

Physics B

General Certificate of Secondary Education

Unit **B651/02**: Unit 1 – Modules P1, P2, P3 (Higher Tier)

Mark Scheme for January 2011

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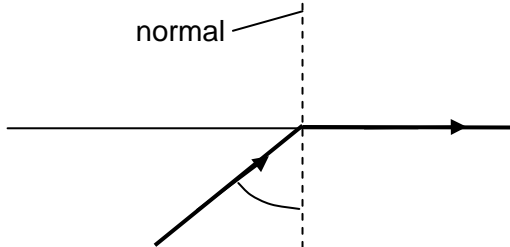
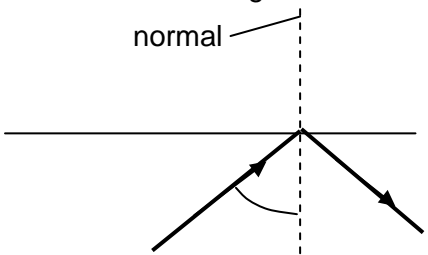
Abbreviations, annotations and conventions used in the detailed Mark Scheme.

/	=	alternative and acceptable answers for the same marking point
(1)	=	separates marking points
not	=	answers which are not worthy of credit
reject	=	answers which are not worthy of credit
ignore	=	statements which are irrelevant
allow	=	answers that can be accepted
()	=	words which are not essential to gain credit
<u> </u>	=	underlined words must be present in answer to score a mark
ecf	=	error carried forward
AW	=	alternative wording
ora	=	or reverse argument

Question		Expected Answers	Marks	Additional Guidance
1	(a)	to break (inter-) molecular bonds / AW (1)	1	allow overcome forces between molecules or particles allow break bonds between particles ignore idea of molecules breaking free from each other ignore reference to latent heat or change of state not intra-molecular bonds not break (intermolecular) forces not just break bonds
	(b)	350000 (2) but if answer is incorrect energy \div mass / e \div m or 1400000 \div 4 (1)	2	allow 3.5×10^5 allow 350 if units clearly changed to J/g (2) if answer line units not changed allow 1400000 \div 4000 (1)
		Total	3	

Question		Expected Answers	Marks	Additional Guidance
2	(a)	3 and 7	1	both needed mark table first but look for answers in working space if table is blank
	(b)	shorter / shortest / quickest payback time.	1	credit correct answer even if figures in the table contradict the answer allow only 3 years payback time allow ecf for cavity wall payback time if less than 7 years allow idea of saving money over shorter time ignore idea of saving up to pay for the insulation
	(c)	0.25 (2) but if answer is incorrect $30000 \div 120000$ (1)	2	allow 25 % (2) if % clearly shown 25 on its own or 25 J or 25N (1) allow $\frac{1}{4}$ (1) allow 0.25% for 1 mark but if answer is incorrect $(30000 \div 120000) \times 100$ (1) ignore any units other than % on answer line eg 0.25J or 0.25N scores (2)
	(d)	decreases / AW expanded / AW rise / AW	2	all three correct = (2) 2 correct (1) only 1 correct (0)
		Total	6	

Question	Expected Answers	Marks	Additional Guidance
3	<p>USE ✓'s IN THIS QUESTION</p> <p>any three from: idea that microwaves (m.w.) pass through plastic or glass (1)</p> <p>idea that m.w. reflect off side of oven / metal or onto food (1)</p> <p>reflected by door or mesh / cannot penetrate or escape through mesh or door (1)</p> <p>idea of danger of harm to humans or health if m.w. escape (through door or gaps) (1)</p> <p>conduction/convection to centre of food (1)</p>	3	<p>ignore pass a few cm into food and references to water (absorbing)</p> <p>allow plastic or glass or container do not reflect (m.w.) allow ORA eg metal containers reflect (m.w.)</p> <p>allow bounces or rebounds ignore reflects heat or IR</p> <p>allow bounces or rebounds off door allow gaps in mesh prevent diffraction of microwaves to outside of oven ignore reflects heat</p> <p>maximum of 1 mark for “bounces” for points 2 and 3</p> <p>allow burns (the skin) ignore causes cancer ignore to make it safer or it is harmful or dangerous on its own ignore just m.w. escape</p> <p>allow description of food particles passing on k.e. or description of convection current</p>
	Total	3	

Question		Expected Answers	Marks	Additional Guidance
4	(a)	idea of continuously variable / many / range of values or lots of values (1)	1	<p>allow any value / varies between two values or varies between 0 and 1</p> <p>not just variable or varying values</p> <p>allow constantly variable signals</p> <p>allow more values or more than two values</p> <p>allow varies in amplitude</p> <p>ignore fluctuates and references to frequency</p>
	(b)	<p>B ray refracted along boundary (1)</p>  <p>C ray reflected between angles of 40° and 70° (1)</p> 	2	<p>ignore reflected ray</p> <p>any clear space between refracted ray and boundary (0)</p> <p>maintain the correct angle of 30° between red lines on the marking overlay tool</p> <p>reflected ray within lines of on-screen marking overlay tool (1)</p> <p>the marking tool is merely an aid to marking, the reflected ray between 40° and 70° is the crucial decision</p> <p>allow two reflected rays within the acceptable angles</p> <p>but ray along the surface as well as a correct reflected ray scores zero</p>
	(c)	interference (1)	1	<p>allow signals become muddled</p> <p>allow idea of difficult to tune into station /AW (1)</p> <p>ignore ghosting</p>
		Total	4	

Question		Expected Answers	Marks	Additional Guidance
7	(a)	<p>daytime any one from: energy / IR / light / radiation (from the Sun) enters the room / AW (1) energy / IR / light / radiation from the Sun absorbed by walls or room or objects or ground (in room) AW (1) night time heat / IR / energy radiated (back into room) / AW (1)</p>	2	<p>allow Suns rays / waves ignore collects or stores energy ignore heat</p> <p>allow heat / IR emitted or given out (back into room) ignore releases heat / IR / energy allow higher level answers eg long(er) wavelength(s) reflected by glass (back into room) long(er) wavelength(s) given out by objects (in the room)</p>
	(b) (i)	<p>any one from: low maintenance (1) no need for power cables / AW (1) no need for fuel (1) long life (1) rugged / AW (1) renewable (energy source) (1) no polluting waste / does not produce greenhouse gases / CO₂ (1)</p>	1	<p>allow conserves fossil fuels allow idea of no emission of pollution not merely do not pollute ignore environmentally friendly</p>
	(ii)	<p>little or no power / current / electricity / energy / at night or in bad weather / if photocells covered in dust or dirt (1)</p>	1	<p>allow examples of bad weather eg cloudy or not always sunny allow idea of works poorly or inefficiently in bad weather allow idea of no (sun)light no power allow only works with (sun)light or on sunny days / ORA ignore just does not work or unusable at night / only works during the day but allow do not work when it is dark allow only collect energy or charges a battery during the day / AW allow idea of little electricity produced (by photocells) / AW allow low voltage / current produced by photocells / AW ignore need good weather /AW ignore references to cost</p>

Question	Expected Answers	Marks	Additional Guidance
(iii)	light or sunlight or radiation or Suns rays / waves or energy absorbed by photocell or silicon or crystal or semiconductor (1) idea of electrons become (knocked) loose / are released / idea of <u>free</u> electrons move around (1)	2	ignore energy converted or transferred to electricity ignore light or sunlight or radiation or Suns rays / waves or energy enters ignore solar panels ignore current
Total		6	

Question		Expected Answers	Marks	Additional Guidance
8	(a)	burned / combustion (of fuel) (1)	1	allow release energy as heat
	(b)	fermentation / fermenting / ferments (1)	1	allow anaerobic digestion / composting / transesterification / decay / decomposition ignore thermal decomposition ignore biodegrading
	(c)	any two from: remains radioactive / active or gives out radiation for a long time / long time to decay / long half life (1) terrorist threat (1) problem with leaching into groundwater (1)	2	ignore reference to cost / harmful / dangerous / pollutes / causes cancer or harms human cells or tissue / causes health problems / have to bury underground / takes up space in landfill sites harms wildlife / destroys habitats / harms the environment / mutations throughout answer allow thousands or hundreds of years or many years but not just years not just degrading / breaking down / wasting away as an AW for 'radioactive' not just remains there for a long time ignore stolen unless qualified eg stolen to make bombs (1) allow contaminates water sources or supply eg pollutes drinking water polluting lakes or rivers
	(d)	reduced current (1) less energy loss or idea of less heat loss (in cables) (1)	2	ORA allow high current wastes more energy (2) allow heat loss depends on square of current / I^2 not no energy loss or stops energy loss ignore efficiency ignore resistance in answer
		Total	6	

Question		Expected Answers	Marks	Additional Guidance
9	(a)	<p>any one from: large amount of fuel needed (1) long time taken (1) effect of low gravity on body (1) radiation or cosmic rays (1) stable atmosphere (1) idea of keeping suitable temperature in the spacecraft (1) food / drink / provisions / oxygen (1)</p>	1	<p>not merely fuel</p> <p>allow idea of the large distances involved allow physical and mental health problems for astronauts ignore death ignore communications</p>
	(b)	<p>any one from: temperature (1) magnetic field (1) radiation (1) gravity (1) atmosphere or oxygen content (1) weather / climate (1) composition of surface or planet / AW (1)</p>	1	<p>allow light levels allow presence of water allow biological content or is life there allow planets mass or size or density allow see if there is water on the planet ignore film / video ignore environmental conditions ignore samples of rock</p>
	(c)	ice [and] dust (1)	1	<p>both needed either order not rock but allow powdered rock</p>
	(d)	<p>any one from:</p> <p>idea of deflection by explosives / missile / rocket / (nuclear) bombs (1)</p> <p>blow it up / explosion near to it / destroy by explosion / destroy with missile or rocket or (nuclear) bomb (1)</p>	1	<p>not merely send an object to deflect /AW ignore deflection on its own eg send into another orbit (0) send into another orbit by bombing it (1) ignore hit to change path or deflect ignore send object to collide with it</p> <p>not just destroy allow attach solar sails and allow pressure of sunlight to deflect it (1)</p>
		Total	4	

Question		Expected Answers	Marks	Additional Guidance
10	(a)	7.2 (2) but if answer not correct 12 x 5 x 0.12 (1)	2	allow 7 (2) allow 7200 (p) (1) allow £7.20 (p) (1)
	(b)	any two from: normally less demand at night or at off peak times / idea of spare capacity at night / more demand during the day / using off-peak could reduce demand during the day (1) less electricity needs to be generated (1) saves energy companies fuel or running costs (1) idea of more consistent energy use across 24 hour period (1)	2	allow difficult / costly to shut down or turn off or restart power stations allow never turned off allow still producing electricity at night or idea of producing electricity 24/7 or electricity cannot be stored ignore electricity would be wasted allow fewer power stations needed ignore idea of improved efficiency or merely saves money allow idea of spreading demand / avoiding spikes or surges in demand / easier to cope with or manage (energy) demand
		Total	4	

Question		Expected Answers	Marks	Additional Guidance
11	(a)	weight is greater than drag or weight is biggest force / drag is smallest force / AW (1)	1	allow more gravitational pull or force than drag but not just more gravity than drag allow weight is stronger than drag ignore upthrust
	(b)	Idea that forces of weight and drag are equal (and opposite) / AW (1)	1	allow forces balance or idea of forces are equal ignore upthrust
	(c)	drag is (much) larger than weight / AW (1)	1	allow large (surface) area allow (big) increase in drag or air resistance
	(d)	kinetic (1) kinetic (1) friction / drag / air resistance (1)	3	allow KE but ignore movement allow KE but ignore movement ignore air molecules or air particles not gravity or resistance on its own ignore heat and sound
		Total	6	

Question		Expected Answers	Marks	Additional Guidance
12	(a)	25000 (Watts) (2) but if answer incorrect 50000 ÷ 2 or 50kJ ÷ 2 (1)	2	
	(b)	any two from stopping time or stopping distance increases (1) acceleration decreases (1) (less acceleration means) less force (and reduces injury) (1)	2	ignore references to just the car assume unqualified answers refer to the driver ignore slows the acceleration or impact or crash or time ignore impact
	(c)	hands on steering wheel for longer (1)	1	allow can concentrate or focus on the road / car / driving / steering or steering wheel allow less distracting for the driver allow can keep eyes on the road
		Total	5	

Question		Expected Answers	Marks	Additional Guidance
13	(a)	4 (m/s ²) (2) but if answer is incorrect (11 – 3) ÷ 2 or 8 ÷ 2 (1)	2	
	(b)	kinetic energy quadruples (1)	1	if answer line is blank allow correct answer ticked, circled or underlined
	(c) (i)	kinetic energy doubles (1)	1	if answer line is blank allow correct answer ticked, circled or underlined
	(ii)	any 2 from: more work done (by car / engine) (1) more ke used or needed (at same speed) (1) idea of more frictional forces (at same speed) or greater energy losses due to drag or friction or air resistance (1)	2	allow description eg engine is working harder (1) ignore power allow more energy used / needed
	(d)	2000 (N) (3) but if answer incorrect award 6000 (N) (2) but if this is incorrect 2000 x 3 (1)	3	if no mark scored allow 3000 or 1000 x 3 (1) for the 2 marks 6000 must be on answer line or clearly the final answer
		Total	9	

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