RECOGNISING ACHIEVEMENT

GCSE

Science B

General Certificate of Secondary Education

Unit **B712/02:** Unit 2: Modules B2, C2, P2 (Higher Tier)

Mark Scheme for June 2012

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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.

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For answers marked by levels of response:

a. **Read through the 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 may 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.

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
	Level 1
	Level 2
	Level 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)		class (1)	1	**allow** classes (1)
	(b)	(i)	idea that oryx might have a different name in another language but the binomial name is consistent (1)	1	**allow** international name / agreed name / universal name / Latin name (1) **allow** can be identified in any language / country (1) **allow** species and genus put together (1) **allow** includes the genus (1)
		(ii)	idea of **mating** or breeding (1) **but** if they don't mate (they are different species) / the offspring are **not** fertile / ora (2)	2	**allow** (compare) DNA or genes or genome (1) **allow** mate them to see if they are fertile (1)
	(c)	(i)	actual value is 55.2% (2) **or** (2001 is 250 so) 50% is 125 (1) any number from 110 to 115 is less than 125 /AW (1)	2	**allow** 54-56% (2) **allow** (any number from 135 to 140) ÷ 250 x100 (1) If correct calculations but candidate then says that the conclusion is incorrect then scores max 1 **allow** it has dropped by more than 125 (1) **allow** any number from (135 to 140) is more than half (1) **allow** $\frac{(110 \text{ to } 115)}{250} \times 100 = (44\text{-}46)\%$ therefore conclusion is correct (2)

Question			Answer	Marks	Guidance
		(ii)	**any 2 from:** the Oryx could eat local crops (1) which means there would be less or no food for the locals or loss of income (1) people could see the Oryx without going into the park (1) idea that they would make less money from tourism (1) idea that if they go free they could be hunted (1) (as their numbers are going down) they could become extinct or endangered (1)	2	**allow** could cause traffic accidents (1) **allow** idea of competition for grazing land (1) **ignore** they can be a nuisance or damage to buildings or harms humans unless qualified e.g. by reference to horns **allow** spread disease or catch diseases (1) **allow** attract predators (1)
			Total	**8**	

Question			Answer	Marks	Guidance
2	(a)		**any 1 from:** respiration (1) excretion (1) egestion (1)	1	**allow** heat (energy) / movement (1) **allow** urine (1) **allow** faeces (1) **allow** not all the dead plants are used by mushrooms / energy is lost in spore production / not all parts of mushroom eaten (1) **ignore** references to growth
	(b)		idea that humans / mushrooms / dead plants belong to more than one food chain (1) idea that need to measure **dry** mass (1)	2	e.g. mushrooms not just eaten by humans (1) e.g. other decomposers may break down the dead plants (1) **allow** difficult to measure dry mass (1) as have to kill organism (1) **allow** idea of sampling (dry) mass and calculating an average (1)
`	(c)		mushrooms breakdown proteins or amino acids or urea (1) into ammonia (1)	2	**ignore** mushrooms recycle nitrogen **ignore** references to nitrates
			Total	**5**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>3</td><td>(a)</td><td></td><td>mutualism (1)</td><td>1</td><td>allow mutual or mutualistic (1)
allow symbiosis (1)</td></tr>
<tr><td></td><td>(b)</td><td></td><td>any 3 from:
<table><tr><th>Adaptation</th><th>Explanation</th></tr><tr><td>have rounded / stone shaped leaves (no mark)</td><td>to store water (1)</td></tr><tr><td>have long or deep or wide or spreading roots (1)</td><td>to collect water (1)</td></tr><tr><td>few leaves or less stem above the ground (1)</td><td>to reduce water loss (1)</td></tr><tr><td>(shaped like a stone) so less surface area compared to volume (1)</td><td>to reduce water loss (1)</td></tr><tr><td>thick cuticle or waxy leaves (1)</td><td>to reduce water loss (by evaporation) (1)</td></tr></table></td><td>3</td><td>answer must include max 2 for adaptations; explanation mark must be linked to correct adaptation

allow idea of the plants are camouflaged to stop them being eaten / AW (1)

allow high level answers
e.g. sunken or hairy stomata (1) to reduce transpiration / water loss (1)
e.g. idea of opening stomata at night and closing them during the day (1) means less water loss during hot part of day (1)</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>4</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
4	(a)		**Level 3** **Applies understanding of natural selection but also includes ideas about how competition is different on the different islands and includes ideas about gene pool and shows understanding of why long necks are a new species** Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **Level 2** **Explains ideas about natural selection but also compares the competition on different islands** Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **Level 1** **Explains ideas about natural selection to include variation or competition or survival of the fittest.** 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/A*** **Indicative scientific points at Level 3 may include:** • gene pool changes as more tortoises had the longer necks • genes or alleles for smaller necks lost from population • DNA became so different they were unable to breed (becomes new species) • on larger island less chance of isolation as population larger **Indicative scientific points at Level 2 may include:** • Less food available (on smaller islands) leads to increased competition • increased competition means shorter necked tortoises more likely to die out / ora • More food available on some islands or larger islands so less competition so less chance of short necks dying out / ora **Indicative scientific points at Level 1 may include:** • islands had tortoises with different length necks • those with longer necks were able to reach more food • longer necks meant more likely to survive and pass on genes
			Total	**6**	

Question			Answer	Marks	Guidance
	(b)		no actual proof (1) more evidence may be collected in the **future** to disprove the theory (1)	2	**allow** no (scientific) evidence (1) **allow** idea that fossil record is incomplete (1) **allow** no ancestors to compare with modern tortoises (1) **allow** no DNA available to identify changes (1) **allow** idea that changes are very slow (1) **ignore** ideas that we have not seen them
			Total	**8**	

Question			Answer	Marks	Guidance
5	(a)		aluminium (1) **any two from:** because it is least dense or low density (1) because it is attractive to look at or shiny (1) because it is strong (1)	3	**If choice is neither steel or aluminium scores zero** **allow** because aluminium does not rust or corrode(1) **allow** lightweight but ignore light **allow** steel (1) because it is cheap(est) (1) because it is strong(est) (1) **ignore** references to melting point
	(b)	(i)	$4Fe + 3O_2 \rightarrow 2Fe_2O_3$ correct formulae (1) balancing (1)	2	balancing mark is conditional on correct formulae **allow** any correct multiple e.g. $8Fe + 6O_2 \rightarrow 4Fe_2O_3$ **allow** = or ⇆ for arrow **not** 'and' or & for + **allow** one mark for correct balanced equation with incorrect use of upper and lower case formulae e.g. $4FE + 3O^2 \rightarrow 2Fe_2o_3$ (1)
		(ii)	oxidation (1) loss of electrons (1)	2	mark independently **ignore** ionising or ionisation
			Total	**7**	

Question			Answer	Marks	Guidance
6	(a)		$C_2H_4 + H_2O \rightarrow C_2H_6O$ (1)	1	**allow** C_2H_5OH for C_2H_6O **allow** any correct multiple e.g. $2C_2H_4 + 2H_2O \rightarrow 2C_2H_6O$ (1) **allow** = or ⇆ for arrow **not** 'and' or & for +
	(b)		decreases / goes down / AW (1)	1	
	(c)		**any three from:** idea that lower temperature gives higher yield (1) but reaction too slow at lower temperature / ora (1) but unreacted gases are recycled (1) idea that high pressures or 70atm give higher yield (1) and higher rate (1) but high pressures or high temperatures are expensive to generate (1) catalyst increases rate of reaction (1)	3	**allow** catalyst does not affect yield (1)
			Total	**5**	

Question			Answer	Marks	Guidance
7			**any two from:** to predict future eruptions (1) to minimise danger to life or keep people safe (1) to reveal information about the **structure** of the Earth (1)	2	**ignore** to predict earthquakes **allow** so they can understand how volcanoes are formed (1) **ignore** to understand about the Earth or tectonic plates
			Total	**2**	

Question	Answer	Marks	Guidance
8	**Level 3** **Applies knowledge of acids and alkalis to name both chemicals required and the answer includes a comprehensive explanation of eutrophication which includes reference to bacteria using up oxygen.** Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **Level 2** **Applies knowledge of acids and alkalis to name at least one chemical required and the answer includes an appreciation of increased growth of algae due to fertiliser in the water.** Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **Level 1** **Applies knowledge of acids and alkalis to name one correct chemical and/or a limited description of eutrophication is offered.** 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/A*.** **Indicative scientific points at level 3 may include:** most of the points mentioned up to level 2 and • reference to **bacteria or decomposers** using up oxygen. • alkali is potassium hydroxide (KOH) or potassium oxide (K_2O)and acid is nitric acid (HNO_3) A comprehensive explanation of eutrophication but either no mention of chemicals used or both chemicals named incorrectly scores level 2 (4 marks). If one chemical correct then 5 marks. **Indicative scientific points at levels 1 and 2 may include:** Eutrophication involves: • 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
	Total	**6**	

Question			Answer	Marks	Guidance
9	(a)		hydrogen (1)	1	**allow** H_2 / H (1)
	(b)		chloride ions removed at or attracted to anode / hydrogen ions removed at or attracted to cathode (1) so Na^+ and OH^- left (making sodium hydroxide) (1)	2	**allow** hydrogen produced at the cathode / chlorine produced at the anode (1) **allow** positive electrode for anode or negative electrode for cathode **allow** Na^+ and OH^- do not react at the electrodes but the other ions do (2)
	(c)		idea that water is pumped underground (1) salt dissolves (1)	2	**allow** flood the mine or fill the mine with water (1)
			Total	**5**	

Question			Answer	Marks	Guidance
10	(a)		idea of fuel **burnt** idea of steam generated idea of steam drives or turns turbine idea of turbine drives generator	2	all correct (2) one missing or out of order (1) **allow** correct descriptions of a generator e.g. a coil turns inside a magnet
	(b)		0.235 or 23.5(%) (1)	1	**allow** any value from 0.23 to 0.24 (1) **allow** any value from 23(%) to 24(%) (1) **allow** 0.2 (1) 0.24% or 0.235% scores (0)
	(c)	(i)	5000 (A) (2) **But if incorrect** $\frac{500\ 000\ 000}{100\ 000}$ (1)	2	**allow** $\frac{500}{100\ 000}$ or 0.005 (A) (1) **or** **allow** $\frac{500\ 000}{100\ 000}$ or 5 (A) (1)
		(ii)	(idea that) increasing the voltage reduces the current (1) (idea that) **less current** reduces the energy or heat loss / ora (1)	2	 **not just** reduces energy loss **not** less current stops energy loss **ignore** references to efficiency **allow** halving current decreases energy loss by a factor of 4 (2)
	(d)	(i)	any value from 7.0(%) to 20.0(%) (1)	1	

Question			Answer	Marks	Guidance
		(ii)	**any two from:** **environmental issues** idea that there is concern about climate change and air quality or amount of carbon dioxide being produced or reducing carbon footprint / less demand due to energy saving e.g. better insulation or sustainable transport (1) **economic issues** idea of economic recession / idea of changing price of non-renewable fuel or fossil fuel / incentives to install renewable energy sources / less money available to develop renewable energy resources / economic growth or demand for non-renewables on a world market (e.g. China) is increasing / increase use of renewable energy sources to power homes and /or businesses e.g. solar panels (1) **technological issues** idea of improved technology e.g. more efficient power stations or discovering new energy sources (1) **political issues** idea of pressure groups / change in government policy / change in international context e.g. war (1)	2	**ignore** fossil fuels may run out **ignore** merely (unspecified) find a new way of making electricity
			Total	**10**	

<table>
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<tr><td>11</td><td>(a)</td><td></td><td>
<table>
<tr><td>Radiation (max 1)</td><td>linked reason</td></tr>
<tr><td>not alpha</td><td>(idea that) no change / little change in count rate with paper absorber (1)</td></tr>
<tr><td>beta</td><td>(idea that) reduced count rate with aluminium (1)</td></tr>
<tr><td>gamma</td><td>(idea that) reduced count rate with lead / some is stopped by lead / some can pass through (thin) lead (1)</td></tr>
<tr><td>(gamma)</td><td>radiation travels through aluminium or not all radiation is stopped by aluminium (1)</td></tr>
</table>
</td><td>3</td><td>Max 1 for correct type(s) of radiation present stated.
but if a list is given and includes any incorrect type of radiation this negates the mark
e.g. gamma & alpha (0) gamma & UV (0)

To score max 3 marks, explanations must be correctly linked to the type of radiation.

allow it is gamma (1) because it goes though all the absorbers (1)
allow gamma is only stopped by thick lead (1)

allow change with paper due to random nature of radiation (1)</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>removal or addition of an electron (from an atom) (1)</td><td>1</td><td>not removal or addition of an electron from an ion or a cell
allow removal or addition of an electron from a particle or a molecule (1)</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>DNA or genes or chromosomes or chromatin damaged (1)</td><td>1</td><td>allow cells damaged / nucleus (of cells) damaged (1)

allow can mutate living cells (1)

ignore idea of causes uncontrolled cell division
ignore kills cells</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>5</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
12			**Level 3: (5 – 6 marks)** **Interpret the data to give balanced arguments of the advantages and disadvantages of each lamp to include delay with fluorescent. LED or filament suggested as the best lamp with a reasoned argument.** Quality of written communication does not impede communication of the science at this level. **Level 2: (3 – 4 marks)** **Interpret the data to give some balanced arguments of the advantages and disadvantages of at least two lamps. A reasoned suggestion of the best lamp given (not necessarily LED or filament)** Quality of written communication partly impedes communication of the science at this level. **Level 1: (1 – 2 marks)** **Interpret the data to give advantages and /or disadvantages of any of the lamps**. 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 grade C** **LED:** **advantages** • has long(est) lifetime • comes on immediately • uses least power **disadvantages** • most expensive • gives out least light **Filament:** **advantages** • comes on immediately • gives out most light • cheap(est) **disadvantages** • has short(est) lifetime • takes most power (would need too many photocell panels) **Fluorescent:** **advantages** • gives out most light • reasonable lifetime • uses small amount of power **disadvantages** • delay in coming on • reasonably expensive
			Total	**6**	

Question			Answer	Marks	Guidance
13	(a)		(£)18 (2) **but** **if incorrect** 3 x 0.2 x 30 (1)	2	**allow** 1800p (2) **allow** 1800 (1) **allow** 3000 x 30 x 0.2 (1) **allow** 3 x 30 x 20 (1)
	(b)		idea of evens out the energy demand / no need to switch off power stations / electricity cannot be stored (1)	1	**allow** reduces the need for more power stations at peak times (1) **allow** idea that power company can **still** sell the electricity (1) **ignore** to make more profit **ignore** so electricity is not wasted
	(c)		idea of would not be able to use appliances / named appliances during the day or when off-peak electricity is not available eg watch TV during the day, fridge is on all day (1)	1	**allow** only available at night (1) **allow** some appliances cannot be used at night e.g. electric fire (1)
			Total	**4**	

Question			Answer	Marks	Guidance
14	(a)		likely that wind power will continue to increase (1) likely that other sources e.g. tidal will continue to increase (1) likely that hydro–electric will stay the same (1)	3	if no other mark scored, the idea of an overall increase in use of renewables scores (1) **allow** trends shown on the graph without a prediction for 2014 e.g. hydroelectric power has stayed near the same value (1)
	(b)	(i)	both bio-fuels have shown an increase (1) **but** bio-ethanol has shown a (gradual) increase and idea that bio-diesel has increased rapidly **more recently** (2)	2	 **allow** reference to any year between 2003 and 2007
		(ii)	**any two from:** greater land area used for bio-fuels / ora (1) so less available for food production (1) idea that greater use of bio-fuels leads to less burning of fossil fuels / making fossil fuels last longer (1) so reducing carbon footprint or AW (1)	2	 **allow** food prices will increase (1) **allow** food shortages may occur or more food may need to be imported (1) **allow** reduced global warming (1) **ignore** plants reduce CO_2
	(c)	(i)	St. Mawgan (1) has highest (average) wind speed for **most** (months) of the year (1)	2	2nd mark is dependent on St Mawgan being chosen **allow** the **yearly** average wind speed is the highest or shown by calculations that it is higher on average than the others (1) **ignore** wind speed higher in **all** months of the year
		(ii)	population size in the area / ease of connection to the National Grid / environmental lobby / residents objections / (1)	1	**allow** type of landscape(1) **allow** enough space (1) **allow** whether to build on land or at sea (1) **allow** noise or eyesore or visual pollution (1) **allow** affects habitats or wildlife (1) **ignore** any reference to cost **ignore** references to weather as this is in the stem of the question
			Total	**10**	

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