charge • greater cross sectional area • easier for current/electrons/charge to get through • Use of V=IR **Improvements:** • more wires / longer wires / thicker wires / other wire types • repeat readings • find mean/average reading • control variables (use same meter, leads, temperature) • connect meter to known resistor • description of other suitable correct method • someone else could reproduce the experiment **Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.**
	Total	**6**	

Question			Answer	Marks	Guidance
8			gamma can exit/be detected outside the body / alpha cannot exit body (1); use of data for sources B or C to show their half-life is 1 hour (1) C (1);	3	**not just** gamma is more penetrating eg. 950 is about half of 2000 look at table for indication of calculation outcomes **not just** 'it goes from 2000 to 950 and then to 485' **do not allow** incorrect statements such as 'half-life is 500'
			Total	3	

Question			Answer	Marks	Guidance
9	(a)		$E=mc^2$ / $5x10^{-8}$ x $(3x10^8)^2$ (1); $4.5x10^9$ (J) (1)	2	**allow** 4500 MJ, 4500000000 or other variations of correct answer such as 4.5E9 Correct answer without working gets 2 marks
	(b)		any **TWO** from: placed in water (until it cools); put in glass; put in (stainless) steel/concrete put **deep** underground	2	**ignore** put in sea/swimming pool **not just** metal/lead **not just** buried / put underground
	(c)		any **THREE** from: perceived risks; more serious consequence; cannot see radiation; reports from news/media/past events; lack of control; he doesn't want the power station built near him	3	e.g Chernobyl / Fukushima
	(d)	(i)	α will not penetrate **any** of the windows/materials in the badge	1	**not just** α/it won't penetrate the badge / won't even penetrate card **allow**: Alpha is absorbed by air (before reaching badge)
		(ii)	β only……..2^{nd} from top film γ only……top film	2	1 mark for each correct line
			Total	10	

Question			Answer	Marks	Guidance
10			**[Level 3]** Detailed explanation of sterilisation process **AND** gives at least two reasons why concerns are unfounded. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Simple explanation of sterilisation process **AND** gives at least two reasons why concerns are unfounded. Detailed explanation of sterilisation process without any reasons why concerns are unfounded gains max 3 marks. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Simple explanation of sterilisation process **OR** gives at least two reasons why concerns are unfounded Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to A*** **Indicative scientific points may include:** **Sterilisation of vegetable:** **Simple explanation** • penetrates the vegetables • damage living cells / mutates DNA • kill living cells/bacteria • bacteria causes rotting/decaying • sterilisation/irradiation stops vegetables rotting/decaying **Detailed explanation** • gamma or beta used because it will penetrate the vegetables and packaging • vegetables are sterilised while they are in the packet to avoid re-infection by microbes • irradiation produces ions/breaks molecules into bits • ions can take part in other chemical reactions and so kill bacteria • ions cause mutations in DNA **At L3, allow partial credit only for explanations using alpha radiation or x-rays** **Reasons why concerns are unfounded:** • vegetable not radioactive / not a source of radiation • the source is not on/in contact with the vegetables • the vegetables are not contaminated (by the source) • contamination means direct contact with source • irradiation is used for sterilising other things e.g. medical eqpt. **Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.**
			Total	6	

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