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 2015

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.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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.

© OCR 2015

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:

	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
	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
	draw attention to particular part of candidate's response
	draw attention to particular part of candidate's response
NBOD	no benefit of doubt
R	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 <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 <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**

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:

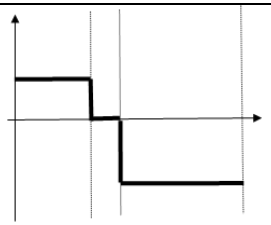
Descriptor	Award mark
A good match to the level descriptor	The higher mark in the level
Just matches the level descriptor	The lower mark in the level

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

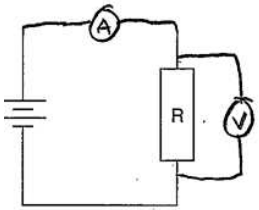
Quality of Written Communication skills assessed in 6-mark extended writing questions include:

- 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 (3rd answer)	1	
	(b)	(i)	1.0(2) (kgm/s)	1	**not** 1 unless 1.02 seen in working
		(ii)	10.(2) **but** if incorrect, for 1 mark, look for correct **substitution**: (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	**allow** e.g stops quicker/faster / slows down faster **do not allow** stops immediately/straight away **ignore** 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 **N.B.** just stating a formula is insufficient for the justification mark.
			Total	9	

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

Quest	Answer	Marks	Guidance
3	**[Level 3]** Describes interaction pair (words or arrows) **AND** explains the effect of icy **and** normal conditions on motion. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** **EITHER** Describes interaction pair (words or arrows) **OR** Explains the effect of icy **and** normal conditions on motion. **OR** Describes one half of the interaction pair (words or arrow) **and** makes a correct statement about icy **or** normal conditions. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** **EITHER** describes one half of the interaction pair (words or arrow) **OR** makes a correct statement about icy **or** normal conditions. 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:** **Arrows on diagram:** • arrow to right on road • arrow to the left on the car/above the road • arrows same length **Interaction pair of forces:** • (rotating) wheel pushes road backwards • road pushes wheel/car forwards • (resultant) force moves the car **Effect of normal conditions:** • friction/grip between wheel and road • wheel does not spin/slip • exerts force on road/car **Effect of icy conditions:** • little/no friction/grip between wheel and road • wheel spins/slips • exerts little/no force on road/car **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	Total	6	

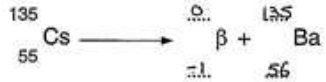
Question			Answer	Marks	Guidance
4	(a)		correct symbol for ammeter in series with R (1); correct symbol for voltmeter in parallel with R or battery (1)	2	symbols are free-hand circles with a capital letter **ignore** lines through symbols e.g. an ammeter or voltmeter drawn on solid lines **ignore** small gaps next to symbols eg of answer gaining 2 marks:  (= 2 marks) **but** if no other mark awarded: **allow** 1 mark if both correct symbols for ammeter **and** voltmeter are seen
	(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)		LDR resistance decreases (1); **Either**: voltage/pd across LDR decreases (1); Idea that resistor gets increased share/proportion of voltage (1) **OR** current in circuit increases (1); reference to V=IR for **resistor** (1) **OR** resistor now has greater proportion of total resistance (1); idea that resistor gets increased share/proportion of voltage (1)	3	**but** if no other mark awarded: **allow** 1 mark for linking increased voltage to increased resistance **or** decreased voltage to decreased resistance
			Total	8	

Question	Answer	Marks	Guidance
5	**[Level 3]** Valid comment on Pat's statement **and** on Chris's statement, with use of data to justify **both** of the comments. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Valid comment on Pat's statement **and** 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) **[Level 1]** Valid comment on Pat's statement **and** on Chris's statement. **OR** does a correct resistance calculation without comment or justification. 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:** **Correlation:** • Pat is wrong • Larger voltage gives larger current • There is a correlation as both increase • Not linear/proportional relationship • Would not give straight line graph • Use data to show not proportional **Resistance:** • Chris is wrong • Use of resistance formula using data • Resistance increases with current • Not linear/proportional relationship • Would not give straight line graph • Lamp filament gets hotter • Hotter wire has more resistance • Calculates resistance values (5; 5.75; 7; 10) **Use the L1, L2, L3 annotations in Scoris; do not use ticks.** (Check table in question for candidate's resistance values)
	Total	**6**	

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	**not** induced/creates current **allow** magnetic field around the wire (produced by the current) **allow** between magnets/poles **ignore** N and S
	(b)		**any THREE** from: • allows coil/motor to spin/rotate • without tangling the wires • allows current to flow (in/out of coil) • reverses direction of current • reverses direction of the coil's magnetic field • keeps forces on coil in same direction • every half turn/each time coil passes vertical	3	
			Total	6	

Question			Answer	Marks	Guidance
7	(a)		**any TWO** from: • irradiation: no direct contact with radiation source • contamination: radiation source material on clothes/body/ breathed in/swallowed • idea that contamination with alpha is ionizing/more hazardous • nothing to protect internal organs (if swallowed or breathed in) • clothes/skin is some protection from irradiation • idea that exposure time is greater with contamination	**2**	
	(b)	**(i)**	best fit curve drawn i.e. single **smooth** 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**	**allow** radiation in the atmosphere/air **ignore** named sources or references to natural sources / radiation from the air
	(c)	**(ii)**	any value in the range from 2 to 3 inclusive **but** 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
			Total	**7**	

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)		α 4 and 2 (1); β 0 and -1 (1); U 234, 92 **and** Ba 135, 56 (1)	3	both needed; correct answers only   (= 3 marks)
	(c)		**any TWO** from: • consequences of nuclear accidents / radiation exposure • the perceived risk is high • it is not his decision to build the power station • he does not control the risk • it will affect his house price/damage the environment	2	
			Total	7	

Question	Answer	Marks	Guidance
9	**[Level 3]** Identifies two or more risks **and** explains how all three procedures reduce risk. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Identifies two or more risks **and** explains how two procedures reduce risk. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Identifies one risk **and** explains how one procedure reduces risk. 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:** **Risks:** • Radioactive sources emit ionising radiation • Radiation damages human cells • Radiation damages DNA • Radiation can cause cancer • Radiation ionises molecules, which can take part in chemical reactions • Contamination / irradiation **Explanations of how procedures reduce risk** **Gloves:** • Barrier to prevent contamination • Barrier to alpha irradiation **Tongs:** • Increase distance (to reduce irradiation) • To avoid direct contact with/contamination by source • To direct the source away from observers **Monitoring badge:** • Monitoring exposure over time • Indicates when to avoid further exposure • Idea of safe limit of exposure **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	Total	**6**	

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; 1 Hills Road, Cambridge, CB1 2EU
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553

© OCR 2015

PART OF THE CAMBRIDGE ASSESSMENT GROUP

LLOYD'S REGISTER QUALITY ASSURANCE · ISO9001 · UKAS MANAGEMENT SYSTEMS 001