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 2015

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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

Annotation	Meaning
	correct 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
L1	Level 1
L2	Level 2
L3	Level 3

ADDITIONAL OBJECTS: You **must** assess and annotate the additional objects for each script you mark. Where credit is awarded, appropriate annotation must be used. If no credit is to be awarded for the additional object, please use annotation as agreed at the SSU.

When you open the script if the message appears that there are additional objects you must check these additional objects.

The additional objects are normally additional sheets of answers that must be marked. You should immediately link each extra answer with the appropriate question using the paper clip icon.

PLEASE ASK YOUR TEAM LEADER IF YOU DO NOT KNOW HOW TO DO THIS.

It is vitally important that all parts of the candidate's answer are marked.

Subject-specific Marking Instructions

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	0.72 (volts) (2) **but if answer incorrect** 0.7185 or 0.718 or 0.719 or 0.7 (volts) (1)	2	 **Allow** 0.15 x 4.79 (1)
ii	**D** (1)	1	if answer line blank allow correct answer circled or underlined more than one answer = 0 marks
b	**Any two from:** increase the current by one from - moving the slider clockwise or upwards or to the left - having less wire / fewer coils in circuit [1] decrease the current by one from - moving the slider anticlockwise or downwards or to the right - having more wire / coils in circuit [1] increasing length increases resistance / increasing resistance decreases current / ORA [1]	2	**allow** labelled arrows or indications on diagram to indicate correct directions for upwards **allow** towards the power supply for downwards **allow** away from the power supply **Allow** changing length changes resistance [1] **But** increasing length decreases resistance / ORA [0] **Allow** changing resistance changes current [1] **But** increasing resistance increases current / ORA [0]
	Total	**5**	

Question	Answer	Marks	Guidance
2	**[Level 3]** **descriptions about <u>all three</u> from:** - **ultrasound v surgery** - **ultrasound v X rays** - **detailed information about the display** Quality of written communication does not impede communication of the science at this level (5 – 6 marks) **[Level 2]** **descriptions about <u>any two</u> from:** - **ultrasound v surgery** - **ultrasound v X rays** - **basic information about the display** Quality of written communication partly impedes communication of the science at this level (3 – 4 marks) **[Level 1]** **descriptions about <u>any one</u> from:** - **ultrasound v surgery** - **ultrasound v X rays** - **basic information about the display** 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 A*.** **ultrasound used rather than surgery may include:** non-invasive / no damage to human / no scars (more) accurate method fat thickness can be measure at different parts of the body quick method **ultrasound used rather than X rays may include:** produces images / readings / results for soft tissue does not damage living cells **allow** reverse arguments e.g. x rays do not show soft tissue **detailed information about the display may include:** peak **A** is at 5 - 7 (mm) peak **A** is at the fat-muscle layer the thickness of fat in the arm is 5 - 7 (mm) peaks **A B** and **C** are at different depths in the body **basic information about the display may include:** each peak is at a tissue boundary waves reflect from tissue **boundary** the first peak shows the body fat thickness (shows) reflections at different depths / distances **Use the L1, L2, L3 annotations in scoris.** **Do not use ticks.**
	Total	**6**	

Question	Answer	Marks	Guidance
3 a OVERLAP	**any two from** (idea that for **absolute dating**) absolute dating gives a more exact date / ora (1) (Idea about **absolute dating**) not enough Carbon-14 in old rocks (for absolute dating) or absolute dating only works when there is enough carbon in the sample (1) (idea that **relative dating**) can get the age of (very) old plants / wider age range of plants / ORA [1] (idea that for **relative dating**) need comparative data eg. requires knowledge of the ages of surrounding rocks (1) Idea that using **both methods** together gives a more **reliable** / valid / complete answer or both results support each other / [1]	2	**Allow carbon dating for absolute dating** **Eg** more accurate / precise **Ignore** 'better result' **allow** relative dating can get the age of (very) old rocks [1] **Eg both methods** give more certain answer [1] **Eg, both methods** give more confidence in the result [1] **Allow both methods** give a more accurate answer [1] **Accuracy mark can only be given once.**
b	lead (1)	1	if answer line blank allow correct answer circled or underlined more than one answer = 0 marks
	Total	**3**	

Question	Answer	Marks	Guidance
4 a	a **fast moving** electron (1)	1	if answer line blank allow correct answer circled or underlined more than one answer = 0 marks
b	mass number is unchanged ✓ nucleus has one more neutron ☐ nucleus has one more proton ✓ atomic number decreases by one ☐	1	both ticks required more than two ticks = 0 marks
c i	$\rightarrow {}^{237}_{93}Np + {}^{4}_{2}He$ (2)	2	any two or three numbers correct = 1 mark

Question	Answer	Marks	Guidance
ii	**any two from** alpha particles cause the air inside the smoke detector to ionise (1) idea that smoke particles absorb / stop (some alpha) radiation (1) less ionisation (of air) **with smoke** [1] current is reduced (causing alarm to sound) (1)	2	**Ignore** references to alpha detector **Ignore** merely particles 'hit' But alpha particles absorbed or stopped by smoke particles so less ionisation of air particles (2)
	Total	**6**	

Question	Answer	Marks	Guidance
5 a	he **gains** negative charge (from the carpet) (1) **but** he **gains electrons** (from the carpet) (2)	2	Any mention of **positive electrons** [0] Any mention of **moving** positive charge [0] if no other marks scored **allow** idea that there is a transfer of electrons (1)
b i	(electrostatic) voltage increases with distance / AW [1] (idea of) voltage related to charge / electrons [1] the increase in (electrostatic) voltage is faster at the start / increases slower at the end / the increase is not linear [1]	2	**allow** the (electrostatic) voltage increases as more electrons are transferred (1) **eg.** the (electrostatic) voltage increases with distance as he gains more (negative) charge or electrons [2] **allow** there is a steeper gradient at the start (1) **allow** trend shown with data from the graph: e.g. (electrostatic) voltage rises from 0 to 6kV in 2 metres but by only 2 in the next 3 metres [2]
ii	**more moisture** in air / surroundings / clothing / shoes / carpet [1] **idea of more conductive** air / surroundings / clothing / shoes / carpet [1] less friction / rubbing [1]	1	**Eg.** Wet day / wet shoes [1] **allow** idea of less insulated [1] **allow** more charge has leaked away (to earth) [1] allow bare feet / use of anti-static spray / [1] **allow** idea that feet are picked up or feet are not dragged along the carpet (1) **ignore** speed of walking [1]
	Total	**5**	

Question	Answer	Marks	Guidance
6 a	**7** minutes scores [3] **but if answer incorrect or incomplete then:** $\frac{1,680,000 \times 2}{8,000}$ or 420 scores [2] **but if no marks scored then:** either use of correct average speed, 4000 or 210 or 3.5 minutes scores [1]	3	7 **seconds** scores [2] **Ignore** units
b i	**lower speed** (than 8000m/s) then: - centripetal / gravitational force too high (to stay in this orbit) [1] - rocket may fall / move or spiral to Earth [1] **higher speed** (than 8000m/s) then: - centripetal / gravitational force too low (to stay in this orbit) [1] - rocket may move away from Earth / spiral out of orbit [1] (idea of) higher stable orbits experience lower gravitational force or lower speed / ORA [1]	3	**Eg.** rocket may fall as centripetal / gravitational force is too big [2] **eg.** rocket may move away as centripetal / gravitational force is too small [2] **allow** any idea that correct speed needed to allow correct angle of re-entry to avoid overheating [1]

Question	Answer	Marks	Guidance
ii	(+/-) 4 (m/s^2) scores [3] **but if answer is incorrect then:** (+/-) $\frac{(120^2 - 2000^2)}{2 \times 5 \times 10^5}$ [2] **Or if no other marks scored then** evidence of correct substitution into $v^2 = u^2 + 2as$ **or** evidence of **rearranged** formula: $\frac{v^2 - u^2}{2s}$ [1]	3	**allow** 3.99 **/** 3.9856 (m/s^2) [3]
c i	share expertise / knowledge / data / workload interpretations of evidence [1] check / test / compare (each other's) results [1]	1	**Eg.** work / ideas can be shared [1] **Eg.** more data collected [1] **Eg.** more / different jobs can be done (at same time) [1] **Eg**. Idea of international collaboration / sharing cost [1]
ii	other scientists can check or test or verify findings / develop ideas or theories / use or compare the data / improve knowledge or education / more data available / credit or acknowledgement of work [1]	1	**allow** (idea of) peer review [1]
	Total	**11**	

Question	Answer	Marks	Guidance
7 a	(suggestion) idea of exact alignment with receiver [1] (explanation) to maximise signal received / AW [1] (suggestion) idea of making dish larger [1] (explanation) to reduce diffraction / so wave spreads less / to maximise signal received / to produce a parallel beam / AW [1] (suggestion) position dish high up / sensible place [1] (explanation) avoids obstacles / maximise signal received / avoids signal loss [1]	4	**Answers in either order acceptable** Eg. line of sight needed [1] Eg. Point in right direction [1] Eg more waves hit receiver / more chance of receiving the signal / stronger signal (received) [1] **Ignore** focussed **Ignore** more curved **Allow** stronger signal received [1] **Ignore** focussed Eg. Ensures line of sight [1] **Eg.** no obstacles to absorb microwaves [1]
OVERLAP b i	**B** [1] less than 30MHz / low**est** frequency / few**est** MHz / high**est** wavelength [1]	2	**If B not chosen (0)** **Allow** 15m or 20MHz [1] **second mark is conditional on B being chosen** look for a comparison. Eg. 'it's the low frequency one [1]
OVERLAP ii	**C** [1] above 30GHz (waves absorbed or scattered) [1]	2	**If C not chosen (0)** Allow 0.006m or 50GHz [1] **second mark is conditional on C being chosen**
	Total	**8**	

Question	Answer	Marks	Guidance
8	**Level 3: (5 – 6 marks)** **Answer shows understanding of** **For higher frequencies the speed slows / direction changes the most.** **AND for higher refractive index the speed slows / direction changes the most.** Quality of written communication does not impede communication of the science at this level. **Level 2: (3 – 4 marks)** **Answer shows understanding of the nature of the colour of light.** Quality of written communication partly impedes communication of the science at this level. **Level 1: (1 – 2 marks)** **Answer shows a simple appreciation of the nature of light.** Quality of written communication impedes communication of the science at this level. **Level 0: (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted up to grade A*** **NB. Answers can be given (ORA) in terms of red light.** **Indicative scientific points may include:** **Level 3:** • violet light has highest frequency / shortest wavelength and speed slows most / direction changes the most / AW • violet light has highest refractive index and slows most / direction changes the most / AW **Level 2:** • EITHER violet light slows down most • OR violet light has higher frequency / shorter wavelength • OR violet light has higher refractive index **Level 1:** • EITHER light slows down when entering glass • OR different colours have different speed changes • OR different colours have different refractive index • OR different colours have different frequencies / wavelength **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>9</td><td>[Level 3]
truth table all correct
AND
An explanation about how logic system is used to display different numbers
AND
numbers (eg. 2) used to illustrate answer
Quality of written communication does not impede communication of the science at this level
(5 – 6 marks)
[Level 2]
truth table all correct
AND EITHER
explanation about how logic system is used to display different numbers
OR
Numbers (eg. 2) used to illustrate answer
Quality of written communication partly impedes communication of the science at this level
(3 – 4 marks)
[Level 1]
at least two rows in truth table correct
OR
explanation about how logic system is used to display different numbers
OR
numbers (eg. 2) used to illustrate answer
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)</td><td>6</td><td>This question is targeted at grades up to A.

completed truth table:

<table><tr><td>1</td><td>1</td><td>1</td></tr><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>1</td><td>1</td></tr></table>
how his logic system is used to display different numbers may include:
• Signals / states can be 0 / low / off or 1 / high / on
• logic system made of three OR gates and one NOT gate
• logic gates work to give different combinations of 0 and 1
• when the output / G is 1 then the shaded segment is switched on / ora

numbers to illustrate the answer may include:
• numbers 1 3 4 5 6 7 8 9 0 need G to be 1 to be correctly displayed
• number 2 need G to be 0 to be correctly displayed
• numbers 1, 7 and 0 need the middle bar to be 0

Use the L1, L2, L3 annotations in scoris.
Do not use ticks.</td></tr>
<tr><td></td><td>Total</td><td>6</td><td></td></tr>
</table>

Question	Answer	Marks	Guidance
10 a i	iron / soft iron / laminated (core) secondary (coil) primary (coil) step-down	2	4 correct = 2 marks 2 or 3 correct = 1 mark
ii	375 (V) (2) **but if calculation incorrect** $\frac{10\,000}{\text{output}} = \frac{4000}{150}$ (1)	2	Allow 374.5 to 376 [2] $\left[\frac{4000}{150}\right] = 26.6(67) / 26.7$ [1] **allow** correct versions of this substituted equation e.g. output x 4000 = 10 000 x 150 (1)
b	AC produces a **changing** magnetic field (1) a changing magnetic field produces a changing voltage / current in the coil (1) if no marks scored electromagnetic induction (only happens with AC) [1]	2	**allow** DC does not produce a changing magnetic field (1) **allow** idea of changing magnetic field needed for **any** voltage / current to be induced (1)

Question	Answer	Marks	Guidance
c	Reduced chance of a shock [1] provides isolation from 230V / mains (1)	2	eg. mains shavers can safely be used in (wet) bathroom [1] eg. Can protect workers using appliances outside (in wet conditions) [1] **ignore** merely 'safer' touching live does not complete a circuit [1] **allow** 'safer' if qualified **eg**. but if isolated from mains will make it safer [2]
	Total	**8**	

Question	Answer	Marks	Guidance
11 a COMMON	82 104 128 (1)	1	all correct for 1 mark
COMMON b i	I_b is (always much) smaller than I_c / ORA [1]	1	
COMMON ii	(idea that) a small base current is needed to switch on the transistor (1) (this allows) a large current through the transistor (1)	2	**allow** higher level answers e.g. transistors have a high gain (1)

Question	Answer	Marks	Guidance
c	**max two from any of these advantages:** robot can do jobs that are more: boring / dangerous / unpleasant / intricate / labour intensive / hygienic / take longer Other advantages are that robots are safer / stronger / more efficient / faster Other advantages that robots don't get sick / don't take holidays / don't get paid / don't make human errors / don't take breaks / don't need feeding / don't get tired **max two from any of these disadvantages:** robots may be limited in decision making / need reprogramming / expensive to buy or maintain / robots take peoples jobs / may take over (the world) / dangerous to humans if a fault develops (1)	3	**Ignore** can do repetitive work **Ignore** robots do jobs that humans don't want to do
	Total	**7**	

Question	Answer	Marks	Guidance
12 a	coil is rotated / moves (in a magnetic field) to produce current in the coil [1] induction / (current or voltage) induced [1] slip rings / brushes keep circuit complete or make sure the current continues to flow (in the external circuit) [1] brushes make good / continuous contact (between the coil and the external circuit) [1]	2	If motor is described award a maximum of [1] available for last two marking points **Eg** coils break magnetic field lines to produce current [1] **Eg** magnets make coil spin and a current is induced [0] **BUT** magnets make coil spin and a current is induced and the slip rings pass current into the circuit [1] **Eg**. coil spins and induces current [2] Eg. Slip rings keep current flowing [1] **Ignore** Slip rings prevent wires tangling Eg. brushes / slip rings carry / pass on current to (external) circuit [1]
b	increase the speed / frequency of rotation of the coils (1) **and any one from** decrease the number / area of coils (1) reduce the magnetic field strength / AW (1)	2	 **Allow** weaker / less powerful magnet [1] **Allow** move magnets apart [1] **ignore** size of magnet
	Total	**4**	

Question	Answer	Marks	Guidance
13 a i	ideas of: (**for test group**) inaccurate or unreliable measurement(s) [1] (**for test group**) small(er) sample in group / [1] (**for test group**) group not representative / research more representative [1]	3	 Eg. Equipment may be faulty [1] Eg. method may be flawed [1] Eg. large(r) sample in research [1] **allow** example of how the group is not representative eg. **Test group**, some have a hearing impairment [1] eg. All aged16 in test group / AW [1] eg. (**test group**) result(s) look anomalous [1]
ii	19 000 [2] **but if answer is incorrect or incomplete then:** evidence of multiplying average by 5 [1] **or** $\frac{80\,000 + \text{Dionne}}{5}$ [1]	2	**If no answer on answer line check table**

Question	Answer	Marks	Guidance
b i	**any 2 from:** greater hearing loss with ageing [1] greater hearing loss with greater frequency [1] rate of hearing loss increases with ageing [1] rate of hearing loss increases with increasing frequency [1]	2	Eg. as you get older your ability to hear reduces [1] **BUT allow** as you get older your ability to hear higher frequencies reduces [2]
ii	hearing aid lowers (6000Hz) sounds to 3000(Hz) [1] (with hearing aid) less hearing loss at 3000(Hz) / lower frequency sounds heard more easily [1] (at age 60) hearing aid reduces hearing loss by 10 - 15(dB) / AW [1]	3	**Look for use of data in answers.** **Allow** other value of frequency correctly halved [1] **ignore** just frequency halved Eg better hearing (range) at 3000(Hz) **Eg.** (at 60) aid reduces hearing loss from 27 to 13 (dB **Allows** halves hearing loss [1]
	Total	**10**	

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