



General Certificate of Secondary Education

Physics 3451/F *Specification B*

Mark Scheme

2006 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)	<p>4 correct lines drawn</p>	<p>1 mark for each correct line</p> <p>if more than 4 lines are drawn mark incorrect ones first. Mark only 4 lines</p>	4
(b)	4		1
(c)(i)	nuclear		1
(ii)	(natural) gas	do not accept natural	1
total			7

3451/F Q2

question	answers	extra information	mark
(a)(i)	ultra violet		1
(ii)	kill the cells	accept destroys the cells accept makes cells cancerous accept damage cells accept harms cells accept changes DNA accept cause cells to mutate accept skin cells for cells accept cause cancer do not accept skin for cells do not accept burns the cells	1
(b)(i)	the sunbed uses an alternating current (a.c.) supply		1
(ii)	10.8	accept 1 mark for correct substitution of power in W or kW <u>and</u> time in hours or seconds	2
total			5

3451/F Q3

question	answers	extra information	mark
(a)(i)	M		1
(ii)	K		1
(iii)	J		1
(iv)	O		1
(b)(i)	billions of years		1
(ii)	red giant	any answer in terms of explosion or supernova is incorrect	1
	contracts / shrinks to	incorrect reference to black hole negates 1 mark	1
	white dwarf		1
total			8

3451/F Q4

question	answers	extra information	mark
(a)(i)	A and C	both answers must be correct in either order	1
(ii)	A and B	both answers must be correct in either order	1
(iii)	same number of protons plus neutrons or same number of nucleons	accept number of particles in nucleus the same do not accept they add up to 6 unless qualified	1
(b)(i)	any two from: • boron - 12 • carbon - 14 • oxygen - 15 • lead - 209	both required both name and number must be given	1
(ii)	any two from: • boron - 11 • carbon - 12 • oxygen - 16 • lead - 207	both required both name and number must be given	1
(c)	alpha		1
total			6

3451/F Q5

question	answers	extra information	mark
(a)	(good) insulator	accept does not conduct (electricity) accept does not conduct heat or electricity do not accept does not conduct heat outside is tough is insufficient	1
(b)	fuse		1
(c)	connect the green and yellow / earth wire	accept wires must be connected to screws	1
	swap the brown and blue wires round		1
total			4

3451/F Q6

question	answers	extra information	mark
(a)	fossils	answers can be in either order	1
	water		1
(b)	increased		1
(c)	radio telescope		1
total			4

3451/F Q7

question	answers	extra information	mark
(a)(i)	electrical		1
	kinetic	accept movement	1
(ii)	heat	answers can be in either order	1
	sound		1
(b)(i)	360	accept 1 mark for correct substitution	2
(ii)	watt		1
(c)	the stairlift is not moving the stairlift is moving at constant speed	both answers are required for the mark	1
total			8


3451/F Q8

question	answers	extra information	mark
(a)(i)	(up) further	any reference to downwards movement loses credit accept <u>with</u> more force accept motion would increase	1
	or (up) faster		
(ii)	down	accept the opposite way accept drop	1
(b)(i)	direct current		1
(ii)	Z		1
total			4

3451/F Q9

question	answers	extra information	mark
(a)	level of radiation (detected) will not change	ignore reference to particles	1
	if thickness of aluminium changes	accept for both marks a specific example eg if the aluminium gets thicker the level of radiation detected stays the same. accept for 1 mark gamma will pass through aluminium	1
	QoWC for 2 points in a sensible sequence		1
(b)	S W T V	all in correct order accept 2 marks for 2 correct accept 1 mark for 1 correct	3
total			6

3451/F Q10

question	answers	extra information	mark															
(a)	thermistor(s) LDR(s) switch(es) LED(s) buzzer(s) motor(s)	1 mark each or light dependent resistor(s) or light emitting diode(s)	6															
(b)(i)	<table><tr><td>1st input</td><td>2nd input</td><td>Output</td></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table>	1 st input	2 nd input	Output	0	0	0	1	0	0	0	1	0	1	1	1	all correct	1
1 st input	2 nd input	Output																
0	0	0																
1	0	0																
0	1	0																
1	1	1																
(ii)	<table><tr><td>Input</td><td>Output</td></tr><tr><td>0</td><td>1</td></tr><tr><td>1</td><td>0</td></tr></table>	Input	Output	0	1	1	0	both correct	1									
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1	0	1																
0	1	1																
1	1	1																
(c)(i)		do not credit any attempt which could equally well be a poorly drawn attempt at the symbol for a cell	1															
(ii)	charge increases	accept ‘electrons’ accept ‘energy’ or gets bigger/larger	1 1															
total			12															

3451/F Q11

question	answers	extra information	mark
(a)(i)	A		1
(ii)	B		1
(iii)	mass is larger	credit if the response is clear by some other means e.g. it is ringed	1
	wire is shorter	credit if the response is clear by some other means e.g. it is ringed	1
(b)	moment		1
	distance		1
(c)(i)	1		1
(ii)	5		1
(iii)	any two from <ul style="list-style-type: none"> remove slotted mass(es) slide (slotted) masses / weights nearer pivot slide forcemeter away from the pivot slide rod to the left 	or to the left or to the right or so that the slotted masses side is shorter or so that the forcemeter side is longer	2
(d)	centre of the rectangle	accept 2mm tolerance any direction	1
	centre of the circle	accept 2mm tolerance any direction	1
	on centre line and 10mm above base	accept 2mm tolerance any direction	1
total			13

3451/F Q12

question	answers	extra information	mark
(a)	0.05 (A)	ignore incorrect units if given accept 'the same' / 'the same as K' / 'the same as the other ammeter' do not accept 'same as the other meter'	1
(b)(i)	any two from: <ul style="list-style-type: none"> two cells are joined + to + some of the cells potential difference is across the diode / ammeters / wires or the pd of the cells is shared by all components the other components have a resistance cells not fully charged or cells partially run down cells have an internal resistance 	answers in terms of current gain no marks accept one cell in the wrong way accept two cells are joined back-to-back accept two cells are joined – to – accept battery for cell do not accept answers in terms of all the cells or in terms of energy only accept voltage for pd do not accept using up pd accept a named component / components / wire has a resistance do not accept voltage of cells is less than 1.5 unless explained do not accept cells are not as powerful unless explained	2
(ii)	the diode has a (very) <u>high</u> resistance (in the reverse direction)		1
	a diode only conducts / allows current to flow in one direction	accept little / no current flows do not accept blocks / cuts flow	1

Continued

3451/F Q12

question	answers	extra information	mark
(c)	QoWC for the use of the word resistance	annotate Q✓ Q✗ accept resistant	1
	accept increase / change / decrease throughout question but a contradiction loses one mark with change as neutral		
	as the pd / current increases / changes	accept voltage for pd must be correctly linked to at least one of the following points accept	1
	the temperature of the filament increases / changes	lamp / bulb for filament accept filament becomes hotter	1
	increasing / changing the resistance of the lamp	accept for 1 mark only the filament lamp does not obey Ohm's law	1
total			9

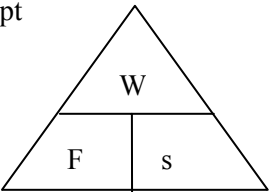
3451/F Q13

question	answers	extra information	mark
(a)	0.5		1
	hertz	accept Hz but not HZ / hz / hZ	1
		accept (waves) per second or / sec or / s or s ⁻¹ or sec ⁻¹	
(b)	any one from: <ul style="list-style-type: none"> any named part of the electromagnetic spectrum S – waves / secondary waves wave on a rope 	do not accept seismic waves / earthquake do not accept slinky unless clearly described	1
(c)	transverse – disturbance / vibration is perpendicular to the direction of energy transfer / wave travel	accept a correctly labelled diagram	1
	longitudinal – disturbance / vibration is parallel to the direction of energy transfer / wave travel	accept a correctly labelled diagram part explanation of the difference between transverse and longitudinal gains 1 mark	1
(d)(i)	TIR shown	needs to stay inside water jet ignore number of reflections or arrow heads lines straight by eye	1
(ii)	bigger than	any indication of correct answer	1
total			7

3451/F Q14

question	answers	extra information	mark
(a)	W		1
	has only two states or is either on or off	accept discrete values only do not credit answer purely in terms of shape	1
(b)	any one from: • higher quality • increased carrying capacity • errors can be rectified	accept clearer do not accept easier to read ignore faster accept <u>less</u> distortion or <u>less</u> weakening of signal strength do not accept no distortion / weakening on its own accept more information can be sent or more channels	1
total			3

3451/F Q15

question	answers	extra information	mark
(a)(i)	all points plotted accurately	accept 1 mark for 5 correct plots $\pm \frac{1}{2}$ small square on stopping distance	2
	line of best fit must be continuous	accept attempt at a reasonable curve does not need to go through 0 0 do not accept a straight line do not accept dot-to-dot	1
(ii)	4 to 6 (metres)	accept ecf from (a)(i) accept 1 mark for value taken correctly from graph at 25mph or correct method shown	2
(b)(i)	0.7 (s)	incorrect unit = 0 marks	1
(ii)	constant speed / velocity	accept (continued as) 30mph accept did not change / stayed the same accept no acceleration	1
(iii)	3.3(s)	penalise incorrect unit once only	1
(iv)	reaction time <u>increases</u> / is <u>longer</u> or thinking distance <u>increases</u>	do not accept reaction time slower or reactions are slower	1
	stopping distance / it <u>increases</u>	do not accept travels at constant speed for longer	1
(c)(i)	work done = force (applied) \times distance (moved)	accept $W = F \times s$ or $W = F \times d$ accept  provided subsequent method is correct	1

Continued

3451/F Q15

question	answers	extra information	mark
(ii) E	2100	accept 2.1 kilo accept 1 mark for using 7000N	2
(iii)	2100 (joules)	accept their (c)(ii)	1
total			14

3451/F Q16

question	answers	extra information	mark
(a)(i)	refraction		1
(ii)	it changes speed or change in density	accept it speeds up do not accept it slows down do not accept air is more dense than glass	1
(b)(i)	sound / waves <u>diffract</u> through the gap (in the wall) or over the wall or because the gate is open	do not accept reflection this only scores if first marking point is given accept for 1 mark only sound / waves go through the gap and <u>spread out</u> or diagram showing wave fronts spreading out from open gates if diagram is labelled as diffraction both marks can be scored	1 1
(ii)	less diffraction	accept no diffraction accept gates <u>absorb</u> sound / noise / waves accept gates <u>reflect</u> sound / noise / waves do not accept rebounds / stops / blocks out	1
total			5

3451/F Q17

question	answers	extra information	mark
(a)	both rays brought to a focus at F on the right	do not have to be continued beyond F	1
	lines have been drawn accurately with a ruler	only credit if 1st mark credited do not credit if contradictory arrow(s) added	1
(b)	rays seem to come from a focus at G on the left and continued to the right of the lens	this mark is for the current idea of divergence	1
	lines have been drawn accurately with a ruler	only credit if 1st mark credited do not credit if contradictory arrow(s) added	1
(c)	...lens... ...image... ...object... ...image... ...object... ...lens...	lens as 1st and 6th words (1) image and object in the correct order 2nd and 3rd words (1) image and object in correct order 4th and 5th words (1)	max 3
(d)(i)	correct statement about real image real rays intersect / cross to form a real image or a real image can be formed on a screen or real image is (always) on the opposite side (of the lens) or real image is (always) upside down (to the object)	may be credited from a correct diagram	1
	correct statement about virtual / imaginary image virtual / imaginary rays intersect / cross to form a virtual image or a virtual / imaginary image cannot or virtual / imaginary image is (always) on the same side (of the lens) or virtual / imaginary image is (always) same way up (as the object)	may be credited from a correct diagram	1

Continued

3451/F Q17

question	answers	extra information	mark
(ii)	either image needs to fall on / affect the film or image needs to fall on / affect the light sensors / charged coupled devices (CCDs) (in a digital camera / mobile phone) or image needs to cause a chemical reaction (in / on the film)		1
total			10

3451/F Q18

question	answers	extra information	mark															
(a)	AND (gate)	accept ‘and’	1															
	OR (gate)	accept ‘or’	1															
	NOT (gate)	accept ‘not’ or invert gate	1															
	LED or light emitting diode	accept ‘led’	1															
(b)(i)	NOT (gate) and AND (gate)	both in either order or ‘(the) gates’ any additions lose the mark	1															
(ii)	<table border="1"><thead><tr><th>Switch for fire</th><th>Tilt switch</th><th>Signal to relay</th></tr></thead><tbody><tr><td>0</td><td>0</td><td>...0...</td></tr><tr><td>0</td><td>1</td><td>...0...</td></tr><tr><td>1</td><td>0</td><td>...1...</td></tr><tr><td>1</td><td>1</td><td>...0...</td></tr></tbody></table>	Switch for fire	Tilt switch	Signal to relay	0	0	...0...	0	1	...0...	1	0	...1...	1	1	...0...	all correct allow off or no off no on yes off no	1
Switch for fire	Tilt switch	Signal to relay																
0	0	...0...																
0	1	...0...																
1	0	...1...																
1	1	...0...																
(iii)	(relay) acts as / is a switch	accept implication that it works as a switch e.g. ‘turns on fire’	1															
	either small current from the electronic / control circuit / system (1)	or ‘small current through the coil (of the relay)’	1															
	large current through the output / (electric) fire (1)	do not accept small current is turned into a large current	1															
	or full current through electronic control system (1) may damage components / lead to overheating / electric shock (1) QoWC for correct use of the scientific term ‘current’	annotate Q✓ Q✗ if answer in terms of voltage isolation / voltage/ p.d. accept QoWC mark for correct use	1															
total			10															