



General Certificate of Secondary Education

Physics 3451/F *Specification B*

Mark Scheme

2005 examination - June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Physics (Specification B) Foundation Tier 3451/F

3451/F Q1

question	answers	extra information	mark
(a)(i)	less than	accept any correct indication	1
(ii)	more than	accept any correct indication	1
(b)	any two from: stays <u>above</u> the same place above the equator one orbit takes 24 hours	do not accept stays <u>in</u> the same place do not accept goes around equator unless qualified do not accept orbit at same speed as Earth do not accept orbit at a constant speed accept has same angular speed / velocity as Earth	2
total			4

3451/F Q2

question	answers	extra information	mark
(a)	comet		1
(b)	<u>large</u> group / number / collection of stars	ignore reference to planets accept millions of stars do not accept thousands of stars do not accept loads of stars	1
(c)	giant supernova neutron		1 1 1
total			5

3451/F Q3

question	answers	extra information	mark
(a)(i)	radio		1
(ii)	gamma	accept microwave accept infrared	1
(iii)	ultra violet		1
(iv)	microwaves		1
(b)	the same as		1
(c)	X-rays do not go through lead	references to gamma rays are incorrect accept lead protects them from the X-rays accept not exposed to X-rays	1
	lead stops / reduces risk of X-rays harming / damaging / killing (persons) <u>cells</u>	accept X-rays (may) cause cancer accept organs for cell do not accept references to electric shock do not accept stops bones of people showing on X-ray answers involving the horse wearing an apron are incorrect	1
	Quality of written communication	award for a sensible sequence of two points	1
total			8

3451/F Q4

question	answers	extra information	mark
(a)	light		1
	electrical		1
(b)	15% or 0.15	correct substitution gains 1 mark only an answer of 15 with no unit or an incorrect unit gains 1 mark an answer of 0.15 given with a unit gains 1 mark	2
(c)	the ticket machine is a long way from other electricity supplies		1
(d)	any figure between 5 and 10 inclusive	unit not required but if given must match numerical answer	1
total			6

3451/F Q5

question	answers	extra information	mark
(a)(i)	radon (gas)	do not accept gas	1
(ii)	background		1
(b)	bigger	accept any word which means bigger	1
(c)	Z	if Z is not given, the reason does not score	1
	alpha will not pass through aluminium or lead	accept alpha cannot go through metals / dense material accept there is nothing to stop the radiation accept alpha will not pass through aluminium do not accept alpha will not pass through lead do not accept alpha stopped by air	1
total			5

3451/F Q6

question	answers	extra information	mark
(a)	loses negative charge / electrons	do not accept positive charge transfers to the comb do not accept friction	1
(b)	A attract		1
	B repel		1
	C attract		1
(c)	F A D E	allow 2 marks for 2 letters in the correct place allow 1 mark for 1 letter in the correct place	3
total			7

3451/F Q7

question	answers	extra information	mark
(a)	all points correctly plotted	tolerance $\pm \frac{1}{2}$ square on y axis only allow 1 mark for 3 correctly plotted points	2
	attempt made to draw a smooth curve	do not accept dot-to-dot line	1
(b)(i)	3 days \pm 0.2 or any value correctly obtained using their graph line	if no line drawn in (a), answer must be exactly 3	1
(ii)	3 days or their (b)(i)		1
(c)	radon-222	accept radon or 222 accept alpha or 3.8 correct isotope required for reason to score	1
	has the shortest <u>half-life</u>	accept the others have longer <u>half-lives</u>	1
total			7

3451/F Q8

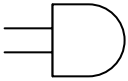


question	answers	extra information	mark
(a)	fossils of Cynognathus are found in Africa and South America		1
	the shapes almost fit together	only two boxes should be ticked deduct 1 mark for each additional box to a minimum mark of 0	1
(b)	continental		1
	crust		1
	tectonic		1
total			5

3451/F Q9

question	answers	extra information	mark																				
(a)	capacitor	accept condenser	1																				
	LDR	or light dependent resistor accept 'ldr', 'Ldr' etc.	1																				
	relay (normally open)	do not accept 'relay normally closed'	1																				
(b)(i)	battery	accept '(battery of) cells' do not accept 'battery / cell'	1																				
(ii)	LED	or light emitting diode accept 'led' or 'Led' do not accept just 'diode'	1																				
(iii)	B will light (but C will not)	accept '(only) B will work' accept 'one is on the other is off' do not accept 'C is on and B is off'	1																				
(iv)	any one from: B is connected the right way round (and C is not) a (light emitting) diode only allows (a significant) current to flow in one direction B's anode is connected to the positive side of the supply B's cathode is connected to the negative terminal	N.B. the candidate's answer to part (b)(iii) may include this mark but do not credit if the response to part (b)(iii) is incorrect or there is any other contradiction if (iv) is completely consistent with (iii) which is wrong, allow 1 mark	1																				
(c)(i)	<table border="0"> <tr> <td>first input</td> <td>second input</td> <td>output</td> <td></td> </tr> <tr> <td>0</td> <td>0</td> <td>0</td> <td></td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td></td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td></td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td></td> </tr> </table>	first input	second input	output		0	0	0		1	0	0		0	1	0		1	1	1		<p>all correct</p> <p>allow: OFF NO OFF NO OFF NO ON YES</p>	1
first input	second input	output																					
0	0	0																					
1	0	0																					
0	1	0																					
1	1	1																					
(ii)	truth (table)		1																				

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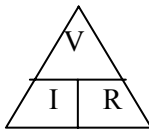
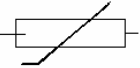
3451/F Q9 cont...

(iii)		<p>a Roman upper case D in any orientation without contacts is acceptable but if contacts are shown do not give the mark if there is any ambiguity or contradiction</p> <p>allow</p>  
(d)	<p>light sensor</p> <p>NOT gate</p>	<p>or light dependent resistor or LDR accept 'ldr', Ldr' etc allow solar cell, photo cell</p> <p>accept 'Not gate' or 'not gate'</p> <p>if both correct but in the wrong order credit with 1 mark</p>
total		12

3451/F Q10

question	answers	extra information	mark
(a)(i)	rays continued to meet on the right hand side of the lens and beyond	must be straight lines from the right hand side of the lens ignore details through the lens allow if no arrows	1
	meet exactly on the axis	negate mark if contradictory arrow(s) added do not need to go beyond the focus for this mark	1
(ii)	(principal) focus	or focal (point)	1
(iii)	converging	or convex	1
(b)(i)	A		1
(ii)	rays seem to come from this point	or words to this effect or shows this on the diagram	1
(iii)	diverging	or concave	1
(c)	film	accept any unambiguous method of showing the correct response	1
	smaller than		1
	further away from		1
(d)	any three from:		3
	<ul style="list-style-type: none"> • real image can be put on a screen • virtual image cannot be put on a screen / film • virtual image is imaginary • real image is formed where (real) rays cross / converge • virtual image is where virtual / imaginary rays (seem to) come from • virtual image formed where virtual rays intersect / cross 	allow film allow real image has light travelling through it or virtual image is where rays seem to come from	
total			13

3451/F Q11

question	answers	extra information	mark
(a)(i)	$A_1 = 0.5$	ignore any units	1
	$A_4 = 0.5$	allow 1 mark for $A_1 = A_4 \neq 0.5$	1
(ii)	the resistance of P is more than 20Ω		1
	a smaller current goes through P / A_2 (than 20Ω)	dependent on getting 1 st mark correct accept converse	1
(b)(i)	potential difference = current \times resistance	accept pd / voltage for potential difference accept $V = I \times R$, correct symbols and correct case only accept volts = amps \times ohms accept  provided subsequent method is correct allow combination of physical quantities and named units allow voltage = $I \times R$	1
(ii)	6	allow 1 mark for correct substitution	2
(iii)	6	accept their (b)(ii)	1
(c)	<u>thermistor</u> or 	accept correct circuit symbol allow phonetic spelling	1
	<u>resistance</u> goes down (as temperature of thermistor goes up)	do not accept changes for goes down do not accept an answer in terms of current only answers in terms of other components are incorrect	1
total			10

3451/F Q12

question	answers	extra information	mark
(a)(i)	larger the distance, greater the time	accept 'they are proportional' accept converse	1
(ii)	any value between 6 and 9 years inclusive		1
(b)(i)	carbon dioxide		1
(ii)	(Venus) has <u>higher</u> temperature (than Mercury)	accept has the <u>highest</u> temperature accept Venus is <u>hotter</u> / <u>hottest</u> do not accept has a high / very high temperature	1
	(Venus) further from the Sun than Mercury	accept 'Venus is not the closest planet to the Sun' answer in terms of greenhouse effect only, scores 0 marks	1
total			5

3451/F Q13

question	answers	extra information	mark
(a)(i)	20		1
(ii)	convection		1
(iii)	fit draughtproof strips	accept lay carpet accept fit curtains accept close doors / windows / curtains accept any reasonable suggestion for reducing a draught 'double glazing' alone is insufficient	1
(b)	air is (a good) insulator or air is a poor conductor	accept air cavity / 'it' for air	1
	reducing heat transfer by <u>conduction</u>	accept stops for reduces ignore convection do not accept radiation do not accept answers in terms of heat being trapped	1
(c)(i)	most cost effective	accept it is cheaper or <u>lowest</u> cost accept shortest payback time accept in terms of reducing heat loss by the largest amount do not accept it is easier ignore most heat is lost through the roof	1
(ii)	4		1
total			7

3451/F Q14

question	answers	extra information	mark
(a)(i)	<u>constant</u> speed	do not accept normal speed do not accept it is stopped / stationary	1
	in a straight line	accept any appropriate reference to a direction constant velocity gains 2 marks 'not accelerating' gains 2 marks terminal velocity alone gets 1 mark	1
(ii)	goes down owtte	accept motorbike (it) slows down	1
(b)(i)	20 (m/s)	ignore incorrect units	1
(ii)	acceleration = $\frac{\text{change in velocity}}{\text{time (taken)}}$	do not accept velocity for change in velocity accept change in speed accept $a = \frac{v-u}{t}$ or $a = \frac{v_1 - v_2}{t}$ or $a = \frac{\Delta v}{t}$ do not accept $a = \frac{v}{t}$	1
(iii)	4 or their (b)(i) \div 5	allow 1 mark for correct substitution	2
	m/s ²	m/s/s or ms ⁻² or metres per second squared or metres per second per second	1
(c)	vehicle may skid / slide	loss of control / brakes lock / wheels lock accept greater stopping distance or difficult to stop	1
	due to reduced friction (between tyre(s) and road)	accept due to less grip do not accept <u>no</u> friction	1

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3451/F Q14 cont...

(d)	<p>any three from:</p> <ul style="list-style-type: none"> • <u>increased</u> speed • <u>reduced</u> braking force • <u>slower</u> (driver) reactions • <u>poor</u> vehicle maintenance • <u>increased</u> mass / weight of vehicle • <u>poor</u> road surface • <u>more</u> streamlined 	<p>do not accept night time / poor vision</p> <p>N.B. specific answers may each gain credit eg tiredness (1), drinking alcohol (1), using drugs (1), driver distracted (1) etc</p> <p>specific examples may each gain credit eg worn brakes or worn tyres etc</p> <p>accept large mass / weight of vehicle</p> <p>if candidates give three answers that affect stopping distance but not specific to <u>increase</u> award 1 mark only</p>	3
total			13

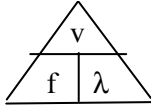
3451/F Q15

question	answers	extra information	mark
(a)(i)	arrow from centre of the ball and at right angles to the string and in the correct direction	arrow should point to the student's belt accept free-hand 'straight' line do not accept curved line	1
(ii)	increase increase increase	accept 'be stronger / bigger' accept 'be stronger / bigger' accept 'be stronger / bigger'	1 1 1
(b)	speed velocity direction	all three correct any two correct for 1 mark otherwise 0 marks	2
(c)(i)	centripetal	accept 'centripedal' and other minor misspellings do not accept anything which could be 'centrifugal'	1
(ii)	gravity	accept 'weight' accept 'force of attraction due to mass(es) (of the Moon and the Earth)'	1
(iii)	electron(s)		1
(iv)	electrostatic	accept 'electrical' do not accept just 'centripetal'	1
total			10

3451/F Q16

question	answers	extra information	mark
(a)(i)	X at the centre of the lifebelt	measuring from the centre of X, allow 2 mm tolerance in any direction	1
(ii)	any two from: below the point of suspension at the centre (of the lifebelt) (because) the lifebelt / it is symmetrical	if X is on vertical line below the hanger (but not at centre) can gain the first point only accept '(vertically) below Y' accept 'in the middle' or (because) the mass / weight is evenly distributed	2
(b)	Nm or newton metre(s) 750	accept Newton metre(s) do not accept any ambiguity in the symbol ie NM, nM or nm (moment) = force \times (perpendicular) distance (between line of action and pivot) or (moment) = 500×1.5 gains 1 mark	1 2
(c)	Quality of written communication: any three connected points from: low(er) <u>centre of mass / gravity</u> (more) <u>stable</u> less likely to fall over the <u>turning effect / moment</u> (of the weight of case) is less so the pull on her arm is less	for 2 of the underlined terms used in the correct context or <u>centre of mass / gravity</u> will be close(r) to the wheels / axle / ground or less <u>unstable</u> accept 'less likely to overturn' do not accept 'will not fall over' or so less effort is needed to hold the case ignore references to pulling the case	1 3
total			10

3451/F Q17

question	answers	extra information	mark
(a)	any two from:		2
	<ul style="list-style-type: none"> • amplitude decreasing • wavelength increasing • frequency decreasing 	accept siren / sound getting quieter do not accept sound decreases accept pitch decreasing ignore reference to transverse wave ignore reference to speed contradictory statements within each point lose the mark	
	Quality of written communication	all emboldened terms in candidate's answer used correctly	1
(b)(i)	ultrasound or ultrasonic		1
(ii)	wave speed = frequency \times wavelength	accept speed / velocity for wave speed accept $v = f \times \lambda$ do not accept w for λ do not accept s for v accept 	1
(iii)	339.2 or 340 or 339	allow 1 mark for using 212 000 allow 1 mark for correct substitution an answer of 0.3392 or 0.34 or 0.339 gains 1 mark only award full credit for a correct numerical answer with the unit changed to km/s	3
total			8