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 2016

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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.

1. Annotations used in scoris

Annotation	Meaning
	correct response
	incorrect response
	benefit of the doubt
	benefit of the doubt **not** given
	error carried forward
	information omitted
	ignore
	reject
	contradiction

2. 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	alpha cannot get through the body (to reach the detector) [1] alpha is absorbed by the body / skin / tissue / flesh [1]	1	**allow** only beta **and** gamma can penetrate the skin / get through the body (to the reach the detector) [1] **allow** alpha does not penetrate (tissue / body / skin) [1] **ignore** references to alpha and paper **ignore** references to damage
b i	(can cause) cancer / mutations [1] can damage or ionise cells / DNA / tissues / (named) organs [1]	1	 **allow** can kill for idea of damage **eg** kills cells [1] **not** merely 'damage'
ii	half-life [1]	1	**allow** correct descriptions of half-life **allow** rate of (radioactive) decay **ignore** speed of decay / mass or amount of sample **ignore** because it decays quickly
c	**any two from** so (all) gamma is (only) concentrated / focussed on the **tumour** / **cancer cells** AW [1] so that healthy / normal / other / non-cancerous cells receive less gamma / AW [1] otherwise (if patient moves) gamma may damage / affect (more) healthy / normal cells or tissue / ora [1]	2	 Eg. idea that tumour has maximum exposure / cancer cells get a lethal dose [1] cancer cells rather than healthy cells get a lethal dose [2] **allow (**clamp is needed to hold the patients head still) to avoid damage to other tissue [1]
	Total	**5**	

Question	Answer	Marks	Guidance
2	**[Level 3]** **Explains all three from:** **-why the plug only needs two wires** **-explains why the plug needs a fuse** **-why the fuse is 13A (rather than 3A).** Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** **Explains two from:** **-why the plug only needs two wires** **-explains why the plug needs a fuse** **-why the fuse is 13A (rather than 3A).** Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** **Explains one from:** **-why the plug only needs two wires** **-explains why the plug needs a fuse** **-why the fuse is 13A (rather than 3A).** 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 B.** **Description about why the 13A fuse is important:** • 13 A fuse is above the normal working current for the hairdryer / the normal working current of the hair dryer is less than 13 A • 3A fuse would blow under normal use as more current is required by hairdryer • correct explanation using power = voltage x current to choose the correct fuse **Why a fuse is needed:** • idea that fuse melts if too much current flows • safety reason explained e.g. a small increase in the normal current will cause the fuse to melt / blow so very high current due to a fault will not happen. Eg. too large a current causes the fuse (wire) to melt / blow • reduces the risk of fire (if the hair dryer develops a fault) eg. prevents the flex / hair dryer overheating / causing a fire **Why the plug only needs two wires:** • earth wire not needed • only needs live and neutral wires • the hair dryer is double insulated / has a plastic case / has no touchable metal parts • the plastic case is an insulator / non conductor / cannot become live **Use the L1, L2, L3 annotations if needed; do not use ticks.**
	Total	**6**	

Question	Answer	Marks	Guidance
3 a i	(The car seat becomes) **positive(ly) / +** (charged because it loses) **electron(s)** [1]	1	**both required for one mark** **not** positive electrons
ii	(idea that) antistatic sprays are made of a conducting (polymer) material / contains a substance that is a good conductor [1] Car seat (now) conducts [1]	1	**ignore** charge cannot build up **allow** enables charge to move / leak to earth [1]
iii	(idea that the strip provides earthing but as the car moves) the strip is not always in contact with the road [1]	1	**allow** (idea that) the car is already earthed because there is graphite in the tyres so this additional earthing does not make a difference [1] **ignore** strip breaks / gets damaged / falls off
b COMMON	**benefit: any one from** the idea that (as the petrol is pumped faster): people can fill up their cars faster [1] there will be fewer queues for petrol [1] **risks: any one from the** idea that (as the petrol is pumped faster): charge could build up (quicker) [1] there is a (greater) risk of sparks / explosion / fire / static discharge [1]	2	Do not credit simple statements such as ' petrol leaves pump quickly' (as this is in the question). **Allow** it is quicker (to fill up) [1] **allow** (idea that as the petrol is pumped faster) garage sells more fuel / increases profits [1] **Ignore** getting splashed with fuel / electric shock / static electricity
	Total	**5**	

Question	Answer	Marks	Guidance
4 a	(D) ➔ B ➔ E ➔ F ➔ A ➔ (C) [2]	2	all correct = 2 marks if incorrect, B anywhere before F scores [1]
b	the control rods absorbs neutrons [1] there must be enough (free) neutrons to keep the process going [1]	2	For absorb **allow** reduce/ stop / block [1] Not merely 'affect neutrons' **ignore** just control / slow down neutrons **BUT** control **numbers** of neutrons [1] **allow** neutrons are needed for fission [1] **allow** rate of fission or energy production would be too low [1] eg not enough power produced (if rods left inside) [1] eg. too many neutrons are absorbed [1]
	Total	**4**	

Question	Answer	Marks	Guidance
5 a COMMON	94 (W) [2] **but if answer incorrect** 20 x 4.7 [1]	2	 **Allow** 230 x 4.7 or 1081 scores [1]
b i COMMON	Kenya **and** **high**(est) voltage / **high**(est) number (of volts in table) / 240(V) [1]	1	**Both required for the mark** **Eg.** Kenya has a high number [1] **Allow** since the current is constant it needs a high(er) voltage to get a high(er) power / wtte [1]
b ii	reducing resistance increases current / ora [1] Higher current gives higher power [1] **more power** / **current** makes iron hotter or work better or remove creases more easily [1] Japan has lowest voltage so power / current needs to be increased [1]	2	**Allow** variable resistor can give a higher current [1] **BUT ignore** increased resistance increases current **Ignore simply** removes creases / iron hotter / works better **Allow** Lower resistance gives higher power [2] **Allow** higher level answers in terms of I^2R or IxV
	Total	**5**	

Question	Answer	Marks	Guidance
6 a i COMMON	speed is scalar / velocity is vector [1] **or** velocity gives direction / speed does not have direction / AW [1]	1	**allow** one is scalar and the other is vector [1] **allow** speed **only** has size / magnitude [1]
ii COMMON	**Y** [1] Maximum of one mark for the (idea that): - same direction so add velocities [1] - opposite direction so subtract velocities [1] - (resultant is) **6m/s** [1]	2	more than one letter = 0 marks if V, W or X is chosen then [0] (see advice below) if no letter is chosen one mark is still available --- In the unusual circumstances that a candidate misinterprets the information such that boat velocity is taken as the resultant velocity then award a maximum of [1] mark for W **and** X.
b	7 (s) [2] **but if answer is incorrect or incomplete then either** $\frac{28}{4}$ **or** $\frac{28 \times 2}{2+6}$ [1]	2	 **allow** correct substitution into an appropriate equation of motion eg. 28 = 4 x t [1]
	Total	**5**	

Question	Answer	Marks	Guidance
7 a	**any two from** (fast air) particles hit bag (causing force) [1] (more) frequent collisions (with wall of bag) [1] **change** in momentum causes a force / pressure [1] **BUT** change in momentum of **particles** (hitting the bag) causes a force / pressure [2]	2	 **ignore** collisions between air particles **ignore** references to momentum of **car** **allow** force = <u>change in momentum</u> [1] time
b	 **EITHER** <u>6.5</u> (m/s) **AND** this is less than 9m/s **OR** <u>6.5</u> (m/s) **AND** no [3] **OR** it is <u>2.5</u> (m/s) **below the speed limit** [3] But if incorrect or incomplete then: 1000 x V + 8000 x 2 = 9000 x 2.5 scores [2] But if incorrect or incomplete then: **EITHER** (momentum after): 9000x2.5 or 22500 [1] **OR (**momentum before): 1000 x V + 8000 x 2 [1]	3	**Speed limit mark is only available with a correct value** **Allow** <u>6.5</u> and yes / breaks speed limit scores [2] **Allow** <u>6.5</u> and no comment given [2] **qualitative** idea the momentum is conserved e.g. no momentum is lost or gained / momentum before = momentum after [1]
	Total	**5**	

Question	Answer	Marks	Guidance
8 a	Any one from reflect from (upper) atmosphere / ionosphere (over obstacles or over horizon) [1] **OR** diffract (more easily) around / over obstacles [1]	1	 **ignore** ozone / stratosphere **allow** diffracts (more easily) around Earth's curvature / through gaps [1] **NOT** diffract through obstacles (for this marking point only) **Allow** (the idea that) gap size of obstacle is similar to wavelength increases diffraction [1]
b i	**any two from** coherent scores [2] **but** if incomplete or incorrect then: **same** wavelength / **same** frequency [1] similar amplitude / same amplitude [1] in phase / AW [1]	2	Award marking points if clearly shown in a diagram **Ignore** monochromatic / same colour **Eg.** all peaks line up [1] **Allow** 'in sync' [1] **Allow** reverse argument for destructive interference. **Eg**. (for destructive interference 180^0) out of phase [1]

Question	Answer	Marks	Guidance
ii	(two sources have slightly) different amplitudes [1] waves do not cancel out completely [1] waves are not exactly 180^0 out of phase [1] (signal goes from) strong to weak / strength changes with time [1]	2	**Allow** answers clearly illustrated in a diagram / explained in terms of sound **allow similar or slightly** different frequencies / wavelengths [1] **allow** peaks do not **exactly** line up with troughs [1] **but** peaks do not line up with troughs scores [0] **allow** (waves go from) loud to quiet / never becomes silent [1]
	Total	**5**	

Question	Answer	Marks	Guidance
9 a	change in wave speed / refractive index [1] **but** (in air) wave speed increases / lower refractive index / ora [2]	2	one side of wave (front) / ray changes speed before the other [1] one side of wave (front) / ray speeds up before the other [2] **allow** if **no** other marks scored that air is less dense (than glass) / ora [1]
b	Violet light has a greater change in speed (from glass to air) / ora scores [1] **BUT** Violet speeds up **more** (from glass to air) / ora [2] red and violet have a different refractive index scores [1] **BUT** refractive index is larger for violet / ora [2]	2	**Assume** answer refers to violet compared to red unless indicated otherwise **Assume** light goes from glass to air unless indicated otherwise **But** violet slows down more than red / ora [1] **Ignore** merely 'violet is faster ' / ora **allow** violet light has shorter wavelength / higher frequency (than red light) / ora [1]
	Total	**4**	

Question	Answer	Marks	Guidance
10	**Level 3: (5 – 6 marks)** Answer explains that there is no horizontal acceleration but there is vertical acceleration **AND** shows a successful calculation for the time taken. Quality of written communication does not impede communication of the science at this level. **Level 2: (3 – 4 marks)** Answer describes **EITHER** that there is no horizontal acceleration but there is vertical acceleration AND shows partial success at calculating the time taken **OR** gives the correct calculation. Quality of written communication partly impedes communication of the science at this level. **Level 1: (1 – 2 marks)** **Answer describes** **EITHER** that the path has vertical acceleration **OR** has no horizontal acceleration **OR** a simple attempt at a relevant calculation with numbers 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*** **Indicative scientific points may include:** **Level 3:** • constant speed / no horizontal acceleration BUT there is vertical acceleration BECAUSE gravity acts vertically • t = 0.447 / 0.4 / 0.45 (s) • $t = \sqrt{0.2}$ or $t = \frac{1}{\sqrt{5}}$ or $t = \frac{\sqrt{5}}{3}$ **Level 2:** • constant (horizontal) speed / no horizontal acceleration AND vertical acceleration / increasing speed • $t^2 = 0.2$ • $1 = ½ \times 10 \times t^2$ • appreciation that ut = 0 • correct substitution into equation $s = ut + ½ at^2$ **Level 1:** • no horizontal acceleration / constant (horizontal) speed • vertical acceleration / increasing speed • quote an equation of motion with values. **Use the L1, L2, L3 annotations if needed; do not use ticks.**
	Total	**6**	

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>11 a</td><td>Column D 1,1,1,1,0,0,0,0 [1]

Column E 0,0,0,1,0,0,0,1 [1]

Column output 0,0,0,0,1,1,1,0 [1]

<table>
<tr><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th><th>OUTPUT</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td></tr>
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</table></td><td>3</td><td></td></tr>
<tr><td>b</td><td>output / current / voltage / power of a logic gate is small [1]

relay switches on a circuit with a larger current / voltage / power AW [1]</td><td>2</td><td>Eg. low power logic gate cannot power the bell [1]

Ignore references to transformers
Not merely isolates logic circuit from bell circuit</td></tr>
<tr><td></td><td>Total</td><td>5</td><td></td></tr>
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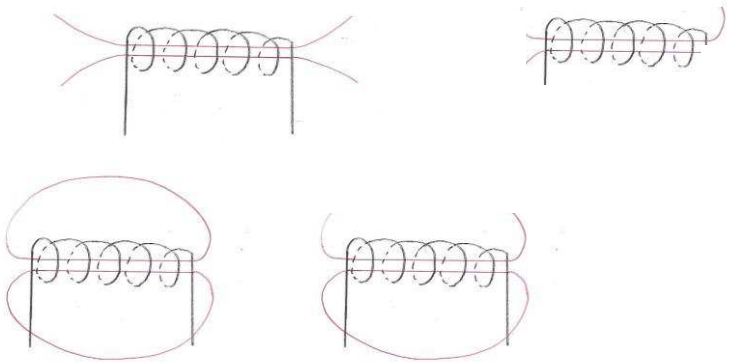
Question	Answer	Marks	Guidance
12 a	2 (MW) [2] **but if answer is incorrect** 10 000 x 200 **or** 100^2 x 200 [1] **or** 2 000 000 [1]	2	
b	risk of electrocution / (severe) shock / death [1] **benefit** reduces power / heat / energy loss [1]	2	**NOT** merely (causes more) damage / more dangerous **ignore** heating of wires as a risk **allow** other sensible risks if qualified **allow** conserves fuel resources / reduces costs for the power company / more efficient [1] **ignore** more power transmitted / lower current
c	**C** has input and output voltages wrong way round / should be 1000(v) then 50(v) / could be 50(v) then 2.5(v) / ratios incorrect [1] **D** the ratio is wrong / output should be 200 / input should be 50 / correct ratio of 20:1 [1]	2	If **no** other marks scored then: **EITHER** C **and** D identified **OR** C is a step-down transformer so output voltage should be lower / AW [1]
	Total	**6**	

Question	Answer	Marks	Guidance
13 a i	uniform field inside the (middle of) solenoid [1] correct outer shape [1]	2	**Ignore** arrows on field lines minimum of two 'straight and parallel' lines through solenoid minimum of one correctly drawn loop outside the solenoid **OR** a divergent field line outside the solenoid  [2]
ii	(same strength but) reverses direction / (same strength but) changes direction / AW [1]	1	**Allow** flips (direction) [1]
b	**any one from** more turns / AW [1] stronger magnetic field / (soft) iron core / AW [1]	1	**Ignore** change voltage / resistance / improve brushes for better connection **allow** idea of greater turns or coils concentration / turns closer together / greater density of turns or coils [1] **ignore** larger (sized) magnets **allow** use a radial field or curved magnets / bringing magnets closer together [1]
	Total	**4**	

Question	Answer	Marks	Guidance
14 a	20 (Ω) [2] **but if answer incorrect** evidence of calculating a gradient or correctly substituting the values of one data point into R=V/I [1]	2	 Eg. 3 / 0.15 **or** 6 / 0.3 scores [1] inspect graph for possible answers
b	Maximum of two from: Steeper / greater gradient scores [1] But gradient is 3 x greater scores [2] need three times the voltage (to get the same current) / current will be 3 times less (for the same voltage) [1]	2	 **allow** correct gradient drawn on graph / line through (0,0) and (0.1,6) [2] eg. 6 / 0.1 or 60 (rather than 20) [1]
	Total	**4**	

Question	Answer	Marks	Guidance
15	**Level 3: (5 – 6 marks)** Answer correctly describes that less light increases the resistance of the LDR and **explains** how the potential divider works to increase the voltage output. Quality of written communication does not impede communication of the science at this level. **Level 2: (3 – 4 marks)** Answer correctly describes that less light increases the resistance of the LDR and states that the output voltage increases. Quality of written communication partly impedes communication of the science at this level. **Level 1: (1 – 2 marks)** Answer describes that light (level) changes the resistance of the LDR and states that this turns on the light / changes voltage. 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 Indicative scientific points may include (but are not limited to) the following: **Level 3** • In low light, resistance of LDR is greater than that of the fixed resistor which gives a higher share of the voltage / ora • In low light, the ratio of the LDR resistance to the fixed resistor increases which gives a higher share of the voltage / ora **Level 2** • LDR resistance is low in light / (very) high in dark • The voltage (output) across LDR increases in dark / ora **Level 1** • LDR resistance changes in light or dark • Voltage (output) depends on (ambient) light / resistance **Use the L1, L2, L3 annotations if needed; do not use ticks.**
	Total	**6**	

Question	Answer	Marks	Guidance
16 a i	4 [2] **but if answer is incorrect** $\frac{7300}{5 \times 365}$ [1]	2	
COMMON ii	(idea of) more people in UK or less people in Belgium [1]	1	**allow** different populations [1] **allow** justified examples e.g. industry use in UK is higher [1] Belgium uses more gas / wastes less energy [1] (idea that) Belgium uses more efficient appliances (than the UK) [1] **Eg**. Belgium uses more LEDs than the UK [1] **Allow** other sources of power used. Eg solar heating of water [1]
COMMON b i	1200 [2] J [1] but if answer is incorrect 2.00 x 12 x 50 scores [1]	3	 **NOT** W/s or W But **allow** J/s [1] mark unit independently e.g. 6 J [1] 1200 W [2] 2 x 12 x 50 J [2] 2 x 12 x 50 W [1]
COMMON ii	increases / AW [1]	1	**allow** 'faster' conduction / AW [1]

Question	Answer	Marks	Guidance
c	40 (m^2) [3] **but if answer is incorrect** $\frac{240}{0.5 \times 12}$ (m^2) [2] **but if answers above are incorrect or incomplete then** 0.5 x 12 [1] **Or** 12 (^{0}C) (difference between temperatures) [1]	3	 **Allow** $\frac{240}{0.5 \times 10}$ or 48 (m^2) scores [1] **Allow** $\frac{240}{0.5 \times 22}$ or 21.8 (m^2) scores [1] **allow** area x 0.5 x 12 = 240 [2] **allow** 240/6 [2]
	Total	**10**	

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