

Physics B

General Certificate of Secondary Education

Unit **B751/01**: Unit 1: Modules P1, P2, P3 (Foundation Tier)

Mark Scheme for January 2013

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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.

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Annotations

Annotation	Meaning
	correct response
	incorrect response
	benefit of the doubt
	benefit of the doubt <u>not</u> given
	error carried forward
	information omitted
	ignore
	reject
	contradiction
	Level 1
	Level 2
	Level 3

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

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

Question			Answer	Marks	Guidance
1	(a)		spray foam (1) thinnest / lowest thickness / AW (1)	2	allow less needed or only 74mm needed ignore takes up less space
	(b)		(foil) reflects heat or IR or energy (back into house) (1)	1	ignore attracts heat ignore bounces ignore particles not merely reflects
			Total	3	

Question			Answer	Marks	Guidance
2	(a)	(i)	same speed / all at speed of light (1)	1	allow all at 300 000 000 m/s (1) ignore fast or very fast
		(ii)	any 2 from: remote control or example eg tv remote (1) telescope (dishes) (1) automatic doors (1) (heat / night-time) photography / imaging (1) heating / cooking (1) sensors / PIR's / burglar alarms (1) games consoles / Wii (1) heat treatment for sports or muscle injury (1)	2	allow examples of wireless technology using infrared eg short range data links (1) ignore wireless technology on its own ignore mobile phones unless qualified eg for mobile phones (0) eg transferring data from a mobile phone (1) eg sending information short distances from a mobile (1) allow idea of detection of heat ignore just sending information or 'communication' allow examples of PIR's eg automatic lights

Question			Answer	Marks	Guidance
		(iii)	<p>any 2 from: portable / AW (1)</p> <p>convenient / AW (1)</p> <p>idea of allowing access or use when on the move or can connect using WiFi / other devices (1)</p>	2	<p>allow can be used away from device eg car or garage door ignore can be used anywhere</p> <p>allow can be used many places / any where in your house / or building / AW ignore can be used anywhere</p> <p>ignore 'no wires' ignore cost</p>
		(b)	<p>5 (m/s) (2)</p> <p>but if the answer is incorrect</p> <p>20 x 0.25 (1)</p>	2	<p>allow 1 mark for correct calculation using a wrong wavelength ie (wavelength = 40 m) speed = 10 (m/s) (1) (wavelength = 10m) speed = 2.5 (m/s) (1)</p>
			Total	7	

Question			Answer	Marks	Guidance
3	(a)		30240 and 35000 heater or E (2) but if the answer incorrect or no heater selected $0.6 \times 12 \times 4200$ or 30240 (1)	2	no mark for just choosing E with no working or answer no mark for choosing E with an incorrect calculation
	(b)	(i)	idea that it stays the same (1)	1	allow reaches its maximum / does not go any higher ignore a given temperature value
		(ii)	10 200 (2) but if the answer incorrect 12×850 (1)	2	
		(iii)	any two from: energy needed to heat beaker / heater (1) heat air / surroundings (1) counteract cooling / AW (1) idea of part of heater exposed / not in ethanol (1)	2	ignore efficiency ignore energy wasted or heat escapes unless qualified ignore greater mass amount of ethanol / s.l.h. greater than expected
			Total	7	

Question	Answer	Marks	Guidance
4	<p>Level 3 (5–6 marks) Candidates must conclude correctly and quantitatively the efficiencies or fractional energy loss or output of both heaters. This should be justified with reasons for the different efficiencies. When only one reason is in the answer award 5 marks. Quality of written communication does not impede communication of science at this level.</p> <p>Level 2 (3–4 marks) Candidates must conclude that heater A is more efficient and offer a reasonable qualitative or quantitative explanation as to why. Correct efficiency or fractional calculations will be awarded 4 marks. When only one heater explained award 3 marks. Quality of written communication partly impedes communication of science at this level.</p> <p>Level 1 (1–2 marks) Answers should have a simple explanation that heater A gives more heat to room and B gives less to the room or a reason for this. When only one heater is mentioned or the reason is unclear award 1 mark. Quality of written communication impedes communication of science at this level.</p> <p>Level 0 (0 marks) Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p>This question is targeted at grades up to E</p> <p>Relevant points include:</p> <p>heater A</p> <ul style="list-style-type: none"> • efficiency is 0.8 or 80% • gives more heat to the room / AW • (only) 1/5 of energy / heat goes up chimney • has a lower energy input • less energy given to wall / less wasted • is all in room • has a larger surface area giving out heat • black /dark colour emits more heat <p>heater B</p> <ul style="list-style-type: none"> • efficiency is 0.5 or 50% • gives less heat to the room / AW • ½ of heat / energy goes up chimney • has greater energy input • more energy given to wall / up chimney / wasted • is in / behind the wall • has a smaller surface area giving out heat • white / light colour emits less heat <p>A or B: heaters have different flue / chimney systems</p> <p>Use the L1, L2, L3 annotations in scoris. Do not use ticks.</p>
	Total	6	

Question			Answer	Marks	Guidance
5	(a)		idea that tsunamis are caused by earthquakes / AW (1)	1	allow (pressure) sensors in oceans can detect tsunamis allow visual confirmation of tsunami (eg water recedes) allow correct description eg plates move and cause tsunami eg earth movement disturbed water and made tsunami eg earthquake happens under water ignore merely rising sea levels
	(b)		idea of more data gathered / AW or better able to process (more) data now / AW or better (more sensitive) equipment / better technology or idea of better positioning of monitors or constant or more frequent monitoring (1)	1	ignore idea of data sharing allow description eg use more sensors or put sensors in areas known to produce earthquakes / AW
			Total	2	

Section B

Question			Answer	Marks	Guidance
6	(a)		<p>total cost £3.52 or 352 pence and over-budget / yes (3)</p> <p>but if answer is incorrect</p> <p>£1.80 / 180 pence or cost = £1.72 + £1.80 or £3.52 or 352 pence (2)</p> <p>4 x 3 x 15 (1)</p> <p>or</p> <p>adding an incorrect calculated value to £1.72 (1)</p>	3	<p>allow '52 pence over (budget)' (3)</p> <p>not merely 'over budget' must be qualified with calculation</p> <p>eg £18 + 1.72 = £19.72 (1)</p> <p>60p + 1.72 = £2.32 (1)</p>
	(b)		<p>276 (W) (2)</p> <p>but if answer incorrect</p> <p>1.2 x 230 scores (1)</p> <p>Hovergold is cheapest to run (per minute) / AW (1)</p>	3	<p>allow less expensive than the others</p> <p>allow cheaper to run</p> <p>allow ecf from calculation if working mark gained</p> <p>ignore Hovergold has least power</p>
			Total	6	

Question	Answer	Marks	Guidance
7	<p>Level 3 (5–6 marks) Answers must refer clearly to the use of lead to absorb gamma and that paper and aluminium will not stop gamma. The count only being reduced with a lead absorber or stopped by lead must be included. Safety should be addressed. If only one safety point addressed or there is one error with absorption award 5 marks. Quality of written communication does not impede communication of science at this level.</p> <p>Level 2 (3–4 marks) Answers refer to the idea of using absorbers and relative penetrating power. If absorption of alpha, beta and gamma are not all included award 3 marks. Quality of written communication partly impedes communication of science at this level.</p> <p>Level 1 (1–2 marks) Answers are limited to stopping one type of radiation or one safety features or the set-up. Errors in what absorbs a radiation will result in 1 mark being awarded. Quality of written communication impedes communication of science at this level.</p> <p>Level 0 (0 marks) Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p>This question is targeted at grades up to C</p> <p>Relevant points about absorption include:</p> <ul style="list-style-type: none"> • alpha stopped by paper or aluminium / (thin) metal • beta stopped by aluminium / (thin) metal • count does not reduce with paper and / or aluminium • gamma passes through paper / (thin) metal • gamma stopped by lead or concrete. <p>Relevant safety points include:</p> <ul style="list-style-type: none"> • protective clothing • tongs / keep a safe distance • short exposure time • keep class a safe distance • direction of source points away from teacher. <p>Relevant points about set-up include:</p> <ul style="list-style-type: none"> • GM tube detects radiation • source, absorber then GM tube. <p>Some answers may be wholly or partly expressed in diagrams so mark them accordingly e.g:</p> <ul style="list-style-type: none"> • experimental set up • relative absorptions • identification of source as gamma emitter <p>Use the L1, L2, L3 annotations in scoris. Do not use ticks.</p>
	Total	6	

Question			Answer	Marks	Guidance
8	(a)		no because count is above 10 / AW (1) but no, count is 20–30 (2)	2	no mark for 'no' on it's own if no mark is awarded for correct reference to count(s) then and answer is 'no' allow max (1) for correct idea of extrapolation / extension of graph to decide answer
	(b)		low levelput in landfill (sites) / AW (1) high level encasing in glass / ceramic or vitrified / stored in steel or iron or concrete or lead or sealed containers / idea of (stored) deep underground (1)	2	allow waste sites / waste dump / rubbish tip ignore dumped or buried or in the sea allow 'reprocessed' but ignore 'recycled' (1) not merely buried but allow (stored) in mines allow deep-geological placement or geological disposal or in a geological depository allow transformed into non-toxic form of waste allow in water pools or water storage tanks / AW ignore references to away from earthquake sites or areas that could result in leakage to groundwater ignore send it into space or put in sea / lakes not in a glass box
			Total	4	

Question			Answer	Marks	Guidance
9	(a)		<p>USE ✓'s IN THIS QUESTION</p> <p>maximum of 2 marks for:</p> <p>craters (1)</p> <p>climate change (1)</p> <p>species extinction (1)</p> <p>maximum of 2 marks for:</p> <p>(layers of) unusual elements in rocks (1)</p> <p>sudden changes in fossil numbers between adjacent layers of rock (1)</p>	3	<p>ignore references to radioactivity</p> <p>allow</p> <p>explosion (1)</p> <p>tsunami (1)</p> <p>(global) firestorm not merely 'fires' (1)</p> <p>dust storm (1)</p> <p>fall in (global) temperature (1)</p> <p>allow examples eg disappearance of dinosaurs / AW</p>
	(b)	(i)	increase confidence / accuracy of predictions (1)	1	<p>allow to help scientific research on asteroids eg so we can understand more about them</p> <p>allow idea of finding out if we are more likely to be hit by an asteroid / AW</p> <p>allow to (better) track their movement</p> <p>ignore more reliable</p> <p>ignore references to radioactivity</p> <p>ignore references to protection</p>
		(ii)	check findings / verify conclusions / check method of data collection (1)	1	<p>allow to verify or check ideas / to check 'they' are right but</p> <p>ignore to check 'it' (i.e. data) is correct</p> <p>ignore retest</p> <p>ignore to check accuracy of results / check data</p>
			Total	5	

Question			Answer	Marks	Guidance
10	(a)		any value in range 0. 10 – 0.12 (1)	1	if answer line is blank allow correct answer in table
	(b)		(larger angle) more current / AW / ORA (1)	1	ignore stronger current
	(c)		$5 \times 0.22 = 1.10$ (1)	1	allow first answer $\times 5$ / answer in table (for 90^0) $\times 5$
	(d)		angle photocell to face the Sun / track position of Sun (1)	1	allow follow the Sun / always face the Sun / tilt towards the Sun / moves towards the light allow idea of photocell always facing south
			Total	4	

Section C

Question			Answer	Marks	Guidance
11	(a)		<p>16.9 (2)</p> <p>but if answer is incorrect</p> <p>$442 \div 26.1$ (1)</p> <p>then correct comparison eg higher / exceeds cars speed eg 1.2 m/s faster (1)</p>	3	<p>allow 16.9348.... or 17 (1)</p> <p>no mark for third marking point without correct calculation eg higher speed (alone) (0) but no or incorrect answer and $442 \div 26.1 =$ higher speed (2)</p>
	(b)	(i)	B to C (1)	1	if answer line is blank allow correct answer shown on graph
		(ii)	<p>USE ✓'s IN THIS QUESTION</p> <p>stopped / zero speed (1)</p> <p>but stopped / zero speed at a (particular) floor or to allow people in or out (2)</p> <p>but stopped / zero speed at a (particular) floor or to allow people in or out and stopped in FG or second stop for longer time or for more people to get in or out / RA for DE eg time stopped DE is shorter than FG (3)</p>	3	<p>if no mention of being stopped allow idea of people getting in or out of lift (1)</p> <p>if no mention of being stopped allow idea of more people getting in or out of lift at FG (2)</p> <p>ignore lift broken down</p>
	(c)	(i)	<p>144000 (2)</p> <p>but if answer is incorrect</p> <p>$600 \times 8 \times 30$ (1)</p>	2	<p>allow $600 \times 30 = 18000$ or force x distance =18000</p>

Question			Answer	Marks	Guidance						
		(ii)	<table><tr><td>more work is done in the second journey</td><td>✓</td></tr><tr><td>the same amount of work is done in the second journey</td><td></td></tr><tr><td>less work is done in the second journey</td><td></td></tr></table> <p>(1)</p>	more work is done in the second journey	✓	the same amount of work is done in the second journey		less work is done in the second journey		1	
more work is done in the second journey	✓										
the same amount of work is done in the second journey											
less work is done in the second journey											
			Total	10							

Question			Answer	Marks	Guidance
12			<p>Level 3 (5 or 6 marks) Answer identifies up to six arguments at least two for and two against. Only five arguments scores 5 marks providing there are at least two for and two against arguments. Quality of written communication does not impede communication of science at this level.</p> <p>Level 2 (3 or 4 marks) Answer identifies up to four arguments at least one for and one against. Only three arguments scores 3 marks providing there is a for and against argument. Quality of written communication partly impedes communication of science at this level.</p> <p>Level 1 (1 or 2 marks) Answer identifies two arguments either for or against. One argument only; award 1 mark. Quality of written communication impedes communication of science at this level.</p> <p>Level 0 (0 marks) Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p>This question is targeted at grades up to C Any point in the extract must be developed to gain credit. Indicative scientific points may include:</p> <p>For:</p> <ul style="list-style-type: none"> • no petrol / diesel or fuel used (in car) • no emissions given out (by car) or at point of use • less sound pollution / quieter environment • grants / lower tax make them less expensive • likely to become less costly • easily charged from mains or at home • conserves or reduces reliance on fossil fuels / fuel can be put to other uses <p>Against:</p> <ul style="list-style-type: none"> • fuel or power source needed for electricity • emissions / CO₂ at power station • emissions / CO₂ add to global warming • pedestrians may not hear (quiet) car • expensive to buy (at the moment) • charging facilities not always available • low top speed • idea of threats to jobs in petrochemical industry • long time / 12 hours to fully charge • easier / quicker to fill cars with fuel • short range • battery disposal or replacement issues <p>Use the L1, L2, L3 annotations in scoris. Do not use ticks.</p>
			Total	6	

13	(a)		weight / gravity (1)	1	allow gravitational force but not gravitational potential force
	(b)		drag / friction / air resistance (1)	1	ignore upthrust / resistance on its own / wind
	(c)	(i)	BC (1)	1	if answer line is blank allow correct answer ticked circled or underlined
		(ii)	forces are / become balanced (1)	1	allow higher level answers eg weight and drag are equal eg gravity and air resistance are equal or balanced eg drag increases to the same level as weight
	(d)		Y (1) because Y has largest mass / one of the largest masses / AW (1) biggest height / one of the biggest heights / AW (1) or all GPE calculations shown V = 2000 / W = 4000 / X = 40000 and Y = 80000 (2)	3	allow greatest weight or greatest force allow calculations eg 200x40 is the greatest (G) PE / AW (3) ignore heaviest if Y is not chosen allow for max (1) <ul style="list-style-type: none"> greater or big height if W is chosen greater or larger mass if X is chosen
			Total	7	

Question			Answer	Marks	Guidance
14			<p>protect driver or passenger / reduce injuries / absorb energy (1)</p> <p>but protect driver or passenger / reduce injuries / absorb energy in the event of a crash or collision / AW (2)</p>	2	<p>allow increase time of collision / impact or reduce force or reduce acceleration (on people in car) (1)</p> <p>but increase time of collision / impact or reduce force or reduce acceleration (on people in car) so reducing injuries (2)</p> <p>or increase time of collision or impact / reduce force / reduce acceleration in a crash (2)</p> <p>ignore crash or collision on its own if no mark awarded allow max (1) for ABS with correct reason eg ABS prevents skidding (1)</p>
			Total	2	

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