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 2014

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

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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 scoris to annotate scripts:

BP	Blank Page – this annotation **must** be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.
	correct response
	incorrect response
BOD	benefit of doubt
NBOD	no benefit of doubt
ECF	error carried forward
0 , L1 , L2 , L3	indicate level awarded for a question marked by level of response
^	information omitted

CON	contradiction
R	reject
	indicate uncertainty or ambiguity
	draw attention to particular part of candidate's response

ADDITIONAL OBJECTS: You **must** assess and annotate the additional objects for each script you mark. Where credit is awarded, appropriate annotation must be used. If no credit is to be awarded for the additional object, please use annotation as agreed at the SSU.

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. 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 <u>should be blank</u> (or have indication of choice crossed out).

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

d. 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 Scoris 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	Mark	Guidance
1	a		9.7 (s)	1	**allow** from 9.6 to 9.8 (inclusive)
	b		average	1	**allow** if indicated in list
	c		velocity/speed decreases at the end / he slows down at the end	1	**allow** reference to correct time instead of at end
	d		any value from 2.0 to 2.8	1	**allow** 2
	e		(always) running in the same direction/forward	1	
			Total	**5**	
2	a	i	greater mass / momentum = mass x velocity	1	**ignore** heavier
		ii	smaller force (1); change in momentum = force x time (1)	2	 change in momentum is constant and (when dividing by) a longer time gives a smaller force = 2 marks
	b*	i	K.E = 0.5 x 0.3 x 4^2; = 2.4 (J); (The window does NOT break) **because** the balls ke (2.4J) is less than the windows breaking energy (10J);	1 1 1	 correct numerical response = 2 marks **allow ecf** from incorrect value for KE **accept** doesn't break because 2.4 is less than 10
		ii	2	1	**allow** -2
			Total	**7**	

Question			Answer	Mark	Guidance
3			**[Level 3]** Describes two or more aspects of making the long jump (running and/or jumping) and explains link between distance of the jump and time in the air, and uses it to justify running beforehand Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Describes two or more aspects of making the long jump (running and/or jumping). Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Describes one aspect involved in increasing speed during running. 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*** **Points may be made on diagrams.** **Indicative scientific points may include:** **Running;** • running increases forwards momentum / velocity/speed / kinetic energy • increasing forwards velocity/momentum increases distance jumped • forces acting during run, eg friction between shoe and ground, action and reaction • ignore air resistance during run **Jump:** • Amir's foot pushes down on ground when he jumps • reaction force from ground pushes up on Amir • jump gives Amir upward velocity/momentum • gravity provides downwards force during jump • downwards force of Amir brings him back to ground in a certain time • forwards distance moved during jump depends on forwards velocity/momentum • energy transformation from KE to GPE • air resistance during jump **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
			Total	**6**	

Question			Answer	Mark	Guidance
4*	a		axes labelled – power (lost) , current; line going up to the right; curves towards the power axis / away from current axis;	1 1 1	units not required, **not** just scales **allow** units instead of quantity i.e. amps instead of current, and joules or J/s or watts for power lost. **accept** power or current as vertical axis **accept** attempt to plot the points without a line use scales on axes to identify curvature if no labels line does not have to go through the origin a bar chart can score mp1 and mp3
	b		**any 3** correlation comment is correct / there is a correlation; because as current increases so does power; directly proportional is incorrect / it isn't directly proportional; because power does not double as current doubles/ not a straight line/ line is a curve / square relationship;	3	 **not** just he is correct; **accept** his first comment is correct **not** just he is wrong; **accept** his second comment is wrong
			Total	**6**	

Question			Answer	Mark	Guidance
5	a	i	3 (kΩ)	1	**allow** identification on diagram
		ii	The same battery voltage causes a larger current to flow through a smaller resistance than through a bigger one. More work is done by the charge moving through a large resistance than through a small one. ✓ A change in the resistance of one component will result in a change in the potential difference across all the components. The current through each component is the same as if it were the only component present.	1	
		iii	the work done on each unit of charge by the battery (1); must equal the work done by charge on the circuit components.(1)	2	work done by the battery is the same as the work done by all the components = 1 mark.
	b		100 kΩ 100 kΩ and 200 kΩ in series 100 kΩ and 100 kΩ in parallel ✓ 100 kΩ and 100 kΩ in series	1	
	c	i	voltage increases current increases voltage increases current stays the same voltage decreases current increases voltage stays the same current stays the same ✓	1	
		ii	battery produces d.c. / this circuit is d.c. (1); a.c/varying current is required for transformer (to work) (1)	2	
			Total	**8**	

Question			Answer	Mark	Guidance
6			**[Level 3]** Links high resistance of filament to thinness (ORA) and links resistance to temperature/energy transfer. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Links high resistance of filament to thinness (ORA). Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Identifies resistance as key difference between filament and connecting wires OR links temperature of filament to light emission. 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:** • an electric current/charge does work on a component **Explanation** • heating effect caused by collisions/interactions between moving electrons and stationary ions in the wire. • filament is thin and supports are thick • thick wires have a smaller resistance / thinner wires have higher resistance • higher resistance will transfer more energy per second • more work is done by the charges when they pass through **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
			Total	6	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>7</td><td>a</td><td></td><td><table>
<tr><td>detecting cracks in metal pipes</td><td></td></tr>
<tr><td>as a tracer in the body</td><td></td></tr>
<tr><td>sterilising surgical instruments</td><td>✓</td></tr>
<tr><td>irradiating food</td><td>✓</td></tr>
<tr><td>treating cancer</td><td>✓</td></tr>
<tr><td>Detecting smoke</td><td></td></tr>
</table></td><td>2</td><td>3 correct =2 marks
2 correct = 1 mark
1 or 0 correct = 0 marks</td></tr>
<tr><td></td><td>b</td><td>i</td><td>gamma detected by/passes through B and C (1);

beta detected by/passes through C (1)

OR
C detects gamma and beta (1);

B detects gamma (1)</td><td>2</td><td>allow aluminium for B; card for C throughout</td></tr>
<tr><td></td><td>b</td><td>ii</td><td>(the covering of) all the windows blocks alpha</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>5</td><td></td></tr>
</table>

Question			Answer	Mark	Guidance
8	a	i	(m=) E/c^2 (1); = $3 \times 10^9 / (3 \times 10^8)^2$ OR $m = 3 \times 10^9 / 9 \times 10^{16}$ (1); 3.3×10^{-8} (1)	3	This correct substitution implies correct rearrangement so also scores first marking point **allow** 3×10^{-8} **allow** 3 marks for correct numerical answer
		ii	(much) greater mass of coal used (1); because nuclear reactions release much more energy than chemical reactions (1);	2	Allow higher level responses involving correct use of $E=mc^2$ with energy the same and therefore mass the same for 2 marks
	b	i	**135** (1); **52** (1)	2	
		ii	chain reaction - produces energy in the fuel rod / correct description of chain reaction (1); fuel rod - contains the **nuclear** fuel / it's where fission takes place (1); control rod - absorbs neutrons (1); coolant - absorbs heat from the reaction / transfers heat (1)	4	**allow** contains uranium/plutonium **ignore** prevent overheating/cooling
			Total	11	

Question			Answer	Mark	Guidance
9*			**[Level 3]** Explains risk of radioactive waste AND discusses methods of disposal of different types of waste. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Explains risk of radioactive waste and describes a method of disposal OR discusses methods of disposal of different types of waste. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** States a harmful effect of radioactive waste OR describes a method of disposal of the waste. 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 C** **Indicative scientific points may include:** • radioactive waste emits ionising radiation • ionising radiation damages/kills living cells • ionising radiation may cause cancer • radioactive materials become less so over time • different types High, Intermediate, Low **High level** • e.g. spent nuclear fuel rods • very radioactive, high risk • embedded in glass stored underwater **Intermediate level** • e.g. materials used to handle fuel rods, decommissioned reactors • less radioactive, medium risk • stored in drums, usually underground **Low level** • e.g. medical waste, protective clothing • little radioactivity, low risk • buried in landfill • not all radioactive material is hazardous • waste can be radioactive for a very long time • those at risk may not be the ones who benefit the most **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
			Total	**6**	

* - overlap

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