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 2015

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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.

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MARK SCHEME

Question	Answer	Marks	Guidance
1 C O M M O N	Correct comparison: cost higher than expected / less than 18% saving **/ saving is less** [1] correct relevant calculation [1] some years are warmer / colder than others [1] the average may not be representative / average calculated over atypical years AW [1] differences in behaviour [1] cost of energy higher in later years [1]	3	**allow** 2012 and 2013 are higher / 2014 is lower [1] **allow** average is £920 **allow** any other correct use of data e.g. 2014 is £98 lower / £32 per year saving / £96 saved over 3 years [1] eg. only 15% lower / [2] **not** merely 'different weather' [0] **allow** examples e.g. 2009-11 may have been warmer than usual [1] allow examples e.g. Simon may have had windows opened more (often) / more people at home / more time at home / more heating used / more TV watched / settings on heating changed / alterations to house / different or extra appliances used / other or different insulation or energy collecting methods fitted [1]
	Total	**3**	

Question	Answer	Marks	Guidance
2 a i	Idea that **electrons** are involved / collide with ions or atoms (in aluminium) [1] But idea that electrons pass on energy [2] idea that particles vibrate **more** / get fast**er** / gain KE [1] idea that (kinetic) energy / movement is passed from particle to particle [1]	3	**allow** electrons vibrate [1] **ignore** 'particles start to vibrate' **allow** vibrate faster [1] **allow** 'particles move more' [1]
ii	The water is heated and it **expands**. [1] This makes the water **less dense** so it rises. [1]	2	**one mark for each correct sentence** **allow** equivalent answers worded differently. e.g. occupies a larger volume / takes up more space / particles spread out [1] **ignore** particles expand **allow** equivalent answers worded differently. **eg.** denser water sinks [1] **ignore** particles become more dense
b i	idea that microwaves heat water (and fat) only / microwaves penetrate food [1] **but** microwaves increase **KE** / movement / vibration of water (or fat) particles [2]	2	**allow** IR heats all particles on surface / IR heats surface only [1] **ignore** microwaves cook from the centre **allow** IR increases KE of all food particles / particles on the surface [2]

ii	(Both are) electromagnetic waves / reflected by shiny surfaces or metal walls / conduction or convection (heat) to centre of food [1] both transfer KE to particles / [1]	2	**maximum two marks** **ignore** references to heat **eg** (both) conduct to the rest of the food [1] **allow** both cause particles to vibrate more / vibrate faster [1] eg 'KE passed on to other particles in the rest of the food scores' [2]
	Total	**9**	

Question	Answer	Marks	Guidance
3	**Level 3: (5 – 6 marks)** **Describes the nature of laser beam AND explains where and how information is stored AND explains how information is read from the disc.** Quality of written communication does not impede communication of the science at this level. **Level 2: (3 – 4 marks)** **Describes any two from:** **the nature of laser beam OR** **explains where and how information is stored OR explains how information is read from the disc.** Quality of written communication partly impedes communication of the science at this level. **Level 1: (1 – 2 marks)** **Describes any one from:** **the nature of laser beam OR** **explains where and how information is stored OR** **explains how information is read from the disc.** . 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:** **Nature of a laser beam** • **EITHER** laser beam is coherent • **OR** is in phase or in sync **AND** has same frequency / wavelength / is monochromatic **Where and how information is stored** • storage by pits and bumps / lands **How information is read from the disc** • read by reflection of laser from pits and / or bumps or lands (collected by receiver) **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	Total	**6**	

Question	Answer	Marks	Guidance
4 a	P wave (no mark) because they are faster [1]	1	**Allow** primary / pressure / longitudinal wave **Ignore** 'powerful / stronger' S wave …etc scores [0]
b	can measure lag time / time between waves [1] idea that distance is determined by lag time [1] **but** difference in time can be used to calculate the distance from earthquake [2] determine wave direction **/** direction that the wave(s) have come from / AW [1] idea of triangulating the results [1] compare results from different sites [1]	2	**maximum 2 marks** find time taken by waves [1] **Eg** readings taken from different points on Earth [1]
c	(can't get through because) **outer** core is liquid [1]	1	**Ignore** S-waves can't get through liquid Eg. S-waves can't get through liquid **inner** core scores [0]

d i	speed = 0.96 (m/s) [2] **but if answer is incomplete then** 0.80 x 1.2 [1]	2	**allow** correct substitution of a reasonable wavelength **only acceptable alternatives allowed are:** 1.92 [1] (i.e. 1.60 x 1.2) [1] 0.48 [1] (i.e. 0.4 x 1.2) [1] **but** ignore other wavelengths when awarding this mark
ii	0.11(m) [1]	1	if not answer on line allow correct answer indicated in list
	Total	**7**	

Question	Answer	Marks	Guidance
5 a	**any two from** (short wavelength radiation) penetrates atmosphere / heats Earth / AW [1] Earth emits heat or radiation of **longer wavelength** [1] Emitted radiation absorbed by atmosphere or greenhouse gas(es) [1]	2	 **Accept** correct answers in terms of **lower frequency** Allow emitted radiation cannot escape, gets trapped or reflects back (to Earth) [1] **ignore** 'ozone'.
b i	(water) – weather / water cycle / evaporation / (aerobic) respiration / transpiration / (natural) combustion (CO_2) – respiration / (natural) combustion / volcanoes (methane) – decomposition / rotting 3 rows correct [2] 1 or 2 rows correct [1]	2	**Allow** clouds / breathing (out) / volcanoes [1] **allow** breathing (out) / forest fires / deforestation [1] **allow** dead plants / animals or named animal / manure / animal gas emissions / rubbish tips / excretion / digestion / volcanoes / rice fields / wetlands / permafrost (region) / mining [1]
ii COMMON	idea that global warming has happened **/ more** CO_2 **in the** (distant) **past** [1]	1	answer must indicate idea of in the past / before man / before the industrial revolution etc. Eg 'the ice age', 'tropical eras'. **allow** large fluctuations in temperature **in the past** [1] **allow** had peaks and troughs **in the past** / had peaks and troughs before the industrial revolution [1] **allow** idea that global warming has always been there [1]

iii COMMON	**any one from** short life (in atmosphere) [1] variability of water vapour levels / [1]	1	**Eg.** 'not in atmosphere long enough to measure properly' [1]. (Vapour only) lasts a few days [1] **eg.** 'they are not sure what the number is' [1] **eg.** only an approximation / number changes [1]
c COMMON	**any one from the following comparisons:** less in atmosphere / less methane [1] lasts for less time / does not last as long [1]	1	**assume answer refers to methane unless otherwise stated** more CO_2 [1] **but allow** CO_2 lasts longer [1] **allow figures used from the table to illustrate a comparison**
	Total	**7**	

Question	Answer	Marks	Guidance
6	**Level 3: (5 – 6 marks)** **Correctly identifies three sources with an explanation** **AND** **explains the usefulness of all three sources in terms of penetration.** Quality of written communication does not impede communication of the science at this level. **Level 2: (3 – 4 marks)** **Correctly identifies three sources** **OR** **explains the usefulness of all three sources in terms of penetration.** Quality of written communication partly impedes communication of the science at this level. **Level 1: (1 – 2 marks)** **Describes two basic trends in the data** **OR** **identifies one source correctly.** 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:** • **X** is gamma, **Y** is alpha, **Z** is beta • gamma – no differential, alpha stopped too easily, beta shows differential with paper (thickness) **Level 2:** • **X** is gamma, **Y** is alpha, **Z** is beta • gamma – no differential, alpha stopped too easily, beta shows differential with paper (thickness) **Level 1:** • **X** / gamma unaffected • **Y** / alpha stopped by paper • **Z** / beta reduced with thickness • one source identified Answers which incorrectly identify X, Y or Z are limited to level 2 (4 marks) **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	Total	**6**	

Question	Answer	Marks	Guidance
7 a	**any two from** radioactive waste / radiation **leak** (in event of an accident) [1] **but** radioactive waste is active for a long time / difficult to dispose of or manage safely [2] plutonium / waste used to make (nuclear) bombs [1] accidents can be severe [1]	2	**maximum 2 marks** **allow** nuclear waste [1] **ignore** toxic **ignore** merely 'radiation' **eg. Risks from:** meltdown / explosion / earthquake / tsunami [1] **allow** (exposure to) radioactive waste can cause cancer [2] **allow** radioactive waste can contaminate water (supplies) [2] **allow** radioactive waste needs to be encased (in glass) / buried (deeply) underground [2] Eg. greater terrorist risk [1] **Eg.** After effects can cause cancer / mutations / ionisation / damage to DNA [1]
b	**any two from** reduce time spent near reactor (i.e. rescue workers to reduce exposure to radiation) [1] extra medication given [1] radiation (doses) monitored (to limit / check exposure) [1] use of shielding / protective clothing [1]	2	**maximum 2 marks** **allow** exclusion zone [1] **eg.** radiation tablets [1] **allow specific examples** **eg.** 'use of radiation badges / radiation detecting (to limit exposure)' [1] **eg.** gasmasks / lead (lined) suits [1]

c	measure radioactivity (in area) [1] (allow back) when activity (almost) equals background / when activity (almost) equals safe level / AW [1]	2	**Eg.** use radiation detectors / Geiger tubes or counters [1] **ignore** merely 'when it is safe' 'when level is low enough or acceptable' [1]
	Total	**6**	

Question	Answer	Marks	Guidance
8 a **C O M M O N**	(full calculation): (720 – 240p =) 480p or £4.80 **and** Habib is correct scores [3] **if numerical answer above is incorrect or incomplete then:** cooker: 2 x 6 x 20p = 240p [1] immersion heater : 3 x 12 x 20p = 720p [1] **or** use of **2** x 6 **and** 3 x 12 [1] use of x 20p [1]	3	**answers acceptable in pence or pounds** **allow** 720 – 240p = 480p with no comment [2] **allow** 720 – 240p = 480p and Habib is correct [3] **allow** £4.80 with no comment [2] **allow** 720 – 240p = 480p [2] **allow** £4.80 and Alice is correct [2] Other acceptable full calculations: **But** £2.40 + £5.00 = £7.40 and this is near to £7.20 so Habib is correct [3] **OR** 2 x £2.40 = £4.80 which is less than £7.20 so Habib is correct [3] **Only** award 3 marks if Habib is identified along with a full calculation

b	**(at a voltage of 4.00 x 10^5)** 5(.00) x 10^3 **or** 5000 (A) [1] **(at a voltage of 2.75 x 10^5)** 7.273 x 10^3 **or** 7.273 x 10^3 **or** 7273 **or** 7272 (A) [1] (higher voltages best because) lower current / keeps wires cooler / reduces heat loss or energy waste [1]	3	for higher voltage **allow** 7270 **allow** 7.3 x 10^3 or 7300 **allow** 7200 or 7.2 x 10^3 [1] **allow** (higher voltages) - greater efficiency / less power loss [1] **ignore** cost
	Total	**6**	

Question	Answer	Marks	Guidance
9 a i	Golf (1)	1	
ii	7.7 (s)(1) Skoda (because it takes less than 7.7 seconds) (1)	2	**allow** 7.69..... (1) **allow** 'Skoda' [1] (even if working incomplete or incorrect)
b **COMMON**	Jo (no mark) idea that Jo will have the longest thinking time / distance (1) Chris (no mark) largest braking distance / less friction, **grip or traction** (1)	2	answer must be Jo to score the mark for the explanation **allow** slowest reaction [1] **NOT** slowest time / slowest reaction time answer must be Chris to score the mark for the explanation **if no marks scored** allow Jo (for tired) and Chris (for icy) (1)

c	yes / no (no mark) **any three from** idea that CO_2 **produced** when biofuel made (1) carbon dioxide is given out (when fuel burns) (1) (biofuel is made from) plants / animals / living things (1) (plants) photosynthesise [1] carbon neutral (1)	3	**Allow trees [1]** **but** plants photosynthesize (2) **allow** plants take in carbon dioxide when they grow (2) **Award marks for combining marking points:** eg. 'CO_2 given out (by fuel) compensated by photosynthesis [2] Eg. carbon dioxide given out when fuel burns = carbon dioxide taken in by plants [3]
d	brakes automatically go on and off (frequently or quickly) (1) when the car likely to skid (1)	2	**Allow** 'pumping of the brakes' [1] **allow** example of when likely to skid e.g. on icy roads (1) **allow** to continue to control the car while braking / prevents skidding or wheels locking (1)
	Total	**10**	

Question	Answer	Marks	Guidance
10 a	9.8 (m) or $\frac{1}{2}$ x 14 x 1.4 (2) **but if incorrect allow** attempt at calculating area under the graph (1)	2	 **Eg** shown on graph by shading / AW [1] **If no other marks scored then allow** 14 x 1.4 or 19.6 [1]
b i	instantaneous deceleration at point P is (more representative of) when diver enters water [1] idea of ignoring anomalous results / point Q is not on the line / (1) Elaine's method covers more data / more appropriate data / AW [1] (gradient gives a more) accurate result (1)	2	**allow** Q is (some time) after diver enters water [1] allow deceleration / acceleration changes (after P) [1] **eg** point Q is anomalous [1]
b ii	1200 (N) (1)	1	**Allow** -1200 (N) [1]
	Total	**5**	

Question	Answer	Marks	Guidance
11	**[Level 3]** **Describes how KE changes in both sections AND describes how GPE changes in both sections** **AND calculates the maximum KE or difference in height.** Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** **Describes how KE AND how GPE changes for both sections** **OR describes correctly how KE changes over both sections and calculates maximum KE** **OR describes correctly how GPE changes over both sections and calculates maximum KE** **OR calculates difference in height.** Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** **Realises that KE depends on speed and describes changes over part of journey** **OR describes how GPE changes over part of journey** **OR attempts to calculate maximum KE /height** **OR loss in KE = gain in PE (on either section)** **ORA** 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*** **Ignore points after C** **Indicative scientific points at all levels may include:** • KE increases from **A** to **B** • KE decreases from **B** to **C** • GPE decreases from **A** to **B** • GPE increases from **B** to **C** • loss in GPE = gain in KE • KE = $\frac{1}{2}mv^2$ • maximum KE = 51200J • GPE = mgh • 51200 = mgh = 400 x10 x h • height = 12.8m **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	Total	**6**	

Question	Answer	Marks	Guidance
12 a COMMON	**ideas that** cost (per km) does not depend on distance travelled (1) petrol engines / cars cost more **to run** (per km) than diesel engines (1) cost (per km) decreases with speed up to 80 km/hr / increases above 80km/hr / ORA (1)	3	 Eg. Lower fuel consumption with diesel [1] **Ignore** diesel engines cost less **allow** cost is a minimum at 80km/hr
b	**any one from** few charging points (1) long time to recharge (1) frequent charging needed (compared to re-fuelling) [1] limited mileage / range (for one charge) (1) lower top speed [1] (high) cost of batteries (1) large space needed for batteries [1] (too) **quiet** (for pedestrians to hear) [1]	1	**ignore** cost of car **ignore** need to be charged **allow** slower [1] **ignore** 'fossil fuels still needed for electricity for charging'
	Total	**4**	

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

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Head office
Telephone: 01223 552552
Facsimile: 01223 552553