OCR
Oxford Cambridge and RSA

GCSE

Physics B

Unit **B752/02:** Unit 2 – Modules P4, P5, P6 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2014

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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.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

Annotations used in scoris

Annotation	Meaning
	correct response
BP	Blank Page – this annotation **must** be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.
	incorrect response
BOD	benefit of the doubt
NBOD	benefit of the doubt **not** given
ECF	error carried forward
^	information omitted
I	ignore
R	reject
CON	contradiction

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 i	(area) where the lines / particles / molecules / layers are close(r) together [1]	1	**allow** area higher density / pressure [1] **allow** correct compression indicated on diagram [1] Ignore waves / wavelength / frequency.
ii	simple comparison of movement [1] **longitudinal waves** (particles or vibrations) move in the same direction as wave movement / AW [1] **transverse waves** (particles or vibrations) move at right angles to the direction of movement of the wave / AW [1]	3	**allow** all marking points from labelled diagrams eg one moves up and down and the other moves side to side [1] **Allow** backwards and forwards / to and fro **allow** (idea that) (particles or vibrations) move side to side along (the wave) [1] **allow** (idea that) (particles or vibrations) move up and down across (the wave) [1] **Allow** 90^0 / perpendicular [1] Longitudinal and transverse waves explained fully scores [3]
b	no (no mark) (idea that) we can't hear high pitched sounds [1] **BUT** We cannot hear 20 000 (Hz) (or above) scores [2]	2	'yes' scores [0] **Allow** (idea that) 25 000 (Hz) is higher than we can hear [1] **Allow** frequencies above a threshold: eg. Can't hear above 18 000 (Hz) [1] **Allow** 20kHz **Allow** correct references to wavelength for [1]
	Total	**6**	

Question	Answer	Marks	Guidance
2	**[Level 3]** Correct answer of 3.26 Amps **AND** explains why the fuse melts **AND** correct statements on use of 3, 5 13 Amp fuse. Quality of written communication does not impede communication of the science at this level (5 – 6 marks) **[Level 2]** Correct answer of 3.26 Amps **AND** explains why the fuse melts. Quality of written communication partly impedes communication of the science at this level (3 – 4 marks) **[Level 1]** Evidence of a calculation using power = voltage x current **OR** describe why the fuse melts. Quality of written communication impedes communication of the science at this level (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)		**This question is targeted at grades up to A*.** **Indicative scientific points at level 3 may include:** 3.26 or 3.3 (amps) **AND** 3 amp fuse melts as current too large **AND** best fuse to use is the value just above 3.26 or 3.3 (amps) which is 5 amp fuse 13 amp fuse not used because a large current (above the 3.26 amps) is needed before it melts **Indicative scientific points at level 2 may include:** 3.26 or 3.3 (amps) **AND** 3 amp fuse melts as current too large **Indicative scientific points at level 1 may include:** evidence of power = voltage x current evidence of current = power / voltage 750 / 230 too much current / (fuse gets too) hot Allow answers in terms of power only – maximum of [3] marks. **Use the L1, L2, L3 annotations in scoris.** **Do not use ticks.**
	Total	**6**	

Question	Answer	Marks	Guidance
3 a	**any two from:** person may have different diets / foods or drinks [1] person may live in different areas of UK (where there is more radon gas / granite) [1] person may have had more medical tests / treatment **involving radiation** [1] person may use aeroplanes more (and so be exposed to more cosmic rays) [1] person is close to / works in a **nuclear** power station / **nuclear** facility / radiology / radiography [1]	2	 **Allow buildings** Eg. Radiotherapy treatment. **Ignore** unqualified medical tests **ignore** medical workers allow idea that near hospitals that use radiation [1]
b	**any two from:** compare different areas [1] show / compare changes over time [1] provides more data [1] check each other's data / reliability / peer review [1] idea of informing other scientists / public /government [1]	2	
	Total	**4**	

Question	Answer	Marks	Guidance
4 a i	Decreases [1] **but** decreases by half / by 30 (decays per second) [2]	2	 **allow** from 60 to 30 [2] **eg 60 and 30 indicated on graph scores [2]** if **NO** marks awarded **allow** by one half life [1]
ii	line starting at 120 and always to the right and above right element A [1]	1	Any line curving upwards (at any part) scores [0] graphs must not cross each other
b	$^{(99)}_{(43)}Tc \rightarrow {}^{99}_{44}Ru + {}^{0}_{-1}\beta$ [1] [1]	2	Mark rubidium and beta independently Both mass **and** atomic number needs to be correct for a mark
	Total	**5**	

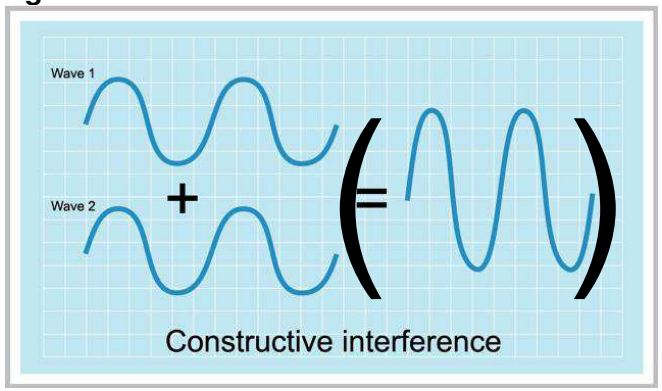
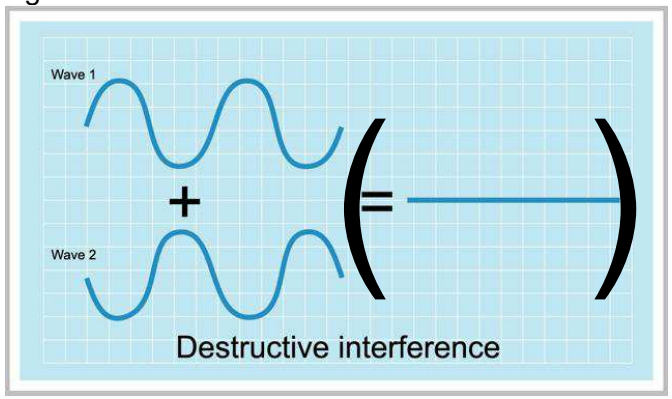
Question	Answer	Marks	Guidance
5 a	….. charge / positive charge / negative charge ….. move away from each other / repel / disperse ….. attracted (to the car) **any two from** even coat / shadows painted / less waste / fine spray [3]	3	5 gaps correct for 3 marks 4 gaps correct for 2 marks 3/2 gaps correct for 1 mark **Allow** positive or negative if first answer is 'charge' **allow** better finish for even coat **allow** cheaper for less waste
b	**any one from:** **gun** loses electrons **to paint** [1] **paint** gains electrons **from gun** [1] **paint** loses electrons **to object** / bike [1] **object** / bike gains electrons **from paint** [1]	1	Reference to 'positive electrons' scores [0]
	Total	**4**	

Question	Answer	Marks	Guidance
6 a	Maximum range (achieved) at 45^0 [1] **BUT** Range rises with angle until 45^0 then falls [2]	2	**Ignore** references to height eg 'the further away from 45^0 the lower the range scores' [2] **if no marks awarded:** **allow EITHER '**rises and falls' **OR** 'as the angle increases the range decreases' [1] eg 'range goes up and then goes down' [1]
b	90^0 [1]	1	**allow** vertical / AW [1] **allow** suitable annotation of the diagram
c i	Parabolic / parabola [1]	1	**ignore** curve / arc / arch on its own **ignore** trajectory
ii	(Vertical / upward) velocity decreases [1] Acceleration (remains) constant / AW [1]	2	Mark points independently: eg. vertical velocity and acceleration are reduced for a maximum of [1] eg. vertical velocity and acceleration are constant for a maximum of [1]
iii	no effect (by gravity) / AW [1]	1	**Allow** doesn't (change) [1] **Allow** (Stays) constant [1]
	Total	**7**	

Question	Answer	Marks	Guidance
7 a	**Any two from**: Above equator [1] Above fixed point / AW [1] Orbits in 24 hours / same rate as Earth / AW [1] **AND** (idea of) transmitter points in same fixed position / provides a constant signal / line of sight [1]	3	Eg 'above the same point on the equator' scores [2] **Ignore** orbits at same speed as Earth **Allow** rotates with Earth / in sync with Earth[1] **allow** satellite dishes don't have to move [1] **allow** 'to give good coverage / AW [1]
b i	(idea that) only orbits once every 90 minutes [1] (idea that) shorter time would be lower orbit and unsafe [1]	1	e.g. It is not always above storm cloud / covers other parts of Earth/ needs to complete a full orbit [1] **ignore** dangerous to be near the storm
ii	Any three from: Low polar orbit faster than geostationary orbit / ORA [1] (attraction of) gravitational force is greater / ORA [1] Centripetal force needed for orbital / circular motion [1] (idea that) centripetal force needs to be bigger at lower altitude/ORA [1] (idea of) gravity provides this centripetal force [1]	3	**Ignore** unqualified references to gravity. Eg gravity is stronger [0]
	Total	**7**	

Question	Answer	Marks	Guidance
8	**Level 3: (5 – 6 marks)** Answer shows qualitative understanding in terms of forces and momentum **AND** a full mathematical understanding of the 'explosion' idea. Quality of written communication does not impede communication of the science at this level. **Level 2: (3 – 4 marks)** Answer shows a qualitative understanding in terms of **either** forces or momentum. **OR** A correct mathematical answer showing both have equal momentum. Quality of written communication partly impedes communication of the science at this level. **Level 1: (1 – 2 marks)** Answer indicates a simple idea of equal and opposite forces **OR** momentum. Quality of written communication impedes communication of the science at this level. **Level 0: (0 marks)** Insufficient or irrelevant science. Answer not worthyof credit.	6	This question is targeted up grade A* **Indicative scientific points may include:** **Qualitative understanding** • Both have same momentum • Same force produces higher acceleration on Nina but less on Matt because he has more mass • Nina has less mass so more speed and Matt has more mass and less speed (level 3) • Force produces different speeds on different masses (level 2) • Momentum before and after is the same **Mathematical understanding** • Momentum before and after is zero (level 3) • 60 x -5 + 100 x 3 = 0 (level 3) • 0 = (60 x -5) + (100 x 3) (level 3) • 0 = -300 + 300 (level 3) • 60 x 5 = 100 x 3 (level 2) • 300 = 300 (level 2) **Level 1:** • Forces are equal and opposite • Momentum is conserved Use the L1, L2, L3 annotations in Scoris; do not use ticks.
	Total	**6**	

Question	Answer	Marks	Guidance
9 a	(idea of) angle of incidence = angle of reflection / AW [1]	1	**Eg.** reflects at same angle [1]
b	Particles do **not** undergo • diffraction [1] • interference [1] Waves undergo • diffraction [1] • interference [1]	2	Assume the answer refers to the particle theory unless indicated otherwise.

Question	Answer	Marks	Guidance
c	Constructive interference – peaks on both waves add / in phase / AW [1]	2	**allow** 'in sync' for in phase **Allow** marks from suitable diagrams. **Eg.**  [1]
	Destructive interference – peak and trough on waves cancel / out of phase / AW [1]		**allow** 'out of sync' for out of phase Eg.  [1]
	Total	**5**	

Question	Answer	Marks	Guidance
10 a	**LDR** resistance decreases as light (level) increases / AW [1] **Thermistor (NTC)** resistance decreases as temperature increases / AW [1]	2	**allow** ORA [1] **allow** ORA [1] **allow** heat for temperature **allow** Thermistor PTC resistance increases as temperature increases [1]
b	**Any two from current passes:** Idea of threshold voltage reached / AW [1] in one direction / AW [1] when the voltage is positive / resistance is low/AW [1]	2	 e.g. if voltage is high enough/ 0.6V **Allow** (the idea that) current is correct direction for the diode [1] **allow** no current when voltage is negative [1] **allow** (idea that) circuit diagram shows diode in forward bias / current direction is L to R / anticlockwise for this diode [1]
	Total	**4**	

Question	Answer	Marks	Guidance
11	**[Level 3]** **Answer includes both similarities and differences AND calculates output voltage and turns ratio AND explains how transformers work** Quality of written communication does not impede communication of the science at this level (5 – 6 marks) **[Level 2]** **Answer includes one difference and one similarity AND calculates one output voltage or turns ratio** Quality of written communication partly impedes communication of the science at this level (3 – 4 marks) **[Level 1]** **Answer includes the basic construction of a transformer** **OR one difference and one similarity** Quality of written communication impedes communication of the science at this level (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to grade A.** **Indicative scientific points may include:** **Similarities (in order of increasing demand)** both have an iron core / same input voltage / 20 volts AC both change the output voltage (compared to the input voltage) **Differences** transformer A is a step-up transformer transformer B is a step down transformer both have different ratio of turns on the primary compared to the secondary **Differences in output voltage** the output of transformer A will be more than 20 V the output of transformer A calculated using transformer equation as 40V the output of transformer B will be less than 20 V the output of transformer B calculated using transformer equation as 10V **How transformers work** changing current in primary coil produces a changing magnetic field in core changing magnetic field in the core induces a changing voltage in the secondary coil **Construction** • two coils on an (iron) core **Use the L1, L2, L3 annotations in scoris.** **Do not use ticks.**
	Total	**6**	

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>12 a</td><td><table><tr><th>X</th><th>Y</th><th>Z</th></tr><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></table>[2]</td><td>2</td><td>all correct for 2 marks

2 or 3 rows correct for 1 mark</td></tr>
<tr><td>b</td><td><table><tr><th>E</th><th>F</th><th>G</th></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr></table>[2]</td><td>2</td><td>all correct for 2 marks

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Question	Answer	Marks	Guidance
13 a	7.5 (ohms) [2] **but if answer incorrect** correct values of voltage and current from graph [1]	2	 correct values e.g. 3 and 0.4 or 6 and 0.8
b	**E** (no marks) Idea that longer conductors have a greater resistance [1] (idea that) the line with the shallowest / least gradient has the greatest resistance [1]	2	If E **NOT** chosen [0] Longer length has lower current [1] allow credit for candidates who calculate the resistance of E as 200 (Ω) [1]
c	**mistakes are:** **electrons** not protons are the charge carriers atoms vibrate **more** not less **increases** the resistance of the conductor not decreases it	2	**allow mistakes indicated on the text** three mistakes corrected [2] one or two mistakes corrected [1]
	Total	**6**	

Question	Answer	Marks	Guidance
14 a	Clockwise anticlockwise clockwise [1]	1	**allow** appropriately drawn curly arrows
b i	 (idea of using) variable resistor [1] (idea of using) more or less or changing the: voltages / pd / current / power (input) [1]	1	 **ignore** stronger current **ignore** changes to coils **ignore** changes to field / magnets
ii	**any two from:** when switched on the motor's speed increases [1] when switched off the motor's speed decreases [1] the motor doesn't stop spinning [1]	2	 **Allow** high voltage for 'switched on' **Allow** low voltage for 'switched off' Ignore reference to constant speed If no mark scored **allow** one mark for 'speed varies'
iii	**any one from:** (idea of) smoother speed / less jerky [1] (idea that) **variation** in motor speed will be less [1]	1	
	Total	**5**	

Question	Answer	Marks	Guidance
15 a	1.9(333) (g/cm^3)	1	
b	2.7 (g) [2] **BUT** if answer is incorrect then 0.9 x 3 scores [1]	2	
c	Mark explanation only B is heaviest [0] Unknown liquid is denser than water [1] Unknown liquid is denser than oil [1] and is liquid X [1]	3	If answer is A then it is still possible to gain up to 2 marks If no clear reference to density of water or oil is made then **allow** unknown liquid is heavier than oil / water [1]
d i	Oil (linear) reduction in density with increasing temperature / ORA [1]	1	
ii	Water density rises up to 5˚ and then falls (non-linearly) as temperature increases AW [1]	1	**Eg.** water's maximum density is at 5^OC [1] **Allow** 3^OC - 6^OC tolerance
d iii	Any two from: Ice (at 0^oC) is less dense (than water at 0^oC) [1]	2	

Question	Answer	Marks	Guidance
	Density of water increases up to 5°C [1] (Idea that) water warm**er** as depth **increases** [1]		e.g. 'warmest water at the **bottom**' scores [1]
	Total	**10**	

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