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 2014

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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
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	idea that more (male) skin exposed(to UV light) (which causes skin cancer) / ORA (1)	1	**allow** (short hair) less(UV) absorbed/blocked greater exposure(to UV)[1] less protection(to UV) eg less protected by hair eg female skin more shaded by hair (1)
b	**any two from** idea of surveying people (1) large sample size(1) example of fair test/ comparison (1) type of exposure(1) eg sunbed and sun	2	 surveying lots of people (2) eg time exposure /comparing outcomes/similar skin types [1] **allow** suitable experiments e.g. expose people or animals / cells to sunbed and compare with people or animals not exposed to sunbed (2)
c i	**darker skins** absorb UV (1) let less UV reach **underlying** tissue AW (1)	2	 **allow** contains (more) pigment / melanin (1) **ignore** filters
ii	A and C (1)	1	**both required either order**
	Total	**6**	

Question	Answer	Marks	Guidance
2 a	infrared heats surface / skin (only) (1) (this causes) water to evaporate from surface (making it crispy)AW (1)	2	**allow** microwaves do not just heat the surface /microwaves penetrate into the food / heat the first cm of potato(1)
b	**Microwaves** any two from: (only) **absorbed** by water or fat (1) do not heat container or oven / pass through plastic or glass plate (1) penetrates food further (so less distance needed for conduction) (1)	2	**ignore** heat the food / water **allow** penetrates specified distance up to 10 cm (1)
c	IR will not penetrate to centre of potato / only crisps / heats the outside (in a short time /8 minutes) (1) so need all the microwave heating / 8 minutes of microwave heating / all the cooking done by the microwaves (1)	2	**allow** IR has very little effect on cooking the potato in the first few minutes (1) **allow** only energy from microwaves reach the centre in 8 minutes (1) **allow** energy is also needed to heat up the oven (to emit IR before it can crisp the potato) (1)
	Total	**6**	

Question	Answer	Marks	Guidance
3	**Level 3: (5 – 6 marks)** **Full quantitative** **AND** **a qualitative comparison.** Quality of written communication does not impede communication of the science at this level. **Level 2: (3 – 4 marks)** **Partial quantitative comparison** **OR** **qualitative comparison showing alloy has greater mass but smaller specific heat capacity.** Quality of written communication partly impedes communication of the science at this level. **Level 1: (1 – 2 marks)** **Idea of same mass of water** **OR** **water rises in temperature by the same amount** **OR** **same energy needed** 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 ay level 3 may include:** **relevant points for level 1 and level 2 and** • idea that heat capacity / energy is the same for each • correct calculation to show heat energy capacity is the same for each e.g. 400 x 1.5 x 80 = 500 x 1.2 x 80 400 x 1.5 = 500 x 1.2 **Indicative scientific points ay level 2 may include:** • alloy has a smaller specific heat capacity • alloy has greater mass • stainless steel has a larger specific heat capacity • stainless steel has smaller mass • heat capacity /(energy) correctly calculated e.g. 400 x 1.5 (x 80) 500 x 1.2 (x 80) **Indicative scientific points ay level 1 may include:** • mass of water is the same / mass of water in each kettle is 1.8 kg • temperature rise of water in each kettle is the same / water rises from 20^0C to 100^0C in each kettle / temperature rise of water in each kettle is 80^0C • power of kettle is the same • same amount of water (1.8 kg) and temp rise (80^0C) • water heating needs same energy for each kettle **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	Total	**6**	

Question	Answer	Marks	Guidance
4 a	**gamma** **X-ray** (1) (ultraviolet) **(visible) light** **infrared** **microwave** (1) (radio)	2	top two rows correct (1) rows 4 to 6 correct (1)
b	number of waves / oscillations / cycles **in a second** / **unit of time** / AW (1)	1	**allow** number of times a crest / trough / peak / wave passes a point each second (1) **NOT** peaks **AND** troughs
c	**evidence of any correct calculation** 3 X 10^8 / wavelength value (1) 4.05 x 10^{14} (1) 0.01 x 10^{14} (1) **evidence of subtracting** 4.05 x 10^{14} - 0.01 x 10^{14} = 4.04 x 10^{14} (1)	4	**N.B. this is not a calculation so do not merely award 4 marks for correct answer** **Must calculate frequency not wavelength** **look** for candidates who subtract wavelengths first. Then use this value to calculate frequency. This can only score the first mark .
	Total	**7**	

Question	Answer	Marks	Guidance
5 a	**Risk max 1** radiation **leak** / **leak** of nuclear material / **leak** of nuclear waste (1) power station / reactor may get damaged / attacked by terrorist / earthquake (1) radiation sickness / poisoning (1) **how the risk is reduced/managed max 1** monitor people (for contamination) (1) monitor radiation around the nuclear power station (1) safe storage or disposal of nuclear materials (1) idea of better control of reactor (1) better shielding against radiation loss (1) have good shut down / emergency procedures (1) extra protection if in earthquake risk area (1) better security at nuclear power station (1)	2	**ignore** power stations emit radiation **allow** correct examples such as radioactive materials stored (deep) underground / encased in (thick) concrete / lead (1) **allow** correct examples such as surround the reactor with (thick) concrete walls (1)

Question	Answer	Marks	Guidance
b	idea of voltage change (1) but voltage increase / steps up voltage (2) **reduces** energy loss / **reduce** the cost (1)	3	**allow** higher level answers e.g. idea of current change (1) but to reduce current (2) **allow** voltage reduces (1) **allow** reduces power loss (1) **allow** increases efficiency (1) **ignore** stops energy loss
	Total	5	

Question	Answer	Marks	Guidance
6 a i	when (the orbit is) near Sun / Earth (1) (because) it is illuminated (by Sun) / has trail or tail / reflects light (from the sun)(1)	2	**allow** when it is not too far away (from the Earth) to be seen (1) **ignore** answers about night and day **allow** reverse argument
ii	(shape is) elliptical (1) (so it) speeds up approaching the sun / has greater KE near Sun / ORA (1) gravity or gravitational force is greater / AW (1)	3	**from diagram** approximately elliptical orbit **ignore** sun position for shape **ignore** oval as description

Question	Answer	Marks	Guidance
b i	(relatively) small / far away(1) reflect little light / do not emit light (1)	1	 **ignore** dark
ii	**max two from advantages** destroys the asteroid / breaks it into small fragments(1) but the smaller fragments created will burn up in the atmosphere (2) (idea that) as it is very distant if the first attempt misses the asteroid there will be time for a second attempt (1) as very distant a small deflection can still miss the Earth (1) **maximum two from disadvantages** (needs to be very accurate otherwise) it may miss the asteroid (1) if could cause more fragments to hit Earth/satellite or could cause smaller more unpredictable parts (1) if the asteroid is large unlikely to have an effect or deflect path enough / may not work (1)	3	**maximum three marks** **allow** may deflect it (so that it misses the Earth) (1) **allow** So far away difficult to hit the asteroid (1) **allow** Could cause more fragments to be pulled towards Earth/ remains of asteroid may fall to Earth (1) **allow** Could deflect towards the earth (1)
	Total	9	

Question	Answer	Marks	Guidance
7	**Level 3: (5 – 6 marks)** **fuel power station AND pumped storage system linked together with demand** **Quality of written communication does not impede communication of the science at this level.** **Level 2: (3 – 4 marks)** **fuel power station OR pumped storage system linked together with demand** **Quality of written communication partly impedes communication of the science at this level.** **Level 1: (1 – 2 marks)** **sensible comment about the system** **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:** **fuel power station (on own)** difficulty in stopping and starting fuel power stations generates electricity all (or most of) the time at a steady rate cannot store electricity **pumped storage system (together with fuel power station)** with pump storage system it can store surplus energy energy stored off peak or when demand is low / in the middle of the night. with pump storage system it can generate electricity when needed water released when extra energy needed at high or peak demand **changes in demand** can cope with surges in demand (idea that there is) a (relatively fast) response time to demand less likely to result in power cuts (when demand is greater than steady supply) (idea that) energy not 'wasted' so cheaper for both consumers and producers saves the need to redistribute energy using the national Grid **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	Total	**6**	

Question	Answer	Marks	Guidance
8 a	**Idea that:** water heated /steam is produced / fuels release heat / AW (1)	1	**allow** Heat energy is used (to produce electricity) (1) **ignore** burning Heat unqualified = 0 fuel is heated =0
b	renewable energy (1) less polluting gases (1) fossil fuels finite (1)	1	 **allow** reduces CO_2 output / greenhouse gases (1**)** **allow** fossil fuels are running out (1) **allow** no fuel costs (1) **not** just environmentally friendly
c	19800 (MJ) (3) **But if answer is incorrect** 330 (MW) (2) 66% of 500 or .66 x 500 (1)	3	**if no other marks scored allow** evidence of power x time (1) **allow** 500 – 170 OR 330 (2) **allow** 34% of 500 or 0.34 x 500 = 170 (1)
	Total	5	

Question	Answer	Marks	Guidance
9 a	1.25 (m/s) (2) **but if answer is incorrect** $\frac{1000}{800}$ (1)	2	 **ignore** $\frac{500}{400}$ as this is incorrect from the graph
b	2 (m/s) (2) **but if answer is incorrect** $\frac{500}{250}$ (1)	2	 tolerance of 500/240 =2.1 to 500/260 = 1.9 mark to 1 decimal place
	Total	4	

Question	Answer	Marks	Guidance
10 a i	C (1)	1	
ii	**any two from** Reference to speed changing (1) Reference to load(1) Reference to road conditions (1) Reference to driving style (1)	2	**must relate to more fuel used** eg traffic is heavy / needs to stop and start a lot / lots of braking and accelerating/ traffic lights / not optimum speed eg large load carried / increased number of passengers /towing/ open windows / air con /heaters/ eg hilly / bends / wet/ windy eg heavy braking / rapid acceleration / wrong gear **allow** manufacturers' data is at a steady speed on a level road (1)

Question	Answer	Marks	Guidance
b	**advantages (maximum 2 marks)** no emissions at point of use (1) quieter car (1) cheaper to run / no road tax (1) conserving fossil fuel (1) **disadvantages (maximum 2 marks)** limited range / frequent recharging (1) limited speed (1) few recharging points / takes a long time to recharge (1) batteries expensive to replace / car expensive initially (1) few models to choose from (1)	3	**ignore** environmentally friendly / AW **ignore** unqualified reference to pollution **allow** qualified quieter car as disadvantage (1)
	Total	6	

Question	Answer	Marks	Guidance
11	**(Level 3)** **calculates the force** **AND** **Gives a detailed linked answer in terms of forces or acceleration** Quality of written communication does not impede communication of the science at this level (5 – 6 marks) **(Level 2)** **calculates the force** **AND** **Gives a simplistic answer in terms of forces or acceleration** Quality of written communication partly impedes communication of the science at this level (3 – 4 marks) **(Level 1)** **calculates the force** **OR** **Gives a simplistic answer in terms of forces or acceleration** 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 up grade C** **Indicative scientific points at level 3 may include:** **The calculation from level 1 and 2 and a link between change in distance or stopping time to acceleration or force.** • increases distance travelled by dummy so this reduces force / acceleration of dummy • increase stopping time of dummy so this reduces force / acceleration of dummy • reduced acceleration so reduced force • reduces the rate of change of momentum • **Indicative scientific points at level 1 and 2 may include:** • force = 28020 or 28000 N **seatbelts** • hold dummy in seat / stop dummy hitting windscreen • stretches • reduce forces on dummy • increase stopping time of dummy • decrease acceleration of dummy **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	Total	**6**	

Question	Answer	Marks	Guidance
12 a	11.25 m (3) **but if incorrect** 56.25 = 5 x h (2) **but if incorrect** KE = ½ x 0.5 x 15 x 15 (1) **or** m g h = ½ m v^2 / PE = KE (1)	3	 **allow** 56 = 5h (2) 11.25 (3) **if incorrect** time = 1.5 (seconds)(1) average speed = 7.5 (1) **allow** other correct calculations using equations of motion
b	**any one from** (idea that the) mass cancels out on the equation (1) (idea that without air resistance) both masses have the same acceleration (and so reach the same speed in the same time) (1)	1	
	Total	**4**	

Question	Answer	Marks	Guidance
13 a	Sand provides friction force (1) Going uphill KE lost/ slows the car down (1) car has less KE so less energy needed in braking (1)	2	going uphill increases drag (1) Sand absorbs some of the energy of the car(1)
b	**passengers (maximum two marks)** **risks** may be trapped if in accident or in water (1) **benefits** will prevent head hitting windscreen in accident (1) will prevent being thrown out of car in accident (1) **wider community (maximum two marks)** **benefits** reduction in number of serious injuries /deaths so reduction in hospital costs (1) less chance of trauma of relatives due to road accident / AW (1) **risk** more chance of injury to pedestrians / themselves as drivers take more risk (1)	3	**allow** specific example of where belt may injure passengers in accident (1) eg whiplash, bruising, crushed ribs **ignore** unqualified statements **allow** reduces injuries / chance of death (1)
	Total	**5**	

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