

Mark Scheme for January 2012

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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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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	alternative wording
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
	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

- If a candidate alters his/her response, examiners should accept the alteration.
- 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 boxes 3 and 4 are required for the mark:

Put ticks (✓) in the two correct boxes.

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

This would be worth 1 mark.

Put ticks (✓) in the two correct boxes.

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

This would be worth 0 marks.

Put ticks (✓) in the two correct boxes.

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

Always check the additional guidance.

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. If there are no ticks, accept clear, unambiguous indications, e.g. shading or crosses.

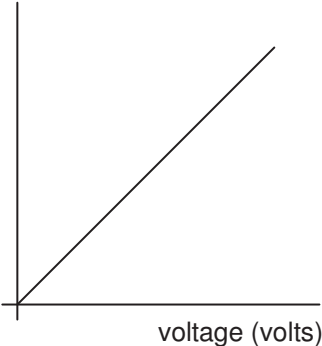
Credit should be given for each box correctly ticked. If more boxes are ticked than there are correct answers, then deduct one mark for each additional tick. Candidates cannot score less than zero marks.

E.g. If a question requires candidates to identify a city in England, then in the boxes

Edinburgh	
Manchester	
Paris	
Southampton	

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

Question			Answer	Marks	Guidance								
1	(a)	(i)	resistance increases	1	both answers required								
		(ii)	<p>current (amps)</p>  <p>voltage (volts)</p>	1	line must look straight and go through the origin Allow 2mm tolerance.								
	(b)		<table border="1"> <tbody> <tr> <td>...has an efficiency of 15%</td> <td></td> </tr> <tr> <td>...uses 15 amps of current</td> <td></td> </tr> <tr> <td>... uses a potential difference of 15 volts</td> <td></td> </tr> <tr> <td>... transfers 15 joules of energy every second</td> <td>✓</td> </tr> </tbody> </table>	...has an efficiency of 15%		...uses 15 amps of current		... uses a potential difference of 15 volts		... transfers 15 joules of energy every second	✓	1	
...has an efficiency of 15%													
...uses 15 amps of current													
... uses a potential difference of 15 volts													
... transfers 15 joules of energy every second	✓												
	(c)		Idea of current /moving charges in the filament (1) (current) causes a heating effect (1)	2	allow higher level responses involving energy transfer. allow (filament) heats up/gets hotter/temperature increases etc								
	(d)		£30.00	1									
			Total	6									

Question		Answer	Marks	Guidance										
2	(a)	E B A D C	1											
	(b)	<table border="1"> <tr> <td>placing an aluminium core inside the coil</td> <td></td> </tr> <tr> <td>decreasing the strength of the magnet</td> <td></td> </tr> <tr> <td>increasing the speed of rotation of the magnet</td> <td>✓</td> </tr> <tr> <td>heating the coil of wire</td> <td></td> </tr> <tr> <td>decreasing the resistance of the wire</td> <td>✓</td> </tr> </table>	placing an aluminium core inside the coil		decreasing the strength of the magnet		increasing the speed of rotation of the magnet	✓	heating the coil of wire		decreasing the resistance of the wire	✓	2	
placing an aluminium core inside the coil														
decreasing the strength of the magnet														
increasing the speed of rotation of the magnet	✓													
heating the coil of wire														
decreasing the resistance of the wire	✓													
	(c)	<p>any two from: easier to generate/distribute (1) more efficient (to distribute) (1)</p> <p>can be used with transformers (1)</p>	2	<p>Ignore cost arguments ignore transport in place of distribute allow less heating (of wires)/less energy loss for second marking point. allow specific transformer reference for third marking point e.g. can be stepped up/down.</p>										
	(d)	<p>two coils of wire on an <u>iron</u> core (1)</p> <p>output coil has more turns than input coil (1)</p>	2	<p>both marks can be from an appropriately labelled diagram</p> <p>If input and output not identified, assume the input is on the left.</p>										
		Total	7											

Question			Answer	Marks	Guidance								
3	(a)	(i)	<p>speed of the motorbike</p> <p>changes from 20 m/s to 25 m/s</p> <p>changes from 20 m/s to 15 m/s</p> <p>stays constant at 20 m/s</p> <p>forces</p> <p>the driving force is the same as the counter force</p> <p>the driving force is greater than the counter force</p> <p>the driving force is smaller than the counter force</p>	1	all three lines needed for the mark								
		(ii)	<table border="1"> <tr> <td>the motorbike's momentum is always zero when the driving force is equal to the counter force</td> <td></td> </tr> <tr> <td>the motorbike's momentum decreases when its kinetic energy increases</td> <td></td> </tr> <tr> <td>the motorbike's momentum does not change when the resultant force on the motorbike is</td> <td>✓</td> </tr> <tr> <td>the motorbike's momentum increases when the driving force is smaller than the counter force</td> <td></td> </tr> </table>	the motorbike's momentum is always zero when the driving force is equal to the counter force		the motorbike's momentum decreases when its kinetic energy increases		the motorbike's momentum does not change when the resultant force on the motorbike is	✓	the motorbike's momentum increases when the driving force is smaller than the counter force		1	
the motorbike's momentum is always zero when the driving force is equal to the counter force													
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the motorbike's momentum does not change when the resultant force on the motorbike is	✓												
the motorbike's momentum increases when the driving force is smaller than the counter force													
	(b)	(i)	$KE = 0.5 \times 250 \times 20^2$ (1) $= 50\,000$ (J) (1)	2	Correct answer = 2 marks								

Question			Answer	Marks	Guidance
3	(b)	(ii)	any two from; (kinetic energy/KE) becomes heat (and sound) (1) in the brakes/brake pads/to the air/surroundings (1) conservation of energy idea eg <u>all</u> KE/50 000J transferred (1)	2	Answers involving transfer to GPE score 0 marks allow higher level responses involving work done (by friction etc.) e.g. K.E. is transferred into heat by friction from the brakes would score 2 marks. allow ecf from previous question in terms of amount of KE.
		(iii)	momentum = $250 \times 20 = 5000$ (kgm/s) (1) force = $5000/5 = 1000$ (N) (1)	2	correct answer 1000 no working = 2 marks allow calculation using $F=ma$ allow work done/ distance travelled with ecf for their KE/ 50m for 2 marks. If incorrect distance is used in place of 50m, award 1 mark.
			Total	8	

Question		Answer	Marks	Guidance																		
4	(a)	75 000 J / 1500 m (1) = 50 (N) (1)	2	correct answer, no working = 2 marks allow 1 mark for 50 000 N (no conversion of km)																		
	(b)	Darrell	1																			
	(c)	<table border="1"> <thead> <tr> <th>statement</th> <th>true</th> <th>false</th> </tr> </thead> <tbody> <tr> <td>work is done by the force of the punch on the bag</td> <td>✓</td> <td></td> </tr> <tr> <td>the maximum kinetic energy gained by the bag is equal to the work done on the bag</td> <td>✓</td> <td></td> </tr> <tr> <td>Emily has the same energy as the bag after she has hit it</td> <td></td> <td>✓</td> </tr> <tr> <td>the kinetic energy gained by the bag is proportional to its speed after it is hit</td> <td></td> <td>✓</td> </tr> <tr> <td>when a force on the bag causes it to move faster, the force must be doing work on the bag</td> <td>✓</td> <td></td> </tr> </tbody> </table>	statement	true	false	work is done by the force of the punch on the bag	✓		the maximum kinetic energy gained by the bag is equal to the work done on the bag	✓		Emily has the same energy as the bag after she has hit it		✓	the kinetic energy gained by the bag is proportional to its speed after it is hit		✓	when a force on the bag causes it to move faster, the force must be doing work on the bag	✓		3	all correct = 3 marks 4 correct = 2 marks 3/2 correct = 1 mark
statement	true	false																				
work is done by the force of the punch on the bag	✓																					
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Emily has the same energy as the bag after she has hit it		✓																				
the kinetic energy gained by the bag is proportional to its speed after it is hit		✓																				
when a force on the bag causes it to move faster, the force must be doing work on the bag	✓																					
	(d)	force from Emily's hand onto the punch bag and the punch bag pushing Emily's hand	1	both answers required for the mark																		
Total			7																			

Question		Answer	Marks	Guidance										
5	(a)	diffraction (1) amplitudes (1) constructive destructive (1)	3	words must be in the correct order.										
	(b)	<table border="1"> <tbody> <tr> <td>absorption of light</td> <td></td> </tr> <tr> <td>constant speed of light through space</td> <td></td> </tr> <tr> <td>diffraction of light</td> <td>✓</td> </tr> <tr> <td>interference of light</td> <td>✓</td> </tr> <tr> <td>reflection of light</td> <td></td> </tr> </tbody> </table>	absorption of light		constant speed of light through space		diffraction of light	✓	interference of light	✓	reflection of light		2	
absorption of light														
constant speed of light through space														
diffraction of light	✓													
interference of light	✓													
reflection of light														
	(c)	gamma/ γ (rays) infrared/IR microwaves (1) 6×10^{-8} / 0.00000006 (1) 5×10^7 / 50 000 000 (1)	3	1 mark for all three labels on top row must be in the correct order.										
Total			8											

Question			Answer	Marks	Guidance																		
6	(a)	(i)		1	approximately same angle on the other side If more than 1 line drawn then 0 marks. ignore any arrows indicating direction. allow “angles equal”/“ $i=r$ ” written on diagram with line to indicate that the angles are equal even if they may not appear to be.																		
		(ii)	internal reflection (1) refraction (1) 90 (1)	3	Must be in correct order. Not internal <u>refraction</u> for first marking point.																		
		(iii)	digital radio mobile phones optical fibres satellite transmission	1																			
	(b)		<table border="1"> <tbody> <tr> <td>greater from the torch</td> <td>greater from the torch</td> <td></td> </tr> <tr> <td>greater from the torch</td> <td>greater from the spotlight</td> <td></td> </tr> <tr> <td>greater from the torch</td> <td>same for both</td> <td></td> </tr> <tr> <td>greater from the spotlight</td> <td>greater from the torch</td> <td></td> </tr> <tr> <td>greater from the spotlight</td> <td>greater from the spotlight</td> <td></td> </tr> <tr> <td>greater from the spotlight</td> <td>same for both</td> <td>✓</td> </tr> </tbody> </table>	greater from the torch	greater from the torch		greater from the torch	greater from the spotlight		greater from the torch	same for both		greater from the spotlight	greater from the torch		greater from the spotlight	greater from the spotlight		greater from the spotlight	same for both	✓	1	
greater from the torch	greater from the torch																						
greater from the torch	greater from the spotlight																						
greater from the torch	same for both																						
greater from the spotlight	greater from the torch																						
greater from the spotlight	greater from the spotlight																						
greater from the spotlight	same for both	✓																					
Total				6																			

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