

Physics A

General Certificate of Secondary Education

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

Mark Scheme for June 2013

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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.

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1. 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
<u>words</u>	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:

	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
Λ	information omitted
CON	contradiction
R	reject

	indicate uncertainty or ambiguity
	draw attention to particular part of candidate's response

2. **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.

3. 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 and 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	<input type="checkbox"/>
Manchester	<input type="checkbox"/>
Paris	<input type="checkbox"/>
Southampton	<input type="checkbox"/>

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	✓	x	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	x		✓		✓	✓		✓	
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	Marks	Guidance
1	(a)	(i)	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="margin-bottom: 10px;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">radioactive source</div> <div style="margin-left: 20px;"> <div style="border: 1px solid black; padding: 2px; width: 150px;">particles or waves that can break apart atoms</div> <div style="border: 1px solid black; padding: 2px; width: 150px;">a substance that produces alpha, beta or gamma radiation</div> </div> </div> <div style="margin-bottom: 10px;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">ionising radiation</div> <div style="margin-left: 20px;"> <div style="border: 1px solid black; padding: 2px; width: 150px;">the time taken for half of a radioactive substance to turn into another substance</div> </div> </div> <div style="margin-bottom: 10px;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">decay</div> <div style="margin-left: 20px;"> <div style="border: 1px solid black; padding: 2px; width: 150px;">the particles in a sample naturally change from one element to another</div> <div style="border: 1px solid black; padding: 2px; width: 150px;">energy is released by a chain reaction</div> </div> </div> </div>	3	one mark per correct line.
		(ii)	alpha; (1) both penetrating and would not(1)	2	
	(b)		<p>can cause chemical reactions to take place.</p> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 5px; text-align: center;">✓</div> </div> <div style="display: flex; align-items: center; margin-top: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 5px;"></div> </div> <div style="display: flex; align-items: center; margin-top: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 5px;"></div> </div> <div style="display: flex; align-items: center; margin-top: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 5px; text-align: center;">✓</div> </div> <p>kills living cells.</p>	2	

Question		Answer	Marks	Guidance
	(c)	Source B (1) 2 max from the following some evidence of an attempt at half life calculation; how long it takes for the activity of the source to reach 4/ activity of their source after 1 year; source remains sufficiently active for the majority of the year owtte; source becomes inactive shortly after 1 year.	3	no marks if source D chosen. attempted calculation e.g. 32, 16, 8 etc. allow discussion of safety of source after treatment last 2 points can only be awarded if Source B chosen
	(d) (i)	any three from statement that: the benefits outweigh the risks (1) idea that for the treatment the chance/rate of success is good/high/likely/probable ORA e.g. failure is rare (1) risk (of secondary cancer) is low or secondary cancer could occur anyway (1) risk from prostate cancer is reduced or cancer will spread without treatment (1) will be being checked for secondary cancer or secondary cancer can also be treated (1)	3	ignore just restating the bullet points allow 2 in 125 is a low risk allow he will be cured
	(ii)	the amount (of substance/ drug etc)	1	allow a measure of the possible harm to the body idea of quantification of what is taken by patient
Total			14	

Question	Answer	Marks	Guidance
2	<p>Level 3 (5–6 marks) Discussions of both fusion and fission are correct, with some additional correct detail provided. Quality of written communication does not impede communication of the science at this level.</p> <p>Level 2 (3–4 marks) Brief Discussion of fission and fusion or a discussion of one of these in greater detail. No significant errors in science. Quality of written communication partly impedes communication of the science at this level.</p> <p>Level 1 (1–2 marks) Brief discussion of fission or fusion. Quality of written communication impedes communication of the science at this level.</p> <p>Level 0 (0 marks) Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p>This question is targeted at grades up to A* Relevant points include: Nuclear fission:</p> <ul style="list-style-type: none"> • a neutron • is absorbed by a nucleus • making it unstable • splits a large nucleus • into smaller parts (eg barium and krypton) • releasing more neutrons • can lead to a chain reaction • elements involved: uranium/plutonium. <p>Nuclear fusion:</p> <ul style="list-style-type: none"> • hydrogen/small nuclei collide • at high temperatures/ speeds/ KE • and pressures • fuse (owtte) • to make larger nuclei. • E.g Helium <p>Energy (as possible additional detail):</p> <ul style="list-style-type: none"> • reference to $E=mc^2$ • m is mass lost. • comparison of energy released per event in fission and fusion e.g. more in fission. • energy released as KE of fragments. <p>accept</p> <ul style="list-style-type: none"> • energy released greater than that released by a chemical reaction with a similar mass of material. <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>
	Total	6	

Question		Answer	Marks	Guidance																								
3	(a)	component A – thermistor component B – LDR component C – (fixed) resistor	3	one mark for each correct line.																								
	(b)	<table border="1"> <thead> <tr> <th></th> <th>True</th> <th>False</th> <th>Cannot tell</th> </tr> </thead> <tbody> <tr> <td>Judy repeated her tests three times.</td> <td></td> <td></td> <td>✓</td> </tr> <tr> <td>Judy had an outlier in her results in the temperature experiment.</td> <td></td> <td>✓</td> <td></td> </tr> <tr> <td>Judy had an outlier in her results in the light intensity experiment.</td> <td>✓</td> <td></td> <td></td> </tr> <tr> <td>The temperature in the light intensity experiment was 20° C.</td> <td>✓</td> <td></td> <td></td> </tr> <tr> <td>The light intensity in the temperature experiment was 200 lux.</td> <td></td> <td>✓</td> <td></td> </tr> </tbody> </table>		True	False	Cannot tell	Judy repeated her tests three times.			✓	Judy had an outlier in her results in the temperature experiment.		✓		Judy had an outlier in her results in the light intensity experiment.	✓			The temperature in the light intensity experiment was 20° C.	✓			The light intensity in the temperature experiment was 200 lux.		✓		4	5 rows correct: 4 marks 4 rows correct: 3 marks 3 rows correct: 2 marks 1 or 2 rows correct: 1 mark
	True	False	Cannot tell																									
Judy repeated her tests three times.			✓																									
Judy had an outlier in her results in the temperature experiment.		✓																										
Judy had an outlier in her results in the light intensity experiment.	✓																											
The temperature in the light intensity experiment was 20° C.	✓																											
The light intensity in the temperature experiment was 200 lux.		✓																										
		Total	7																									

Question		Answer	Marks	Guidance
4	(a)	<p>attempt to calculate current from one cell $(I = V/R =) 1.5/2400 = 0.0006(25)(A)$</p> <p>OR</p> <p>attempt to calculate voltage to make motor work $(V = IR =) 2400 \times 0.005 = 12 (V)$</p> <p>8 batteries are required</p>	3	<p>1 mark for selection of appropriate equation and substitution of appropriate numbers</p> <p>1 mark for correct calculation</p> <p>1 mark for correct conclusion based on their numbers (ecf allowed)</p> <p>Final answer 8 = 3 marks</p>
	(b)	<p>at least 2 correct circuit symbols used for battery/power supply, ammeter, voltmeter (1)</p> <p>Ammeter in series, voltmeter in parallel with motor, correctly connected to battery/ power supply (1)</p>	2	ignore any other symbols
Total			5	

Question		Answer	Marks	Guidance						
5		<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>primary coil</th> <th>secondary coil</th> </tr> </thead> <tbody> <tr> <td>(3450)</td> <td>180</td> </tr> <tr> <td>11500</td> <td>(600)</td> </tr> </tbody> </table>	primary coil	secondary coil	(3450)	180	11500	(600)	2	<p>allow 1 mark for correct numbers in wrong positions</p> <p>allow candidate answers which round to the correct answers</p>
primary coil	secondary coil									
(3450)	180									
11500	(600)									
Total			2							

Question	Answer	Marks	Guidance
6	<p>Level 3 (5–6 marks) Detailed descriptions of the generator and the motor. Some correct comparison of the two. Quality of written communication does not impede communication of the science at this level.</p> <p>Level 2 (3–4 marks) Brief description of how a motor works and how a generator works or a more detailed description of either one. Quality of written communication partly impedes communication of the science at this level.</p> <p>Level 1 (1–2 marks) Brief description of how a motor works or how a generator works. May be some confusion of difference between them. Quality of written communication impedes communication of the science at this level.</p> <p>Level 0 (0 marks) Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p>This question is targeted at grades up to A</p> <p>Indicative scientific points:</p> <p>Motor:</p> <ul style="list-style-type: none"> • electricity/current produces rotation • uses direct current • attempt to describe use of commutator <p>Generator:</p> <ul style="list-style-type: none"> • rotation of coil produces electricity • no need for commutator/explains slip rings • example shown produces alternating current • reference to power station/dynamo etc. <p>Both:</p> <ul style="list-style-type: none"> • (stationary) magnetic field • rotating coil • difference between ac and dc • graphs of ac and dc. <p>accept higher level answers regarding interaction of magnetic field and current.</p> <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>
	Total	6	

Question			Answer	Marks	Guidance
7	(a)	(i)	larger shoes take longer; (1) any 1 for justification from the following list, larger shoes experience greater <u>friction/ resistive force</u> , numerical comparison of average times (1)	2	accept answers that state no real trend because the data overlaps too much so no conclusion can be drawn (1) there needs to be more data (1)
		(ii)	ignore yes or no A maximum of 2 marks from: <i>(Ross thinks the mistakes are):</i> *Idea that ramps are different *idea that shoes are different *Results are affected by different reaction times A maximum of 2 marks from: <i>(Discussion of data):</i> *The new result doesn't fit his data e.g. the times should be lower than size 5/7 ORA *Sample size is small *Time differences are small, so correlation (between shoe size and slide-time) is weak * slide-time depends on a combination of factors *calculation of the average of the other student's results = 1.3 seconds (1) *idea that both sets of data show good repeatability (1)	3	the maximum mark is 3 allow e.g length/start-point/steepness/friction allow e.g weight/tread/friction
	(b)	(i)	friction: (friction from) shoe on surface; weight: pull of shoe on Earth	2	do not award first mark if it seems that the candidate is referring to any force that is not along the surface
		(ii)	a (positive) force down the slope/parallel to the slope	1	allow force is 'forward'

Question		Answer					Marks	Guidance	
	(c)		Time	Mass of the trainer	Weight of the shoe	Height of slope	Length of slope	4	ignore mass if included for gPE third row
		average speed along slope	✓				✓		
		average vertical velocity	✓			✓			
		change in gravitational potential energy when the shoe slides down the slope		(✓)	✓	✓			
		average momentum of the shoe down the slope	✓	✓			✓		
	(d)	graph starts at origin; with any kind of positive gradient					2	curve must not show velocity decreasing allow curve increasing or decreasing in gradient or a straight line	
						Total	14		

Question	Answer	Marks	Guidance
8	<p>Level 3 (5–6 marks) Correctly links changes in speed or height to changes in KE or GPE or describes the energy transfer from GPE to KE and explains why the vehicle has lost speed or KE or height or GPE during the ride Quality of written communication does not impede communication of the science at this level.</p> <p>Level 2 (3–4 marks) Links changes in speed or height to changes in KE or GPE at correct points in the ride or describes the energy transfer from GPE to KE or explains why the vehicle has lost speed or KE or height or GPE during the ride Quality of written communication partly impedes communication of the science at this level.</p> <p>Level 1 (1–2 marks) Correctly links GPE with height or KE with speed or limited discussion of energy or forces Quality of written communication impedes communication of the science at this level.</p> <p>Level 0 (0 marks) Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p>This question is targeted at grades up to C</p> <p>Indicative scientific points:</p> <ol style="list-style-type: none"> 1. gains GPE as raised 2. this turns to KE as falls 3. KE increase means speed increases 4. on other side, KE drops, so speed decreases 5. GPE increases again 6. energy lost on each move 7. due to friction 8. heat 9. surroundings/structure/wheels etc 10. so lower speed/lower rise 11. no more energy needed after initial input 12. total energy is conserved. <p>accept correct discussion of forces use of diagrams to explain</p> <p>ignore significant confusion in scientific ideas for Level 1</p> <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>
	Total	6	

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