OCR
RECOGNISING ACHIEVEMENT

GCSE

Physics A

General Certificate of Secondary Education

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

Mark Scheme for January 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.

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

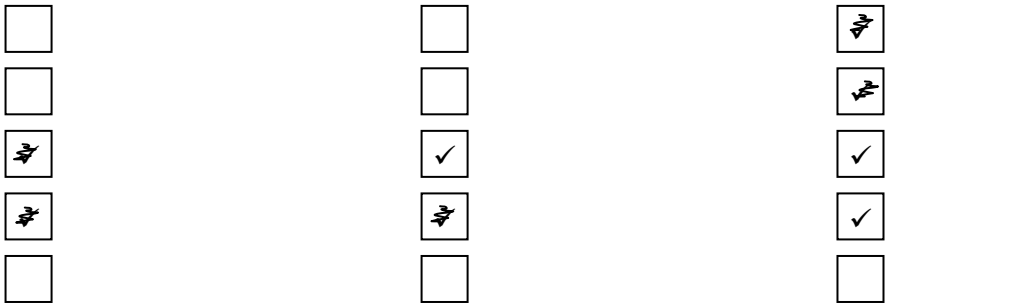
L1 , L2 , L3	indicate level awarded for a question marked by level of response
^	information omitted

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:



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

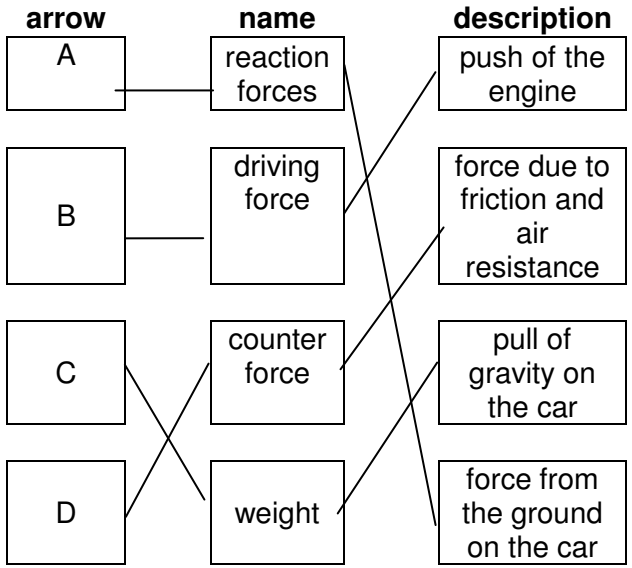
iii. **To determine the mark within the level**, consider the following:

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)	(i)		2	one mark for all four lines on the left hand side one mark for all four lines on the right hand side
		(ii)	6500 (N) forwards/to the right/toward B	2	**allow** any clear indication of direction e.g. arrow drawn
	(b)		2 x 7.5 = 15 (change in speed) (40-15)= 25 (m/s)	2	**allow** 2x7.5 unevaluated for 1st marking point **allow** 1 mark if answer=15 (m/s) answer of 25 scores 2 marks. **allow** 1 mark ecf for final answer of 40-(their value for change in speed)
	(c)		distance: B Velocity: W	1	**both** required for the mark
			Total	**7**	

Question			Answer	Marks	Guidance
2			**Level 3: (5 – 6 marks)** Uses appropriate physics to explain how helmets reduce injuries **and** discusses the data using the idea of correlation and cause. Quality of written communication does not impede communication of the science at this level. **Level 2: (3 – 4 marks)** Uses appropriate physics to explain how helmets reduce injuries **and/or** discusses the data using the idea of correlation and cause. Quality of written communication partly impedes communication of the science at this level. **Level 1: (1 – 2 marks)** Uses basic physics ideas to explain how helmets reduce injuries **or** discusses the data using the idea of correlation and cause. Quality of written communication impedes communication of the science at this level. **Level 0: (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted at grades up to C** possible points relevant to data • recognises that correlation between sets of data does not automatically mean it is causal • correlation not consistent over time • cannot draw a sensible conclusion from limited data • do not know whether the people who died wore helmets/other comment about the accidents • other factors need to be considered to reach a sensible conclusion • discussion of where the data comes from Physics points **Points indicative of L2/3:** time of collision increased same momentum change/ same change of speed so smaller rate of change of momentum/ smaller deceleration therefore reduced force (or alternative discussion in terms of work done) **Points indicative of L1:** idea of helmet reducing force /absorbing energy comparison to crumple zones idea that collision time is longer May suggest alternative reasons for the drop in deaths **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
			Total	**6**	

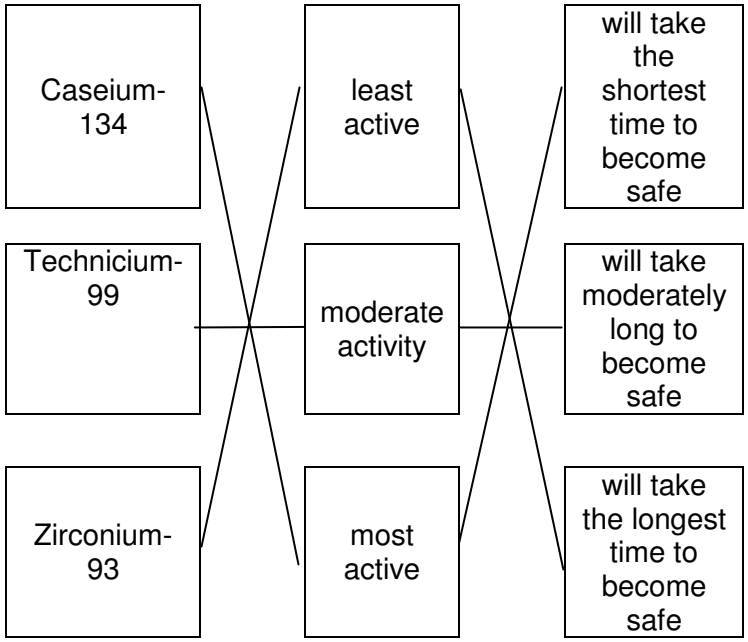
Question			Answer	Marks	Guidance
3	(a)	(i)	0.02 (N)	1	
	(b)		GPE to KE (1) idea that some energy is dissipated as heat/heating to the air (1)	2	**allow** PE or gravitational for GPE **ignore** reference to sound
	(c)	(i)	rearranges correctly; so $v = 5.5\ (5.48)\ (m/s)$	2	$v = \sqrt{(0.03 x 2 / 0.002)}$ or v= √(KEx2/mass) 2nd marking point is consequential on 1st **allow** reverse working i.e. calc of KE using v=5.5 evaluated as 0.03 (0.03025) J Answer of v=5.48 (m/s) scores 2 marks
		(ii)	c(i) assumes no energy loss/ no air resistance (1) John has calculated the average speed/no account of acceleration (1)	2	**allow** energy lost due to heating **ignore** references to incorrect measurements
			Total	**7**	

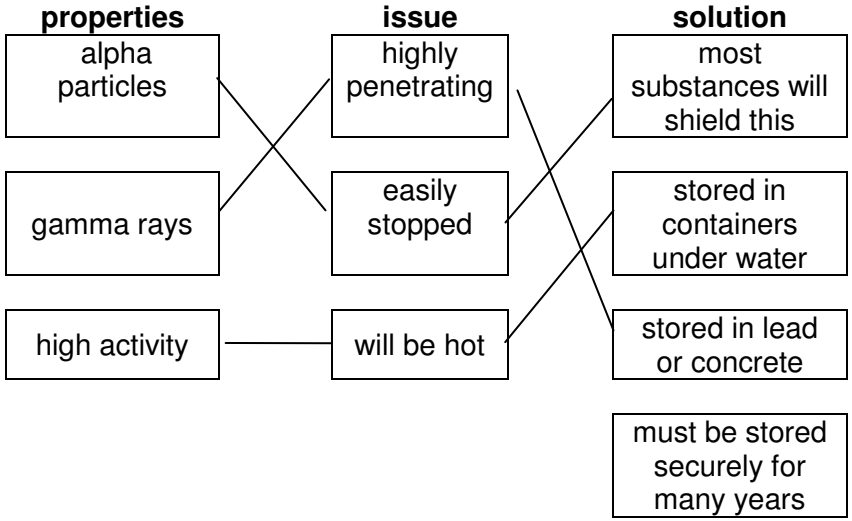
Question			Answer	Marks	Guidance
4			**Level 3: (5 – 6 marks)** Shows understanding of proportionality in relation to this data. Explains heating effect due to current and relates to shorter wire having higher resistance than expected. May suggest improvements to method. Quality of written communication does not impede communication of the science at this level. **Level 2: (3 – 4 marks)** Clearly identifies how this data is not proportional at short lengths and/or recognises proportionality at longer lengths. Idea that more current in shorter wire leads to heating effect and/or increased resistance. Quality of written communication partly impedes communication of the science at this level. **Level 1: (1 – 2 marks)** Describes how they know the data is not proportional. Links increased temperature to simple model of charge collision at short lengths. Quality of written communication impedes communication of the science at this level. **Level 0: (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted at grades up to A** **Relevant points include:** • doesn't go through origin so • not proportional or reverse argument • heating effect of a large current • this increases the resistance of the wire • discussion of heating effects of current • for large lengths, double length = double resistance • so proportional • discussion of data e.g. 15cm could be anomalous • discussion of zero error/systematic error in the data • discussion of energy in circuit **Note** at level 3 candidates will typically be expected to describe resistive heating in terms of electron collisions with other particles in the wire. **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
			Total	**6**	

Question			Answer	Marks	Guidance
5	(a)		(electromagnetic) induction/because magnetic field is changing	1	**allow** idea of magnet moving near a coil of wire leads to voltage **allow** induced or induction for 1 mark
	(b)		any 2 from; voltage from power station is higher; experiment produces one cycle, power station is continuous; higher frequency in a power station owtte; both change from positive to negative owtte	2	**accept** 230V if clearly referring to mains **ignore** reference to more electricity **accept** comparison of time of cycles **accept** both are alternating voltage/ current
	(c)	(i)	Transformers can only increase the size… → …of an alternating voltage. Transformers can only decrease the size… → …of a direct voltage. Transformers can either increase or decrease the size… → …of an alternating or direct voltage.	1	
		(ii)	TURPQ in correct order (3)	3	TU in correct space 1 mark PQ in correct space 1 mark R in the middle 1 mark **allow** PQSTU 1 mark **allow** PQRTU 2 marks
			Total	**8**	

Question			Answer	Marks	Guidance
6	(a)		current → the movement of electrons in the wires current → the amount of energy transferred each second potential difference → the number of electrons in the wires potential difference → the work done on the charge as it moves between two points potential difference → the total resistance of the circuit	2	
	(b)		power (W) → 0.33 power (W) → 0.75 power (W) → 1.0 resistance (Ω) → 2.0 resistance (Ω) → 3.0	2	

Question			Answer	Marks	Guidance
	(c)		V is the same / I gets bigger; why voltage stays the same; why current goes up (because resistance is lower)	3	e.g voltage is the same – as the same number of batteries/cells current is higher – as resistance is lower resistance is lower – as more paths (for charges) current is higher as more paths (for charges) gains one mark if no mention of resistance **accept** higher level answers regarding internal resistance/delivery of current **ignore** mention of lamps and brightness
			Total	**7**	

Question			Answer	Marks	Guidance
7	(a)	(i)	the time taken for half of a radioactive sample to decay/ time taken for activity to drop to ½	1	not radioactivity in place of activity **allow** count rate in place of activity
		(ii)		2	one mark for the left, one for the right
		(iii)	measurement of half life off graph (28 years); so not the same as any of the other isotopes	2	**allow** 27-31 / half life may be marked on graph second mark dependent on first mark being awarded must be a comparison- not just "no"
	(b)	(i)	$^{134}_{55}Cs \rightarrow {}^{134}_{56}Ba + {}^{0}_{-1}\beta$	2	barium correct = 1 mark beta correct = 1 mark **allow** 1 mark for any numbers which balance left and right of equation

Question	Answer	Marks	Guidance
(c)		1	all correct for 1 mark
(d)	<table><tr><td>to treat cancer</td><td>✓</td></tr><tr><td>to sterilise surgical instruments</td><td>✓</td></tr><tr><td>as a tracer in the body</td><td>✓</td></tr><tr><td>as a vaccine</td><td></td></tr><tr><td>in X-rays</td><td></td></tr></table>	1	all correct for 1 mark
	Total	**9**	

Question			Answer	Marks	Guidance
8	(a)		when inside the body (1) could cause (lung) cancer / damage DNA or cells / cause cells to mutate/ alpha highly ionising (1)	2	**ignore** reference to ionising cells
	(b)		Max 2 marks from any one group economic argument; residents	3	**economic arguments** idea of cost/ who pays consequence of less money for other areas/ services reduced healthcare costs (as less cases of cancer) increase in local employment **residents** reduced risk (of cancer for medium radon level) correct use of data to discuss level of risk idea that not everyone benefits disruption during fitting
			Total	**5**	

Question			Answer	Marks	Guidance
9			**Level 3: (5 – 6 marks)** Explains in detail the risks due to exposure to ionising radiation and compares to the benefits. Considers other factors relevant to decision. Makes good use of data to justify answer. Quality of written communication does not impede communication of the science at this level. **Level 2: (3 – 4 marks)** Describes risks and compares to benefit. Makes some use of data to support their decision. May consider other factors relevant to decision. Quality of written communication partly impedes communication of the science at this level. **Level 1: (1 – 2 marks)** Describes risks and/or makes relevant comment based on data. May comment on benefit. Quality of written communication impedes communication of the science at this level. **Level 0: (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted at grades up to A*** **risk due to ionising radiation** • increased dose means more ionising radiation • ionising radiation can damage/mutate cells/dna • so risk of radiation is cancer • therefore higher dose leads to an increased risk of cancer **other factors relevant to the decision** • Zoe's background/work dose (eg radon in house/air stewardess) • previous treatment that may contribute to dose • Whether she is pregnant. • number of CAT scans is not specified • idea that dose is cumulative • other techniques that do not use ionising radiation may be available **benefit** • need to know the details of the problem/need to understand the risks of not having the scan • her doctor thinks that the benefit outweighs the risk **data** refers to data in article in a comparative way **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

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Head office
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Facsimile: 01223 552553