

Science B

General Certificate of Secondary Education

Unit **B712/01**: Unit 2: Modules B2, C2, P2 (Foundation Tier)

Mark Scheme for January 2013

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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.

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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:

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

Annotations

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)	(i)	caterpillar = 16 (J) (1) maggot = 48 (J) (1)	2	
		(ii)	(just as active as) same (figure) for respiration / both transfer 32J (1) growth figure / growth energy for maggot (much) greater than for caterpillar / 48J is (much) greater than 16J (1)	2	allow maggot have less waste (so more available for growth) ORA (1) allow ecf as long as supports Tom's statement
	(b)		any two from: no legs (1) but no jointed legs (2) body not split into 3 section (1) but do not have head, thorax and abdomen (2) no wings (1) no antenna(e) (1) no compound eyes (1)	2	assume unqualified answers refer to larvae ignore reference to size
	(c)		animal (1) arthropod (1)	2	
			Total	8	

Question	Answer	Marks	Guidance
2 (a)	<p>Level 3 (5–6 marks) A detailed description of natural selection that covers most of the points OR Description of at least one way they have become more streamlined and link it to survival. AND At least two stages of natural selection given. Quality of written communication does not impede communication of the science at this level.</p> <p>Level 2 (3–4 marks) Description of at least one way they have become more streamlined and link it to survival. OR At least two stages of natural selection given. Quality of written communication partly impedes communication of the science at this level.</p> <p>Level 1 (1–2 marks) Description of at least one way they have become more streamlined. OR Links streamlining to survival. OR At least one stage of natural selection given. Quality of written communication impedes communication of the science at this level.</p> <p>Level 0 (0 marks) Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p>This question is targeted at grades up to C.</p> <p>Indicative scientific points about stages of natural selection may include:</p> <ul style="list-style-type: none"> • idea of variation within species • some penguins were more streamlined than others • idea of competition • idea of selection / survival of the fittest • idea of passing advantage from one generation to another / inheritance • streamlining is controlled by genes <p>Indicative scientific points links to survival may include:</p> <ul style="list-style-type: none"> • better able to catch food / escape predators / more likely to survive <p>Indicative scientific points of ways they have become streamline may include: idea of how they are streamlined e.g.</p> <ul style="list-style-type: none"> • pointed beak / head • flipper like wings • shorter legs / legs tucked in <p>Use the L1, L2, L3 annotations in scoris. Do not use ticks.</p>

Question	Answer	Marks	Guidance
(b)	Kevin (1) we can never be sure we have found the earliest fossils (1)	2	if choose either Liz or Paul then no marks allow might find older fossils later/not every fossil will ever be found (1) allow older fossils may have been destroyed (1) ignore don't know how old the fossils are (1)
(c)	any three from: colouration (1) camouflage (1) so hidden from predators (1) or eyes on side of head / wide field of view (1) so can see predators approaching (1)	3	max two if only give adaptations with no explanation allow insulation / trapped air / fat / feathers / water proofing (1) to keep warm / reduce heat losses (1) or rounded body shape / low SA (to vol ratio) (1) to keep warm / reduce heat losses (1) or small / sharp / thin beak (1) to catch fish / prey (1) or wings are small or fin / flipper (like) (1) to steer / move / swim faster(1) but allow flipper/fins to help it swim faster / improve swimming (1) or webbed feet (1) to swim faster (1) explanation marks can only be awarded if linked to the correct adaptation e.g. legs to swim faster (0)
	Total	11	

Question			Answer	Marks	Guidance
3	(a)	(i)	<p>any two from:</p> <p>decay / decomposition / decomposing (1)</p> <p>respiration (1)</p> <p>from microbes / bacteria / fungi / animals / plants (1)</p>	2	<p>allow decomposers (1)</p> <p>allow (by) humans (1)</p> <p>allow animals (breathe it out) / humans (breathe it out) / we (breathe it out) (1)</p> <p>allow living things / organisms / named organism (1)</p> <p>allow volcanoes (1)</p> <p>allow weathering (1)</p> <p>ignore combustion / burning but allow combustion / burning of wood (1)</p> <p>ignore when trees are cut down</p> <p>ignore breathing</p>
		(ii)	<p>photosynthesis (1)</p> <p>by plants / trees (1)</p>	2	<p>allow absorbed / dissolved by water (1)</p> <p>allow forming carbonic acid / carbonate / limestone (1)</p>
	(b)	(i)	(too) unreactive (1)	1	
		(ii)	nitrate(s) / ammonium (1)	1	<p>allow correct formulae NO_3^- / NH_4^+</p> <p>ignore ammonia</p> <p>allow example of correct formula eg NH_4NO_3</p>
			Total	6	

Question			Answer	Marks	Guidance
4	(a)	(i)	potassium (1)	1	ignore K
		(ii)	contains all three essential elements / contains potassium, nitrogen and phosphorus (1)	1	allow contains NPK allow contains more essential elements allow contains nitrogen or N / phosphorus or P (for growth)
	(b)		advantages increases crop yield / will solve food shortages / AW (1) disadvantage idea of pollution of water by fertilisers / eutrophication (1)	2	allow idea of speeds up growth (1) allow grows bigger (1) ignore grows better / healthier growth allow examples of affect of eutrophication e.g. kills fish / aquatic life (1) allow pollutes water (1) ignore just 'causes pollution' one mark for an advantage, one mark for a disadvantage
	(c)	(i)	sulfuric acid / H ₂ SO ₄ (1)	1	allow hydrogen sulfate
		(ii)	add universal indicator / pH paper (1) if colour goes green it is neutral / match colour with neutral colour (1)	2	allow add (red and blue) litmus (1) the litmus does not change colour (1) allow use a pH meter (1) and it should be pH 7 (1) allow check the pH see if it is 7 (1) mark for colour change must link correctly to indicator used
Total				7	

Question		Answer	Marks	Guidance
5	(a)	reversible / AW (1)	1	allow forms an equilibrium / reaction goes backwards / products make reactants / reaction reverses / reaction goes both ways
	(b)	<p>catalyst has no effect (1)</p> <p>(percentage) yield increases as temperature increases / ora / AW (1)</p> <p>(percentage) yield decreases as pressure increases / ora / AW (1)</p>	3	<p>USE TICKS AND CROSSES IN THIS QUESTION</p> <p>allow as temperature gets hotter % goes up / AW / ora</p> <p>ignore changing the temperature increases the yield</p> <p>allow as pressure goes up % goes down / AW / ora</p> <p>ignore changing the pressure decreases the yield</p>
	(c)	<p>any two from:</p> <p>cost of energy / cost of temperature / cost of pressure / cost of electricity (1)</p> <p>cost of raw materials / cost of starting materials / cost of CH₄ / cost of H₂O (1)</p> <p>wages / salary / workers (1)</p> <p>cost of equipment (1)</p> <p>cost of catalyst / how quickly it can be made (1)</p> <p>cost of maintaining plant (1)</p>	2	allow two marks which give a cost and then give some detail about the cost eg cost of wages (1) which can be reduced by automation (1)
		Total	6	

Question		Answer	Marks	Guidance
6	(a)	mixture containing a metal (1)	1	<p>allow a mixture of metals not a compound containing two metals not a metal joined / combined to another element</p>
	(b)	<p>Level 3 (5–6 marks) Identifies at least one relevant property of chosen metal and explains why it is needed in building carriages. AND Makes a choice between aluminium or steel AND Explains why either aluminium or steel is more suited for the use. Quality of written communication does not impede communication of the science at this level.</p> <p>Level 2 (3–4 marks) Identifies at least one relevant property of aluminium or steel and explains why it is needed in building carriages. OR Explains why either aluminium or steel is more suited for the use. Quality of written communication partly impedes communication of the science at this level.</p> <p>Level 1 (1–2 marks) Identifies at least one relevant property of aluminium or steel. Quality of written communication impedes communication of the science at this level.</p> <p>Level 0 (0 marks) Insufficient or irrelevant science such as repeating the question. Answer not worthy of credit.</p>	6	<p>This question is targeted at grades up to C.</p> <p>Relevant scientific points include: Explanations</p> <ul style="list-style-type: none"> • low density so less fuel needed / travel faster • does not corrode so lasts longer • malleable so can be easily shaped • strong to protect in a crash <p>ignore strong so last a long time choices for aluminium</p> <ul style="list-style-type: none"> • lower density • does not corrode • malleable <p>choices for steel</p> <ul style="list-style-type: none"> • stronger • malleable • cheaper <p>Properties needed</p> <ul style="list-style-type: none"> • low density • does not corrode • malleable • strong <p>if references to conduction / magnetism is a property needed for making carriages then treat as poor communication</p> <p>Use the L1, L2, L3 annotations in scoris. Do not use ticks.</p>

Question		Answer	Marks	Guidance
	(c)	<p>any two from:</p> <p>saves natural resources / saves a finite resource (1)</p> <p>saves energy (1)</p> <p>reduces litter / reduces disposal problems (1)</p>	2	<p>ignore saves money</p> <p>allow saves metal / material which is running out / saves mining for new metal (1)</p> <p>allow (uses less energy) so less carbon dioxide / greenhouse gasses released (1)</p> <p>allow less landfill needed (1)</p>
Total			9	

Question		Answer	Marks	Guidance
7	(a)	$2\text{NaCl} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2 + \text{Cl}_2$	1	<p>allow any correct multiple including fractions</p> <p>allow = instead of \rightarrow</p> <p>allow balanced equation on the line or on the original equation. If there is a contradiction take the answer on the answer line.</p> <p>not & or and instead of +</p> <p>ignore poor use of case or subscript</p>
	(b)	ammonia (1)	1	allow any other way of indicating the answer eg ticking, circling or underlining but answer on the answer line takes precedence
	(c)	household bleach (1)	1	allow any other way of indicating the answer eg ticking, circling or underlining but answer on the answer line takes precedence
Total			3	

Question		Answer	Marks	Guidance
8	(a)	direct current (dc) (1)	1	
	(b)	double the size of the panels (1)	1	allow make bigger / add more photocells / add more (solar) panels
	(c)	<p>two marks from:</p> <p>idea of passive solar heating (1)</p> <p>traps / absorbs heat (1)</p> <p>which can be used in the house / to heat water (1)</p> <p>or</p> <p>wind turbines (1)</p> <p>generate electricity (1)</p>	2	<p>allow idea of solar thermal</p> <p>ignore solar panels unless qualified</p> <p>allow description of passive solar heating</p> <p>e.g. sunlight / passes through windows and warms rooms (2)</p> <p>e.g. takes in heat from the sun to warm water (2)</p>
Total			4	

Question		Answer	Marks	Guidance
9	(a)	0.375 (2) but if incorrect <u>300</u> (1) 800	2	<p>allow 0.38 / 0.37 (2)</p> <p>allow 38% or 37.5% or 37% (2)</p> <p>0.375% (1)</p> <p>37.5 or 38 or 37 (1)</p>
	(b)	power station B is more efficient / ora	1	<p>allow B uses same amount coal to produce more electrical energy than A</p> <p>ignore B uses 800 joules to produce 350 joules</p>
Total			4	

Question	Answer	Marks	Guidance
<p>10 (a)</p>	<p>Level 3 (5–6 marks) States, with a reason for each one, how to dispose of all three types of radioactive waste. Quality of written communication does not impede communication of the science at this level.</p> <p>Level 2 (3–4 marks) States, with a reason, how to dispose of one type of radioactive waste AND states how to dispose of the other two types of radioactive waste. OR States, with a reason for each one, how to dispose of two of the types of radioactive waste. Quality of written communication partly impedes communication of the science at this level.</p> <p>Level 1 (1–2 marks) States how to dispose any two of the types of radioactive waste. OR States, with a reason, how to dispose of one of the types of radioactive waste. Quality of written communication impedes communication of the science at this level.</p> <p>Level 0 (0 marks) Insufficient or irrelevant science. Answer not worthy of credit.</p>	<p>6</p>	<p>This question is targeted at grades up to C.</p> <p>Relevant scientific points for uranium could include</p> <ul style="list-style-type: none"> • store in (steel) drums / sealed in glass / buried deep underground • as only alpha emitted / radiation not very penetrating • long half-life / needs long term storage • very radioactive so may generate heat / need cooling <p>Relevant scientific points for iodine could include</p> <ul style="list-style-type: none"> • store in very thick walled containers / buried deep underground / behind several meters of concrete • as gamma is emitted / radiation is highly penetrating • as it has a short half-life it can be stored on the surface until most of the radiation has decayed • very radioactive so may generate heat / need cooling <p>Relevant scientific points for mixed waste could include</p> <ul style="list-style-type: none"> • can be placed in a land fill since it is not very radioactive • could be stored in very thick walled containers / buried deep underground / behind several meters of concrete • as gamma is emitted / radiation is highly penetrating • (but as it has a) short half-life it can be stored on the surface until most of the radiation has decayed <p>Use the L1, L2, L3 annotations in scoris. Do not use ticks.</p>

Question		Answer	Marks	Guidance
	(b)	<p>any two from: use tongs / remote handling / AW (1)</p> <p>use protective clothing / gloves AW (1)</p> <p>limit exposure time / AW (1)</p> <p>storage in lead lined containers (1)</p>	2	<p>ignore do not touch allow (teacher)keep your distance (1) ignore keeping students away</p> <p>ignore lab coat</p> <p>allow wear an indicator badge (1)</p>
Total			8	

Question		Answer	Marks	Guidance
11	(a)	lamp (1)	1	<p>mark answer on line first allow answer ringed, underlined or ticked on diagram if no answer on the answer line allow 60W</p>
	(b)	used for a longer length of time (1)	1	<p>allow used for 1 hour</p> <p>allow used for more time but not used more / more times / more often</p>
	(c)	184 (W) (2) but if incorrect 230 x 0.8 (1)	2	
	(d)	toaster has more power / 800 Watts (1)	1	<p>allow uses more Watts ignore idea that it generates more heat</p>
Total			5	

Question		Answer	Marks	Guidance
12	(a)	they are very hot (1)	1	allow nuclear (fusion) reaction ignore fission allow (balls of) burning gas
	(b)	ignore yes or no answer any two from: ideas that conditions are hostile to man AW (1) idea it would take too long / AW (1) unable to carry sufficient food / water / oxygen or fuel (1)	2	ignore people might die allow value for large number of years even if incorrect value e.g. takes 22.5 years (1) allow idea cannot get the space ship back / people back alive (because it takes so long) (1)
	(c)	any two from: craters (1) dust storms (1) climate change (1) fires / hot rocks (1) species extinction (1)	2	allow large holes (1) allow drop in Earth's temperature but ignore temperature change allow dinosaurs became extinct allow killed most living organisms (1) but not all living organisms
Total			5	

Question			Answer	Marks	Guidance
13	(a)	(i)	292 – 298 / (ppm)	1	allow any answer within this range
		(ii)	<p>any two from:</p> <p>idea that rise at start / between 140 (000) and 130 (000) (1)</p> <p>idea of overall fall in the middle / 130 (000) years and 20 (000) years (1)</p> <p>gradual increase during last 20 (000) years / at the end (1)</p>	2	<p>They must make some reference to a specific section of the graph but describing the whole pattern scores 1 if no other mark scored</p> <p>e.g. it goes up then down then up (1)</p> <p>but e.g. it goes up then down (0)</p>
		(iii)	<p>either</p> <p>as carbon dioxide levels increase so does the Earth's temperature / ora (1)</p> <p>idea that peaks broadly coincide (1)</p> <p>or</p> <p>no direct link between Earth's temperature and carbon dioxide levels (1)</p> <p>idea that peaks do not coincide exactly (1)</p>	2	<p>no mark for yes or no on its own</p> <p>allow correct use of data from the graphs e.g. both graphs have their highest peaks at about 135 (thousands of years before present day)</p> <p>allow as carbon dioxide levels increase so does the change in the Earth's temperature / ora</p> <p>allow graphs follow a similar pattern / graphs have similar fluctuations</p> <p>allow no exact match between surface temperature but the peaks or troughs broadly coincide (2)</p> <p>allow other gases contribute towards global warming</p>

Question		Answer	Marks	Guidance
	(b) (i)	Botswana and Ghana and Mozambique (1) all are developing countries (1)	2	If countries incorrect reason must match countries chosen allow they are poor countries / less industry / less fuel burned (1) allow LEDC / LED countries (1) allow idea of the lowest population AW (1)
	(ii)	$\frac{5729 \times 100}{24983}$ scores (1)	1	allow calc of 5721.107 / close value e.g. 24983×0.229 (<u>22.9</u>) = 5721.107 (100)
	(iii)	any two from: idea that USA uses more than its fair share of resources (1) idea that producing more pollution than they should (1) idea that they have a relatively low population (compared to the emissions) (1) USA should contribute 4.6% of carbon dioxide emissions (1)	2	allow small percentage population but large percentage World pollution / carbon dioxide emissions (2)
		Total	10	

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