OCR
RECOGNISING ACHIEVEMENT

GCSE

Science B

General Certificate of Secondary Education

Unit **B712/02:** Modules B2, C2, P2 (Higher Tier)

Mark Scheme for June 2013

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.

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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. For answers marked by levels of response:
   a. **Read through the whole answer from start to finish**
   b. **Decide the level** that **best fits** the answer – match the quality of the answer to the closest level descriptor
   c. **To determine the mark within the level**, consider the following:

Descriptor	Award mark
A good match to the level descriptor	The higher mark in the level
Just matches the level descriptor	The lower mark in the level

   d. Use the **L1**, **L2**, **L3** annotations in Scoris to show your decision; do not use ticks.

Quality of Written Communication skills assessed in 6-mark extended writing questions include:

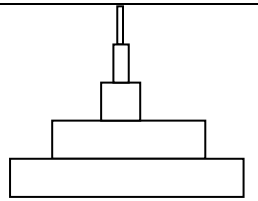
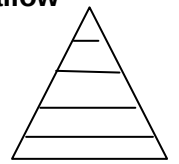
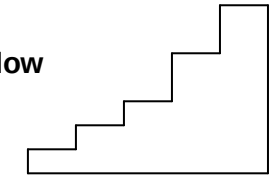
- appropriate use of correct scientific terms
- spelling, punctuation and grammar
- developing a structured, persuasive argument
- selecting and using evidence to support an argument
- considering different sides of a debate in a balanced way
- logical sequencing.

2. **Annotations**

Annotation	Meaning
	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
L1	Level 1
L2	Level 2
L3	Level 3

3. 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)	(i)*	sketched as a pyramid shape with **five** levels (1)	1	 (1) **allow**  (1) **allow**  (1) **allow** other appropriate shapes e.g. domes **ignore** incorrect labelling of levels
		(ii)*	idea that organisms are different sizes so biomass depends on number **and** size (1)	1	**allow** idea that parasites are much smaller than platypus and many parasites can live on one platypus (1) **allow** idea that there may be a lot of organisms that do not weigh a lot (1) **allow** though there are more animals it does not mean they have more mass (1) more parasites than platypus is not sufficient **ignore** idea of losses of biomass e.g. excretion /respiration
	(b)		<u>nitrifying bacteria</u> (1) (changes ammonia) into nitrates/(changes ammonia) into nitrites (1)	2	**not** denitrifying bacteria **allow** reference to ammonium ions rather than ammonia
	(c)		Ornithorhynchus (1)	1	**allow** phonetic spelling – look for ending **chus** **not** ornithorhynch**idae**

* For Braille papers, please see Appendix A

Question			Answer	Marks	Guidance
	(d)		idea that they are **adapted** or have **evolved** to live in different habitats or different environments (1)	1	**allow** specific examples e.g. echidna have feet adapted for living on land (1) platypus feet adapted for swimming in water (1) platypus adapted to feed on aquatic life (1) echidna adapted to eat (insects) in forest (1) adapted to eat different food (1) **allow** they have different genes/they have different DNA (1) **ignore** live in different habitats **ignore** because they need to survive in different environments **ignore** due to a mutation that they have passed on to their offspring
	(e)		**any two from:** idea of less selective pressure needed (to produce live young) (1) idea of (geographical) isolation on islands (1) so they cannot interbreed/idea of reproductive isolation (1)	2	 **allow** no predators to eat the eggs (1) **allow** idea of subject to different challenges to survival (1) **allow** less competition/different predators (1) e.g. on islands separated from other mammals (1) e.g. found away from populations of other mammals (1) **allow** higher level answers e.g. variation within their species did not include animals that gave birth to live young (1)
			Total	**8**	

Question			Answer	Marks	Guidance
2	(a)	(i)	22.00 (2) **but** 1.10 ÷ 0.05 (1)	2	**allow** 22 (2) **allow** 22.0 (2)
		(ii)	name of animal from 2(a)(i) (with lowest surface area to volume ratio) has smaller surface area to volume ratio (1) so would retain more heat or lose less heat (1)	2	**answer from 2(a)(i) must be used for lowest surface area to volume ratio mark otherwise 0 marks** **not** no heat loss **allow** (the elephant because) the cheetah is more likely to lose body heat (in cold) (1) because of larger surface area to volume ratio of cheetah (1)
	(b)		**any two from:** warm blood (in artery) is flowing next or close to cold blood (in vein) (1) warm blood (in artery) is flowing in the opposite direction to cold blood (in vein) (1) as cold blood (from feet) enters body it is warmed by blood (from body) /heat is transferred from the warm blood to the cold blood (1) idea that this reduces the cooling effect of the cold blood on the core temperature (1)	2	**If warm and cold blood is not mentioned and/or incorrect use of arteries and veins then allow 1 mark for either close proximity or opposite directions** **not** blood is transferred from arteries to veins
			Total	**6**	

Question			Answer	Marks	Guidance
3	(a)		**Level 3 (5–6 marks)** **Answer identifies a total of three advantages and disadvantages (to include at least one advantage and one disadvantage) to the people of Madagascar, one of which is correctly qualified or explained.** Quality of written communication does not impede communication of the science at this level. **Level 2 (3–4 marks)** **Answer identifies one advantage AND one disadvantage of the conservation programme to the people of Madagascar OR one advantage or disadvantage qualified or explained.** Quality of written communication partly impedes communication of the science at this level. **Level 1 (1–2 marks)** **Answer identifies one advantage OR one disadvantage of the conservation programme to the people of Madagascar.** Quality of written communication impedes communication of science at this level. **Level 0 (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted at grades up to grade C** **Relevant points include:** **advantages qualified or explained for level 3** • more tourists mean local people could get money as tour guides or park rangers • stops deforestation so preserves the habitats of other animals • more tourism because lemurs are rare • fewer people to disturb the lemurs as they are not allowed in conservation area **disadvantages qualified or explained for level 3** • people worse off because they cannot sell materials they find in forest **advantages** • (more) tourists attracted • (more) jobs • education about lemurs/scientists can study lemurs • could find plants for medical purpose • habitat still available for food • stops deforestation **allow** increase in lemur population/preserve the food chain for the lemurs/protect the lemurs etc. if no other creditworthy response for level 1 (2 marks) **disadvantages** • unable to collect timber / unable to sell timber • can't use rainforest for resources • can't cut down forest to grow own food • more lemurs could alter food chain/ ecosystem • too much tourism causes disruption • expensive to police or maintain the conservation areas **Use L1, L2, L3 annotations in scoris. Do not use ticks.**

Question			Answer	Marks	Guidance
	(b)		(group of organisms capable of interbreeding) to produce **fertile** offspring (1)	1	
	(c)	**(i)**	food chain 1 = 3 (%) (1) food chain 2 = 0.2 (%) (1)	2	**allow** food chain 1 = 0.03 and food chain 2 = 0.002 (1)
		(ii)	**any two from:** food chain with highest efficiency in 3(c)(i) stated or implied **(no mark)** there is less energy lost/more energy is (usefully) transferred (to humans) (1) description of how energy is lost (1) because there are fewer stages/because there are fewer trophic levels (1) (this mark can only can be awarded if food chain 1 is chosen)	2	**if food chain with lowest efficiency is chosen then answer scores 0** e.g. respiration/excretion/egestion/heat/ movement/not all eaten (1) **allow** idea of a shorter food chain (1)
			Total	**11**	

Question			Answer	Marks	Guidance
4	(a)		potassium nitrate (1)	1	**allow** potassium nitrate solution/potassium nitrate salt (1) **allow** KNO_3 (1)
	(b)		$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$ formulae (1) balancing (1)	2	balancing mark is conditional on correct formulae **but** **allow** one mark for balanced equation with minor errors of subscripts, superscripts, etc. e.g. $2NAOH + H_2SO4 \rightarrow Na_2So_4 + 2H_2O$ **not** and or & for + **allow** = instead of → **allow** correct multiples eg $4NaOH + 2H_2SO_4 \rightarrow 2Na_2SO_4 + 4H_2O$
	(c)		**one or two from:** (scientific) conference/lecture (1) (scientific) paper/journal/magazine (1) internet/blog/Twitter/Facebook (1) email (1) book (1) newspaper (1) television (1) **and one or two from:** work can be checked (1) to see if work can be replicated/so work does not need to be duplicated (1) so that further evidence can be collected (1) to provide information to other scientists or public or other organisations /AW (1) so he can get recognition for his work (1)	3	**max 3** send it to a scientist is not sufficient **allow** media or write up his work or writing down his work if no other marks scored from this section (1) **allow** peer-review/work can be evaluated (1) **allow** work can be developed further (1) send it to a scientist is not sufficient **allow** so other scientists cannot take credit (1)
			Total	**6**	

Question			Answer	Marks	Guidance
5	(a)		aluminium (1) low density/lightweight (1) cheapest or just cheap/not expensive (1)	3	**property marks are dependent on the choice of aluminium unless no metal is chosen** **ignore** just light **allow** does not corrode (1) **allow** strong/malleable (1) **ignore** other properties mentioned
	(b)	(i)	**any one from:** **aluminium** (idea of advantage) low density or lightweight or cheap (1) (idea of disadvantage) poor (electrical) conductivity (1) **any one from:** **copper** (idea of advantage) good (electrical) conductor (1) (idea of disadvantage) high density or medium priced or more expensive (1) **any one from:** **silver** (idea of advantage) good (electrical) conductor (1) (idea of disadvantage) high density or (very) expensive (1)	3	full marks can only be scored by consideration of at least two of the following properties: density/cost/relative electrical conductivity (REC) **ignore** reference to high melting point **ignore** just light/weigh less if metals grouped together **allow** correct properties e.g. aluminium, copper and silver are good (electrical) conductors (2)
		(ii)	aluminium (1)	1	
			Total	**7**	

Question			Answer	Marks	Guidance
6	(a)		84 (%) (1)	1	
	(b)		decreases/gets less/AW (1)	1	
	(c)		increases/gets higher/AW (1)	1	
	(d)		**any three from:** idea that high(er) pressures are expensive to generate/ora (1) high(er) pressures give a high(er) yield/ora (1) at a high(er) rate/ora (1) idea that reaction is too slow at low(er) temperatures or rate is fast(er) at 300^{o}C (1) but low(er) temperatures give high(er) yield/ora (1)	3	**allow** 70 atmospheres for low pressure **allow** 400 atmospheres for high pressure **allow** 0^{o}C for low temperature **allow** 300^{o}C for high temperature **allow** idea that high(er) pressures are less safe (1) **allow** high pressure favours the forward reaction/ora (1) **allow** low temperature favours the forward reaction/ora (1)
			Total	**6**	

Question			Answer	Marks	Guidance
7			**Level 3 (5–6 marks)** **Answer includes a full explanation of eutrophication which includes reference to bacteria using up oxygen AND one benefit of using fertilisers is identified.** Quality of written communication does not impede communication of the science at this level **Level 2 (3–4 marks)** **Answer is a partial explanation of eutrophication to include an appreciation of increased growth of algae due to fertiliser in the water AND one benefit of using fertilisers is identified.** Quality of written communication partly impedes communication of the science at this level **Level 1 (1–2 marks)** **Answer describes that fertilisers run off into water sources and / or can cause the death of aquatic organisms OR one benefit of using fertilisers is 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 at grades up to A/A*.** **Indicative scientific points for eutrophication at level 3 may include:** most of the points mentioned up to level 2 and • reference to **bacteria** or **decomposers** or **microbes** using up oxygen. **Indicative scientific points for eutrophication at levels 1 and 2 may include:** • run off • increased fertiliser concentration in water • algal bloom • blocking off of sunlight to other plants • other plants die At level 1, a limited explanation is likely to include reference to run off and the death of aquatic organisms **not** reference to poisoning by fertilisers above level 1 **Farmers use fertilisers to:** • replace essential elements/nutrients/minerals (used by previous crops) • provide nitrogen or phosphorus or potassium (to increase plant growth) • produce more food (as population is rising) • increase crop yield • grow crops more quickly • grow big(ger) crops • increased profit grow better crops or helps crops grow is insufficient **Use L1, L2, L3 annotations in scoris. Do not use ticks.**
			Total	**6**	

Question			Answer	Marks	Guidance
8	(a)		**advantages (max one mark):** no pollution/energy is free (after installation)/do not need to plug it in on land/cheaper than plugging in on land (1) **disadvantages (max one mark):** no power when there is no wind/needs space to operate (1)	2	**allow** no carbon dioxide produced during its use (1) **allow** does not use fossil fuels (1) **allow** it is renewable (1) **allow** sustainable/never runs out (1) **allow** wind is free (1) **ignore** just cheaper/clean electricity **ignore** no harm to environment **allow** cannot increase power output as wind speed cannot be controlled (1) **allow** cannot be used if it is not windy/cannot be used if it is too windy (1) lack of wind/depends on wind is not sufficient **allow** too tall to go through tunnels (1) **ignore** reference to noise pollution/unsightly/ birds may fly into it
	(b)	(i)	**total energy input** 12 500 000 (J) (1) **energy wasted** 7 500 000 (J) (1)	2	**allow** 12500 kJ or 12.5 MJ (1) **allow** 7500 kJ or 7.5 MJ (1) if no mark awarded **allow** consistent decimal place error e.g.: 12500 and 7500 (1) 125000 and 75000 (1) 12.5 and 7.5 (1)

Question			Answer	Marks	Guidance
		(ii)	379 (kg) or 379 (kg/s) (1)	1	**allow** 378.79 or 378.8 or 378.78 or any number of decimal places e.g. 378.787878 (1) **allow** ecf from 8(b)(i) i.e. answer to total energy input divided by 33 000 e.g. $\frac{5\,000\,000}{33\,000}$ = 151.52 or 151.5 or 151.51 or 152 (1) **ignore** units
	(c)		£9600 or 960000p (2) **but if answer incorrect** 5000 x 24 x 0.08 **or** 5000 x 24 x 8 **or** 5000000 x 24 x 0.08 **or** 5000000 x 24 x 8 (1)	2	**allow** 9600 or 960000 with no units (1) if units incorrect answer scores 0 e.g. 9600p
			Total	**7**	

Question			Answer	Marks	Guidance
9			**Level 3 (5–6 marks)** **Candidate makes correct deductions about all three types of radiation with correct reasons.** Quality of written communication does not impede communication of the science at this level **Level 2 (3–4 marks)** **Candidate makes correct deductions about two of the three types of radiation with correct reasons.** Quality of written communication partly impedes communication of the science at this level **Level 1 (1–2 marks)** **Candidate makes a correct deduction about EITHER alpha, beta OR gamma radiation with a reason OR makes correct deductions about two type of radiation (no reasons given).** 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 at grades up to A/A*.** **Relevant points include:** • alpha not present because no radiation is absorbed by paper • gamma present because some radiation passes through aluminium • gamma present because some radiation stopped by lead/gamma present because not all radiation stopped by lead • beta present because some radiation stopped by aluminium if no other marks scored **allow** at level 1 a correct description of two penetrating powers (2 marks) e.g. alpha stopped by (a few sheets of) paper beta stopped by (few mm of) aluminium gamma (mostly) stopped by (a few cm of) lead **Use L1, L2, L3 annotations in scoris. Do not use ticks.**
			Total	**6**	

Question			Answer	Marks	Guidance
10	(a)		**any two from:** idea that nuclear is available 24/7 (1) wind power depends on wind speed (1) idea that nuclear produces no carbon dioxide or greenhouse gases or ash or acid rain (1) coal does produce carbon dioxide or greenhouse gases or ash or acid rain (1)	2	**allow** nuclear is always available (1) **allow** wind is unreliable (1) **allow** nuclear does not contribute to global warming (1) **ignore** references to noise pollution and visual pollution **allow** idea that nuclear has at least 80 years supply (but power station lifetime is only 30 years) /nuclear power has a lifetime greater than the lifetime of a power station/the **supply** lasts a long time/there is a good **supply** (1) **ignore** there is a lot of nuclear/plenty of nuclear
	(b)		**home owner (max one mark)** (idea that can) save money (on energy bills)/can sell electricity back to the National Grid (1) **Government (max one mark)** promotes renewable energy resources/reduces use of non-renewable energy resources/reduces global warming/reduces production of greenhouse gases (1)	2	**allow** eventually photocells will pay for themselves (1) **allow** cheaper over time (1) **ignore** saves energy/(just) cheap/no electricity bill **allow** reduced carbon emissions (1) **allow** reduces carbon footprint (1) **allow** need to build less power stations (1) **allow** provides energy to national grid (1) **allow** less need to buy energy from other countries (1) **allow** it is a sustainable way of producing electricity (1) **ignore** more environmentally friendly/less pollution
			Total	**4**	

Question			Answer	Marks	Guidance
11	(a)	(i)	supernova (1)	1	
		(ii)	(idea that) gravity (pulls it together) (1)	1	**allow** gravitational collapse (1)
	(b)		galaxies or stars are moving away (from the Earth) / Universe is (continually) expanding furthest/further (comparison required) move fastest/faster (comparison required) (2)	2	**allow** the wavelength (of light) increases/the frequency (of light) decreases **allow** the source of light is moving away but **not** the light is moving away **all three correct = 2 marks** **one or two correct = 1 mark**
			Total	**4**	

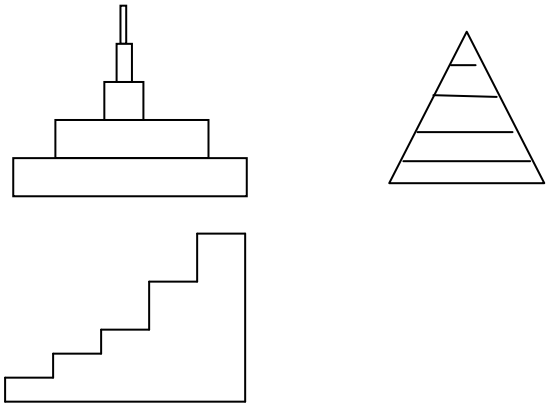
Question			Answer	Marks	Guidance
12	(a)		**any two from:** similar elements or rocks or minerals found on Earth and Moon (1) Moon or Moon materials are less **dense**/ora (1) only Earth has **iron core**/no **iron core** on Moon (1)	2	 **ignore** similar or same materials **ignore** light/lightweight
	(b)		**any two from:** craters (on Earth's surface)/AW (1) unusual elements or metals or minerals found in rocks (1) (evidence of) climate change (1) changes in fossil numbers (between adjacent rocks)/AW (1)	2	 **allow** large holes/ditches (1) **allow** named unusual elements or minerals e.g. iridium (1) **ignore** material from asteroids found **ignore** (rare) rocks from asteroids found **allow** idea of species extinction e.g. extinction of dinosaurs/changes in fossils (1) **allow** sighting of asteroids/AW (1)
			Total	**4**	

Question			Answer	Marks	Guidance
13	(a)	(i)	Lucy (1) idea of greatest increase or greatest change in stopping distance or correct calculation of the changes in stopping distance shown in table for **all** drivers (1) **OR** idea of greatest increase or greatest change in reaction time or correct calculation of the changes in reaction time shown in table for **all** drivers (1)	2	second marking point is dependent on choosing Lucy **allow** Lucy's reaction time has decreased the most (2) calculated changes (**allow** changes rounded): reaction time stopping distance Peter 0.24 9 Mike 0.25 11 Lucy 0.31 14 Emily 0.17 8 **ignore** worst stopping distance **ignore** just longest reaction time
		(ii)	comment made about different **changes** in reaction times **and** data quoted (1) comment made about different **changes** in stopping distances **and** data quoted (1)	2	**PLEASE CHECK THE TABLE FOR CALCULATIONS OF CHANGES FOR REACTION TIME AND STOPPING DISTANCE FOR AT LEAST TWO DRIVERS** if data changes calculated incorrectly in 13(a)(i) **allow** ecf e.g. 24, 25, 31 and 17 correctly described as a change in reaction times scores 1 mark calculated changes (**allow** changes rounded): reaction time stopping distance Peter 0.24 9 Mike 0.25 11 Lucy 0.31 14 Emily 0.17 8
		(iii)	different body masses or sizes/different metabolism/different times over which alcohol was drunk/AW (1)	1	**allow** different gender/different race/different age/medication/different health issues/how much they have eaten/different tolerance to alcohol/different absorption rates (1)

Question			Answer	Marks	Guidance
	(b)	**(i)**	appropriate scales chosen (1) all points plotted correctly and straight line through points (1)	2	scales appropriate if the range (0 to 5 on x axis and range to 130 or 140 or 150 on y axis) extends halfway on both x and y axes and are linear **allow** tolerance of ± ½ square
		(ii)	any number in the range 8.3 – 9.0 (hours) (1)	1	**allow** ecf if number lies outside the range then check graph and if number correctly read off graph (with a tolerance of ± 1.5 small square) award 1 mark if there is a discontinuity on either axis then the graph can**not** be used to take a correct reading
	(c)		there is no pattern (1) correct use of data to explain that there is no pattern (1)	2	**WHEN LOOKING FOR THE EXPLANATION FOR THE SECOND MARKING POINT EXAMINERS NEED TO BE CERTAIN THAT THE CANDIDATE IS REFERRING TO THE RIGHTHAND COLUMN IN THE TABLE** **allow** there is no link (1) examples of correct use of data to explain there is no pattern: idea that Hungary has lowest limit but second highest death rate (1) idea that UK, USA and Canada have highest limits but very different death rates (1) **allow** idea that UK, USA and Canada have same limit but very different death rates (1) idea that other factors involved e.g. speed limits, vehicle condition etc. (1)
			Total	**10**	

Appendix A

Mark scheme for amended Braille questions on B712/02 June 2013.

Question	Answer	Marks	Guidance
1 a i	idea that there are different numbers of organisms (at each level) (1)	1	
ii	5 levels with the widest at the bottom gradually getting less wide towards the top (1)	1	**allow** correct sketch e.g.  (1) **allow** other appropriate shapes e.g. domes **ignore** incorrect labelling of levels

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