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 2016

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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
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

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

MARK SCHEME

Question	Answer	Marks	Guidance
1 a i	(industries) need to reduce CFC production or CFC release [1]	1	Look for answers about advice to industry **Ignore** references to fossil fuels, greenhouse gases, CO_2
ii	**any one from** advice / actions on reducing UV exposure [1] advice / actions on disposal of domestic appliances / correct disposal of refrigerators or dehumidifiers [1]	1	 Eg. Stay out of the sun / use sun creams **Allow** reduced use of aerosols [1] **Allow** reduced use of CFC's [1] Eg. Stop buying products that use CFCs **Ignore** simply 'don't use fridges / freezers'
COMMON b i	**any one from** **repeat** measurements [1] **use** new or different equipment / technology [1]	1	 **Look for an action** **Eg. repeat** their experiments / **use** a longer period of time / **use** measurements from other scientists / **collect** more evidence / peer review [1] Allow more experiments [1]
COMMON b ii	**any one from** results / findings / patterns or trends **confirmed** [1] explanations tested by using new experiments / better equipment / techniques / technology [1] CFCs are banned so their effects are reduced [1]	1	 **Look for a reason** **Eg.** more evidence to support the explanations [1] **Eg.** more / other scientists come to the same conclusion
	Total	**4**	

Question	Answer	Marks	Guidance
2 a	1800 (J) [1]	1	
b	60% or 0.6 [2] if answer is incomplete or incorrect then: $\frac{600}{1000}$ (x 100%) [1]	2	**allow** 60 with incorrect or no unit [1] eg 60 J/s or 60 scores [1] **allow** 0.6% [1]
c	lowest (useful) energy output / input [1] (usefully) uses a greater proportion of energy / wastes a lower proportion of energy / AW [1] **BUT** 80% or 0.8 efficient / [2]	3	**Eg.** Uses least amount of energy [1] **allow** longer time idea explained e.g. Energy = Power x time, and less power but longer time for slow cooker [1] **only** uses 160J/s (output) 200J/s (input) or **only** wastes 40J [1] **ignore** higher / most efficiency **allow** wastes less energy (than others) [1] eg **only** wastes 20% or 0.2 [2] **allow** 80 (linked to efficiency) with incorrect or no unit [1] eg. 80 J/s or 80 scores [1] **allow** 0.8% [1] evidence of the correct efficiency calculation [1] eg 160/200 [1]
	Total	**6**	

Question	Answer	Marks	Guidance
3 a COMMON	payback time (of double glazing) is 25 (years) [2] **but if incorrect or no calculation then** long(est) payback time scores [1]	2	**allow** 25 on / at side of table clearly linked to **double glazing** [2] **allow** CWI saves £50 per year more than DG [2] **allow** takes a long time to payback / takes a long time to get your money back / AW [1] **allow** other correct payback calculations to help prove point: eg. CWI 4 years or DP 120/72 (1.67) or LI 3 years [1] **allow** does not save as much money per year as cavity wall insulation [1] **ignore** comparisons of the 'cost to fit'
b	Idea that they (different colours) suggest different heat losses / temperatures [1] **BUT** white / yellow / red / light(er) show most heat loss / highest temperature AW scores [2] **Or** black / dark blue / purple / dark(er) show least heat loss / lowest temperature [2]	2	**Allow** (different colours) show where (more) insulation is needed [1] Allow (different colours) show which parts are (well) insulated [1] **Allow** most heat lost through windows and / roof or less heat lost through walls [1] **allow** white / yellow / red / light(er) shows where most insulation is needed [2] **allow** black / dark blue / purple / dark(er) shows where less insulation is needed [2]

Question	Answer	Marks	Guidance
c	**Level 3: (5 – 6 marks)** **Answer identifies conduction and convection and gives one simple description in terms of particles.** Quality of written communication does not impede communication of the science at this level. **Level 2: (3 – 4 marks)** **Answer gives two from either** **- identifying conduction** **- or identifying convection** **- or giving a simple description in terms of particles.** Quality of written communication partly impedes communication of the science at this level. **Level 1: (1 – 2 marks)** **Answer identifies either conduction or convection or gives a simple description in terms of particles.** 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 grade A*** **Indicative scientific points may include:** **Particle explanation** • air **particles** collide with glass both inside and outside transferring energy • conduction by transfer of KE between **particles** • **particles** move further apart in air • warm air **particles** rise / cause convection ORA • poor conduction in air because particles are more spaced / moving around / rarely collide **Conduction explanation** • conduction through glass • (little) conduction through (still) air / trapped air is an insulator **Convection explanation** • convection through (trapped) air • reference to (small) convection current in trapped air **ignore** references to vacuum and radiation **Use the L1, L2, L3 annotations when useful. Do not use ticks.**
	Total	**10**	

Question	Answer	Marks	Guidance
4 a	warm water expands [1] warm water becomes less dense [1] warm water rises / cold water sinks [1]	2	**allow** reverse arguments e.g. cool water contracts [1] particles move further apart [1] cool water becomes more dense [1] **NOT** (for 1st two marking point only) 'particles expand / contract / become less / more dense' **ignore** heat rises
b i	water 60(^{0}C) [1] beaker 40(^{0}C) [1] **but** if answer is incorrect or incomplete then: **either** beaker t = $\frac{13\,440}{0.2 \times 1680}$ scores [1] **OR** water t = $\frac{151\,200}{0.6 \times 4200}$ scores [1]	2	**Allow** the energies being used the wrong way round. – so gives 5.3(^{0}C) and 450(^{0}C) [1]
ii	(only) water (particles) absorbs microwaves [1] (only) water is heated by the microwaves [1] beaker does not absorb / not heated by microwaves [1]	1	**ignore** microwaves absorb water **allow** hot water heats the beaker / plastic heated indirectly [1]
	Total	**5**	

Question	Answer	Marks	Guidance
5 a	**any two for one mark from** low maintenance / no cable required / no need for fuel or mains / long life / renewable energy source / idea of no polluting **waste** [1]	1	Eg. 'Don't need to burn fossil fuels to produce electricity' [1] **Ignore** sustainable **Eg.** no CO_2 / acid rain / SO_2 / NOx [1] **Allow** no carbon emissions (when in use) [1] **Ignore** merely 'environmentally friendly / less or no pollution'
b	**any two from** light / photons absorbed by silicon (atoms) [1] electrons knocked out (of silicon atoms in crystal) [1] (causing) current or electrons to move / flow [1]	2	 **allow** light absorbed by photocell [1] **allow** 'free electrons' [1] (for electron flow mark)
c	larger area produces more current / energy / power **OR** larger area absorbs more light / energy / power (from the sun) / AW [1] **But** when **angle** of (sun)light is low larger area allows **enough or more** light / energy / current / power [2]	2	**allow** on a cloudy / dull day a large area is needed for **enough or more** energy / current / power [1] **allow** when sun(light) is low (in sky) larger area allows **enough or more** light / energy / current / power [2]
	Total	**5**	

Question	Answer	Marks	Guidance
6 a C O M M O N	(Water vapour) – (water evaporating) from sea / lakes / rivers / clouds / rain / or combustion [1] (CO_2) –combustion / respiration / AW [1] (Methane) – decomposition / AW [1]	3	**allow** specific examples such as large scale boiling of water [1] eg. (fuel) power stations [1] **ignore** using kettle and other small scale water vapour production methods. **allow** volcanoes [1] **allow** volcanoes / (using) vehicles or engines / (fossil or biofuel) power stations / factories or industry / breathing (out) / release from oceans [1] ignore **nuclear** power station **Ignore simply '**human activity' **allow** named decomposition e.g. (gas from) cows / animal waste / permafrost / bogs / rice fields / biofuels / fermentation [1] allow volcanoes [1]
b C O M M O N	Atmosphere absorbs IR / AW [1]	1	**allow** atmosphere traps IR / stops or reduces the IR reaching the Earth [1] **allow** higher level answers e.g. refracts the IR [1] **ignore** merely reflects **IR /** changes the wavelength / ozone **ignore** references to heat

Question	Answer	Marks	Guidance
c COMMON	(UK may be colder but) other places are probably hotter / AW [1] It is just an opinion / belief (rather than based on reliable scientific evidence) [1] average (global) temperature is more reliable [1] temperature fluctuations (locally) do not undermine the trend [1] her experience is over a short period of time [1] global changes need data from longer periods of time / AW [1]	2	**Allow** only looking at one area / UK [1] **Allow** (weak / limited) no evidence [1] **Allow** there are extreme weather events / flooding / melting ice caps (elsewhere) [1] **Eg**. (local) weather is not a good indicator [1] **allow** idea that her experience is over a limited time but global temperature changes may take decades [2]
d COMMON	(natural) forest fires / volcanoes / decomposition of living matter [1]	1	**allow** specific examples e.g. peat bogs / gas from cows / animal waste [1]
	Total	**7**	

Question	Answer	Marks	Guidance
7 a	(Highest current is the) oven [1] 7.83 (A) [2] **but if calculation incorrect** 1800 / 230 [1]	3	 More or less than 2 decimal places or incorrect 2 decimal places scores maximum of [1] for calculation **eg**. 7.826087 / 7.826 / 7.82 / 7.8 [1] **allow** if incorrect appliance selected allow correct calculation of current e.g. **grill 6.52** (A) / **laptop charger 5.00** (A) / **slow cooker 2.00** (A) [2] correct substitution for incorrect appliances can score [1]
b	540 (pence) or **£**5.40 [2] **but if answer is incorrect** **either** 20 x 18 x 1.5 [1] **or** 20 x 18 x 1500 [1] **or** 540000 (pence) or **£**5400 [1] **or** 1.5 x 20 or 30 [1]	2	5.4 scores [1]

Question	Answer	Marks	Guidance
c	lowers current [1] reduces heating effect (in wires) [1]	2	 **Ignore** less energy is lost. **Allow** less heat loss [1] **Allow** correct use of I^2R
	Total	**7**	

Question	Answer	Marks	Guidance
8	**Level 3: (5 – 6 marks)** **The three types of radiation (alpha, beta and gamma) are correctly identified from at least three of the sources with valid explanations.** Quality of written communication does not impede communication of the science at this level. **Level 2: (3 – 4 marks)** **Two types of radiation (from alpha, beta or gamma) are correctly identified with reasons given.** Quality of written communication partly impedes communication of the science at this level. **Level 1: (1 – 2 marks)** **One type of radiation (from alpha or beta or gamma) with a simple reason is correctly identified OR two types of radiation are correctly identified.** 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 grade A*** **Indicative scientific points may include:** **Sources** • **A** is gamma – affected only by lead • **B** is alpha – stopped by paper / stopped by all barriers • **C** is alpha and beta – alpha as reduction with paper and beta as reduction with aluminium • **D** is alpha and gamma – alpha as reduction with paper, no reduction with aluminium, but gamma as reduction with lead. Ignore any source if all 3 types given (ie. simple guessing) **Use the L1, L2, L3 annotations when useful. Do not use ticks.**
	Total	**6**	

Question	Answer	Marks	Guidance
9 a COMMON	<table><tr><td>A</td><td></td><td>✓</td><td></td></tr><tr><td>B</td><td>✓</td><td></td><td></td></tr><tr><td>C</td><td></td><td></td><td>✓</td></tr></table> [2]	2	**all** correct [2] **any** 1 correct [1] **ignore** any line with more than one tick
b i	acceleration decreases (as speed increases) / non uniform change in acceleration / acceleration drops more quickly at the start [1]	1	
ii	resistive force / friction / air resistance / drag increases (as speed increases) [1] idea that resultant force decreases / the driving force equals the resistive force [1]	2	 Allow forces balance [1]
	Total	**5**	

Question	Answer	Marks	Guidance
10 a C O M M O N	**Maximum of one for:** compare injuries from (a variety of) crashes / compare effects on crash dummies / measure force / acceleration / stretch / momentum [1] **and maximum of one from** for different materials / seatbelts [1] for different people [1] for different speeds [1] for seat positions [1]	2	**Marking points are independent** eg. different types of seatbelt [1] old design of belt compared with new designs [1] lap belt compared to 3-point belt [1] **eg.** sizes
b	they change shape / stretch / get longer [1] (and therefore) absorb energy [1]	2	**allow** reduce pressure by spreading force over a larger area [1] **allow** the KE of driver is converted into elastic (potential) energy in the seat belt [1] **allow** higher level answers referring to eg. increased time / distance [1] eg. reduced force / acceleration [1] eg. decreased rate of change of momentum [2] **allow** prevents impact with steering wheel, windscreen or dashboard [1]

Question	Answer	Marks	Guidance
c	crumple zones **and** air bags [1]	1	**Allow** collapsible steering column / collapsible bumpers
d i	(no) (no mark) doubling speed increases stopping distance [1] **but** doubling speed more than doubles the braking / stopping distance [2]	2	If yes answered [0] marks **Allow** anything more than double the affect **Eg.** doubling speed triples / quadruples braking or stopping distance [2] **Allow** correct calculation and comparison of two stopping distances, e.g. at 32km/h, stopping distance=12m & at 64km/h it is 36m [2]
ii	**any two for one mark** bald tyres / smooth tyres / faulty brakes wet road / ice on road more load in car increased gradient / downhill [1]	1	 **Allow** worn tyres / worn brakes **Allow** reduced friction surface / slippy road [1] **Ignore** bad weather / tyre condition / road conditions **Ignore** merely mass / weight / number of passengers **But allow** more mass / weight / passengers
	Total	**8**	

Question	Answer	Marks	Guidance
11	**[Level 3]** Answer describes correctly what happens in all 4 sections **AND** calculates / states one (average) speed from section A or B or C or over whole journey. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Answer describes correctly what happens in all 4 sections **OR** describes correctly 2 sections **and** calculates / states one (average) speed from section A or B or C or over whole journey. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Answer describes correctly what happens in 2 sections / times **OR** calculates /states one (average) speed from any section or over whole journey. 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** **Section A** • accelerates / speeding up • (average) speed = 10m/s **Section B** • constant speed / zero acceleration • (average) speed = 20m/s **Section C** • deceleration / negative acceleration / slowing down • (average) speed = 10m/s **Section D** • Stationary or (average) speed = 0m/s **Whole journey** (average) speed = 13.3m/s **Use the L1, L2, L3 annotations when useful. Do not use ticks.**
	Total	**6**	

Question	Answer	Marks	Guidance
12 a	2 (m/s^2) [1]	1	**NOT** 2m/s
b	280000 (J) [3] **but if incorrect** 2800 x 100 [2] **but if incorrect** distance = 100(m) OR 2800 x distance OR evidence of **using** work done = force x distance [1]	3	 Eg 2800 x 200 or 560000 [1]
c	56000 (W) [2] **but if answer incorrect** 2800 x 20 [1]	2	
	Total	**6**	

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; 1 Hills Road, Cambridge, CB1 2EU
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553