

Physics B

General Certificate of Secondary Education

Unit **B652/02**: Unit 2 – Modules P4, P5, P6 (Higher Tier)

Mark Scheme for June 2012

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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 not given
	error carried forward
	information omitted
	ignore
	reject
	contradiction

Subject-specific Marking Instructions

Annotation	Meaning
/	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	<p>maximum of three from:</p> <p>idea that cloth and rod attract (each other) [1]</p> <p>idea of electron transfer [1]</p> <p>but correct electron transfer [2]</p> <p>idea that rod has an excess of electrons so is negative / cloth has deficiency of electrons so is positive [1]</p>	3	<p>allow wrong direction if electrons mentioned eg electrons to cloth [1] only</p> <p>eg electrons to rod / from cloth [2] but allow negative charges move to rod scores [1]</p> <p>explanations in terms of 'positive electrons' or movement of positive charge – can only score first marking point</p>
	Total	3	

Question	Answer	Marks	Guidance														
2	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%; padding: 5px;">Dust particles pass...</td> <td style="width: 20%; text-align: center; padding: 5px;">2</td> </tr> <tr> <td style="padding: 5px;">Dust particles are..</td> <td style="text-align: center; padding: 5px;">3</td> </tr> <tr> <td style="padding: 5px;">The metal grid...</td> <td style="text-align: center; padding: 5px;">(1)</td> </tr> <tr> <td style="padding: 5px;">Plates are..</td> <td style="text-align: center; padding: 5px;">6</td> </tr> <tr> <td style="padding: 5px;">This is because..</td> <td style="text-align: center; padding: 5px;">4</td> </tr> <tr> <td style="padding: 5px;">Up to 99%....</td> <td style="text-align: center; padding: 5px;">(7)</td> </tr> <tr> <td style="padding: 5px;">Dust particles form..</td> <td style="text-align: center; padding: 5px;">5</td> </tr> </table> <p style="text-align: right; margin-top: 10px;">[3]</p>	Dust particles pass...	2	Dust particles are..	3	The metal grid...	(1)	Plates are..	6	This is because..	4	Up to 99%....	(7)	Dust particles form..	5	3	<p>if not all correct look for correct sequencing</p> <p>Dust particles pass through ... somewhere before Dust particles are attracted ...</p> <p>Dust particles are attracted ... somewhere before This is because opposite ...</p> <p>This is because opposite ... somewhere before Dust particles form larger ...</p> <p>Dust particles form larger ... somewhere before Plates are knocked ...</p> <p>3 correct = [2] 1 or 2 correct = [1]</p>
Dust particles pass...	2																
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	Total	3															

Question		Answer	Marks	Guidance
3		<p>10 (ohms / Ω) [3]</p> <p>but if answer is incorrect</p> <p>8 \div 0.8 [2]</p> <p>values of 8 and 0.8 (read from graph) [1]</p>	3	<p>allow any correctly paired corresponding values in the correct order eg 6 \div 0.6 / 2 \div 0.2 etc. [2]</p> <p>allow any pair of corresponding values eg 6 and 0.6 / 2 and 0.2 etc. [1]</p> <p>allow 0.6 \div 6 / 0.2 \div 2 etc. [1]</p>
		Total	3	

Question		Answer	Marks	Guidance
4	(a)	ultrasound does not damage living cells / soft tissue [1]	1	<p>x-rays can cause cancer [1] x-rays are ionising (radiation) / AW [1]</p> <p>ignore vague references to 'ultrasound safer' or 'x-rays more dangerous' eg X-rays cause damage / are harmful [0] but X-rays harm / damage cells [1]</p> <p>allow less contrast with (normal) X-rays [1]</p> <p>allow X-rays would pass through the kidney stones (and surrounding tissues) [1]</p>
	(b)	vibrate particles of kidney stone (very rapidly / violently) [1]	1	allow higher level answers in terms of resonance / natural frequency
	(c)	idea of less invasive / quicker recovery time [1]	1	<p>allow shorter / easier operation or no (general) anaesthetic needed [1] allow particles easily passed out of body (in urine) [1] allow less risk of infection / scars / blood loss [1] ignore references to cost unless correctly qualified</p> <p>ignore references to safer unless correctly qualified ignore references to pain</p>
Total			3	

Question		Answer	Marks	Guidance
5	(a)	(average) time for half of (radioactive) nuclei or atoms to decay / AW [1]	1	allow time for activity or radioactivity to half [1] allow time for mass of radioactive isotope / element to be halved [1]
	(b)	50 (s) [1] second mark is for correctly showing an appropriate activity fall and corresponding time on graph [1]	2	allow 48 to 52 (tolerance) [1] if answer line is blank allow correct answer on lines above or on the graph allow this mark if correctly shown but final answer is incorrect
	(c)	2 [1]	1	if answer line is blank allow correct answer ticked circled or underlined
	(d)	lost a (neutron) and gained a (proton) [1]	1	both parts needed in correct order lost neutrons / gained protons [0] but lost (neutron) and gained (proton) [1]
Total			5	

Question		Answer	Marks	Guidance
6	(a)	fission [1]	1	not fusion allow chain (reaction) [1] ignore merely 'splitting'
	(b)	any two from: water boiled / heated / steam made [1] steam turns turbine [1] turbine drives generator [1]	2	
Total			3	

Question		Answer	Marks	Guidance
7	(a)	30 (m/s) [1]	1	allow the same [1]
	(b)	30 (m/s) [2] but if answer incorrect (0 +) 10 x 3 [1]	2	allow correct answer for g= 9.8 eg 29.4 (m/s) [2] credit increase in speed calculation even if initial speed is incorrect eg 30 + (3x10)=60 for [1]
Total			3	

Question			Answer	Marks	Guidance
8	(a)	(i)	24 (hrs) [1]	1	
		(ii)	36000 (km) [1]	1	allow 35 000 – 37 000 (tolerance) [1] allow ecf from 8a(i)
	(b)		idea that gravitational force is stronger / AW [1]	1	allow high level answers in terms of circular motion eg greater centripetal force [1] ignore centrifugal
Total				3	

Question			Answer	Marks	Guidance
9	(a)	(i)	19.5 (°) [2] but if answer is incorrect $(\sin R) = \frac{\sin 30^\circ}{1.5}$ [1]	2	allow 19.47 or 19.5 [2] allow $(\sin R) = 0.33$ [1] allow 19° with correct working [2] common incorrect answers [0] eg 19.1 / 20
		(ii)	any two from: glass is more dense or has a greater refractive index [1] speed decreases / AW [1] wavelength decreases / AW [1]	2	ignore merely 'change in speed' ignore merely 'change in wavelength'

Question		Answer	Marks	Guidance
10	(a)	<p>any three from:</p> <p>ideas / diagram / description which shows:</p> <p>named wave appropriate to the experiment, eg sound / light / microwave / water [1]</p> <p>experimental setup to create interference (source of waves), eg 2 speakers (+ detector) 2 slits or way of splitting waves 2 microwave sources (+ detector) ripple tank with 2 sources or barrier with 2 gaps [1]</p> <p>indication of what is seen / heard ie quiet / no sound and loud sounds light and dark areas large and small deflection on microwave detector large ripples / no ripples in ripple tank [1]</p> <p>explanation of interference – idea of 2 waves joining to either add or cancel each other [1]</p>	3	<p>allow marks for a correctly labelled diagram allow other examples of 2 source interference</p> <p>ignore radio, X-rays and gamma</p> <p>allow a suitable reflection as source</p> <p>allow in phase for constructive / ora [1]</p>
	(b) (i)	idea of vibrations in one plane only [1]	1	<p>eg vibrate only vertically [1] eg vibrate up and down only [1] eg vibrate horizontally only [1] eg vibrate left and right only [1]</p> <p>ignore travel in one plane</p>
	(ii)	(sound waves) are longitudinal / not transverse [1]	1	
Total			5	

Question		Answer	Marks	Guidance
11	(a)	idea that the passengers (initially) carry on moving in a crash / AW [1]	1	allow higher level answers eg (high) acceleration requires a high force [1] eg passengers have inertia and continue to move [1]
	(b)	idea that momentum changes / crumple zones increase the stopping time / force reduced [1] but momentum change per second is reduced / rate of change of momentum reduced [2]	2	allow force = $\frac{\text{change in momentum}}{\text{time}}$ [1] slow down the change momentum [2] but slow down momentum [0] sensible and correct use of formula [2] eg time increases and force = $\frac{\text{change in momentum}}{\text{time}}$ so the force is less [2]
Total			3	

Question			Answer	Marks	Guidance
12	(a)	(i)	<p>more current / voltage [1]</p> <p>stronger magnets / magnetic field [1]</p> <p>more turns of wire [1]</p>	3	<p>allow more power / turn up power [1]</p> <p>ignore resistance</p> <p>ignore idea of radial field</p> <p>allow more coils [1]</p> <p>ignore bigger coil / greater coil area</p> <p>if no marks awarded then allow maximum [1] from: idea of improving contact eg bend brushes round so remain in contact for longer length of time [1] sensible way to reduce friction eg. use oil [1]</p>
		(ii)	reverses direction / AW [1]	1	eg spins backwards [1]
	(b)		<p>circular / curved poles / AW [1]</p> <p>field (cutting) at 90° to wire / AW [1]</p>	2	<p>ignore references to dynamo</p> <p>allow correct answers on a diagram</p> <p>ignore circular magnet</p> <p>allow semi-circular magnets</p> <p>allow experiences the force for more of the cycle [1]</p>
Total				6	

Question		Answer	Marks	Guidance
13	(a)	6000 (turns) [2] but if answer incorrect $\frac{25000}{300000} = \frac{500}{NS}$ / AW [1]	2	allow (because of rounding in calculation) 6002 / 6250 / 6024 (2) allow equation / ratio in other correct permutations [1]
	(b)	maximum of three from: (increasing voltage) means lower current [1] heating loss due to resistance of cables [1] less current causes reduced heat loss [1] but power loss = $I^2 R$ or is proportional to I^2 [2]	3	eg $V_p I_p = V_s I_s$ (or a fixed VI) implies as V increases I decreases [1] ignore references to changing resistance allow energy or heat lost (per second) = $I^2 R$ or is proportional to I^2 [2] allow derivation of I^2 using $R=V/I$ [2]
	(c) (i)	less chance of path from live to earth / AW [1]	1	allow idea that appliance or person is not in contact with the (live) mains circuit [1] allow stops wiring burning out in the secondary circuit [1] allow only magnetic link between supply and appliance [1]
	(ii)	same (number of turns on primary and secondary coils) [1]	1	
Total			7	

Question			Answer	Marks	Guidance																																				
14	(a)	(i)	resistor A resistance = 4.8 (Ω) [1] resistor B current = 1.5 (A) [1] (for a fixed voltage) the larger the resistance the smaller the current / ora [1]	3	ignore stronger / weaker current																																				
	(b)		<table border="1" style="display: inline-table; margin-right: 20px;"> <thead> <tr> <th colspan="3">AND</th> </tr> <tr> <th>A</th> <th>B</th> <th>out-put</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>0</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> </tr> </tbody> </table> <table border="1" style="display: inline-table;"> <thead> <tr> <th colspan="3">OR</th> </tr> <tr> <th>A</th> <th>B</th> <th>out-put</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> </tr> </tbody> </table> all and correct [1] all or correct [1]	AND			A	B	out-put	0	0	0	0	1	0	1	0	0	1	1	1	OR			A	B	out-put	0	0	0	0	1	1	1	0	1	1	1	1	2	
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Question		Answer	Marks	Guidance
	(c) (i)	<p>any one from:</p> <p>completes a circuit between battery and lights / horn [1]</p> <p>allows it to switch on lights / horn / high current / AW [1]</p>	1	<p>read both responses to 14c(i) and 14c(ii) before awarding marks</p> <p>do not award the same marking point on both questions</p>
	(ii)	<p>any one from:</p> <p>only small current from logic gate [1]</p> <p>headlamps / horn need a large current [1]</p> <p>stops the logic gates burning out [1]</p> <p>isolates the two circuits [1]</p>	1	<p>read both responses to 14c(i) and 14c(ii) before awarding marks</p> <p>do not award the same marking point on both questions</p> <p>allow only small voltage from logic gate [1]</p> <p>allow small current switches on a large current [1]</p> <p>allow small voltage controls large voltage (1)</p>
Total			7	

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