OCR
Oxford Cambridge and RSA

GCSE

Additional Science B

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

General Certificate of Secondary Education

Mark Scheme for June 2016

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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.

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

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

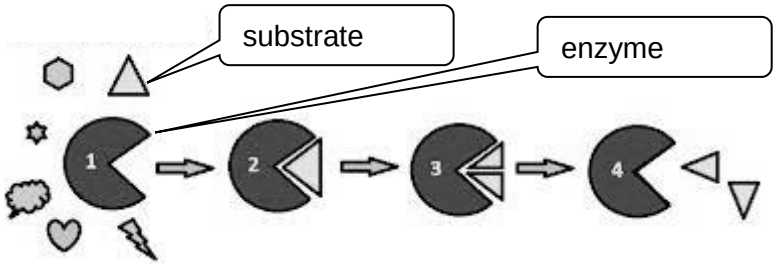
Question	Answer	Marks	Guidance
1 a	any age between 12 to 19 (years of age)	1	
b	**any two from:** 0-4/5 both similar heights (1) 4/5-9 boys taller / Similar heights at 9 (1) girls taller after 9 (1) boys are (slightly) heavier than/ similar to girls (between range 0 to 10 years) ORA (1)	2	0-4/5 both similar heights then boys grow taller than girls (2) **allow** growth is similar aged 0-4/5 **allow** both similar heights but girls shorter between 4/5 and 8 **ignore** statements after 10 years
c	0 to 2 (years)	1	**allow** correct answer ticked, ringed or underlined
	Total	4	

Question	Answer	Marks	Guidance
2 a i	114 -162 (2) but (220 - 30 =) 190 (1)	2	
a ii	train more on his swimming / improve swimming technique ideas (1)	1	**allow** swimming heart rate is too low / swim faster
a iii	**any two from:** take pulse / how pulse is taken e.g. finger on wrist/neck/groin (1) time for 15 seconds/suitable time to calculate beats per minute (1) record until pulse is back to resting pulse (1)	2	**allow** take heart rate **allow** count BPM **allow** until back to normal heart rate **but** take the pulse see how long it takes to get back to normal (2)
b	**any two from:** increased muscle contraction (1) therefore needs more energy (from aerobic respiration) (1) (more energy) to do the extra work (1)	2	answer must be qualitative **allow** muscles work/used more **ignore** Mike's doing more exercise **allow** so energy must come from increased aerobic respiration **allow** more energy for more work (2) if no other mark then **muscles** need **more** oxygen (1)
	Total	7	

Question	Answer	Marks	Guidance
3 a i	**[Level 3]** Must have a comment on the breathing problem **or** just the idea of inbreeding **and** identifies two selective breeding points. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Identifies one selective breeding point **and** suggests one physical characteristic that causes breathing problems **or** Identifies two selective breeding points. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Identifies one selective breeding point **or** suggests one physical characteristic (that causes breathing problems). 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 C.** **Indicative scientific points about breathing problems may include:** • inbreeding leads to shorter and shorter noses • smaller noses/ reduced nasal passages interferes with breathing • small noses can't clean or heat up air so more chance of infections **Indicative scientific points about selective breeding may include:** • identifies selective breeding / inbreeding as process • wolves/dogs show variation (not dogs from different species) • select desired characteristic /shorter nosed/ short legged wolves/dogs • breed shorter nosed grey wolves together • (keep selecting shorter nosed / short legged characteristic) over many generations / over a long period of time **Indicative scientific points about physical characteristic that cause breathing problem** • small nose / squash nose / shorter nose / upturned nose squashed faces / rolls of skin on face = L1 1 **Use the L1, L2, L3 annotations in Scoris. Do not use ticks.**

Question	Answer	Marks	Guidance
a ii	(a change to) a gene / chromosomes / DNA / sequences of bases (1)	1	**allow** something that usually makes the gene faulty **allow** phonetic spelling of gene
b i	**39** (1)	1	
b ii	diploid (1)	1	**allow** correct answer ticked, ringed or underlined
	Total	9	

Question	Answer	Marks	Guidance
4 a i	acid conditions / low pH / pH lower than 7 / (3 drops of) hydrochloric acid / HCl (1) **not** boiled (1)	2	**ignore** with (distilled) water **allow** 'unboiled' (1) **allow** does not work when boiled (1) **allow** higher level responses about denaturing (1) **ignore** at 40 °C / can't be heated / can't be at high temperatures **not** pepsin is killed at higher temperatures
a ii	**any two from** (shape of) pepsin or enzyme is a 'lock'(1) the substrate or protein is a 'key' **and** matches or fits the 'lock' (shape) or pepsin or enzyme (1) other foods like starches will **not** match or fit the 'lock' (shape) or pepsin or enzyme (1)	2	 **allow** higher level answers e.g. pepsin or enzyme has an active site (1) **allow** substrate 'locks' onto the pepsin or enzyme (1) **allow** protein fits into the pepsin or enzyme / protein is specific to the pepsin or enzyme (1) **allow** egg(-white) as idea of protein **ignore** enzyme fits into the pepsin **allow marking points from labelled diagram** 'lock' shape **labelled** pepsin or enzyme (1) 'key' shape **labelled** protein or substrate **and** shown fitting the 'lock' (1) other foods like starch 'key' shown not fitting the 'lock' (1)

Question	Answer	Marks	Guidance
			 (2) **if no other mark awarded allow 1 mark for correct unlabelled diagram**
b	idea of optimum temperature / works best / close to body temperature (1)	**1**	**allow** below 40^0C too slow above 40^0C denatured **not** enzyme killed above 40^0C **allow** idea of fair test / fair comparison
	Total	**5**	

Question	Answer	Marks	Guidance
5 a	calcium carbonate + nitric acid → calcium nitrate + carbon dioxide + water (1)	1	**allow** = instead of → **not** and / & / instead of + **allow** correct formulae but equation does not need to balance e.g. $CaCO_3 + HNO_3 \rightarrow Ca(NO_3)_2 + CO_2 + H_2O$ **allow** mix of correct formulae and words
b i	0.52 (g) (1)	1	**allow** between 0.51 to 0.53g
b ii	between 0 and 1 minute ✓ between 1 and 2 minutes ☐ between 2 and 3 minutes ☐ between 3 and 4 minutes ☐ (1)	1	
b iii	(no) (mass /volume of) gas made (every minute) decreases/slows down / idea that more gas is made in the first minute than in subsequent minutes (1)	1	**no mark for no, mark is for explanation** **allow** two values that indicate the mass every minute is different **allow** if it was the same the graph would be a straight line
c	all (nitric) acid is used up / all calcium carbonate/marble chips is used up (1)	1	**allow** all reactant used up **allow** there was a limiting reactant **ignore** calcium carbonate has dissolved **ignore** loses all its reactants/used up all its substance/nothing left to react with

Question	Answer	Marks	Guidance
d	idea that (acid) particles move slower / particles have less energy (1) idea of less(frequent or effective) collisions(between acid and marble chips) (1)	2	**assume unqualified answer refers to cold acid** **allow ora** if specified **allow** fewer collisions **ignore** slower collisions/vibrate **allow** higher level answers e.g. collisions between marble chips and acid are less energetic
e	**any two from:** increase concentration (1) make particles more crowded (1) have more (frequent) collisions (1) use powdered or crushed material (1) use more surface area (1) stir / shake (1) add a catalyst (1)	2	 **ignore** pressure/more acid/more calcium carbonate **allow** cutting reactant smaller **ignore** use smaller particles
	Total	**9**	

Question	Answer	Marks	Guidance
6 a	Mg / H_2O (1)	1	**any incorrect formula is zero** **allow** $2H_2O$ / Mg + H_2O / Mg + $2H_2O$ **allow** correct answer ticked, circled or underlined in equation if answer line is blank **ignore** magnesium and water
b	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 (limit of acceptability) **ignore** gives more energy **NOT** energy or heat is created
c	B (1) largest temperature rise per minute (1)	2	 **allow** all correct calculations of temperature rise per minute in table (A - 5°/min; B - 6°/min; C - 4°/min; D - 5°/min)
	Total	**4**	

Question	Answer	Marks	Guidance
7 a	**any two from:** batch process makes small/limited/fixed amounts **ora** (1) idea that batch makes chemicals on demand **ora** (1) idea that batch process does not operate 24/7 **ora** (1) idea that in batch process need to clean the containers between batches (1)	2	**allow** ora for continuous process **allow** idea of not as much/certain amount each day/made in groups **ignore** made in batches / continuous are made continuously **allow** does not have to be stopped and restarted / is not using a production line / does not carry on until somebody switches the machine
b	**any two ideas from** long time (1) laws (1) safety (1) research or development (1) raw materials (1) conditions (1) labour (1)	2	**allow** idea of a long time needed / takes 10 years / can take years to develop / can take years to test a new medicine / its extensive work / time consuming (1) **allow** strict safety laws must be met / need government approval (1) **allow** safe to use / make sure it doesn't harm people (1) **allow** has to be trialled / has to be tested / has to be developed / has to be researched (1) **allow** supplies may be rare or costly (1) **allow** specific conditions needs / need high temperatures / need (specialised) equipment (1) **allow** less automation is possible / high wages / labour intensive / need big team (of scientists) (1)

Question	Answer	Marks	Guidance
c	**Level 3 (5 – 6 marks)** calculates the percentage yield for method C **and** identifies D or B and explains which method should be used to make the painkiller. Quality of written communication does not impede communication of the science at this level. **Level 2 (3 – 4 marks)** calculates the percentage yield for method C **or** identifies D or B and explains which method should be used to make the painkiller. Quality of written communication partly impedes communication of the science at this level. **Level 1 (1 – 2 marks)** Identifies which method (either D or B) should be used to make the painkiller with little or no explanation **OR** attempts to calculate the percentage yield for method C. 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 C** **Indicative scientific points may include:** % yield for method **C** = $\frac{6.9}{11.5}$ x 100 = 60% Method **D** should be used to make the painkiller as it has the highest percentage yield and a high atom economy. • high/highest percentage yield / 90% • high atom economy / 80% but **not highest** • high/highest actual mass produced /12 g / waste is only 1.3 g / less/least waste Method **B** has the highest atom economy but the lowest percentage yield. • high/highest atom economy / 85% • lowest percentage yield / 50% gives an incorrect value in the table and nothing else = L1 1 **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	Total	**10**	

Question	Answer	Marks	Guidance
8	**any two from:** high melting point (1) insoluble in water (1) lustrous or shiny (1)	2	**allow** solid
	Total	**2**	

Question	Answer	Marks	Guidance
9 a	joule [1]	1	**allow** correct answer circled [1]
b i	300 (J) [2] **but if answer incorrect** 0.6 x 500 **OR** 0.15 x 4 x 500 scores [1]	2	 **allow** 0.15 x 500 = 75 (J) [1]
ii	doubled [1]	1	**allow** increased by 300 (J) or ecf from (b)(i) e.g. 150 **allow** 600 (J)
c	Thursday [1]	1	more than one answer = 0 **allow** correct answer indicated in table if answer line blank [1]
	Total	**5**	

Question	Answer	Marks	Guidance
10	**[Level 3]** Describes **six** changes in acceleration **/** speed. Quality of written communication does not impede communication of the science at this level (5 – 6 marks) **[Level 2]** Describes **four** changes in acceleration / speed. Quality of written communication partly impedes communication of the science at this level (3 – 4 marks) **[Level 1]** Describes **two** changes in acceleration / speed. **or** Describes the shape of the graph 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 C.** **descriptions of changes in acceleration:** accelerating between **A** and **B** no acceleration between **B** and **C** deceleration between **C** and **D** greater acceleration shown by higher gradient / deceleration between **C** and **D** is LESS than acceleration between **A** and **B** / acceleration time is less than deceleration time **descriptions of changes in speed:** increasing speed between **A** and **B** constant speed between **B** and **C** decreasing speed between **C** and **D** **descriptions of changes in the shape of the graph:** positive gradient / line goes up between **A** and **B** horizontal line / no gradient / between **B** and **C** negative gradient / line goes down between **C** and **D** acceleration changes A➔B gradient is greater / line is steeper than C➔D gradient the speed changes over the journey / speed is not constant for the whole journey **Use the L1, L2, L3 annotations in scoris.** **Do not use ticks.**
	Total	**6**	

Question	Answer	Marks	Guidance
11 a i	**any two from** (use crash test) dummies (1) use sensors / computer simulations / computer models (1) measure or observe the injuries or forces or impact / assess the damage done (1) use the same conditions for all tests (1) carry out the test with and without the seat belt / with different seatbelts (1) idea of questionnaires / surveys(1)	2	**allow** crash tests (1) **allow** sensors on (crash test) dummies (2) **allow** measure or observe the injuries or forces or impact on (crash test) dummies when the car crashes (2) **allow** named examples of the same conditions e.g. same speed / same car (1) same size dummy (2)
ii	**any two from** to improve the design (of the seatbelt) (1) so public or scientists or manufacturers know about the tests (1) to compare results / check their results (1) to use the results (for further tests) / to improve (the tests) / to develop (the tests) (1) **but** so public or scientists or manufacturers can compare the seatbelts / public or scientists can see which is best (2)	2	**ignore** for publicity / so idea are not stolen / to have the rights / to gain credit **allow** 'peer review' / try for themselves / for proof / are they right or wrong (1) **allow** to repeat the test (1)

Question	Answer	Marks	Guidance
b	**any one from** holds the driver in the seat / restrains the bottom half of the body (1) spreads the force over a larger area (1) can stretch **more /** can stretch **further** (1) has stronger anchorage / more anchorage (1)	1	**assume answer is about 3-point seat belt unless otherwise stated** **allow** not move around as much / better hold / more secure / more strapped in / supporting in more areas / stops you slipping out (1) **allow** less pressure / spreads the impact / reduces the impact (1) reduces the force (1) **ignore** momentum **allow** stronger / less likely to break (1)
c	(idea that seat belts must have) ability to stretch [1] once seat belts have been in an accident they cannot stretch again [1]	2	**allow** material must be strong / flexible / expandable / elastic [1] **allow** higher level answers: e.g. ability to absorb energy [1] **allow** lose elasticity / lose ability to absorb energy / permanently stretched / overstretched **allow** the anchorage points / seat belts may be damaged by the accident [1]
d	ABS / traction control / electric windows / (intelligent) cruise control / paddle shift controls / adjustable seats [1]	1	**allow** any suitable feature but ignore those that protect in an accident e.g. airbags / crumple zones
	Total	**8**	

Question	Answer	Marks	Guidance
12 a i	to (make it easier to) compare / AW [1]	1	
ii	**any two from** fuel consumption is more for Model S (as it has a bigger engine / heavier / AW) **ora** [1] fuel consumption is greater in towns (as changing speed / stopping and starting / AW) **ora** [1] the combined fuel consumption is a value between the other two (as there are different speeds) [1]	2	**ignore** references to CO_2 / efficiency **allow** car R cheap**er** to run
b	**F** [1] (anywhere in the range of £)150 ➔ 350 [1]	2	more than one letter no credit for first marking point.
c	slower / less speed / less velocity / **ora** [1]	1	**allow** she stops more often [1] **allow** lower speed limits/cannot go as fast
	Total	**6**	

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