OCR
Oxford Cambridge and RSA

GCSE

Physics B

Unit **B751/02:** Modules P1, P2, P3 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2017

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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
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.
	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

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	completely curved waves (with no straight sections) drawn (1) wavelength remains the same (by eye) (1)	2	Waves do **not** have to touch the barrier Mark first 4 wave-fronts (on left) only **Accept** (variation in) wavelengths between ½ and double original wavelength (as checked on central line through the slit)
b	**any one from:** diffraction is only at the edges (1) there is less / no diffraction (1)	1	 **Allow** straight sections in the middle and curved at edges / waves are straighter (1) **Allow** less curved / bend less **Ignore** 'spread out more' and 'spread out less' / smaller diffraction
	Total	**3**	

Question	Answer	Marks	Guidance
2	**Level 3: 5-6 marks** **Correct material suggested for both types of floors** **AND** **an explanation of conductor in room A AND an explanation of insulator in room B.** Quality of written communication does not impede communication of science at this level. **Level 2: 3-4 marks** **Correct material chosen for both types of floors** **AND**	6	**This question is targeted up to A*** **Indicative scientific points may include (but are not limited to) the following:** Room **A** • under floor heating requires heat to be able to conduct through the floor. • a poor insulator / good conductor is required • ceramic tiles / or Lino are suitable to use Room **B** • for a room without underfloor heating a good insulator is

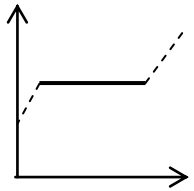
	an explanation of conductor OR insulator for either room. Quality of written communication partly impedes communication of science at this level. **Level 1: 1-2 marks** **Correct material chosen for both types of floor OR** **An explanation of conductors OR insulators for either room.** Quality of written communication impedes the communication of science at this level **Level 0: 0 marks** Insufficient or irrelevant science. Not worthy of credit.		required (otherwise the floor will feel cold) • cork tiles / wool carpet / oak wood would be suitable to use
	Total	**6**	

Question	Answer	Marks	Guidance
3 a i	**any two from:** (a series of) on/off signals (1) (Idea that) they are **sent** / received as a code (1) using relay stations (for greater distances) (1)	2	**Ignore** 'digital' **Allow** dots and dashes / long and short pulses / flashes (of light) (1) **Allow** pattern / sequences represent letters / language (1)
ii	it only has two values / it is just on-off signals / AW (1)	1	**Allow** long and short flashes / dots and dashes (1) **Ignore** references to multiplexing / noise / signal quality
b	infrared ray entering / leaving the optical fibre **at an end** (1) they hit the side of the fibre at more than the critical angle / AW (1) the rays are totally internally reflected / reflected **AT** the surface (on diagram) / AW (1)	3	**Allow** full marks for correctly drawn diagram Do **not** allow a poor diagram to negate marking points clarified in the text refraction on entering / leaving the fibre is **not** required **accept** reflections with angle $i = 45^{o}$ (by eye) or higher **allow** 'TIR' for total internal reflection If diagram is correct then check writing for any contradictions.

c	$2.2x10^{14}$ Hz (3) **if incorrect or incomplete then allow:** $2.22x10^{14}$Hz **or** $2.222x10^{14}$Hz (2) **or** $2.0x10^{14}$ or 2.2 or 2.22..etc (1) **or** (for correct substitution) $f = \frac{2 \times 10^{8}}{9 \times 10^{-7}}$ (1)	.3	 **Allow** any other value that rounds to $2.2x10^{14}$ (2) Allow 2.2×10^{x} or $2.22\ldots \times 10^{x}$ (1)
	Total	**9**	

Question	Answer	Marks	Guidance
4 a	**any one from:** loss of line of sight (due to curvature of the Earth / hills / obstruction) (1) transmitter – receiver distance too large / AW (1) no / little diffraction of microwaves around obstacles (1) interference (between signals) (1)	1	**Allow** references to satellites combined with a correct statement; Eg. Line of site to satellite is blocked (1) **Allow** reasonable examples of obstructions eg**.** hills / buildings / in a tunnel / curvature of earth / (large areas of) water (scatter signals) / AW (1)

b	**any one from:** put transmitters closer together (1) build more transmitters (1) more power / energy from signals or transmitters / stronger signal (1) position transmitters / receivers at higher levels / AW (1)	1	**Ignore** any references to digital signals or satellites **Allow** move closer to a mast (1) **Allow** more powerful transmitters (1) **Allow** put masts in line of sight (1)
c	**any one reason AGAINST from:** • (microwave) radiation could be damaging / safety (concerns) (1) • little is known about the effects of (high energy) microwaves (1) • unsightly / visual pollution / occupy (otherwise useful) land (1) **any one reason FOR from:** • improved communication / coverage (1)	2	**Ignore** references to cost **Ignore** references to 'dangerous' (as it is in the question) Eg. Increases health risk / (Radiation may) cause cancer / cause (brain) tumours / harm people (1) **Ignore** just 'fear' **BUT** fear of cancers scores (1) **Eg.** **Allow** better service / more or stronger signals (1) **Allow** easier to keep in touch (1) **Allow** faster service (1)
	Total	**4**	

Question	Answer	Marks	Guidance
5 a	7,910,000J / 7.91MJ / 7910kJ / 7.91x10^{6}J (1) **if incorrect or incomplete then:** 3.5 x 2260000 (1)	2	**allow** correctly rounded answers to 2 significant figures
b	horizontal line shown on graph (1)	1	allow written description which covers the marking point 
	Total	**3**	

Question	Answer	Marks	Guidance
6 a	toaster (1)	1	
b	fridge (1)	1	
c	96 (p) (2) **if incorrect or incomplete then:** 0.5 x 12 x 16 = ? scores (1) OR 0.5 x 12 = **6.0** (1)	2	£0.96 scores [2] 0.96 (p) (1)
	Total	**4**	

Question	Answer	Marks	Guidance
7 a	1,050,000 J (3) **If incorrect or incomplete then:** 450000 J (2) **or** 1,500,000 x 0.3 (1)	3	
b	reduces energy or power waste / heating (in cables) or increases efficiency (1) reduces costs (1) (enables) use of thinner wires (1) reduced current (due to increased voltage) (1)	2	Ignore references to 'electricity' or voltage. Eg. gets more electricity to houses (0) Eg. Less voltage lost (0) No absolutes accepted: Eg. **NOT** stops energy waste (completely) Eg. **NOT** wires don't get hot **BUT** wires do not get **as** hot scores (1) **Allow** more power / energy to the consumer / AW (1)
c i	0.4 (seconds) (1)	1	**ignore** any units
ii	30 **or** -30 (volts) (1)	1	**ignore** any units

	Total	**7**	
Question	**Answer**	**Marks**	**Guidance**
8	**Level 3: 5-6 marks** **Answer shows FOUR simple ideas of which TWO are explained in detail.** Quality of written communication does not impede communication of science at this level. **Level 2: 3-4 marks** **Answer shows either FOUR simple ideas** **OR TWO ideas explained in detail.** Quality of written communication partly impedes communication of science at this level. **Level 1: 1-2 marks** **Answer shows TWO simple ideas** **OR ONE idea explained in detail.** Quality of written communication impedes, communication of science at this level **Level 0: 0 marks** Insufficient or irrelevant science. Not worthy of credit.	6	**This question is targeted up to A*** **Indicative scientific points may include (but are not limited to) the following:** **DETAILED ideas** (can be in terms of wavelength or frequency) **TRANSMISSION:** • glass is transparent to the Sun's short-wave radiation • The atmosphere is transparent to the Sun's short-wave radiation **ABSORPTION:** • surfaces in the home absorb short-wave radiation and emit long-wave • the Earth absorbs short-wave radiation and emits long-wave radiation **RE-EMMISION:** • (warmed) surfaces in the home emit long-wave radiation • (warmed) surface of the Earth emits long-wave radiation **TRAPPING:** • the glass reflects the long-wave radiation back into the room • the (greenhouse gases in the) atmosphere absorbs or reflect the long-wave radiation **SIMPLE ideas** **TRANSMISSION** • radiation from the Sun passes through the atmosphere OR radiation from the Sun passes through the glass **ABSORPTION** • radiation is absorbed by the Earth OR radiation is absorbed by the surfaces in the home **Re-EMMISION** • (warm) surfaces in home emit radiation

			OR (warm) surfaces on Earth emit radiation **TRAPPING** • (emitted) radiation / heat is trapped or reflected by glass OR (emitted) radiation is trapped in or by the atmosphere Can then choose, say, 4 comparisons for L3, three comparisons for L2 & two comparisons for L1 ?
	Total	**6**	

Question	Answer	Marks	Guidance
9 a i	**TOP BOX:** (Gravitational) collapse / (dust and gas) pulled together / proto-star (1) **LEFT BOXES:** (planetary) nebula **and then** white dwarf OR (planetary) nebula **and then** black dwarf OR white dwarf **and then** black dwarf (1) **RIGHT BOXES:** supernova **and then** neutron star / black hole (1)	3	**NOT** Proto**n** star **in correct order and both required for (1) mark** **in correct order and both required for (1) mark** **If middle box is a neutral answer then award this mark if answer is correct in lowest box.** **Eg.** LHS: middle box – it explodes and sheds its outer layer Bottom box – white dwarf then black dwarf (1)
ii	(Difference in) **mass** / weight (1)	1	**Allow** (differences in) the number of (hydrogen) nuclei (1) **Ignore** references to size / large and small stars
b	red shifts (1) ozone layer (1)	3	

	gravitational attraction of Jupiter (1)		
c	gravitational attraction / gravity (1)	1	**Ignore** weight
	Total	**8**	
Question	**Answer**	**Marks**	**Guidance**
10 a	Maximum of **TWO** marks from: • increase stopping / collision **time** (1) • decrease **acceleration** (1) • reduces the rate of change of momentum / AW scores (2) **and ONE** mark for: • increase stopping / collision **distance** (1) •	3	**ignore** references to energy / changing shape assume 'longer' refers to time unless indicated otherwise **Not** merely 'Slows it down more gradually' / 'less suddenly' **NOT** merely 'slower acceleration' or 'rate of acceleration' Look for **use** of the equation rather than simply stating it.
b i	**any one from:** driver tiredness (1) influence of alcohol / drugs (1) **greater** speed (1) distractions (1) lack of concentration (1)	1	 **not** just speed **allow** named distractions, e.g. radio / talking / mobile phone

ii	**any one from:** wet / icy / slippery road conditions (1) **worn** brakes (1) **worn** / **poor** tyres (1) **greater** speed (1)	1	 **Not** merely 'road conditions' **Allow** poor road conditions (1) **allow** poor brakes (1) **not** merely 'condition of brakes' **not** merely quality /condition of tyre **not** just speed **Allow** high speed (1) **Allow** more mass / heavier car (1)
c	(Idea that) there is not enough **reaction time** or enough **thinking distance** to stop the car / AW (1)	1	**Allow** you will crash before you have reacted (1) **Allow** not (even) enough time to start braking (1) **Ignore** there is not enough time to think **ignore** 'you will crash' / 'you are too close'
	Total	**6**	

Question	Answer	Marks	Guidance
11 a	**any two from:** **diesel cars:** • have better / low(er) fuel consumption / ORA (1) • have less carbon emissions / ORA (1) **more seats / larger cars:** • gives more carbon emissions / ORA (1) • gives worse / high(er) fuel consumption / ORA (1) **better /low(er) fuel consumption** • gives low(er) carbon emissions / ORA (1)	2	For **WORSE** / **HIGH(ER)** fuel consumption allow reference to low(er) values in the table For **BETTER** / **LOW(ER)** fuel consumption allow reference to high(er) values in the table
b	car **D** (1) it has the best fuel consumption / is the most efficient (1)	2	If D is **not** selected then zero marks for the whole question. Look for answers that use the information rather than just quote it For **BETTER** / **LOWER** fuel consumption allow reference to high(er) values in the table
c	**any two from:** so people can make the right decisions /ORA / AW (1) reliable information / unbiased / avoids cheating on tests (1)	2	**Ignore** 'accurate' as it is in the stem of the question Also read the stem to avoid repetition in answers. Eg. so you can make an informed choice (1) Eg. Car salesmen may tell lies etc. Eg. Need to be confident in the information Do not award marks for vague answers: Eg. Customers will not be happy
	Total	**6**	

Question	Answer	Marks	Guidance
12	**Level 3: 5-6 marks** **Forces discussed and linked to acceleration at three points AND drag linked to acceleration / velocity / speed.** Quality of written communication does not impede communication of science at this level. **Level 2: 3-4 marks** **Forces discussed and linked to acceleration at two points.** Quality of written communication partly impedes communication of science at this level. **Level 1: 1-2 marks** **Forces discussed and linked to acceleration at one point** **OR forces discussed at two points** **OR acceleration described at two points** Quality of written communication impedes the communication of science at this level **Level 0: 0 marks** Insufficient or irrelevant science. Not worthy of credit.	6	**This question is targeted up to grade A** **Ignore** references to energy **Drag is equivalent to air resistance or friction** **Indicative scientific points may include (but are not limited to) the following:** **At point A** • drag is zero/minimal • weight is greater than drag • there is a resultant force • object accelerates (maximum acceleration) **At point B** • as speed/velocity increases, drag increases • increasing drag means a smaller resultant force • acceleration is reduced, but still positive • object has lower acceleration **At point C** • drag equals weight so no acceleration / terminal velocity • no resultant force so no acceleration / terminal velocity
	Total	**6**	

Question	Answer	Marks	Guidance
13 a	6,250 or – 6,250 (N) (2) **if incorrect or incomplete then:** 50000/8 (1)	2	
b	1.25 or – 1.25 (m/s^2) (2) **if incorrect or incomplete then:** 6250/5000 (1)	2	**allow** ecf from 13a
	Total	**4**	

Question	Answer	Marks	Guidance
14 a	20 or -20 (m/s) (2) **if incorrect or incomplete then:** v=√2gh **or** 400 (1)	2	Allow answers using other valid equations of motion: Eg. $v^2 = u^2 + 2as$ v=√2as (1)
b	**any one from:** top of a mountain (1) under surface of Earth (1)	1	 **ignore merely** 'not at, above or below sea level' **But** 'standing on the bottom of the sea' (1) Look for any high or low position **connected** to Earth **ignore** 'in an aircraft' **allow** equator / poles (1) **allow** other correct examples eg. bottom of a mineshaft (1) If answer goes into detail and states the incorrect difference in gravity then ignore the detail: eg. On top of a mountain gravity is 'higher' [1] (This still shows a difference so scores the mark)
	Total	**3**	

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