



## **GCSE**

### **Physics A**

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

General Certificate of Secondary Education

**Mark Scheme for June 2015**

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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.

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**Annotations**

Used in the detailed Mark Scheme:

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
(1)	separates marking points
<b>not/reject</b>	answers which are not worthy of credit
<b>ignore</b>	statements which are irrelevant - applies to neutral answers
<b>allow/accept</b>	answers that can be accepted
<u>words</u>	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:

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

 ,  , 	draw attention to particular part of candidate's response
	information omitted
	indicate uncertainty or ambiguity
	benefit of doubt
	contradiction
	incorrect response
	error carried forward
	draw attention to particular part of candidate's response
	draw attention to particular part of candidate's response
	draw attention to particular part of candidate's response
	no benefit of doubt
	reject
	correct response
	draw attention to particular part of candidate's response
	information omitted

**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:

<input type="checkbox"/>
<input type="checkbox"/>
<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>
<input type="checkbox"/>

*This would be worth  
1 mark.*

<input type="checkbox"/>
<input type="checkbox"/>
<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>
<input type="checkbox"/>

*This would be worth  
0 marks.*

<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>
<input type="checkbox"/>

*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	<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	✓	✗	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	✗		✓		✓	✓		✓	
<b>Score:</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>NR</b>

## e. For answers marked by levels of response:

- Read through the whole answer from start to finish**
- Decide the level that best fits** the answer – match the quality of the answer to the closest level descriptor
- To determine the mark within the level**, consider the following:

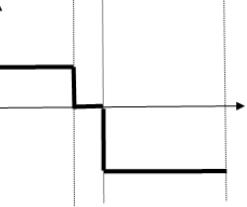
Descriptor	Award mark
A good match to the level descriptor	The higher mark in the level
Just matches the level descriptor	The lower mark in the level

- Use the **L1, L2, L3** annotations in Scoris to show your decision; do not use ticks.

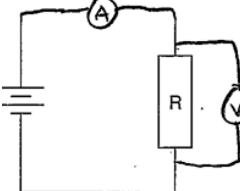
Quality of Written Communication skills assessed in 6-mark extended writing questions include:

- 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)	44N (3 <sup>rd</sup> answer)	1	
	(b) (i)	1.0(2) (kgm/s)	1	<b>not 1 unless 1.02 seen in working</b>
	(ii)	10.(2)  <b>but</b> if incorrect, for 1 mark, look for correct <b>substitution:</b> (change of momentum/time =) 1.0(2)/0.1	2	ecf from b(i) gains both marks  ecf from b(i)
	(iii)	shorter time (to stop) OWTTE (1);  larger (resultant) force (1)	2	<b>allow</b> e.g stops quicker/faster / slows down faster <b>do not allow</b> stops immediately/straight away  <b>ignore</b> references to impact/harder
	(c)	speed is same / George is correct about speed / Kate is wrong about speed (1);  KE is different / George is wrong about KE / Kate is correct about KE (1);  justification for speed or KE (1)	3	e.g. appropriate use of average speed equation travels same distance in same time they have the same acceleration (g) appropriate use of KE formula KE formula has mass in it speed formula has no mass in it heavier ball has more GPE at beginning so KE is greater at end  <b>N.B.</b> just stating a formula is insufficient for the justification mark.
		<b>Total</b>	<b>9</b>	

Question		Answer	Marks	Guidance																					
2	(a)	<p>Type of motion</p> <table> <tr> <td>stationary</td> <td><b>Region</b></td> <td>A</td> <td>B</td> <td>C</td> <td>D</td> <td>E</td> </tr> <tr> <td>moving with constant speed</td> <td></td> <td>✓</td> <td></td> <td>✓</td> <td></td> <td></td> </tr> <tr> <td>fastest instantaneous speed</td> <td></td> <td>✓</td> <td></td> <td>✓</td> <td></td> <td></td> </tr> </table>	stationary	<b>Region</b>	A	B	C	D	E	moving with constant speed		✓		✓			fastest instantaneous speed		✓		✓			2	<p><b>Mark by row</b></p> <p>All rows correct = 2 marks 1 or 2 rows correct = 1 mark</p>
stationary	<b>Region</b>	A	B	C	D	E																			
moving with constant speed		✓		✓																					
fastest instantaneous speed		✓		✓																					
	(b)	 <p>bottom left diagram</p>	1																						
	(c)	<p>velocity starts at 0 (1);</p> <p>line with continuously positive slope to dotted line (1)</p>	2	<p><b>allow</b> slope beginning anywhere between origin and letter A on x-axis</p> <p><b>allow</b> straight or curved or combination of both</p> <p><b>ignore</b> lines on or to right of dotted line</p>																					
		<b>Total</b>	<b>5</b>																						

Quest	Answer	Marks	Guidance
3	<p><b>[Level 3]</b> Describes interaction pair (words or arrows) <b>AND</b> explains the effect of icy <b>and</b> normal conditions on motion. Quality of written communication does not impede communication of the science at this level.   <b>[Level 2]</b> <b>EITHER</b> Describes interaction pair (words or arrows) <b>OR</b> Explains the effect of icy <b>and</b> normal conditions on motion. <b>OR</b> Describes one half of the interaction pair (words or arrow) <b>and</b> makes a correct statement about icy <b>or</b> normal conditions. Quality of written communication partly impedes communication of the science at this level.   <b>[Level 1]</b> <b>EITHER</b> describes one half of the interaction pair (words or arrow) <b>OR</b> makes a correct statement about icy <b>or</b> normal conditions. Quality of written communication impedes communication of the science at this level.   <b>[Level 0]</b> Insufficient or irrelevant science. Answer not worthy of credit.</p> <p>(5 – 6 marks)</p> <p>(3 – 4 marks)</p> <p>(1 – 2 marks)</p> <p>(0 marks)</p>	6	<p><b>This question is targeted at grades up to C</b></p> <p><b>Indicative scientific points may include:</b></p> <p><b>Arrows on diagram:</b></p> <ul style="list-style-type: none"> <li>• arrow to right on road</li> <li>• arrow to the left on the car/above the road</li> <li>• arrows same length</li> </ul> <p><b>Interaction pair of forces:</b></p> <ul style="list-style-type: none"> <li>• (rotating) wheel pushes road backwards</li> <li>• road pushes wheel/car forwards</li> <li>• (resultant) force moves the car</li> </ul> <p><b>Effect of normal conditions:</b></p> <ul style="list-style-type: none"> <li>• friction/grip between wheel and road</li> <li>• wheel does not spin/slip</li> <li>• exerts force on road/car</li> </ul> <p><b>Effect of icy conditions:</b></p> <ul style="list-style-type: none"> <li>• little/no friction/grip between wheel and road</li> <li>• wheel spins/slips</li> <li>• exerts little/no force on road/car</li> </ul> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>
	<p><b>Total</b></p>	6	

Question		Answer	Marks	Guidance
4	(a)	correct symbol for ammeter in series with R (1); correct symbol for voltmeter in parallel with R or battery (1)	2	<p>symbols are free-hand circles with a capital letter</p> <p><b>ignore</b> lines through symbols e.g. an ammeter or voltmeter drawn on solid lines</p> <p><b>ignore</b> small gaps next to symbols</p> <p>eg of answer gaining 2 marks:</p>  <p>(= 2 marks)</p> <p><b>but if no other mark awarded:</b> <b>allow 1 mark if both correct symbols for ammeter <b>and</b> voltmeter are seen</b></p>
	(b) (i)	0.1A (first answer)	1	
	(ii)	0.4A (fourth answer)	1	
	(iii)	0.2A (second answer)	1	

Question		Answer	Marks	Guidance
4	(c)	<p>LDR resistance decreases (1);</p> <p><b>Either:</b></p> <p>voltage/pd across LDR decreases (1); Idea that resistor gets increased share/proportion of voltage (1)</p> <p><b>OR</b></p> <p>current in circuit increases (1); reference to <math>V=IR</math> for <b>resistor</b> (1)</p> <p><b>OR</b></p> <p>resistor now has greater proportion of total resistance (1); idea that resistor gets increased share/proportion of voltage (1)</p>	3	<p><b>but if no other mark awarded:</b> <b>allow</b> 1 mark for linking increased voltage to increased resistance <b>or</b> decreased voltage to decreased resistance</p>
		<b>Total</b>	8	

Question	Answer	Marks	Guidance
5	<p><b>[Level 3]</b>            Valid comment on Pat's statement <b>and</b> on Chris's statement, with use of data to justify <b>both</b> of the comments.            Quality of written communication does not impede communication of the science at this level.            (5 – 6 marks)</p> <p><b>[Level 2]</b>            Valid comment on Pat's statement <b>and</b> on Chris's statement, with use of data to justify one of the comments.            Quality of written communication partly impedes communication of the science at this level.            (3 – 4 marks)</p> <p><b>[Level 1]</b>            Valid comment on Pat's statement <b>and</b> on Chris's statement. <b>OR</b> does a correct resistance calculation without comment or justification.            Quality of written communication impedes communication of the science at this level.            (1 – 2 marks)</p> <p><b>[Level 0]</b>            Insufficient or irrelevant science. Answer not worthy of credit.            (0 marks)</p>	6	<p><b>This question is targeted at grades up to A</b></p> <p><b>Indicative scientific points may include:</b></p> <p><b>Correlation:</b></p> <ul style="list-style-type: none"> <li>• Pat is wrong</li> <li>• Larger voltage gives larger current</li> <li>• There is a correlation as both increase</li> <li>• Not linear/proportional relationship</li> <li>• Would not give straight line graph</li> <li>• Use data to show not proportional</li> </ul> <p><b>Resistance:</b></p> <ul style="list-style-type: none"> <li>• Chris is wrong</li> <li>• Use of resistance formula using data</li> <li>• Resistance increases with current</li> <li>• Not linear/proportional relationship</li> <li>• Would not give straight line graph</li> <li>• Lamp filament gets hotter</li> <li>• Hotter wire has more resistance</li> <li>• Calculates resistance values (5; 5.75; 7; 10)</li> </ul> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p> <p>(Check table in question for candidate's resistance values)</p>
	<b>Total</b>	<b>6</b>	

Question			Answer	Marks	Guidance
6	(a)	(i)	downwards arrow	1	Needs to be near CD
		(ii)	current / moving charge / moving electrons (in wires) (1);  (in) magnetic field (1)	2	<b>not</b> induced/creates current <b>allow</b> magnetic field around the wire (produced by the current)  <b>allow</b> between magnets/poles <b>ignore</b> N and S
	(b)		any THREE from: <ul style="list-style-type: none"><li>• allows coil/motor to spin/rotate</li><li>• without tangling the wires</li><li>• allows current to flow (in/out of coil)</li><li>• reverses direction of current</li><li>• reverses direction of the coil's magnetic field</li><li>• keeps forces on coil in same direction</li><li>• every half turn/each time coil passes vertical</li></ul>	3	
				Total	6

Question		Answer	Marks	Guidance
7	(a)	<p><b>any TWO</b> from:</p> <ul style="list-style-type: none"> <li>• irradiation: no direct contact with radiation source</li> <li>• contamination: radiation source material on clothes/body/ breathed in/swallowed</li> <li>• idea that contamination with alpha is ionizing/more hazardous</li> <li>• nothing to protect internal organs (if swallowed or breathed in)</li> <li>• clothes/skin is some protection from irradiation</li> <li>• idea that exposure time is greater with contamination</li> </ul>	2	
	(b) (i)	best fit curve drawn i.e. single <b>smooth</b> curve with roughly equal number of points either side of the line	1	judge by eye
	(ii)	from 5.5 to 7.0 inclusive	1	
	(c) (i)	radiation present in the environment/around us / radiation that is always present	1	<b>allow</b> radiation in the atmosphere/air  <b>ignore</b> named sources or references to natural sources / radiation from the air
	(c) (ii)	any value in the range from 2 to 3 inclusive  <b>but</b> if incorrect, for 1 mark, look for working applications of the half-life over at least two halvings, starting at any number	2	e.g. 124-62-31 or 20-10-5
		<b>Total</b>	<b>7</b>	

Question		Answer	Marks	Guidance
8	(a) (i)	these neutrons trigger further (fission) reactions that produce more neutrons	1	
	(ii)	absorb/stop neutrons	1	allow soak up as AW for absorb ignore move rods in/out
	(b)	$\alpha$ 4 and 2 (1); $\beta$ 0 and -1 (1); U 234, 92 and Ba 135, 56 (1)	3	both needed; correct answers only $^{238}_{94}\text{Pu} \longrightarrow ^{4}_{2}\alpha + ^{234}_{92}\text{U}$ $^{135}_{55}\text{Cs} \longrightarrow ^{0}_{-1}\beta + ^{135}_{56}\text{Ba}$ (= 3 marks)
	(c)	any TWO from: <ul style="list-style-type: none"><li>consequences of nuclear accidents / radiation exposure</li><li>the perceived risk is high</li><li>it is not his decision to build the power station</li><li>he does not control the risk</li><li>it will affect his house price/damage the environment</li></ul>	2	
		Total	7	

Question	Answer	Marks	Guidance
9	<p><b>[Level 3]</b> Identifies two or more risks <b>and</b> explains how all three procedures reduce risk. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p><b>[Level 2]</b> Identifies two or more risks <b>and</b> explains how two procedures reduce risk. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p><b>[Level 1]</b> Identifies one risk <b>and</b> explains how one procedure reduces risk. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p><b>[Level 0]</b> Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p><b>This question is targeted at grades up to A</b> <b>Indicative scientific points may include:</b></p> <p><b>Risks:</b></p> <ul style="list-style-type: none"> <li>• Radioactive sources emit ionising radiation</li> <li>• Radiation damages human cells</li> <li>• Radiation damages DNA</li> <li>• Radiation can cause cancer</li> <li>• Radiation ionises molecules, which can take part in chemical reactions</li> <li>• Contamination / irradiation</li> </ul> <p><b>Explanations of how procedures reduce risk</b></p> <p><b>Gloves:</b></p> <ul style="list-style-type: none"> <li>• Barrier to prevent contamination</li> <li>• Barrier to alpha irradiation</li> </ul> <p><b>Tongs:</b></p> <ul style="list-style-type: none"> <li>• Increase distance (to reduce irradiation)</li> <li>• To avoid direct contact with/contamination by source</li> <li>• To direct the source away from observers</li> </ul> <p><b>Monitoring badge:</b></p> <ul style="list-style-type: none"> <li>• Monitoring exposure over time</li> <li>• Indicates when to avoid further exposure</li> <li>• Idea of safe limit of exposure</li> </ul> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>
	<p><b>Total</b></p>	6	

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