

**Physics B**

General Certificate of Secondary Education

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

**Mark Scheme for January 2012**

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## Annotations

Annotation	Meaning
	correct response
	incorrect response
	benefit of the doubt
	benefit of the doubt <b>not</b> given
	error carried forward
	information omitted
	ignore
	reject
	contradiction

## Subject-specific Marking Instructions

- / = 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)	black is better absorber (of radiation) / ora [1] <b>or</b> white reflects (radiation) away / ora [1]	1	<b>ignore</b> attract <b>ignore</b> bounce <b>ignore</b> references to conduction and convection	
	(b)	(i)	idea of using different colours / AW [1]	1	not merely description of a thermometer
		(ii)	<b>A</b> [1]  because high(er) temperature / AW [1] and black <b>emits</b> more than white / AW [1]	3	<b>mark explanation independently.</b>  eg Cup B [0] because highest temperature [1] and white emits most heat [0]  <b>ignore</b> gaining heat from surroundings <b>allow</b> 90°C and black [1] <b>allow</b> (for emit) gives out / loses heat or radiates [1]
	(c)	<b>B and D</b> [1] no temperature change / AW [1]	2	<b>must be correct order</b> <b>allow</b> horizontal line / flat / level [1] <b>ignore</b> line / graph is straight <b>ignore</b> graph stationary	
			<b>Total</b>	<b>7</b>	

Question		Answer	Marks	Guidance
2	(a)	seismometer [1]	1	More than one answer scores [0] mark answer line <b>first</b> but if no answer given look for answer in list circled or indicated.
	(b)	(i) P – solid <b>and</b> liquid rock [1] S – solid rock only [1]	2	More than two ticks scores [0] for that wave
		(ii) <b>A</b> (P waves travel faster) [1]	1	More than one answer scores [0] mark answer line <b>first</b> . But if no answer given look for answer in list circled or indicated.
	(c)	5400 m/s <b>AND</b> Jill or 45 x 120 <b>AND</b> Jill [2] <b>either</b> 5400 m/s on its own scores [1] <b>or</b> 45 x 120 on its own scores [1]	2	allow 4500 is less than 6000 [2] 'Jill' on its own scores 0
<b>Total</b>			<b>6</b>	

Question	Answer	Marks	Guidance
3	<p><b>[Level 3]</b>  <b>Solution given with an explanation in terms of the data (payback times or money saved) <u>AND</u> an explanation of how energy losses are reduced</b>  Quality of written communication does not impede communication of the science at this level.  (5–6 marks)</p> <p><b>[Level 2]</b>  <b>Solution given with either an explanation in terms of payback times / money saved, <u>OR</u> explanation of reducing energy losses.</b>  Quality of written communication partly impedes communication of the science at this level.  (3–4 marks)</p> <p><b>[Level 1]</b>  <b>A solution is given with a simple explanation.</b>  Quality of written communication impedes communication of the science at this level.  (1–2 marks)</p> <p><b>[Level 0]</b>  Insufficient or irrelevant science. Answer not worthy of credit.  (0 marks)</p>	6	<p><b>This question is targeted at grades up to E</b></p> <p><b>Indicative scientific points may include:</b></p> <p><b>DATA</b></p> <ul style="list-style-type: none"> <li>• loft insulation / cavity wall insulation have lowest pay back times.</li> <li>• Idea that loft insulation and cavity wall insulation have largest savings.</li> <li>• Idea that loft insulation / cavity wall insulation have lowest cost to fit.</li> <li>• Idea that cavity wall plus loft insulation is the best solution.</li> </ul> <p><b>ENERGY TRANSFER</b></p> <ul style="list-style-type: none"> <li>• trap or contain air</li> <li>• reduce conduction or convection</li> <li>• air is a good insulator / AW</li> </ul> <p><b>ignore</b> ‘heat escapes’  <b>ignore</b> ‘heat particles’ at all levels</p> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>
	<b>Total</b>	<b>6</b>	

Question	Answer	Marks	Guidance
<p>4 (a)</p>	<p><b>in support of danger max. two from</b> possible health risks from radiation / m.w. [1]</p> <p>concentrated microwaves / lots of signals emitted / greater power <b>near the mast</b> [1]</p> <p>lots of time spent in house so high dose / continuous exposure [1]</p> <p><b>in support of little danger max. two from</b> mast is well above house [1]</p> <p>idea of fabric of the house absorbing some microwaves [1]</p> <p>microwave power output is low / AW [1]</p> <p>reference to long wavelength or lower frequency not harming (human) cells [1]</p>	<p>2</p>	<p><b>allow</b> reference to heating effects / health risks or examples eg brain tumours / cancer / heating brain / damage to human or body cells / tissue / m.w. could be absorbed by human cells or tissue</p> <p><b>ignore</b> danger from mast falling</p> <p><b>ignore</b> can be struck by lightning / cause electric shocks</p> <p><b>ignore</b> illness on its own / affects mind / harm people</p> <p><b>ignore</b> interference with house circuits</p> <p><b>ignore</b> idea of interfering with other signals</p> <p><b>ignore</b> heat fat or water molecules <b>only</b> eg absorbed by water molecules [0] <b>but</b> absorbed by / heats water molecules in the brain [1]</p> <p><b>ignore</b> gives a better phone signal</p> <p><b>allow</b> not ionising (like X-rays / gamma rays etc)</p> <p><b>allow</b> little evidence for the harmful effect of m.w.</p>

Question	Answer	Marks	Guidance
(b)	<p><b>any two from:</b></p> <p>idea of explanations being provisional [1]</p> <p>lack of (enough) data / quality of data [1]</p> <p>not enough evidence or proof that m.w. cause cancer / not certain of the risks of using phones [1]</p> <p>idea of conflicting evidence [1]</p> <p>idea of low power of mobile phones / different phones emit different levels / use of headset / texting (at arm's length) [1]</p> <p>long time for symptoms to occur [1]</p> <p>idea of difficulty of control group / elimination of other factors [1]</p>	2	<p><b>but</b> idea of not enough data to make a firm conclusion <b>yet</b> [2]</p> <p><b>allow</b> examples of conflicting evidence</p> <p><b>allow</b> no correlation between m.w. and effects on humans</p> <p><b>allow</b> examples eg phones only widespread for last few /15 years / mobile phones not in use long enough [1]</p> <p><b>allow</b> examples                      eg examples people affected differently                      frequency / amount of use                      different levels of exposure                      can't test everyone that has a mobile phone</p>
	<b>Total</b>	<b>4</b>	



Question		Answer	Marks	Guidance
5		analogue has values that are continuously changing / continually variable [1]  digital has values that are either on / off, high or low [1]	2	<b>allow</b> marks for correct diagrams must be clear which type of wave is referred to  <b>ignore</b> references to analogue and digital devices
		<b>Total</b>	<b>2</b>	

Question		Answer	Marks	Guidance
6	(a)	electricity [1] area [1]	2	<b>allow</b> electric / electrical (energy)
	(b)	<b>any two from</b> solar heating panel [1] light / heat passes through glass / into house [1] light / heat absorbed by walls / surfaces / floors [1] passive solar heating [1]	2	<b>allow</b> 'solar panel' [1] <b>allow</b> (solar panel) to heat water [1] but <b>ignore</b> 'solar panel' to make electricity eg. greenhouse / conservatory / windows / AW [1] <b>ignore</b> indirect examples eg wind turbines
<b>Total</b>			<b>4</b>	

Question		Answer	Marks	Guidance
7	(a)	<p><b>any two from</b></p> <p>carbon dioxide</p> <p>methane</p> <p>water vapour [1]</p>	1	<p><b>two correct for 1 mark</b></p> <p><b>allow</b> correct formula: CO<sub>2</sub> CH<sub>4</sub> H<sub>2</sub>O <b>ignore</b> CFC's / carbon monoxide</p>
	(b)	<p><b>any two from</b></p> <p>using (more) energy / cars / transport / factories / fossil fuels / AW [1]</p> <p>(increased) CO<sub>2</sub> emissions [1]</p> <p>deforestation / AW [1]</p> <p>landfill / waste decomposition [1]</p> <p>more intensive farming / cows producing methane [1]</p>	2	<p><b>ignore</b> references to the ozone layer</p> <p><b>ignore</b> merely 'litter'</p>
	(c)	<p><b>measurements - any one from</b></p> <p>difficult to collect 'average' temperatures [1]</p> <p>temperature / weather fluctuates [1]</p> <p>temperatures slow to change [1]</p> <p>only have data covering recent years / AW [1]</p> <p>other factors may be at work [1]</p> <p><b>sharing data - any one from</b></p> <p>they can check / re-test / analyse / compare data [1]</p> <p>more data available (to scientists to increase confidence in findings) [1]</p>	2	<p>eg long period of time needed to monitor measurements [1]</p>

Question	Answer	Marks	Guidance
(d)	<p><b>[Level 3]</b>  <b>One or more natural dust source(s) described and explanation given linked to the effect of the process.</b>  Quality of written communication does not impede communication of the science at this level.  (5–6 marks)</p> <p><b>[Level 2]</b>  <b>One natural dust source described and a description of the processes.</b>  Quality of written communication partly impedes communication of the science at this level.  (3–4 marks)</p> <p><b>[Level 1]</b>  <b>One natural dust or gas source described-</b>  Quality of written communication impedes communication of the science at this level.  (1–2 marks)</p> <p><b>[Level 0]</b>  Insufficient or irrelevant science. Answer not worthy of credit.  (0 marks)</p>	6	<p><b>This question is targeted at grades up to C</b></p> <p><b>Indicative scientific points may include at level 3: EFFECT of process linked</b></p> <ul style="list-style-type: none"> <li>• dust / ash reflects Sun’s heat away causing cooling</li> <li>• CO<sub>2</sub> / methane traps radiation inside atmosphere causing warming</li> </ul> <p><b>Indicative scientific points may include at level 2: DESCRIPTION OF PROCESS</b></p> <ul style="list-style-type: none"> <li>• volcanic dust projected into air / atmosphere</li> <li>• soot / ash / CO<sub>2</sub> from burning</li> <li>• dust / ash from asteroid impact</li> <li>• methane from intensive farming / landfill</li> </ul> <p><b>Indicative scientific points may include at level 1: natural DUST or GAS SOURCE</b></p> <ul style="list-style-type: none"> <li>• volcano erupting</li> <li>• asteroid impacting</li> <li>• forest fires</li> <li>• methane from biological processes</li> </ul> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>
	<b>Total</b>	<b>11</b>	

Question		Answer	Marks	Guidance
8	(a)	heater ..... because of the (highest) power / AW [1]	1	<p><b>ignore</b> references to voltage</p> <p><b>allow</b> most energy used (in 30 minutes) [1]</p> <p>answer must make clear that power is the key reason.                      eg heater because of the power [1]                      eg heater because it is 3 200 (W) / AW [1]                      eg heater because of the voltage and power [0]  <b>allow</b> heater because it has the highest power and voltage [1]</p>
	(b)	<p><b>number of kWh</b> 0.75 (kWh) [2]</p> <p><b>but if answer incorrect</b> 0.5 x 1.5 [1]</p> <p><b>cost of using iron</b> 13.5 (pence) [1]</p>	3	<p><b>Use ✓'s in this question</b> <b>allow</b> 750 [1]</p> <p><b>allow</b> ecf from kWh calculated                      eg 7.5 kWh.....135p / £1.35 [1]                      750 kWh.....13500p / £135 [1]  <b>allow</b> 13 or 14 (p) if correct working shown</p>
	(c) (i)	transformer [1]	1	<b>ignore</b> step down / step up
	(ii)	<p><b>any two from</b></p> <p>radio on longer time / more [1]</p> <p>idea of energy loss in charger / charger is inefficient or loses heat [1]</p> <p>batteries cost money to buy [1]</p>	2	
<b>Total</b>			<b>7</b>	

Question		Answer	Marks	Guidance
9	(a)	idea of (alpha / gamma) having <b>smallest</b> range in soil [1]	1	<b>allow</b> most effective at stopping (gamma) radiation <b>ignore</b> just stops radiation <b>allow</b> all radiation stopped within 300cm [1]
	(b)	<b>any two from</b>  <b>in glass</b> radioactive material cannot move [1] idea that glass cannot decompose [1] beta has shortest range in glass [1]  <b>in soil</b> radioactive material can move / get dug up in future [1] idea of contamination / organisms affected [1] may get into food chain / (drinking) water [1]	2	<b>allow</b> encasement idea using other materials, eg lead [1]  <b>ignore</b> radiation moves through soil eg radioactive material washed away [2]
		<b>Total</b>	<b>3</b>	

Question			Answer	Marks	Guidance
10	(a)	(i)	<b>C (and) D</b> [1]	1	<b>allow</b> correct letters in any order mark answer line <b>first</b> but if no answer given look for answer in list circled or indicated.
		(ii)	<b>A (and) B</b> [1] <b>E (and) F</b> [1]	2	<b>allow</b> correct pairs of letters in any order
	(b)	(i)	1.7 [2]  <b>but if answer is incorrect</b>  900 ÷ 540 [1]	2	<b>allow</b> 1.66 or 1.67 [1]  <b>allow</b> evidence of any of the given distances / time. <b>allow</b> evidence of any summative combination of distances / time eg 900 / 9 [1] eg. 100 [1] eg. (400 + 450) / 540 [1]
		(ii)	yes (no mark) idea that Laura walks at different speeds [1]	1	<b>allow</b> does not walk at a constant or steady or same speed throughout journey or she stops for part of the walk / AW [1] <b>allow</b> numerical examples
			<b>Total</b>	<b>6</b>	

Question		Answer	Marks	Guidance	
11	(a)	15 [1]	1		
	(b)	<p><b>max two from</b></p> <p>driving with:  windows open [1]  roof box on [1]  or greater load / mass (because of roof box) or could be carrying (more) passengers [1]</p> <p>driver has a different driving style [1]</p> <p><b>and max 2 from</b>  increased drag / air resistance / friction [1]  more work needs to be done / more energy needed / AW [1]</p>	3	<p><b>ORA for all marking points</b></p> <p><b>eg allow</b> examples such as speeds up / slows down a lot</p> <p><b>allow</b> more drag / less streamlined car [1]</p> <p>eg more drag from roofbox leads to a greater driving force needed so more work is done or greater power (from <math>P = F \times v</math>) [3]</p>	
	(c)	<p><b>C</b> (no mark)  emits more or most CO<sub>2</sub> / carbon dioxide into atmosphere [1]</p>	1	<p><b>allow</b> highest (carbon or CO<sub>2</sub>) emissions / largest carbon footprint [1]  <b>ignore</b> CO<sub>2</sub> harms the environment</p>	
	(d)	(i)	1050000(J) [2]	2	
			<p><b>but if answer is incorrect</b></p> <p>1500 x 700 [1]</p>		<p><b>allow</b> force x distance or evidence of this relationship [1]</p>
		(ii)	idea that there is more <b>force</b> to overcome due to open windows or roof box fitted [1]	1	<p><b>allow</b> more force to counteract [1]  eg more air resistance / drag [1]  eg. more driving force needed [1]</p>
<b>Total</b>			<b>8</b>		



Question	Answer	Marks	Guidance
12	<p><b>[Level 3]</b> Explanation of the reasons for having crumple zones in a car including the ideas of force reduced or lower rate of change of momentum. A more detailed description of the method(s) of testing or the use of the data or retesting should be included. Quality of written communication does not impede communication of the science at this level. (5–6 marks)</p> <p><b>[Level 2]</b> Ideas of longer time of collision or lower acceleration or transfer of energy resulting in reduction of injury. Some reference to testing should be included. Quality of written communication partly impedes communication of the science at this level. (3–4 marks)</p> <p><b>[Level 1]</b> Idea of changing shape and protecting occupants or reduce injuries in a crash may be included <b>or</b> mentions simple points in the testing process. Quality of written communication impedes communication of the science at this level. (1–2 marks)</p>	6	<p><b>This question is targeted up grade C</b> <b>Indicative scientific points at Level 3 may include:</b></p> <ul style="list-style-type: none"> <li>• idea of spreading the momentum change on passenger</li> <li>• longer time collision time to transfer momentum</li> <li>• retest with new design feature</li> <li>• measure forces on test dummies</li> <li>• how crumple zones protect dummies</li> <li>• crumple zone design or placement improved</li> <li>• collection and analysis of data from actual crashes</li> <li>• video crash tests</li> </ul> <p><b>allow higher level answers at level 3</b></p> <ul style="list-style-type: none"> <li>• forces reduced due to increased stopping / collision distance or time</li> <li>• lower acceleration (of driver or passenger)</li> <li>• spreading change in momentum over longer time reduces forces on driver or passenger and reduces potential injury</li> </ul> <p><b>Indicative scientific points at Level 2 may include :</b></p> <ul style="list-style-type: none"> <li>• longer time collision time or distance produced</li> <li>• idea of transfer of the car's / driver's energy</li> <li>• injuries in a crash are due to rapid deceleration of parts of the body</li> <li>• features are to reduce injuries to driver or passenger</li> <li>• measurements made on test dummies</li> <li>• assessment of effectiveness of crumple zones</li> <li>• new improved design fitted to car</li> </ul> <p><b>Indicative scientific points at Level 1 may include:</b></p> <ul style="list-style-type: none"> <li>• features change shape in a crash</li> <li>• features absorb energy in a crash</li> <li>• crash simulation</li> <li>• 'dummy' driver / passengers used</li> <li>• crumple zones examined</li> </ul>

Question			Answer	Marks	Guidance
			<p><b>[Level 0]</b>            Insufficient or irrelevant science. Answer not worthy of credit.</p> <p style="text-align: right;">(0 marks)</p>		<p><b>throughout answer</b>  <b>ignore</b> slows down impact or force  <b>ignore</b> absorbs force or impact</p> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>
			<b>Total</b>	<b>6</b>	

Question	Answer	Marks	Guidance
13	<p><b>must have at least one driver and one environment / atmosphere point for full marks</b></p> <p><b>implications for John / driver max two from</b>  short range [1]  need for (frequent) charging [1]  low top speed [1]  good for short journeys / urban use / use in city centres / AW [1]</p> <p><b>implications for environment / atmosphere max two from</b>  reduces pollution <b>given out</b> by car / less (CO<sub>2</sub> / carbon dioxide / carbon) emissions (by car) [1]  no fossil fuels used by car [1]  fossil fuels burned in power generation [1]  implications for environment from disposal of (spent) batteries [1]  reduced noise pollution [1]  possible hazard for pedestrians because cars are (very) quiet [1]</p>	3	<p><b>ignore</b> references to hybrid or solar powered cars</p> <p><b>allow</b> quieter for John  <b>allow</b> higher level answers  eg needs recharging (regularly)  eg problems of insufficient charging points  <b>ignore</b> references to cost</p> <p>eg no carbon monoxide [1]</p> <p><b>allow</b> higher level answers  idea that still need electricity for charging battery [1]  electricity generation produces pollution / CO<sub>2</sub> / carbon dioxide / carbon emissions [1]</p>
	<b>Total</b>	<b>3</b>	

Question		Answer	Marks	Guidance
14		A has larger surface area / ORA [1] A has more drag or air resistance / ORA [1]	2	<b>allow C</b> is more streamlined / aerodynamic / ORA [1] <b>ignore</b> any references to weight or mass eg. drag increases with area of card [2]
		<b>Total</b>	<b>2</b>	

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