

Additional Science B

General Certificate of Secondary Education

Unit **B721/01**: Modules B3, C3, P3 (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 sue 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
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

Subject specific Marking Instructions

/	=	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
<u> </u>	=	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)	diameter (of the onion) (1)	1	allow width ignore time
		(ii)	wider / widest / bigger / biggest (1)	1	answer must be a comparison but allow it has a diameter of 50 (cm) allow grew more ignore grows faster / better
	(b)		any two from: (idea of) use a layer (of onion tissue) (1) put a stain on it (1) use of cover slip (1)	2	allow thin piece / thin slice / one cell thick piece (of onion) / so light can pass through ignore just small / slice / skin / little strip / use a cell allow put iodine on it / use a dye ignore use ink allow cover with a (microscope) slide
			Total	4	

Question		Answer	Marks	Guidance
2	(a)	respiration (1) so that the muscles can contract (1)	2	allow to release energy / for energy / give energy to muscles / provides energy for muscles ignore to store energy / make energy / produce energy allow so muscles can move / muscles can work allow muscles need energy to contract (2) allow muscle cells need energy to work (2)
	(b) (i)	(idea that) the fitter a person is, the higher their VO ₂ Max / the more strenuous the sport, the higher their VO ₂ Max (1)	1	allow ORA allow a sportsman has a higher VO ₂ Max / ORA allow the more sports you do the higher VO ₂ Max / ORA allow the fitter a person is, the bigger the range of VO ₂ Max / ORA allow positive (relationship)
	(ii)	60 = 2 marks but indication of resting rate of 50 and maximum rate of 200 = 1	2	allow indication of values marked on graph
	(iii)	No, because the minimum for a cross-country skier is 65 / not in range 65-94 (1)	1	allow idea of outside the range eg because a cross-country skier is in the range of 64-95 / 'it is not high enough' / below the range / to be a cross country skier he would have to increase his VO ₂ Max by 5 allow ECF from b) ii)

Question		Answer	Marks	Guidance
	(c) (i)	<p>any two from:</p> <p>more blood (pumped per heart beat) (1)</p> <p>so more oxygen / more glucose (1)</p> <p>more respiration possible (1)</p> <p>but</p> <p>more blood to the muscles (2)</p> <p>more oxygen to the muscles / more glucose to the muscles (2)</p>	2	<p>allow blood pumped more quickly</p> <p>allow heart can pump with slower heart beat but with same results</p> <p>allow (muscles get) oxygen quicker / (muscles get) glucose quicker</p> <p>ignore more oxygen is made</p> <p>allow more oxygenated blood (2)</p>
	(ii)	<p>platelets will clot the blood (1)</p> <p>will not get pumped out / block blood vessels (1)</p>	2	<p>allow clots in the blood</p> <p>allow (idea that) the blood cannot flow / less blood flow / blood moves slower</p> <p>allow blocks the chambers (of the heart)</p> <p>ignore causes heart attack / heart disease</p>
	(iii)	<p>percentage in the sample (13 out of 78 / 16.7%)</p> <p>is similar to the percentage in the whole population / 15% (1)</p>	1	<p>answer must have a comparison</p> <p>allow 15% of 78 is close to 13</p> <p>allow 15% of whole population have fibrillation and haven't skied</p> <p>ignore same number in the sample as in the whole population</p>
Total			11	

Question	Answer	Marks	Guidance
3	<p>Level 3 (5–6 marks) Answer includes information about natural cloning in plants <u>and</u> animals AND Answer includes information about artificial cloning in plants <u>and</u> animals Quality of written communication does not impede communication of the science at this level.</p> <p>Level 2 (3–4 marks) Answer includes information about natural cloning in plants <u>or</u> animals AND includes simple information about artificial cloning in plants <u>or</u> animals OR Answer includes information about natural cloning in plants <u>and</u> animals OR Answer includes information about artificial cloning in plants <u>and</u> animals Quality of written communication partly impedes communication of the science at this level.</p> <p>Level 1 (1–2 marks) Answer includes information about natural cloning OR Answer includes information about artificial cloning 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 up to grade E</p> <p>Relevant points include:</p> <p>Natural cloning:</p> <ul style="list-style-type: none"> • natural cloning is an example of asexual reproduction / mitosis • natural cloning produces genetically identical copies • named example or description of natural cloning in plants e.g. bulbs / potatoes / runners / strawberries • named example or description of natural cloning in animals e.g. identical twins <p>Artificial cloning:</p> <ul style="list-style-type: none"> • artificial cloning produces genetically identical copies • named example or description of artificial cloning in plants e.g. cuttings / tissue culture • named example or description of artificial cloning in animals e.g. Dolly the sheep <p>allow higher level answers about tissue culture techniques / nuclear transfer / genetic engineering</p> <p>Use the L1, L2, L3 annotations in scoris. Do not use ticks.</p>
	Total	6	

Question		Answer	Marks	Guidance
4	(a)	mutation (1)	1	
	(b)	(i) lactic acid is made (1) by anaerobic respiration (1)	2	ignore anaerobic exercise as an extra marking point allow carbon dioxide is released / idea of more carbon dioxide
		(ii) do not fit through (small) blood vessels (so easily) / get tangled / clumped together (1)	1	allow named blood vessels allow (idea that they) do not flow easily / do not have such a large surface area / do not absorb oxygen so quickly / less oxygen carried / less oxygen absorbed / less haemoglobin carried not no oxygen is carried
		Total	4	

Question		Answer	Marks	Guidance
5	(a)	<p>any one from:</p> <p>hard (1)</p> <p>high melting point (1)</p>	1	<p>allow hard wearing / it can't be scratched</p> <p>ignore durable / hard to break / good at cutting things</p> <p>ignore strong / sharp / dense</p> <p>allow it will not melt</p> <p>as an extra marking point</p> <p>allow (good) thermal conductor</p>
	(b)	<p>any two from:</p> <p>black (1)</p> <p>lustrous or shiny (1)</p> <p>opaque (1)</p> <p>slippery (1)</p> <p>(good) conductor of electricity (1)</p> <p>high melting point (1)</p>	2	<p>allow (have layers that) slide</p> <p>ignore soft / lubricant</p> <p>ignore (good) conductor</p> <p>as an extra marking point</p> <p>allow correct chemical properties e.g. burning to give carbon dioxide</p>
		Total	3	

Question		Answer	Marks	Guidance	
6	(a)	<p>continuous runs all the time / constantly being made / made 24 / 7 / production does not start and stop / AW (1)</p> <p>batch made on demand / when it is needed (1)</p>	2	<p>allow ORA for batch e.g. batch makes a quantity and then there is a break in production</p> <p>allow ORA for continuous e.g. continuous is being made even when it is not required</p> <p>ignore lots made / small amounts made</p>	
	(b)	(i)	$C_7H_6O_3$ or C_2H_3OCl (1)	1	<p>allow both ringed</p> <p>ignore name of reactant ringed but if anything incorrect ringed = 0 marks</p> <p>if nothing ringed in the equation allow the reactant or reactants ringed in the table</p>
		(ii)	36.5 (1)	1	

Question	Answer	Marks	Guidance
(iii)	83.1 (%) scores (2) if answer incorrect for one mark: $\frac{180 \times 100}{216.5} \quad \text{or} \quad \frac{M_r \text{ of desired products} \times 100}{\text{sum of } M_r \text{ of all products}}$ $\text{or} \quad \frac{M_r \text{ of desired products} \times 100}{\text{sum of } M_r \text{ of all reactants}} \quad \text{or} \quad \frac{180 \times 100}{138 + 78.5}$ $\text{or} \quad \frac{M_r \text{ of desired products}}{\text{sum of } M_r \text{ of all reactants}} \quad \text{or} \quad \frac{180}{138 + 78.5}$ $\text{or} \quad \frac{M_r \text{ of desired products}}{\text{sum of } M_r \text{ of all products}} \quad \text{or} \quad \frac{180}{180 + 36.5}$	2	allow 83 / any number of decimal places if rounded correctly eg 83.141 (2) but if rounded incorrectly eg 83.140 (1)
(c)	(idea of) safe to use / to check they are safe / to check for side effects / they could be harmful / to make sure they are not harmful (1)	1	allow to check they will work / to see if they can be improved
	Total	7	

Question	Answer	Marks	Guidance
7	<p>Level 3 (5–6 marks) Answer includes a detailed description of the method AND Explains why fuel C is the fuel which gives out most energy. Quality of written communication does not impede communication of the science at this level.</p> <p>Level 2 (3–4 marks) Answer includes a reasonable description of the method AND attempts to work out which fuel gives out most energy Quality of written communication partly impedes communication of the science at this level.</p> <p>Level 1 (1–2 marks) Answer includes a limited description of the method OR attempts to work out which fuel gives out most energy 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 up to grade C Relevant points at level 3 include:</p> <ul style="list-style-type: none"> • method includes same amount of water in calorimeter • measure temperature before and after heating or measure temperature rise • measure mass of burner before and after or mass of fuel burned • fuel C identified due to least mass of fuel burned for same temperature rise <p>Relevant points at level 2 include:</p> <ul style="list-style-type: none"> • water in calorimeter • fuels in the burner • correct reference to a fair test • measure temperature before and after heating or measure temperature rise • measure mass of burner before and after or mass of fuel burned • some evidence of correctly processing data e.g. the temperature has increases by 20°C / uses the least fuel <p>Relevant points at level 1 include:</p> <ul style="list-style-type: none"> • water in calorimeter • fuels in the burner • correct reference to a fair test • measure temperature • measure mass of fuel • some evidence of correctly processing data e.g. same temperature rise / orders the amount of fuel used <p>Use the L1, L2, L3 annotations in scoris. Do not use ticks.</p>
	Total	6	

Question		Answer	Marks	Guidance
8	(a)	magnesium + hydrochloric acid → magnesium chloride + hydrogen (1)	1	<p>not and or & for + allow = instead of → allow correct formulae or mix of words and correct formulae allow $\text{Mg} + \text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$ ie symbol equation does not have to be balanced not '+ energy or + heat' on either side of equation ignore 'heat' written above the arrow not an equation including lumps / solution / gas</p>
	(b) (i)	20 (seconds) (1)	1	
	(ii)	106 (cm ³) (1)	1	
	(c)	acid runs out / magnesium used up (1)	1	<p>allow 'not enough acid available' allow no more reactant(s) / no more chemicals (to react) allow all of the magnesium has dissolved ignore no more gas / no more bubbles produced ignore no more successful collisions</p>
	(d)	(rate of reaction) increases (1) more surface area (of magnesium or powder) (1)	2	<p>allow faster reaction</p> <p>ignore more powder / more particles</p> <p>allow higher level answers in terms of collisions e.g. more frequent collisions (between acid and magnesium)</p>

Question		Answer	Marks	Guidance
	(e)	<p>any three from: increase temperature (of acid) / hotter (acid) / AW (1) use more concentrated acid / AW (1) use a catalyst (1) stir / shake (1)</p>	3	<p>allow heat (the acid)</p> <p>ignore use more acid / stronger acid</p> <p>ignore pressure / pH</p> <p>allow explanations of methods given e.g. increase temperature (1) because particles have more energy / particles move faster (1) and more collisions (1)</p> <p>increase concentration (1) because particles are more crowded (1) and more collisions (1)</p> <p>add a catalyst (1) which will speed up the reaction whilst remaining unchanged itself (1)</p>
Total			9	

Question		Answer	Marks	Guidance
9	(a)	D (1)	1	more than one answer circled = 0 marks
	(b)	Z (1)	1	more than one answer circled = 0 marks
	(c)	(i) (a large) force (on the person) (1)	1	ignore push / g force / friction / momentum
		(ii) any two from: absorbs energy (1) padding squashes / changes shape (1) idea of keeping in seat / AW (1)	2	ignore reduces the impact / absorbs force allow padding acts as a cushion ignore padding takes the force allow stops the person moving (out of the seat) ignore reduces injury as extra marking points allow idea of reduced force (on person) (1) allow idea of increased stopping time (1) allow idea of reduced acceleration / deceleration (1)
		Total	5	

Question	Answer	Marks	Guidance
10	<p>Level 3 (5–6 marks) Compares the accelerations for Helen and Finn over the whole race. Quality of written communication does not impede communication of the science at this level.</p> <p>Level 2 (3–4 marks) Describes the different accelerations for Helen AND Describes the different accelerations for Finn Quality of written communication partly impedes communication of the science at this level.</p> <p>Level 1 (1–2 marks) Describes the different accelerations for Helen OR Describes the different accelerations for Finn OR Describes the accelerations for Helen and Finn for part of the race 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 up to grade C</p> <p>Relevant points at level 3 include:</p> <ul style="list-style-type: none"> between 0 seconds and 900 seconds Finn’s acceleration is greater than Helen’s acceleration / between 0 seconds and 900 seconds they have different accelerations / ORA between 900 seconds and 1800 seconds Helen is moving with steady speed / not acceleration (or decelerating) but Finn is decelerating (at the same rate as he accelerated). <p>need a correct calculation or time references in comparisons</p> <p>Relevant points at level 1 and 2 include:</p> <ul style="list-style-type: none"> at the start Helen is accelerating / increasing in speed / graph has a positive gradient at the start Finn is accelerating / increasing in speed / has a positive gradient towards the end Helen is not accelerating / Helen moves with constant speed / graph is flat towards the end Finn is decelerating / is slowing down / decreasing in speed / graph has a negative gradient <p>if answer only contains information about shape of graph then limited to level one</p> <p>Use the L1, L2, L3 annotations in scoris. Do not use ticks.</p>
	Total	6	

Question		Answer	Marks	Guidance
11	(a)	watt (1)	1	more than one answer circled = 0 marks
	(b)	diesel (1) small (1) any number less than 4.0 (1)	3	
		Total	4	

Question			Answer	Marks	Guidance
12	(a)	(i)	(Braking distance is the distance taken to stop once the) brakes have been applied / pressed (1)	1	allow (brake) pedal has been pushed not once the driver has thought about pressing the brakes
		(ii)	(idea that) the deeper the tyre depth the shorter the braking distance / ORA (1) and any one from: so (with deeper tread) less likely to crash / AW (1) so (with deeper tread) it stops quicker / so (with deeper tread) it takes less time to stop (1)	2	ignore comparisons between good tread and bad tread ignore less dangerous but allow lets the driver control the car
	(b)		advantages max two marks from: safer for longer / AW (1) tyre would not need replacing as much (1) has a shorter braking distance for longer (2) disadvantages max two marks from: (idea that) wear of the tyre is not linear (1) (idea that) tyre can quickly change from safe to unsafe (1) (idea that) need to check the tyre more often once it reaches 4mm or less tread / replace once it reaches 4mm (1)	3	 ignore the tyre (tread) lasts longer ignore tread of tyre goes down faster allow the tyre suddenly becomes unsafe /once it reaches 4mm it increases in braking distance rapidly
Total				6	

Question		Answer	Marks	Guidance
13	(a)	air resistance (1)	1	allow drag / friction / resistance ignore upthrust
	(b)	any one from: reduce the (horizontal surface) area (1) (idea) of moving to a vertical or standing position (1) roll into a ball shape / move arms in (1)	1	allow make streamlined / make aerodynamic / dive head first (1)
	(c)	terminal speed will be less (than 50 m / s) (1) and one from: (idea that) more force (against movement) (1) (idea that) more drag or more air resistance or more friction (against movement) (1) greater (surface) area (1) decreased resultant force (1)	2	not more gravity ignore upthrust
		Total	4	

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