OCR
Oxford Cambridge and RSA

GCSE

Science B

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

General Certificate of Secondary Education

Mark Scheme for June 2016

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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
	correct response
	incorrect response
	benefit of the doubt
	benefit of the doubt **not** given
	error carried forward
	information omitted
	ignore
	reject
	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

Question			Answer	Marks	Guidance
1	a	i	(below critical level) they may become extinct (1)	1	**ignore** become endangered **allow** they will die out (1) **allow** ideas about would affect food chain (1) **allow** decrease in gene pool (1) **allow** decrease (genetic) variation (1) **allow** unable to recover numbers (1) **allow** population not enough to reproduce a healthy number (1)
	a	ii	**any two from** idea that it is difficult to police large areas or idea that it is difficult to enforce (1) need for international agreement (1) idea that some societies need food or resources from whales / whales are a source of income in some communities (1) idea that still need to hunt for research purposes (1)	2	**allow** idea that whales are spread over a wide area (1) **allow** difficult to track them (1) **allow** can't keep them in controlled areas (1) **allow** it is hard to find them (1) **ignore** too big to have in captivity **allow** some countries allow whale hunting (1) **allow** different countries have different laws (1) **allow** idea that whale hunting is traditional in some communities (1)

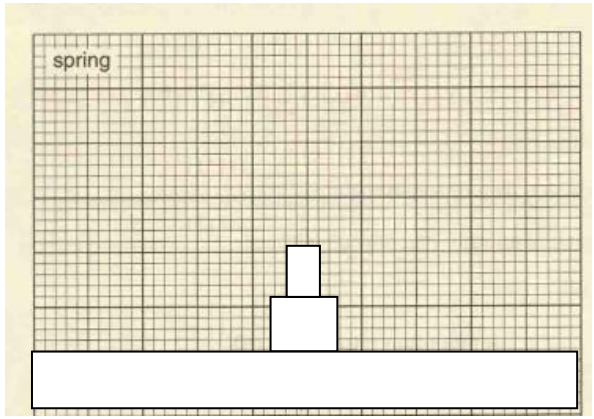
Question			Answer	Marks	Guidance
	b		**any two from** idea that only take a small amount / set quota (1) idea that leave enough to **breed** (and maintain population) (1) idea of taking only whales of a certain minimum size or age (1) educate people (as to why they need to be saved) (1) restrict areas where hunting is allowed (1) seasonal restrictions to hunting (1)	2	**ignore** captive breeding **allow** limit the number of whales killed or hunted (1) **allow** low level of hunting (1) **allow** amount being hunted is equal to amount being born (1) **allow** leave enough to repopulate (1)
			Total	**5**	

Question	Answer	Marks	Guidance
2 a	no (no mark) mistletoe or birch tree is not (mutualism) / mistletoe is a parasite (1) because the tree is harmed / causes less growth in tree / tree does not benefit from it / only one organism benefits (1)	2	**If answer is yes then scores 0.** **allow** the bottom example or the third example or the last example for mistletoe **allow** only the mistletoe benefits (1) **allow** birch tree does not benefit (1) **ignore** any reference to ants harming other trees **allow** converse argument e.g. only bees / flowers and acacia / ants are mutualism (1) as both the organisms benefit from the relationship (1)
b	bacteria gain sugars or food from the plant (1) plant gains nitrates from the bacteria / bacteria help plants make proteins / bacteria fix nitrogen (1)	2	**ignore** bacteria gain nutrients from the plant **ignore** plants take nitrogen from the bacteria **ignore** references to incorrectly named bacteria
	Total	**4**	

Question	Answer	Marks	Guidance
3 a	**[Level 3]** **Explains in detail how carbon became locked up in limestone** **AND** **describes a detailed link between weathering and global warming**. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** **Gives a limited explanation as to how carbon became locked up in limestone** **AND** **describes a simple link between weathering and global warming.** Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** **Gives a limited explanation as to how carbon became locked up in limestone** **OR** **describes a simple link between weathering and global warming.** Quality of written communication impedes communication of the science at this level. (1 – 2 marks)	6	**This question is targeted at grades up to A*** **Indicative scientific points at level 3 include:** **To access level 3 carbonates must be mentioned.** detailed explanation as to how carbon became locked up in limestone • (marine organisms) made shells out of **carbonates** detailed link between weathering and global warming • acid rain reacts with carbonates • weathering **increases** the levels of carbon dioxide in the atmosphere • increased carbon dioxide levels causes global warming **Indicative scientific points at level 1 and 2 may include:** limited explanation as to how carbon became locked up in limestone. • limestone made of shells • limestone contains remains of dead animals • shells contain carbon link between weathering and global warming • acid rain is sulfuric acid • carbon dioxide is a greenhouse gas • weathering releases carbon dioxide • carbon dioxide causes global warming **If just carbon released and nothing else worthy of credit then limited to level 1 (1 mark)** **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**

Question	Answer	Marks	Guidance
	[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0marks)		
b	lichen (1)	1	**ignore** moss
	Total	**7**	

Question	Answer	Marks	Guidance
4 a	no (no mark) **and any one from** idea that **C** and **D** (are more closely related because they) are in the same genus (1) idea that **A** and **B** are in different genera / different genus name (1)	1	**if yes then zero for question** **if unclear assume answer refers to A and B** **allow** *Dytiscus marginalis* for **C** throughout **allow** *Dytiscus latissimus* for **D** throughout **allow** *Gyrinus natator* for **A** throughout **allow** *Orectochilus villosus* for **B** throughout **allow C** and **D** (more closely related) because the first part of their name is the same / both have *Dytiscus* in the name / have similar binomial names (1) **not** same binomial name **allow A** and **B** have different first part of name (1) **allow A** and **B** do not have a similar binomial name (1) **ignore** different binomial names **ignore** references to species

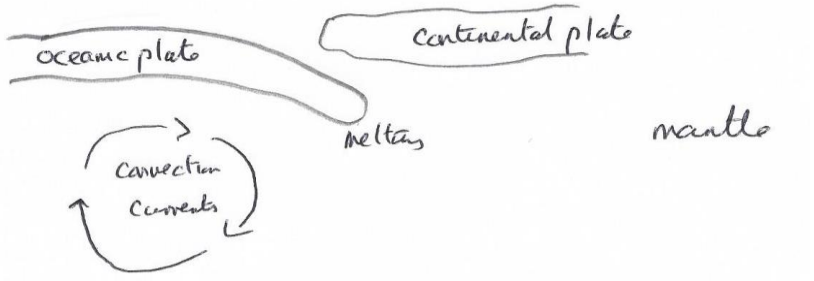
Question	Answer	Marks	Guidance
b i	bars drawn to correct scale ± half a square and in the correct order (1) bars correctly labelled (1)	2	 order of labels secondary consumers (6 mm) primary consumers (12 mm) producers(100 mm) All bars need to be same height as each other – actual height is not important

Question	Answer	Marks	Guidance
b ii	**difference** **any one from** winter (pyramid) is not a pyramid (shape) / in winter there is less (mass of) producers than consumers / ora (1) winter (pyramid) is smaller (than spring pyramid) / ora (1) identifies any level in winter (pyramid) being smaller than spring (pyramid) (1) **reason** (in winter) less light or less energy for photosynthesis / less light or less energy for growth / ora (1)	2	**If unclear assume answer refers to winter pyramid** **allow** less biomass in winter / ora (1) **examples include** less producers in winter (than spring) / ora (1) less consumers or animals in winter (than spring) / consumers or animals hibernate in winter /ora (1) **ignore** less Sun for photosynthesis **allow** (in winter) lower temperature so less photosynthesis / lower temperature so less growth / ora (1) **allow** idea that more energy is lost as heat (1)
	Total	**5**	

Question	Answer	Marks	Guidance
5 a	**any one from** idea that it is based on where they live or their habitat (1) not based on evolution (1)	1	 **allow** they all live near or in the sea (1) **ignore** based on what they look like **allow** not based on genetics or DNA (1)

Question	Answer	Marks	Guidance
b	**Similar** **up to two from** live in similar habitats or environments or climates (1) hold similar niche within habitat (1) feed in similar ways (1) **but** adapted to similar environment (2) **Different** **up to two from:** because they evolved thousands of miles apart (1) live on different hemispheres / geographic isolation (1) had different ancestors (1)	3	**Use ticks on this question** **for maximum three marks at least one difference and one similarity.** **allow** both live in water or cold conditions (1) **allow** both feed on fish (1) **allow** adapted some of the same traits (1) correctly stated adaptation linked to cold climate scores 2 e.g. they are both streamlined to swim (2) e.g. thick feathers to keep warm in the cold environment (2) **ignore** both are birds **ignore** different species or different genes or different DNA or evolved differently
	Total	**4**	

Question	Answer	Marks	Guidance
6 a	(when Wegener made the proposal) there was little or no evidence or no proof (1) now other scientists have tested the theory (1)	2	**allow** people did not believe him because they could not see it happening (1) **allow** it was hard to collect evidence (1) **allow** it was **just** a theory (1) **allow** examples of why he had no evidence e.g. cannot go below the surface and see what is happening (1) **allow** they did not have the technology (1) **ignore** religion / beliefs **allow** collect data (1) **allow** it takes evidence to prove that a theory is correct (2) **allow specific examples of evidence available now e.g.** **allow** not accepted until sea floor spreading discovered / not accepted until submarines could investigate constructive plate margins under the ocean (2) **allow** the technology to observe plate movements was not available in Wegener's time (2)
b	**any three from** convection currents in the mantle (causes plates to move) (1) oceanic plate is more dense (than continental plate) (1) so oceanic plate goes under continental plate (1) oceanic plate or more dense starts to melt (1)	3	**allow** movement of magma drags plates (1) **allow** one plate is more dense (than the other) (1) marks can be scored from a **labelled** diagram e.g.

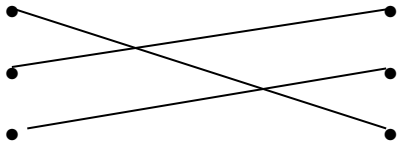
Question	Answer	Marks	Guidance
			 **if both plates not correctly named scores max of 2**
	Total	**5**	

Question	Answer			Marks	Guidance
7	**Name of fertiliser**	**Name of alkali used**	**Name of acid used**	2	**allow** correct formulae
	ammonium phosphate	ammonia	phosphoric acid		
	potassium nitrate	potassium hydroxide	**nitric acid / HNO_3(1)**		
	ammonium sulfate / $(NH_4)_2SO_4$(1)	ammonia	sulfuric acid		**not** ammon**ia** sulfate
	Total			**2**	

Question	Answer	Marks	Guidance
8 a	**A** and **C** both have good (electrical) conductivity / **A** has a better (electrical) conductivity than **C** (1) metal **A** has a high density and is expensive (1) metal **C** has a low density and is cheap (1)	3	**Use ticks on this question.** **ignore** references to other properties **allow** heavy / light for density **allow** correct comparison of conductivity of **A** and **C** (1) **allow** correct comparison of densities of **A** and **C** (1) **allow** correct comparison of costs of **A** and **C** (1)
b	metal **A** **any two from for 1 mark** strong / high density / expensive (1) metal **B** **any two from for 1 mark** strong(est) / high density / cheap(est) (1) metal **C** **any two from for 1 mark** strong / low density / expensive (1)	3	**Use ticks on this question.** **ignore** references to other properties **allow** heavy / light for density
	Total	**6**	

Question	Answer	Marks	Guidance
9 a	decreases / AW (1)	1	**allow** if temp decreases yield increases (1) changes is not sufficient
b i	idea that catalyst increases rate of reaction (1)	1	**allow** increases amount of successful or frequent collisions (1) **allow** lowers activation energy (1)
ii	**any two from** faster at 450°C / slower at 200°C (1) even though yield at 200°C is greater than at 450°C (1) energy needed at 200°C is less than at 450°C (1)	2	**If unclear assume answers refer to 450°C** **allow** idea that 450°C is a compromise (between rate and yield) or 450°C is the optimum temperature (1) **allow** ora **allow** higher level answers e.g. higher temperature means more successful, energetic or frequent collisions (1) **allow** ora
c	$N_2 + 3H_2 \rightarrow 2NH_3$ formulae (1) balancing dependent on correct formulae (1)	2	**allow** any correct multiple e.g. $2N_2 + 6H_2 \rightarrow 4NH_3$ (2) **allow** = or ⇆ for arrow **not** 'and' or & for + **allow** one mark for correct balanced equation with minor errors in case, subscript and superscript e.g. $N^2 + 3h_2 \rightarrow 2NH_3$
	Total	**6**	

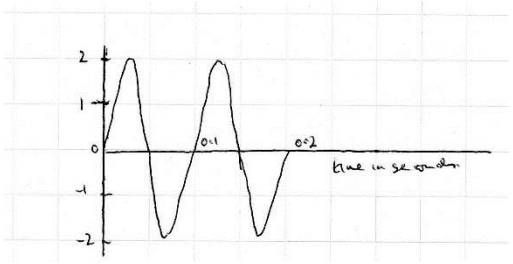
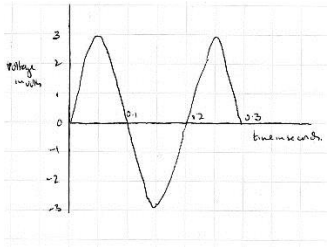
Question	Answer	Marks	Guidance
10	**Level 3** **All three of the products are correctly identified** **AND** **one correct equation for the reaction at one of the electrodes is written.** Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **Level 2** **Two of the products are correctly identified with at least one correct location** Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **Level 1** **One of the products is correctly identified** **OR** **a sensible attempt at an equation for the reaction at one of the electrodes is made** 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. (0marks)	6	**This question is targeted at grades up to A/A*.** **Indicative scientific points may include:** **Products** • chlorine at the anode • hydrogen at the cathode • sodium hydroxide **Equations** • $2H^+ + 2e^- \rightarrow H_2$ • $2Cl^- - 2e^- \rightarrow Cl_2$ / $2Cl^- \rightarrow Cl_2 + 2e^-$ **Other** • Na^+ and OH^- remain in the solution making sodium hydroxide **allow** products and location from (incorrect) equation At Level 1 **allow** correct identification of electrodes to which ions are attracted i.e. Na^+ and H^+ attracted to cathode or negative electrode **and** Cl^- and OH^- attracted to anode or positive electrode. At Level 1 **allow** oxidation at anode or positive electrode **and** reduction at cathode or negative electrode. **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
		6	

Question	Answer	Marks	Guidance
11 a	 (2)	2	3 correct (2) 1 or 2 correct (1)
b	yes if alpha or beta (1) as it will be stopped (by thick aluminium) (1) **or** no if gamma (1) as it can penetrate (aluminium) or not stopped (by aluminium) (1)	2	**allow** alpha will be stopped (by aluminium) (2) **allow** beta will be stopped (by aluminium) (2) **allow** gamma will penetrate (aluminium) (2) **allow** for gamma (thick) lead is needed (2) **if no other marks awarded ignore yes or no and allow 1 mark from** idea that (some types of) radioactive emissions or radiation can penetrate or be stopped by (aluminium) (1) **ignore** waste or liquid penetrates aluminium beta and gamma get through (aluminium) (1) need to use lead (1)
	Total	**4**	

Question	Answer	Marks	Guidance
12 a	**reason for max one from** less or no carbon dioxide / greenhouse gases (1) does not contribute to global warming (1) no smoke or ash (1) no need to transport fuel to power station (1) it is renewable (1) reduces dependency on fossil fuels (1) **reason against max one from** large numbers needed / need 1000 wind turbines / do not produce much power or enough power(1) idea that it is not always windy (1) idea of visual pollution (1) noise pollution (1) need space / use land that could be used for farming (1) kills birds (1)	2	**ignore** produce no pollution **ignore** references to environmentally friendly / eco-friendly / won't harm the environment **allow** reduces climate change (1) **allow** less lorries needed (to transport fuel) (1) **allow** it will not run out (1) **ignore** it is sustainable **ignore** references to cost **allow** power stations produce more power (1) **ignore** use less power **allow** if there is no wind then no electricity is generated (1) **ignore** not reliable **allow** spoils the view / spoils the scenery / unattractive (1) **allow** (noise) will keep people awake (1) **allow** take up a lot of space (1)

Question	Answer	Marks	Guidance
b	**any two from** light or (IR) radiation or (short wavelength) radiation or (high frequency) radiation (from the Sun) passes through glass (1) light or (IR) radiation or (short wavelength) radiation or (high frequency) radiation is **absorbed** by surfaces (1) re-emitted at longer wavelengths or lower frequency (1) longer wavelengths (IR) or lower frequency (IR) is trapped / cannot penetrate through the glass / reflected by the glass (1) **and** idea of maximising the amount of Sun / light (1)	3	**allow** heat passes through the glass (1) **allow** heat **absorbed** by surfaces (1) **allow** named example e.g. use big windows / position the windows so they face the Sun / put windows all the way round (to get as much Sun as possible) / south facing windows (1) **allow** maximise the Sun's potential (1)
	Total	**5**	

Question	Answer	Marks	Guidance
13 a	**[Level 3]** **Gives the four stages in the production of electricity** **AND** **correctly calculates the amount of coal burnt each second.** Quality of written communication does not impede communication of the science at this level (5 – 6 marks) **[Level 2]** **Gives three stages in the production of electricity** **OR** **correctly calculates the energy input each second** **OR** **calculates the coal burnt each second without considering efficiency** Quality of written communication partly impedes communication of the science at this level (3 – 4 marks) **[Level 1]** **Gives two stages in the production of electricity** 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 to A*** **To access Level 3 answer must include at least one correct calculation** **Indicative scientific points may include:** **In the power station** • (in furnace) coal is burnt or stored (chemical) energy is converted to heat energy • (in boiler) water is heated to produce steam • (turbine) turns • drives or spins the generator for electrical production or converts kinetic to electrical energy Ignore references to transmission of electricity **Calculation** **Correct response** • energy input = $\frac{1.5 \times 10^6 \times 100}{30}$ = 5 (.0) x 10^6 J • **coal burnt each second = $\frac{5.0 \times 10^6 \text{ J}}{2 \times 10^4}$** **= 250 (kg)** • coal burnt per second not considering efficiency of transfer = $\frac{1.5 \times 10^6 \text{ J}}{2 \times 10^4}$ = 75 (kg) **Use the L1, L2, L3 annotations in Scoris** **Do not use ticks**

Question	Answer	Marks	Guidance
b	correct diagram showing increased frequency of wave(s) for at least one complete wave (1)  correct diagram showing voltage going up higher and / or down lower (1)  	2	**allow** correct continuation of existing wave more than 1 wave in 0.2 seconds or more than 2 complete waves in the 0.4 seconds amplitude greater than 2V or Peaks and / or troughs greater than 2V
	Total	**8**	

Question	Answer	Marks	Guidance
14 a	0.075 (kW) (2) **but if incorrect** $\frac{1.8}{24}$ (1)	2	
b	28.8 (pence) (1)	1	**allow** 29 (pence)
c	low(est) current (1) (so) low(est) **heating** effect or reduces energy loss through **heating** (1)	2	**allow** as voltage increases current decreases (1)
	Total	**5**	

Question	Answer	Marks	Guidance
15 a	**B** (1) it is travelling faster or fastest **or** because this is where the force is stronger or strongest / greater or greatest force of attraction / greater or greatest gravitational force (1)	2	**If not B then score zero for question**
b	gravitational field of **Jupiter** (prevents planet forming) (1)	1	**allow** gravitational force of Jupiter and Mars (1)
	Total	**3**	

Question	Answer	Marks	Guidance
16 a i	China USA UK Japan Rest of Europe Canada all correct (2) any three on the correct lines (1)	2	**allow** correct numbers i.e. 80 46 30 28 22 14 (all ± 1) all numbers correct (2) any three numbers on the correct lines (1)
ii	idea that population is high(est) / more (heavy) industry (1)	1	**ignore** idea that they have large reserves of coal **ignore** they are larger countries **ignore** idea that population is increasing **allow** produce goods for other countries (1) **ignore** they are developed countries
iii	any three correct conclusions or comparisons within a country or between countries (3)	3	**Use ticks on this question** **ignore answers about coal which repeat the answers given in 16ai** **ignore** incorrect statements Examples of correct conclusions or comparisons include: Canada uses highest proportion of hydroelectricity (1) Canada uses most hydroelectricity (1) Europe has highest proportion of nuclear (1) any correct ranking for any of the fuels (1) UK generates least electricity overall (1) USA generates greatest amount of electricity overall (1)

Question	Answer	Marks	Guidance
b	**any two from** **total or world electricity** production is increasing (1) **total or world electricity** production decreased in 1997 or 2003 or 2007 or 2008 or 2009 (1) **percentage** increased and then decreased (1) **percentage** increased until 1992 / **percentage** highest in 1992 / **percentage** decreased from 1992 (1)	2	**assume total or electricity or world or TWh refers to bar chart** **assume percentage refers to line graph** **not** any incorrect year e.g. total decreased in 1997 and 2006 (0) **allow percentage** decreased after any year in the range of 1992 – 2004 (1) **not** any incorrect year e.g. percentage increased until 1990 (0) **allow percentage** increased quicker until 1987 (2) **allow** total world production must be increasing if total increasing but percentage decreasing (2) **allow** idea that if percentage of nuclear is decreasing then percentage of other fuels or methods is increasing (1)
c	**any two from** idea that need to reduce dependency on fossil fuels (as they are running out) / idea of over-reliance on fossil fuels / idea that fossil fuels or named fossil fuel(s) are running out (1) increased use of nuclear (1) increased use of (named) renewables (1)	2	**allow** idea that as nuclear share is falling other resources will need to be used (1) **allow** non-renewable fuels will run out (1) **allow** nuclear fuel will become scarce or in high demand (1) but **ignore** nuclear fuel will run out **allow** increased use of nuclear will lead to increased problems of disposal of radioactive or nuclear waste (2) **ignore** increased use of alternatives
	Total	**10**	

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