

Physics A
Twenty First Century Science

General Certificate of Secondary Education **J635**

Mark Schemes for the Units

June 2009

J635/MS/R/09

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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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GCSE Twenty First Century Science – Physics A (J635)

MARK SCHEMES FOR THE UNITS

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Guidance for Examiners

Additional Guidance within any mark scheme takes precedence over the following guidance.

1. Mark strictly to the mark scheme.
2. Make no deductions for wrong work after an acceptable answer unless the mark scheme says otherwise.
3. Accept any clear, unambiguous response which is correct, e.g. mis-spellings if phonetically correct (but check additional guidance).
4. Abbreviations, annotations and conventions used in the detailed mark scheme:

/	= 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	= alternative wording
ORA	= or reverse argument

E.g. mark scheme shows 'work done in lifting / (change in) gravitational potential energy'
(1)

work done = 0 marks
work done lifting = 1 mark
change in potential energy = 0 marks
gravitational potential energy = 1 mark

5. If a candidate alters his/her response, examiners should accept the alteration.
6. 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.
7. 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.

8. 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

A331/01 Modules P1, P2, P3 Foundation Tier

Question		Expected Answers	Marks	Rationale				
1	a	<p>older than 4000 million years</p> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	1	Accept any clear and unambiguous response.				
	b	<p>core</p> <input type="text"/> <p>mantle</p> <input type="text"/> <p>crust</p> <input type="text"/>	2	<p>Must be in this order.</p> <p>Accept any clear and unambiguous response.</p> <p>All correct = 2 marks 1 or 2 correct = 1mark</p>				
	c	<table border="1" style="width: 100%; text-align: center;"> <tr> <td style="width: 25%;">B</td> <td style="width: 25%;">C</td> <td style="width: 25%;">A</td> <td style="width: 25%;">D</td> </tr> </table>	B	C	A	D	2	<p>B anywhere before C C anywhere before A A anywhere before D</p> <p>2 marks for all correct 1 mark for 2 correct</p>
B	C	A	D					
	d	<p>... the fusion of hydrogen.</p> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	1	Accept any clear and unambiguous response.				

Question		Expected Answers	Marks	Rationale				
1	e	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td>D</td></tr> <tr><td>E</td></tr> <tr><td>E</td></tr> <tr><td>D</td></tr> </table>	D	E	E	D	3	<p>Accept any clear and unambiguous response.</p> <p>all 4 correct = 3 marks 3 correct = 2 marks 2 correct = 1 mark</p>
D								
E								
E								
D								
		Total	9					

Question		Expected Answers	Marks	Rationale				
2	a	<p>They have studied the radiation from these stars.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td></td></tr> <tr><td></td></tr> <tr><td>✓</td></tr> <tr><td></td></tr> </table>			✓		1	Accept any clear and unambiguous response.
✓								
	b	i	ring around thousands of millions	1	Accept any clear and unambiguous response.			
		ii	ring around thousands of millions	1	Accept any clear and unambiguous response.			
	c		Milky Way	1	Phonetically correct spelling acceptable.			
		Total	4					

Question			Expected Answers	Marks	Rationale
3	a		ring around electromagnetic spectrum	1	Accept any clear and unambiguous response.
	b	i	ring around radio waves	1	Accept any clear and unambiguous response.
	b	ii	Gamma (rays)/ γ Ultraviolet/UV	2	Any order, 1 mark for each correct answer Allow 'X-Rays' as correct.
	c		<p>... certain number of X-ray images <input checked="" type="checkbox"/></p> <p>...</p> <p>... only small areas exposed ... <input checked="" type="checkbox"/></p> <p>...</p>	2	Accept any clear and unambiguous response.
Total				6	

Question		Expected Answers	Marks	Rationale
4	a	ring around last option $\frac{1800 \times 100}{9500}$	1	Accept any clear and unambiguous response.
	b	second distance energy number (either order)	4	1 mark for each correct answer. first 2 answers must be in the order given.
	c	ring around gives you tan ring around Generates Vit D	2	Accept any clear and unambiguous response.
Total			7	

Question		Expected Answers	Marks	Rationale															
5	a	gamma/ γ alpha/ α	2	Answers must be in the order given.															
	b	<table border="1"> <thead> <tr> <th rowspan="2">radiations</th> <th colspan="3">materials</th> </tr> <tr> <th>paper</th> <th>aluminium</th> <th>lead</th> </tr> </thead> <tbody> <tr> <td>most</td> <td></td> <td></td> <td>✓</td> </tr> <tr> <td>least</td> <td>✓</td> <td>✓</td> <td>✓</td> </tr> </tbody> </table>	radiations	materials			paper	aluminium	lead	most			✓	least	✓	✓	✓	2	Mark each row independently. 1 mark for each correct row.
radiations	materials																		
	paper	aluminium	lead																
most			✓																
least	✓	✓	✓																
	c	i	1	Accept any clear and unambiguous response.															
		<p>... activity to fall by a half.</p> <table border="1"> <tr><td></td></tr> <tr><td>✓</td></tr> <tr><td></td></tr> <tr><td></td></tr> </table>		✓															
✓																			

Question			Expected Answers	Marks	Rationale
5	c	ii	<div style="text-align: center;"> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> none of the above <input checked="" type="checkbox"/> </div>	1	Accept any clear and unambiguous response.
	d		<div style="text-align: center;"> <input type="checkbox"/> elements that emit ionising radiation <input checked="" type="checkbox"/> <input type="checkbox"/> </div>	1	Accept any clear and unambiguous response.
	e		treat cancer sterilise food	2	Accept any clear and unambiguous response.
			Total	9	

Question		Expected Answers	Marks	Rationale																				
6	a	wave wind	2	Accept any clear and unambiguous response.																				
	b	carbon dioxide	1	allow CO ₂ (C and O must be capital letters, with 2 as a subscript following the O) Allow water vapour Allow methane																				
	c	<table border="1"> <thead> <tr> <th></th> <th>for</th> <th>against</th> <th>neither</th> </tr> </thead> <tbody> <tr> <td>expensive</td> <td></td> <td>✓</td> <td></td> </tr> <tr> <td>painting</td> <td></td> <td></td> <td>✓</td> </tr> <tr> <td>polluting</td> <td>✓</td> <td></td> <td></td> </tr> <tr> <td>hazardous</td> <td></td> <td>✓</td> <td></td> </tr> </tbody> </table>		for	against	neither	expensive		✓		painting			✓	polluting	✓			hazardous		✓		4	Accept any clear and unambiguous response.
	for	against	neither																					
expensive		✓																						
painting			✓																					
polluting	✓																							
hazardous		✓																						
Total			7																					

A331/02 Modules P1, P2, P3 Higher Tier

Question		Expected Answers	Marks	Rationale
1	a	B C A D B before C C before A A before D	2	3 correct = 2 marks 2 correct = 1 mark
	b	about 5000 million years ago <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> (1) <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	1	tick in third box Allow about 4000 Million Do NOT allow Exactly Any clear and unambiguous response
	c	... the fusion of hydrogen. <input checked="" type="checkbox"/> (1) <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	1	tick in first box Any clear and unambiguous response

Question		Expected Answers	Marks	Rationale				
1	d	<table border="1"> <tr> <td>data</td> <td>explanation</td> </tr> <tr> <td>A D</td> <td>B C</td> </tr> </table>	data	explanation	A D	B C	3	all correct = 3 mark 3 correct = 2 marks 2 correct = 1 mark
data	explanation							
A D	B C							
		Total	7					

Question		Expected Answers	Marks	Rationale				
2	a	<p>They have studied the radiation from these stars.</p> <table border="1"> <tr><td></td></tr> <tr><td></td></tr> <tr><td>✓</td></tr> <tr><td></td></tr> </table> <p>(1)</p>			✓		1	tick in third box Any clear and unambiguous response
✓								
	b	ring around 10^9 to 10^{11}	1	Any clear and unambiguous response				
	c	Milky Way	1	Not MWG				
		Total	3					

Question		Expected Answers	Marks	Rationale												
3	a	ring around radiowaves	1	Any clear and unambiguous response												
	b	infrared microwaves radio waves	1	any order accept visible light												
	c	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td>type of radiation</td> <td>heating</td> <td>breaking</td> <td>both</td> </tr> <tr> <td>ionising</td> <td></td> <td></td> <td>✓ (1)</td> </tr> <tr> <td>non-ionising</td> <td>✓</td> <td></td> <td>(1)</td> </tr> </table>	type of radiation	heating	breaking	both	ionising			✓ (1)	non-ionising	✓		(1)	1 1	tick last box of row one tick in first box of second row for ionising allow 1 mark for first two boxes OR all three boxes ticked Any clear and unambiguous response
type of radiation	heating	breaking	both													
ionising			✓ (1)													
non-ionising	✓		(1)													
	d	ring around sievert	1	Any clear and unambiguous response												
	e	<p>... certain number of X-ray images <input checked="" type="checkbox"/> (1)</p> <p>...</p> <p>... only small areas exposed ... <input checked="" type="checkbox"/> (1)</p>	2	tick in first box tick in third box Any clear and unambiguous response												
Total			7													

Question			Expected Answers	Marks	Rationale
4	a		ring around last option $\frac{1800 \times 100}{9500}$	1	Any clear and unambiguous response
	b		second (1)	1	accept 'minutes' or 'hours' or 'time interval' Not "time" on its own
			distance (1)	1	accept range or length
			number (1) } either order	1	Allow amount instead of number Not accept Size of photon.
			energy (1) }	1	accept frequency/wavelength NOT colour not power
	c	i	Andrew	1	Allow Edwin
		ii	Clarissa	1	
		iii	Amy	1	
			Total	8	

Question			Expected Answers	Marks	Rationale				
5	a		X-ray and ultraviolet	1	either order				
	b		rings around rocks ; cosmic radiation ;	1 1	Any clear and unambiguous response				
	c	i	<p>... activity to fall by a half.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td style="width: 20px; height: 20px;"></td></tr> <tr><td style="width: 20px; height: 20px; text-align: center;">✓</td></tr> <tr><td style="width: 20px; height: 20px;"></td></tr> <tr><td style="width: 20px; height: 20px;"></td></tr> </table> <p style="margin-left: 100px;">(1)</p>		✓			1	tick in second box Any clear and unambiguous response
✓									
		ii	<p>none of the above</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td style="width: 20px; height: 20px;"></td></tr> <tr><td style="width: 20px; height: 20px;"></td></tr> <tr><td style="width: 20px; height: 20px;"></td></tr> <tr><td style="width: 20px; height: 20px; text-align: center;">✓</td></tr> </table> <p style="margin-left: 100px;">(1)</p>				✓	1	tick in fourth box Any clear and unambiguous response
✓									
	d		rings around sterilise food ; treat cancer ;	1 1	Any clear and unambiguous response				

Question		Expected Answers	Marks	Rationale										
5	e	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Source and use</th> <th style="width: 50%;">Reason</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Americium 241 used in Smoke alarms</td> <td style="text-align: center;">long half life and medium penetration</td> </tr> <tr> <td style="text-align: center;">Technetium 99 used to image the inside of humans</td> <td style="text-align: center;">long half life and short range radiation</td> </tr> <tr> <td style="text-align: center;">Strontium 90 used to measure thickness</td> <td style="text-align: center;">short half live and very penetrating radiation</td> </tr> <tr> <td></td> <td style="text-align: center;">short half live and short range radiation</td> </tr> </tbody> </table>	Source and use	Reason	Americium 241 used in Smoke alarms	long half life and medium penetration	Technetium 99 used to image the inside of humans	long half life and short range radiation	Strontium 90 used to measure thickness	short half live and very penetrating radiation		short half live and short range radiation	3	one mark per line
Source and use	Reason													
Americium 241 used in Smoke alarms	long half life and medium penetration													
Technetium 99 used to image the inside of humans	long half life and short range radiation													
Strontium 90 used to measure thickness	short half live and very penetrating radiation													
	short half live and short range radiation													
Total			10											

Question		Expected Answers	Marks	Rationale																				
6	a	rings around hydroelectric wind wave	1	all three for one mark Any clear and unambiguous response																				
	b	<table border="1"> <thead> <tr> <th></th> <th>for</th> <th>against</th> <th>neither</th> </tr> </thead> <tbody> <tr> <td>small fuel</td> <td>✓</td> <td></td> <td></td> </tr> <tr> <td>turbine</td> <td></td> <td></td> <td>✓</td> </tr> <tr> <td>cooling</td> <td></td> <td></td> <td>✓</td> </tr> <tr> <td>nuclear waste</td> <td></td> <td>✓</td> <td></td> </tr> </tbody> </table>		for	against	neither	small fuel	✓			turbine			✓	cooling			✓	nuclear waste		✓		3	all rows correct 3 marks 3 rows correct 2 marks 1 or 2 rows correct 1 mark Any clear and unambiguous response
	for	against	neither																					
small fuel	✓																							
turbine			✓																					
cooling			✓																					
nuclear waste		✓																						
	c	<table border="1"> <thead> <tr> <th></th> <th>Tunde</th> <th>Kelly</th> <th>both</th> <th>neither</th> </tr> </thead> <tbody> <tr> <td>power output</td> <td></td> <td></td> <td>✓</td> <td></td> </tr> <tr> <td>economic factors</td> <td></td> <td>✓</td> <td></td> <td></td> </tr> <tr> <td>environmental cost</td> <td>✓</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		Tunde	Kelly	both	neither	power output			✓		economic factors		✓			environmental cost	✓				3	Any clear and unambiguous response allow credit for ticks for Tunde and Kelly in first row
	Tunde	Kelly	both	neither																				
power output			✓																					
economic factors		✓																						
environmental cost	✓																							
		Total	7																					

A332/01 Modules P4, P5, P6 Foundation Tier

Question			Expected Answers	Marks	Rationale
1	a	i	line from 0,0 to 1.5,30 (1) line is straight (1) horizontal line along 30m/s (1)	3	Give a tolerance of +/- half a small square at (30, 1.5). Check line appears to have been drawn by a ruler, as a rule of thumb the line should go through (10, 0.5) and (20, 1.0) . Ignore anything after 5.5 minutes, allow ecf from wrong first mark as long as horizontal line is 4 mins long
		ii	50 (1) km/h (1)	2	
	b		C (1) B (1) D (1)	3	
Total				8	

Question			Expected Answers	Marks	Rationale				
2	a		<p>Bobby is doing work against gravity</p> <p>Bobby's gravitational potential energy increases</p> <table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td><input type="checkbox"/></td></tr> <tr><td><input type="checkbox"/></td></tr> <tr><td><input checked="" type="checkbox"/></td></tr> <tr><td><input checked="" type="checkbox"/></td></tr> </table>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2	One mark for each box correctly ticked then lose one mark for each additional tick
<input type="checkbox"/>									
<input type="checkbox"/>									
<input checked="" type="checkbox"/>									
<input checked="" type="checkbox"/>									

Question		Expected Answers	Marks	Rationale												
2	b	<table border="1"> <thead> <tr> <th></th> <th>true</th> <th>false</th> </tr> </thead> <tbody> <tr> <td>Bobby has the same kinetic energy as his dad</td> <td></td> <td>✓</td> </tr> <tr> <td>Bobby's kinetic energy increases as he goes faster</td> <td>✓</td> <td></td> </tr> <tr> <td>Bobby's dad goes faster because he is heavier</td> <td></td> <td>✓</td> </tr> </tbody> </table>		true	false	Bobby has the same kinetic energy as his dad		✓	Bobby's kinetic energy increases as he goes faster	✓		Bobby's dad goes faster because he is heavier		✓	2	All three correct 2 marks, Two or one correct 1 mark
	true	false														
Bobby has the same kinetic energy as his dad		✓														
Bobby's kinetic energy increases as he goes faster	✓															
Bobby's dad goes faster because he is heavier		✓														
		Total	4													

Question		Expected Answers	Marks	Rationale								
3	a	<table border="1"> <tbody> <tr> <td></td> <td></td> </tr> <tr> <td></td> <td></td> </tr> <tr> <td>A + B - C</td> <td>✓</td> </tr> <tr> <td></td> <td></td> </tr> </tbody> </table>					A + B - C	✓			1	One mark for correct box ticked then lose one mark for any additional tick
A + B - C	✓											
	b	friction (1) opposite (1) interaction (1)	3	Each mark independent of other marks								
		Total	4									

Question			Expected Answers	Marks	Rationale
4	a	i	C (1)	1	
		ii	B (1)	1	
		iii	16(p) (1)	1	pence not needed but £16 etc gains zero
	b	i	reduced (1) increased (1)	2	
		ii	<p>a transformer works with alternating voltages</p> <p>a transformer is made of two coils of wire on an iron core</p> <div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; width: 40px; height: 100%; margin-right: 10px;"></div> <div style="border: 1px solid black; width: 40px; height: 100%; margin-right: 10px;"></div> <div style="border: 1px solid black; width: 40px; height: 100%; margin-right: 10px;"></div> <div style="border: 1px solid black; width: 40px; height: 100%; margin-right: 10px;"></div> <div style="border: 1px solid black; width: 40px; height: 100%; margin-right: 10px;"></div> </div>	2	One mark for each box correctly ticked then lose one mark for each additional tick
	c	i	3 (1)	1	
		ii	0.4 (1)	1	Unit not needed but incorrect unit will score zero
Total				9	

Question		Expected Answers	Marks	Rationale
5	a	<p>When electric charge flows through the kettle energy is transferred to the kettle</p> <p>The power of the kettle is the rate of which energy is transferred to the kettle</p> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 30px; height: 30px; margin-right: 5px;"></div> <input checked="" type="checkbox"/> </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 30px; height: 30px; margin-right: 5px;"></div> <input checked="" type="checkbox"/> </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 30px; height: 30px; margin-right: 5px;"></div> <input type="checkbox"/> </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 30px; height: 30px; margin-right: 5px;"></div> <input type="checkbox"/> </div>	2	One mark for each box correctly ticked then lose one mark for each additional tick
	b	<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 30px; height: 30px; margin-right: 5px;"></div> <input type="checkbox"/> </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 30px; height: 30px; margin-right: 5px;"></div> <input type="checkbox"/> </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 30px; height: 30px; margin-right: 5px;"></div> <input checked="" type="checkbox"/> </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 30px; height: 30px; margin-right: 5px;"></div> <input type="checkbox"/> </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 30px; height: 30px; margin-right: 5px;"></div> <input checked="" type="checkbox"/> </div>	2	One mark for each box correctly ticked then lose one mark for each additional tick
		Total	4	

Question			Expected Answers	Marks	Rationale			
6	a	i	radio infrared light	2	all 3 correct 2 marks 1 or 2 correct 1 mark			
		ii		2	mark lines from left hand boxes. if more than one line from a left hand box then wrong all 3 correct 2 marks 1 or 2 correct 1 mark			
	b	i	0 and 1s (1) decodes (1)	2				
		ii	digital signals usually have higher quality <table border="1" style="display: inline-table; vertical-align: middle; margin-left: 20px;"> <tr><td> </td></tr> <tr><td>✓</td></tr> <tr><td> </td></tr> </table>		✓		1	
✓								
Total				7				

Question		Expected Answers	Marks	Rationale
7	a	frequency or wavelength (1)	1	either answer is correct
	b	speed (1)	1	
		Total	2	

Question		Expected Answers	Marks	Rationale
8	a	amplitude (1) bright (1) constructive (1)	3	three independent marks
	b	diffraction (1)	1	
		Total	4	

A332/02 Modules P4, P5, P6 Higher Tier

Question		Expected Answers	Marks	Rationale
1*	a	$A + B - C$ <div style="display: flex; align-items: center; justify-content: center; margin-top: 10px;"> <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 style="border: 1px solid black; width: 30px; height: 20px; margin-right: 5px; text-align: center;">✓</div> <div style="border: 1px solid black; width: 30px; height: 20px;"></div> </div>	1	Any additional ticks lose the mark
	b	friction (1) opposite (1) interaction (1)	3	Each mark independent of the other marks
		Total	4	

Question			Expected Answers	Marks	Rationale		
2	a	i	1.28 (1)	1	accept 1.3		
		ii	0.6 (1)	1			
	b	i	22400 (1) kg m/s (1)	2			
		ii	2240/Error carried forward – answer to part b(i) $\div 10$ (1) N/Newton(s) (1)	2	allow 2240 irrespective of answer part b(i), otherwise: if b(i) is 19600 answer is 1960 if b(i) is 42000 answer is 4200 if b(i) is 61600 answer is 6160		
		iii	<p>the force x the time ...</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td> </td></tr> <tr><td> </td></tr> <tr><td>✓</td></tr> <tr><td> </td></tr> </table>			✓	
✓							
Total				7			

Question			Expected Answers	Marks	Rationale
3	a	i	double (1)	1	
		ii	A half of (1)	1	
	b	60000 (1) J (1)	2	accept 60 kJ accept joules accept Nm	
Total				4	

Question		Expected Answers	Marks	Rationale
4	a	<p>When electric charges flow through the kettle energy is transferred to the kettle</p> <p>The power of the kettle is the rate of which energy is transferred to the kettle</p> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 30px; height: 30px; margin-right: 5px;"></div> <input checked="" type="checkbox"/> </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 30px; height: 30px; margin-right: 5px;"></div> <input checked="" type="checkbox"/> </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 30px; height: 30px; margin-right: 5px;"></div> <input type="checkbox"/> </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 30px; height: 30px; margin-right: 5px;"></div> <input type="checkbox"/> </div>	2	<p>One mark for each box</p> <p>If 3 or more boxes ticked then lose 1 mark for each additional tick</p>
	b	<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 30px; height: 30px; margin-right: 5px;"></div> <input type="checkbox"/> </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 30px; height: 30px; margin-right: 5px;"></div> <input type="checkbox"/> </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 30px; height: 30px; margin-right: 5px;"></div> <input checked="" type="checkbox"/> </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 30px; height: 30px; margin-right: 5px;"></div> <input type="checkbox"/> </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 30px; height: 30px; margin-right: 5px;"></div> <input checked="" type="checkbox"/> </div>	2	<p>One mark for each box</p> <p>If 3 or more boxes ticked then lose 1 mark for each additional tick</p>
	c	2300W (1)	1	
		Total	5	

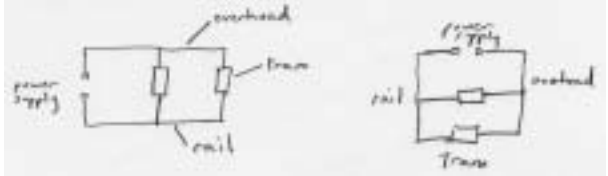
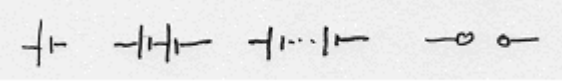
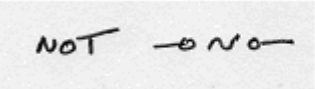
Question			Expected Answers	Marks	Rationale
5	a	i	induction (1)	1	
		ii	C (1) B (1) B (1) A (1)	4	
	b		potential difference (1) (same/opposite (no mark)) opposite (1) negative positive (1)	3	Each mark independent of the other marks – marks are awarded for 1 st , 3 rd , and 4 th sentences, both required in correct order for the mark
			Total	8	

Question		Expected Answers	Marks	Rationale
6*	a	amplitude (1) bright (1) constructive (1)	3	Each mark independent of the other marks
	b	diffraction (1)	1	
Total			4	

Question		Expected Answers	Marks	Rationale
7	a	top left box = A (1) bottom left box = B (1) top right box = C (1)	3	Each mark independent of the other marks Ignore anything in the bottom right box
	b	1.5m (1)	1	
	c	<p>signals are coded as 0s and 1s <input type="checkbox"/></p> <p>signals lose intensity as they travel <input checked="" type="checkbox"/></p> <p>signals pick up noise as they travel <input checked="" type="checkbox"/></p> <p>signals are modulated for transmission <input checked="" type="checkbox"/></p> <p>signals are decoded to produce the original sound <input type="checkbox"/></p>	2	<p>all 3 correct = 2 marks 2 correct = 1 mark 1 correct = 0 marks</p> <p>If 4 boxes ticked then max of 1 mark possible</p> <p>If 5 boxes ticked, then zero</p>
Total			6	

Question			Expected Answers	Marks	Rationale
8	a	i	C (1)	1	
		ii	A and C (1)	1	both required no extra letters allowed
	b		<div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="width: 80%;"> <p>the amplitude of the wave</p> <p>the reflection of the wave</p> <p>the frequency of light wave</p> </div> <div style="width: 15%; text-align: center;"> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> </div> </div>	2	<p>all 3 correct = 2 marks 2 correct = 1 mark 1 correct = 0 marks</p> <p>If 4 boxes ticked then max of 1 mark possible</p> <p>If 5 boxes ticked, then zero</p>
Total				4	

A333/01 Unit 3 Ideas in Context plus P7 Foundation Tier

Question			Expected Answers	Marks	Rationale
1	a	i	ac – any line that included both positive and negative regions; dc – any line that is all positive or all negative;	1 1	
		ii	battery	1	allow cell
	b	i	750	1	
		ii	P=IV; V is 750V 22500 (watts)	1 1 1	allow ecf on voltage from part(ii) 22500 gains 3 marks
	c	i	Friction; air resistance; brakes;	any 2	allow gravity If friction given twice, second example must be qualified eg friction with overhead cables
		ii	driving force greater than counter force	1	Owtte comparison must be evident
	d*	i	parallel circuit; wires labelled overhead and rail (on opposite sides of resistor. Must be parallel circuit); power supply and tram(s) correct symbol and labelled; eg 	1 1 1	Ignore additional parallel lines that short the circuit allow power supply symbols:   ie not ac supply allow a box labelled 'power supply'
				e*	1,100,000
Total				14	

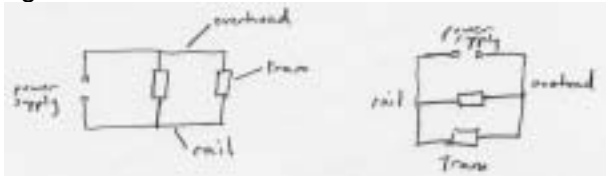
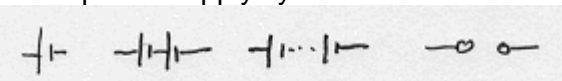
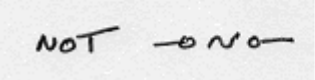
Question			Expected Answers	Marks	Rationale				
2	a	i	In order left to right – cloud of gas; protostar; <i>(Sun now)</i> red giant; white dwarf;	1 1 1 1					
		ii	supernova; neutron star/black hole;	1 1	Accept RED SUPER GIANT				
	b		convection/convective (zone)	1	accept radiative (zone)				
	c	i	hydrogen	1					
		ii	hydrogen	1					
		iii	carbon; oxygen;	1 1	accept nitrogen				
		iv	<div style="display: flex; align-items: center; gap: 10px;"> <div style="width: 250px;"> <p>very high pressures needed</p> <p>iron has a large nucleus</p> </div> <table border="1" style="border-collapse: collapse; text-align: center;"> <tr><td style="width: 30px; height: 20px;"></td></tr> <tr><td style="width: 30px; height: 20px;">✓</td></tr> <tr><td style="width: 30px; height: 20px;">✓</td></tr> <tr><td style="width: 30px; height: 20px;"></td></tr> </table> <div style="width: 30px;"> <p>(1)</p> <p>(1)</p> </div> </div>		✓	✓		1 1	
✓									
✓									
		v	Lead/Uranium	1					
Total				14					

Question			Expected Answers	Marks	Rationale				
3	a	i	A closer than B	1					
		ii	<p>10 parsecs</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td style="width: 20px; height: 20px;"></td></tr> <tr><td style="width: 20px; height: 20px; text-align: center;">✓</td></tr> <tr><td style="width: 20px; height: 20px;"></td></tr> <tr><td style="width: 20px; height: 20px;"></td></tr> </table> <p>(1)</p>		✓			1	
✓									
	b		<p>Advantage – idea of atmosphere in the way; allows use of different parts of spectrum;</p> <p>Disadvantage – cost of launch/setting up/maintenance/repair; uncertainties of space program</p>	<p>max 1</p> <p>max 1</p>	<p>allow clearer image</p> <p>owtte</p> <p>owtte</p>				
	c	i	1.5 (± 0.1)	1					
		ii	5 (± 1); days;	1 1					
	d	i	observed brightness/how bright it looks	1					

Question			Expected Answers	Marks	Rationale	
3	d	ii	size of star	<input checked="" type="checkbox"/> (1)	2	
				<input type="checkbox"/>		
			temperature of star	<input checked="" type="checkbox"/> (1)		
				<input type="checkbox"/>		
	e	i	parsecs; megaparsecs;	1 1		
			ii	light year	1	
			Total	13		

Question			Expected Answers	Marks	Rationale
4	a	i	light pollution /smoke/air pollution	1	do not allow 'pollution' unqualified
		ii	$p = 1 \div 6.2$ OR $0.16(129..)$	1	allow 0.2 if correct working shown.
		iii	(eyepiece lens) more (powerful)	1	do not allow 'stronger'
	b		cost/construction issues eg access/flat land; environmental impact; social impact/effect on local communities; working conditions/access for staff/amenities for staff;	any 2	
	c	i	curved mirror;	1	Independent marks so can still get the 2 nd mark if they have not drawn a curved mirror eg parallel rays passing through a lens and brought to focus.
			parallel rays coming to a point (focus);	1	
		ii	collect light/radiation; produce a brighter/more detailed/sharper/clearer image; to see faint sources/distant sources; reduces diffraction;	any 2	allow 'rays' better image is too vague for credit.
	d		more precise/accurate; continuous control eg can track for 24 hours; easier to find star/point telescope; comfort/cost arguments eg do not have to travel to remote locations/allows telescopes in space; QWoC – two ideas, clear expression	any 2	allow easier to process data allow networking computers if astronomical purpose explained ignore 'human error' as it is insufficient
			1	ideas do not have to be correct but should be relevant. Two relevant but not necessarily correct ideas are required for the QoWC mark.	
	e		high cost;	1	owtte
			pooling/sharing expertise;	1	owtte ignore sharing data/information
Total				14	

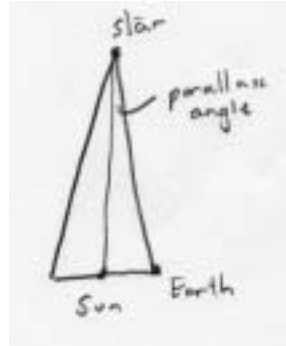
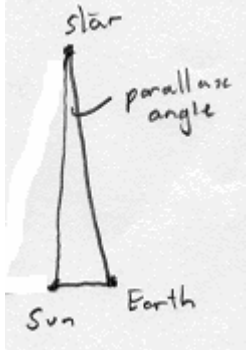
A333/02 Unit 3 Ideas in Context plus P7 Higher Tier

Question		Expected Answers	Marks	Rationale
1	a	<p>parallel circuit; wires labelled overhead and rail (on opposite sides of resistor. Must be parallel circuit); power supply and tram(s) correct symbol eg</p> 	1 1 1	<p>Ignore additional parallel lines that short the circuit allow power supply symbols:</p>  <p>NOT </p> <p>ie not ac supply allow a box labelled 'power supply' accept a variable resistor symbol for trams</p>
	b	1,100,000	1	
	c	i	1 1 1	<p>allow 'converts kinetic energy (to electrical energy)' for the movement mark. award no marks for a transformer explanation do not accept 'induced current' a.c. graph must show positive and negative voltage (allow current) Axes not necessarily labelled.</p>
		ii	2	<p>accept 1 plus explanation eg less energy loss since high voltage = 2 marks ignore 'safety' ideas do not accept 'travel' 'transport' 'send' for 'transmit' do not allow 'can convert ac to dc'</p>

Question			Expected Answers	Marks	Rationale
	d	i	PE= 850,000x20 or 17,000,000 J; links PE to KE; $v^2 = 17,000,000/(0.5 \times 85,000)$ v= 20	1 1 1 1	correct numerical response gains all 4 marks
		ii	energy lost as heat or due to friction/air resistance;	1	
			Total	14	

Question			Expected Answers	Marks	Rationale
2	a	i	light pollution /smoke/air pollution	1	do not allow 'pollution' unqualified
		ii	$p = 1 \div 6.2$ OR $0.16(129..)$	1	allow 0.2 if correct working shown.
		iii	(eyepiece lens) more (powerful)	1	do not allow 'stronger'
	b		cost/construction issues eg access/flat land; environmental impact; social impact/effect on local communities; working conditions/access for staff/amenities for staff;	any 2	Ignore 'safety of construction' ideas
	c	i	curved mirror;	1	Independent marks so can still get the 2 nd mark if they have not drawn a curved mirror eg parallel rays passing through a lens and brought to focus.
			parallel rays coming to a point (focus);	1	
		ii	collect light/radiation; produce a brighter/more detailed/sharper/clearer image; to see faint sources/distant sources; reduces diffraction;	any 2	allow 'rays' do not accept 'better' image
	d		more precise/accurate; continuous control eg can track for 24 hours; easier to find star/point telescope; comfort/cost arguments eg do not have to travel to remote locations/allows telescopes in space;	any 2	allow easier to process data allow networking computers if astronomical purpose explained ignore 'human error' as it is insufficient
			QWoC – two ideas, clear expression	1	ideas do not have to be correct but should be relevant. Two relevant but not necessarily correct ideas are required for the QWoC mark.
	e		high cost;	1	owtte
			pooling/sharing expertise/resources;	1	owtte ignore sharing data/information
			Total	14	

Question		Expected Answers	Marks	Rationale	
3	a	In order left to right: gas cloud/nebula;	1	accept 'hydrogen cloud' 'dust cloud', 'gases' and 'dust and gas' are insufficient	
		protostar;	1		
		(<i>Sun now</i>)			
		red giant; white dwarf;	1 1		accept brown/black dwarf
	b	(<i>giant star now</i>) red supergiant; supernova; neutron star/black hole	1 1 1	diagrams not needed marks are for sequence not for position so all three in correct order = 3 marks any 2 in correct order = 2 marks 1 in the correct position = 1 mark accept super red giant for red supergiant;	
	c	i	red giant/supergiant	1	
		ii	carbon; nitrogen; oxygen;	any 2	allow neon; silicon; magnesium; iron, beryllium accept correct symbols
		iii	helium	1	
		iv	nuclei contain protons; (protons/nuclei) repel each other; in nuclear fusion nuclei collide/in nuclear fusion repulsive force must be overcome; high gravity creates high pressure/high temperature; high pressure/high temperature needed to overcome (repulsive) force/produce collisions;	any 4	ignore references to the strong nuclear force
		Total		15	

Question			Expected Answers	Marks	Rationale
4	a	i	recognisable attempt at diagram to illustrate parallax with Earth, Star, Sun and angle labelled (even if incorrect angle); base of triangle is the diameter (or radius) of Earth's orbit (do not need to have drawn the line); parallax angle correctly labelled;	1 1 1	eg  or 
		ii	5	1	
		iii	avoids atmospheric distortion/refraction/turbulence/can use additional parts of spectrum/increases the size of baseline;	1	do not accept 'interference/affects' or 'light pollution' unqualified or 'no atmosphere' unqualified. accept atmosphere absorbs some radiation
	b	i	10^3 or 1000	1	If no answer provided accept construction on graph
		ii	<u>graph</u> gives Luminosity (intrinsic brightness); measure/use observed brightness; comparing luminosity and observed brightness gives distance;	1 1 1	
	c		Curtis-Shapley about whether nebula within milky way or separate galaxies; Hubble looked at Cepheid variables in nebula; found more distant than any stars in galaxy; hence nebula was a separate galaxy;	any 3	1 st marking point relates to the question/debate accept debate about more than one galaxy This 4 th marking point relates to Hubble's conclusion from the evidence.
			Total	12	

Grade Thresholds

General Certificate of Secondary Education
Physics A (Specification Code J635)
June 2009 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	A*	A	B	C	D	E	F	G	U
A331/01	Raw	42	N/A	N/A	N/A	29	24	20	16	12	0
	UMS	34	N/A	N/A	N/A	30	25	20	15	10	0
A331/02	Raw	42	36	32	26	21	17	15	N/A	N/A	0
	UMS	50	45	40	35	30	25	23	N/A	N/A	0
A332/01	Raw	42	N/A	N/A	N/A	28	24	20	17	14	0
	UMS	34	N/A	N/A	N/A	30	25	20	15	10	0
A332/02	Raw	42	28	24	20	16	12	10	N/A	N/A	0
	UMS	50	45	40	35	30	25	23	N/A	N/A	0
A333/01	Raw	55	N/A	N/A	N/A	26	21	17	13	9	0
	UMS	100	N/A	N/A	N/A	60	50	40	30	20	0
A333/02	Raw	55	36	28	21	14	9	6	N/A	N/A	0
	UMS	100	90	80	70	60	50	45	N/A	N/A	0
A339	Raw	40	33	30	26	23	19	15	12	9	0
	UMS	100	90	80	70	60	50	40	30	20	0
A340	Raw	40	33	31	28	25	21	18	15	12	0
	UMS	100	90	80	70	60	50	40	30	20	0

A339/A340 (Coursework) - The grade thresholds have been determined on the basis of the work that was presented for award in June 2009. The threshold marks will not necessarily be the same in subsequent awards.

Specification Aggregation Results

Overall threshold marks in UMS (ie after conversion of raw marks to uniform marks)

	Maximum Mark	A*	A	B	C	D	E	F	G	U
J635	300	270	240	210	180	150	120	90	60	0

The cumulative percentage of candidates awarded each grade was as follows:

	A*	A	B	C	D	E	F	G	U	Total No. of Cands
J635	21.3	49.0	77.5	94.8	99.0	99.8	100.0	100.0	100.0	15349

15620 candidates were entered for aggregation this series

For a description of how UMS marks are calculated see:

http://www.ocr.org.uk/learners/ums_results.html

Statistics are correct at the time of publication.

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