

**Physics B**

General Certificate of Secondary Education

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

**Mark Scheme for January 2011**

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

/	= alternative and acceptable answers for the same marking point
(1)	= separates marking points
<b>not</b>	= answers which are not worthy of credit
<b>reject</b>	= answers which are not worthy of credit
<b>ignore</b>	= statements which are irrelevant
<b>allow</b>	= 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)	(i)	helium / He (1)	1	<b>not</b> he / HE <b>ignore</b> positive particle / slow moving
		(ii)	electron / e <sup>-</sup> (1)	1	<b>not</b> just e <b>ignore</b> negative particle
	(b)		2 (years) (1)	1	
	(c)		<b>natural causes</b> soil / rocks / radon gas / cosmic rays (1)  <b>man made causes</b> (nuclear or radioactive waste from) industry or hospitals / nuclear accidents / AW (1)	2	<b>allow</b> Sun / space / Earth / named rock / carbon-14 (1) <b>eg</b> granite (rock) (1) <b>not</b> just 'air'  <b>allow</b> tracer / radiotherapy / hospitals / Chernobyl / medical waste/ nuclear waste (1) <b>not</b> just 'X-ray' unit <b>not</b> just medicine
	(d)		carbon (1)	1	if answer line is blank <b>allow</b> correct answer ticked circled or underlined <b>allow</b> C (1)  more than one answer scores (0)
			<b>Total</b>	<b>6</b>	

Question	Expected Answers	Marks	Additional Guidance
2	12 (2) <b>but</b> if answer is incorrect 6 ÷ 0.5 (1)	2	
	<b>Total</b>	2	

Question	Expected Answers	Marks	Additional Guidance
3	<p><b>any two from:</b></p> <p>(positive on) dust particles attracted by (negative) screen (1)</p> <p>screen is (negatively) charged (1)</p> <p>screen has more / lots / excess of <u>electrons</u> (1)</p> <p><b>third mark for correct</b></p> <p>ideas around polarisation / negative repels electrons in dust (1)</p>	3	<p>When marking answer look for these areas for up to 2 marks:</p> <ul style="list-style-type: none"> <li>• charge</li> <li>• electrons</li> <li>• attraction of dust</li> </ul> <p>and 3<sup>rd</sup> mark available for</p> <ul style="list-style-type: none"> <li>• explanation of polarisation</li> </ul> <p><b>not just</b> screen is negative (given on diagram)</p> <p><b>Eg.</b> dust (particles) charged by <b>induction</b> scores (1)</p> <p><b>Eg.</b> screen repels electrons to rear of dust particles (1)</p> <p><b>not just</b> dust polarised</p>
	<b>Total</b>	<b>3</b>	

Question		Expected Answers	Marks	Additional Guidance
4		repel / separate from / spread out / AW ..... fine / particulate / smaller <b>particles</b> / mist / wider (spray) / even / AW (1)  opposite / negative / AW..... attracted AW (1)	2	must have <b>both</b> correct answers in sentence to gain the mark  must have <b>both</b> correct answers in sentence to gain the mark  <b>ignore</b> stuck for the attracted mark
		<b>Total</b>	<b>2</b>	

Question		Expected Answers	Marks	Additional Guidance
5	(a)	uranium / U .... (and) .... neutron (1)  splits ..... (and) ..... (kinetic) <b>energy</b> (1)	2	<b>both needed</b> <b>allow</b> plutonium / Pu for first response <b>not</b> Ur, Pl, u, or p  <b>both needed</b> <b>allow</b> divides / breaks for first response <b>not</b> decays for first response  <b>not</b> nuclear / electrical energy <b>allow</b> (more) neutrons / heat for second response <b>ignore</b> chain reaction / other products of fission
	(b)	gamma (1)  nucleus (1)	2	multiple answers score (0)
		<b>Total</b>	<b>4</b>	

Question		Expected Answers	Marks	Additional Guidance
6	(a)	<p>to and fro or</p> <p>right and left or</p> <p>back and forth or</p> <p>AW (1)</p> <p><b>direction / plane</b> (that the) <b>wave / sound / ultrasound / energy</b> (1)</p>	2	<p><b>both needed</b></p> <p><b>allow</b> idea of vibrations / side to side</p> <p><b>allow</b> correct reference on diagram</p> <p><b>both needed</b></p>
	(b)	above the range of human hearing (1)	1	<p><b>allow</b> frequency / pitch too high / above 20 000 Hz (1)</p> <p><b>ignore</b> just 'high frequency' (0)</p> <p><b>but</b> 'very high frequency' scores (1)</p>
		<b>Total</b>	<b>3</b>	

Question			Expected Answers	Marks	Additional Guidance
7	(a)	(i)	gravity (1)	1	<b>allow</b> weight / gravitational force (1) <b>ignore</b> Earth <b>but</b> Earth's mass [1]
		(ii)	idea of above same point on Earth / in a fixed position / AW (1)	1	<b>not</b> just 'stays in same place' <b>not</b> just same speed as Earth <b>allow</b> above equator (1)
		(iii)	24 (hours) / one day (1)	1	look at part (ii) and (iii) together  <b>allow</b> reference to 24 hours in part (ii) if no answer in part (iii)  if 24 hours in part (ii) but incorrect time in part (iii), it scores (0) for part (iii). But award other correct responses in part (ii).  eg. (ii) 24 hours above equator (1) ie (1) for above equator (iii) 365 days (0) as contradiction  eg. (ii) takes 24 hours to orbit (0) as credited in part (iii) (iii) 24 hours (1)  eg. (ii) takes 24 hours to orbit (0) (iii) ..... (1) as answer (24 hours) in part (ii)

Question		Expected Answers	Marks	Additional Guidance
	(b)	stronger gravitational / centripetal force / AW (1)	1	<b>allow</b> stronger gravity / more gravity <b>not</b> merely more force / merely closer to Earth <b>ignore</b> falling to Earth/ keeps it in orbit
		<b>Total</b>	<b>4</b>	

Question		Expected Answers	Marks	Additional Guidance
8	(a)	idea that radio waves: have a longer wavelength (1) and diffract more / more easily (1)	2	look for a comparison of wavelength and diffraction.  <b>allow</b> diagrams which illustrate the marking points  absolutes may negate a comparison. eg microwaves have a shorter wavelength (1) and do not diffract but radio waves do (0)
	(b)	continuous path shown from Australia to satellite and on to Jenny's house (1)  idea of microwaves used (1)	2	<b>ignore</b> arrows  <b>allow</b> 3GHz waves (1)  <b>additional marking point</b> retransmission clearly stated (1)
		<b>Total</b>	<b>4</b>	

Question			Expected Answers	Marks	Additional Guidance
9	(a)	(i)	11 (m/s) scores (2) <b>but</b> if answer incorrect 5 + (0.5 x 12) or 5 + 6 scores (1)	2	
		(ii)	(momentum) increases / AW (1)	1	<b>allow</b> 5 units to 11 units / more than doubles
	(b)		40 (m/s) scores (2) <b>but</b> if answer is incorrect (200 x v) + (30 x 800) = 800 x 40 (1) <b>or</b> (200 x v) = (800 x 40) – (800 x 30) (1) <b>or</b> (200 x v) = 32000 – 24000 (1) <b>or</b> 200v = 8000 (1) <b>or</b> v = 8000/200 (1)	2	
<b>Total</b>				<b>5</b>	

Question		Expected Answers	Marks	Additional Guidance
10	(a)	two rays converging towards principal axis (1)	1	<b>ignore</b> rays through lens
	(b)	two rays diverging less (1)	1	<b>allow</b> two rays parallel to axis (1) <b>allow</b> two rays converging (but less so than diagram above) (1) <b>not</b> either of rays continuing straight / not deviated (0) <b>not</b> either ray more diverging (0)
	(c)	<b>idea of</b> moving (towards or away from film) (1)  idea of moving along principal axis (towards or away from film) (1)	1	<b>not</b> merely lens turns
	(d)	(i) reduces / AW (1)	1	
		(ii) reduces (1)	1	
		(iii) <b>any two from:</b> blue has a greater change in speed (1) blue has a greater change in wavelength (1) blue has higher refractive index (1)	2	<b>allow</b> reverse arguments for red
<b>Total</b>			<b>7</b>	

Question		Expected Answers	Marks	Additional Guidance
11	(a)	upwards (1)	1	if no answer on line, <b>allow</b> correct answer ticked, underlined or ringed in the list. more than one answer scores (0)
	(b)	upwards (1)	1	if no answer on line, <b>allow</b> correct answer ticked, underlined or ringed in the list more than one answer scores (0)
		<b>Total</b>	<b>2</b>	

Question		Expected Answers	Marks	Additional Guidance
12	(a)	decreases / AW (1)	1	ignore weaker
	(b)	resistance decreases (as temperature increases) / AW	1	
		<b>Total</b>	<b>2</b>	

Question		Expected Answers	Marks	Additional Guidance
13		<p>increase the number of coils / AW (1)</p> <p>speed up the rotation / AW (1)</p> <p>increase the strength of the magnets / stronger magnets (1)</p>	3	<p><b>not</b> bigger coils <b>allow</b> larger (surface) area of coils</p> <p><b>allow</b> quicker / faster movement (1) but <b>ignore</b> more movement (0)</p> <p><b>not</b> bigger magnets <b>allow</b> more magnets <b>allow</b> more current to electromagnet</p> <p>do not credit motor ideas eg more current (0)</p>
		<b>Total</b>	<b>3</b>	

Question			Expected Answers	Marks	Additional Guidance
14	(a)	(i)	iron (1)	1	<b>allow</b> soft iron <b>not</b> steel
		(ii)	(step-up transformers) have more coils on secondary <b>OR</b> fewer turns on primary (1)	1	<b>not</b> just more turns <b>allow</b> reverse argument for correct description for a step-down transformer
	(b)	(i)	energy loss depends on square of current (1)	1	<b>allow</b> $P=I^2R$
		(ii)	current at 100 000V = 10A <b>and</b> current at 1000V = 1000A (1)  much larger current at 1000V so much more energy lost (1)	2	at 1 000V current is 100 x more than at 100 000V (1)  for <b>both</b> marks answers should make some correct use of $I = P / V$
<b>Total</b>				<b>5</b>	

Question		Expected Answers	Marks	Additional Guidance
15	(a)	half wave rectification (1)	1	<b>allow</b> rectified / varying DC / unsmoothed DC / half wave DC <b>ignore</b> just DC / half wave
	(b)	<b>between A and B</b> capacitor is becoming charged / storing charge (1)  <b>between B and C</b> capacitor stops charging / discharges (1)	2	
		<b>Total</b>	<b>3</b>	

Question		Expected Answers	Marks	Additional Guidance															
16	(a)	<table border="1"> <thead> <tr> <th>A</th> <th>B</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>1</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>0</td> </tr> </tbody> </table>	A	B	Z	0	0	1	0	1	0	1	0	0	1	1	0	1	
A	B	Z																	
0	0	1																	
0	1	0																	
1	0	0																	
1	1	0																	
	(b)	<p>output of 1 connected to input of 2 (1)</p> <p>output of 2 connected to input of 1 (1)</p>	2	more than 2 wires – subtract (1) for each incorrect wire															
	(c)	<p>voltage at P is 4.5 V (1)</p> <p>NOR gate on so output off (1)</p>	2																
		<b>Total</b>	<b>5</b>																

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