

Additional Science B

General Certificate of Secondary Education

Unit **B721/01**: Modules B3, C3, P3 (Foundation Tier)

Mark Scheme for June 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:

- 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.

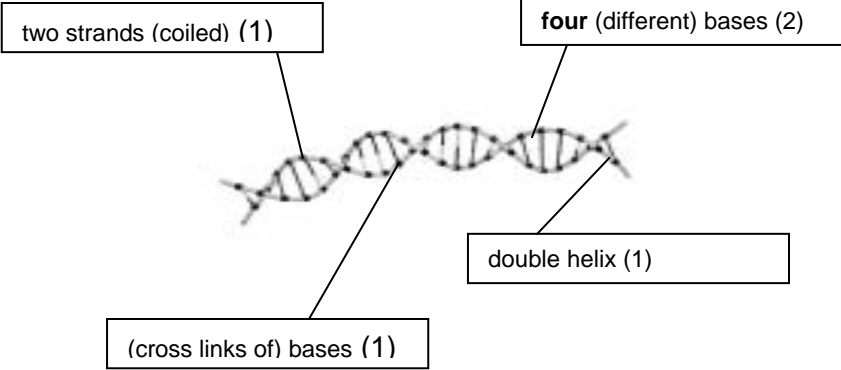
Annotations

Annotation	Meaning
✓	correct response
✗	incorrect response
[D]	benefit of the doubt
[ND]	benefit of the doubt not given
[CF]	error carried forward
[A]	information omitted
[I]	ignore
[R]	reject
[CON]	contradiction
[L1]	Level 1
[L2]	Level 2
[L3]	Level 3

Subject-specific Marking Instructions

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)	nucleus (1) genes (1) clones (1)	3	
	(b)	any two from: two strands (coiled) (1) (strands coiled to form a double helix (1) (with cross links of) bases (1) but four (different) bases (2)	2	<p>allow diagram drawn with one mark for each correct label</p>  <p>allow high level answers eg (bases are) A, T, C, G (1) but has bases A, T, C, G (2) allow idea of complementary bases (2) or A-T and C-G (2) ignore incorrect pairing of bases ignore spiral</p>
	(c)	37 (1)	1	not 37 pairs
Total			6	

Question		Answer	Marks	Guidance
2	(a)	herbicide resistance <input checked="" type="checkbox"/> low protein content <input type="checkbox"/> low yield <input type="checkbox"/> slow growth rate <input type="checkbox"/> survive in drought <input checked="" type="checkbox"/>	2	2 ticks correct = 2 marks 2 ticks with 1 correct = 1 mark 1 tick correct = 1 mark 3 ticks with 2 correct = 1 mark 4 ticks with 2 correct = 0 marks 5 ticks with 2 correct = 0 marks
	(b) (i)	more food/ more crops or beans or plants/ idea that plants can be grown in more places/ idea of grown in more climates/ less need for importing/ reduced famine/ more nutritious food can be grown (1)	1	allow more consumers/more people can have them(1) allow more people can grow beans (1) allow can be grown in more countries/so people in these countries or poor climates can have beans/food/people in poor countries can have food (1) allow idea of less need for transport around the World ignore more money unless qualified eg make more profit as grow more (1) ignore lots can be grown/grown all round the World ignore because the area can now grow beans (repeating the stem) ignore can be grown in a drought/grown anywhere ignore can be exported/easier to transport

Question	Answer	Marks	Guidance
	<p>(ii) any two from:</p> <p>they may have ethical reasons (1)</p> <p>because they may harm the environment/harm biodiversity/disrupt food chains (1)</p> <p>resistance or resistant gene to pesticides or herbicides could get into other plants or could lead to increase in pesticide or herbicide use (1)</p>	2	<p>allow some farmers cannot compete (1) as they cannot afford the GM seeds (1)</p> <p>allow morally or religiously wrong (1)</p> <p>ignore you can't fiddle with nature</p> <p>ignore people don't like the idea of playing God</p> <p>allow reduce biodiversity (1) because everyone grows the same crop (1)</p> <p>allow some harmful effects may not yet have been discovered (1)</p> <p>allow the idea that it would enable use of high levels of pesticides (1) that could lead to build up in the food chain (1)</p> <p>ignore people will not eat it unless qualified</p> <p>eg people will not eat it because it is not natural or organic (1)</p> <p>but ignore they object because 'it's not natural or organic ' on its own</p> <p>ignore may not taste as good</p> <p>ignore idea of all susceptible to the same disease</p> <p>ignore references to (genetic) variation or reduction of gene pool</p>
	Total	5	

Question	Answer	Marks	Guidance
3 (a)	<p>[Level 3] Answer correctly, identifies the complete pattern (increases, decreases, levels off) in the results and explains the reasons for the increase or decrease. Quality of written communication does not impede communication of the science at this level. (5–6 marks)</p> <p>[Level 2] Answer correctly, identifies one of the patterns (not including data) in the results and attempts to explain why heart rate increases or decreases. OR identifies the complete pattern (increases, decreases, levels off) but no explanation given Quality of written communication partly impedes communication of the science at this level. (3–4 marks)</p> <p>[Level 1] An incomplete answer, identifies one pattern in results or attempts to explain why heart rate increases. Quality of written communication impedes communication of the science at this level. (1–2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targeted at grades up to E Indicative scientific points may include:</p> <p>pattern</p> <ul style="list-style-type: none"> • heart rate increases during exercise/reaches maximum • heart rate decreases after exercise • levels off or returns to normal from 16 minutes/at the end • dips below resting level at 14 minutes • recovery time of 10 minutes <p>explains pattern on increase</p> <ul style="list-style-type: none"> • muscles more active • muscles require more energy • muscles require more oxygen • muscles require more glucose • idea of increased blood supply to provide more oxygen • idea of increased blood supply to provide more glucose • muscles produce more carbon dioxide • idea of increased blood supply to remove carbon dioxide • mention of respiration <p>explains pattern on decrease</p> <ul style="list-style-type: none"> • idea that after exercise less energy/oxygen/glucose needed so heart rate falls • takes time to return to normal which is called the recovery time <p>accept high level answers eg mentions recovery time linked to oxygen debt Use L1, L2, L3 annotations in scoris; do not use ticks.</p>

Question		Answer	Marks	Guidance
	(b) (i)	same intensity of exercise/same type of exercise/ (making sure resting) pulse is same at start (1)	1	allow runs or exercises at the same speed allow (increases, decreases, levels out) pulse starts at 66 (beats per minute) each time allow same resting pulse (rate) allow same type footwear/clothing/weather conditions/same track
	(ii)	his conclusion does not match results in table (1) because recovery time in table levels off (1)	2	must refer to table for first mark eg 'he is wrong' = 0 but he is wrong as the results do not show that = 1 allow correct to some extent/not quite correct (1) allow 8 and 10 minutes are the same (1) ignore a description of pattern if no evaluation made eg results go up then level off = 0 but results go up and then level off so he is wrong = 2 (as he evaluates and refers to table) allow ideas about ways he needs to improve to help support conclusion (to be sure conclusion is correct he.....) needs more data (1) because 8 and 10 minutes could be anomalies (1) needs to repeat investigation (1) to see if there were any anomalies (1) could extend range (1) to see if pattern continues (1)
		Total	9	

Question		Answer	Marks	Guidance
4	(a)	<p>any three from:</p> <p>rate of growth in warm room or plant A is greater/ora (1)</p> <p>enzymes work at a faster rate in warmth/ora (1)</p> <p>enzymes needed for photosynthesis (1)</p> <p>enzymes needed for mitosis (1)</p> <p>mitosis needed for growth (1)</p> <p>can photosynthesise faster/cells divide faster so more growth (1)</p>	3	<p>allow plant A grows faster or grows bigger (1)</p> <p>allow enzymes work best or at optimum in warm room or at any temperature in the range 15 – 40°C (1)</p> <p>ignore enzymes grow or more enzymes</p> <p>allow an implication that enzymes control the rate of photosynthesis eg the warmer the room the faster the rate of photosynthesis Enzymes act as a biological catalyst speeding up the rate (2)</p> <p>allow enzymes control growth rate (1)</p> <p>allow temperature is a limiting factor (1)</p> <p>allow higher level answers eg enzymes required for respiration (1) eg can respire faster (in the warm room) (1)</p>
	(b)	<p>any two from:</p> <p>increases the number of plants (1)</p> <p>changes the type of plants (1)</p> <p>increase the range of temperatures used or the number of different temperatures (1)</p>	2	<p>allow ideas about using different measurements eg measure mass (1)</p> <p>allow idea of increasing range eg use higher/lower temperatures/temperatures other than 10 and 20 (1)</p> <p>allow just change temperature or do one at another temperature (1)</p> <p>ignore put plants in different conditions ignore repeat experiment allow more plants in different temperatures = 1 but more than one plant in each of a number of different temperatures = 2</p>
		Total	5	

Question		Answer	Marks	Guidance
5	(a)	0.4 (grams) (1)	1	ignore unit
	(b)	reactant not in excess/reactant that is all used up (at the end of the reaction)/reactant that is used up first (1)	1	ignore only lasts a limited time
	(c) (i)	all points plotted correctly (1) best curve through points (1)	2	points plotted to within ± 0.5 of a square allow 2 errors in plotting line must go through most points not dot to dot marking points are independent
	(ii)	(marble chips) are larg(er) because (rate of reaction is) slow(er) (1)	1	allow small(er) surface area because reaction is slow(er)

Question	Answer	Marks	Guidance
(d)	<p>[Level 3] Applies knowledge and understanding of reacting particle model to explain <u>both</u> factors in detail although the reference to more collisions may only be made for one of the factors. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Applies knowledge and understanding of reacting particle model to explain one of the factors in detail <u>or</u> partially explain both factors Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Appreciation that the rate of any reaction depends on the number of collisions in whatever context it is used Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p>This question is targeted at grades up to C</p> <p>At all levels ignore reference to faster collisions and to more particles and ignore particles vibrate more allow answers that give ora but it must be very clear that this is what candidate has done</p> <p>Indicative scientific points at levels 2 and 3 may include: <u>rate increases with temperature because</u></p> <ul style="list-style-type: none"> • acid particles move faster/acid particles have more energy • more collisions between particles of acid and marble – this does not have to be qualified eg more (successful) collisions or more collisions (per second) <p>allow – higher level answers for temperature that refer to more acid particles having sufficient energy to react or more acid particles having energy above that of the activation energy</p> <p>concentration of hydrochloric acid:</p> <ul style="list-style-type: none"> • idea of more crowded acid particles/more acid particles in same volume • more collisions between particles of acid and marble – this does not have to be qualified eg more (successful) collisions or more collisions (per second) <p>ignore references to ‘more particles’</p> <p>Indicative scientific points at level 1 may include:</p> <ul style="list-style-type: none"> • more collisions gives a faster reaction even if referring to particle size or pressure • link between number of collisions and rate of reaction <p>Use L1, L2, L3 annotations in scoris; do not use ticks.</p>
	Total	11	

Question		Answer	Marks	Guidance
6	(a)	spirit burner (1)	1	allow burner ignore flask/jar/lamp not Bunsen burner/halogen burner
	(b)	(yes because) fuel C gave same temperature rise as other fuels (1) for least/less mass or fuel burned (1)	2	marks are for explanation allow temperature rise was 20°C for all fuels (1) allow only 0.6g of fuel burned (1) allow does not burn as much fuel (as the others) (1) but ignore does not burn much fuel ie answers must be comparative
	(c)	energy given out or heat given out (1)	1	allow temperature increase allow heat or energy produced/made/exits/released allow energy or heat is lost/makes surroundings hotter (limit of acceptability) ignore gives more energy not energy or heat is created ignore references to bonds breaking or forming
	(d)	C – 3 H – 8 O – 1	2	2 or 3 correct scores 2 1 correct scores 1
		Total	6	

Question		Answer	Marks	Guidance
7	(a)	process is greener /more atoms in reactant changed into desired product (1)	1	allow more environmentally friendly allow less waste (biproduct) allow less of reactant atoms wasted allow reaction is more efficient ignore more product/higher percentage yield ignore improves products effectiveness/makes product work faster
	(b)	method B (1) highest atom economy and highest percentage yield (1)	2	If B is not given then no marks allow answers from part (a) as alternatives to highest atom economy allow more atom economy and percentage yield (than the others)(1) ignore high atom economy and high percentage yield
	(c)	(i) any two from: labour/salaries/workers (1) energy/electricity/gas (1) testing/quality control (1) time taken for development/research (1) marketing (1) rent/rates/taxes/insurance (1) plant/buildings/machinery/equipment (1) maintenance/repair/health and safety (1) pollution controls (1)	2	ignore raw materials allow cost of temperature (1) allow advertising (1) ignore transport/packaging
		(ii) (extracted from) plants (1)	1	allow correct description of extraction from plants/named plants allow animals/air/coal/water/crude oil/natural gas/fossil fuels/methane
	(d)	to make sure it works (1) to make sure they do not have (serious) side effects/to make sure they will not harm people (1)	2	allow it might not work(1) allow so they know the correct dosage (1) allow might be harmful to people (1) allow so they know the correct dosage so you don't take enough to harm you (2)
		Total	8	

Question			Answer	Marks	Guidance
8	(a)	(i)	B (1)	1	
		(ii)	D (1)	1	
		(iii)	A and C (1)	1	both needed either order
	(b)	(i)	6 (.0) (m/s) (2) but if answer is incorrect 3000 ÷ 500 (1)	2	allow 0.006 (1)
		(ii)	(idea of) speed changes (1) (idea that) he was stationary during parts of the journey (1) But (idea that) Ravi sometimes travels above average and sometimes below average speed (2)	2	allow Ravi travelling faster for some of the time (1) allow slower for some of the time (1) allow (idea of) Ravi travelling faster and slower during journey (1) allow travels at different speeds (1) allow does not travel at a constant speed all the time (1) ignore he may have travelled at this speed some time allow he stops at traffic lights (1) ignore merely this (value from (b)(i)) is the average
			Total	7	

Question	Answer	Marks	Guidance
9 (a)	<p>[Level 3] Calculates rate of momentum change OR force for both with and without an airbag and comments correctly upon it. Quality of written communication does not impede communication of the science at this level. (5–6 marks)</p> <p>[Level 2] Candidate makes 3 points which must be drawn from both sections A and B. Quality of written communication partly impedes communication of the science at this level. (3–4 marks)</p> <p>[Level 1] Candidate makes any two points from sections A and B. Quality of written communication impedes communication of the science at this level. (1–2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targeted at grades up to C Indicative scientific points may include: A: fundamental ideas:</p> <ul style="list-style-type: none"> • airbag changes shape • airbag absorbs energy (ignore absorbs force) • reduced or no injuries in a collision or crash • deflates after stopping to stop suffocation • increase stopping or collision distance • less force (exerted on driver) • collision lasts for a longer time with airbag/ora • driver takes longer to stop <p>ignore any mention of impact or slowing down time for impact</p> <p>B: use of table data:</p> <ul style="list-style-type: none"> • collision time longer with airbag • longer time to absorb energy <p>C: calculations and comments needed for level 3:</p> <ul style="list-style-type: none"> • momentum change to work out force without airbag = $\frac{15 \times 50}{0.02}$ (N) • momentum change to work out force with airbag = $\frac{15 \times 50}{0.05}$ (N) • Use $F=ma$ to calculate force for each $\frac{15 \times 50}{0.02}$ (N) <ul style="list-style-type: none"> ▪ 0.02 • and $\frac{15 \times 50}{0.05}$ (N) • clear implication of calculations in qualitative form eg same momentum change in shorter time. • less force on driver with airbag or rate of change of momentum is less • less force over longer time with airbag/ora

Question	Answer	Marks	Guidance
			<ul style="list-style-type: none">• leads to less force on driver/ora <p>allow incorrect calculation of force as 750 (N) and 300 (N) with correct comment scores 5 marks.</p> <p>allow idea of reduced acceleration with airbag.</p> <p>Use L1, L2, L3 annotations in scoris; do not use ticks.</p>

Question		Answer	Marks	Guidance
	(b)	<p>any two from: (idea of) difficult to get out of car (in an emergency) (1)</p> <p>(idea of) injury caused by seatbelt in crash or collision or impact eg, chest/neck injury (1)</p> <p>(idea of) poor driving if driver thinks they are protected in a crash or collision or impact (1)</p> <p>evidence from tests and crashes not trusted (by public/drivers)/more evidence or tests needed (1)</p>	2	<p>allow might get trapped/stuck (1)</p> <p>allow could strangle you/idea of hurting when it gets wrapped around the neck (1)</p> <p>ignore of uncomfortable/cause injury while driving</p> <p>allow restricts movement (while driving) (1)</p>
		Total	8	

Question			Answer	Marks	Guidance
10	(a)	(i)	3978 (J) (2) but if answer is incorrect 510 x 7.8 (1)	2	allow 4947 (1)
		(ii)	kinetic/ke/KE (1) gravitational potential/GPE/gpe/ge/potential (1)	2	ignore k on its own allow movement/moving (1) allow just gravitational (1)
	(b)		Twice as much work was done during the second escalator journey. <input checked="" type="checkbox"/> The same amount of work was done during the second escalator journey. <input type="checkbox"/> Half as much work was done during the second escalator journey. <input type="checkbox"/>	1	more than one tick scores 0
			Total	5	

Question	Answer	Marks	Guidance
11 (a)	<p>(idea that) between A and B or idea that weight/gravity is pulling it down (1)</p> <p>(idea that) between A and B there (is also) drag/air resistance/friction (1)</p> <p>But speeds up between A and B because gravity pulling down is greater than air resistance drag/air (2)</p> <p>between B and C forces balanced (1)</p>	3	<p>ignore mass ignore between A and B gravity force is greater</p> <p>allow between A and B gravity force greater than air resistance (1) ignore upthrust ignore resistance on its own</p> <p>allow between B and C weight/gravity = drag/air resistance/friction (1) allow upward force = downward force (1) ignore forces are the same unless forces named elsewhere in answer IF A, B or C are not mentioned then allow descriptions of the correct sections of the graph. eg at the start gravity is pulling it down (1) then the forces become balanced (1)</p>
(b)	<p>There is no gravity on the Moon. <input type="checkbox"/></p> <p>There is no atmosphere on the Moon. <input checked="" type="checkbox"/></p> <p>Objects have no weight on the Moon. <input type="checkbox"/></p> <p>There is no drag as the object falls. <input checked="" type="checkbox"/></p> <p>More drag is produced as the object falls. <input type="checkbox"/></p>	2	<p>2 ticks correct = 2 marks</p> <p>2 ticks with 1 correct = 1 mark</p> <p>1 tick correct = 1 mark</p> <p>3 ticks with 2 correct = 1 mark</p> <p>4 ticks with 2 correct = 0 marks</p> <p>5 ticks with 2 correct = 0 marks</p>
	Total	5	

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