OCR
Oxford Cambridge and RSA

GCSE

Additional Science B

Unit **B721/02:** Modules B3, C3, P3 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2017

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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.

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	**B** (1) high **pressure** (so liquid can squeeze liquid through) / slow or low **speed** (so enough time for exchange) (1)	2	**if A or C then 0 marks for question** **ignore** obtain, under etc. and look for high pressure or idea of a lot of pressure **ignore** takes longer or answers just about the time it takes
b	**A** thick **walls** as pressure is high / muscular **walls** as pressure is high (1) **C** large or wide **lumen** to allow the blood to flow at low pressure / **valves** to allow the blood to flow at low pressure or prevent back flow (1)	2	**ignore** elastic walls **allow** thick walls to stop it bursting (1) **if no other marks then award one mark for any one of the following:** **allow A** has thick **walls** / muscular **walls and C** has large **lumen** / **valves** (1) **allow A** has higher pressure (than **C**) (1) **allow A** is an artery and **C** is a vein (1)
	Total	4	

Question	Answer	Marks	Guidance
2 a i	**acrosome** ✓ **chromosome** **gene** **nucleus** **vein** (1)	1	**more than one tick is 0 marks**
a ii	39 (1)	1	**not** 39 pairs
a iii	**any two from:** **chromosomes** pair up (1) (the pair of) **chromosomes** separate (to opposite poles) (1) **chromosomes** divide (1) **4** (haploid daughter) cells made (1)	2	**allow** marks from detailed labelled diagrams **ignore** references to cells / DNA / duplication / copying **allow** (first division) separates the pairs of chromosomes (2) **allow chromatids** are pulled (apart) / **chromosomes** are pulled (apart) (1) **allow chromosomes** split and half (2) **not** 4 diploid cells are made

b i	**agree:** to cure people / help people live / save lives / prevent illness (1) idea that it is cheap(er) (1) idea that cancer is a serious illness (1) **against:** unsure of effects on chickens / goats / animals / humans / us (1) idea of cruelty to animals / morally wrong / unnatural (1) (medicine) proteins could get into the food (chain) (1) idea that eating chickens / goats / animals could affect us in the long run (1)	**2**	**must have 1 agree mark and 1 mark against** **allow** benefit health (1) **allow** increases yield (1) **allow** concern about the harm it may do to goats / chickens / animals / humans / us (1) **allow** idea of religious reasons / religious belief / unethical / people are vegetarian (1)
b ii	**any one from:** idea of producing **many copies** of animals or plants with desirable characteristics (1) (producing human embryos to supply) stem cells (1)	**1**	 **allow** examples e.g. to produce **lots** of cows that have a high milk yield (1) **ignore** just prevent a species becoming extinct / make the same animals again / replace a beloved pet / provide the food we need **allow** to produce replacement organs / organs for transplant (1)

c	**any two from:** idea of eugenics / people could choose the features of a **human** / idea of 'designer babies' (1) idea that this is germ line modification / that if anything goes wrong it can affect all descendants (1) idea that gene therapy cannot be reversed (1)	**2**	**ignore** general statements about e.g. unethical / immoral / against God / money could be spent elsewhere / religious beliefs **allow** could cause new genetic disorders or mutations (1) **ignore** just changes DNA
d	**advantage maximum 2 marks:** can be sure of the characteristics of the plants (1) all plants will be (genetically) identical (1) it is possible to mass produce plants (1) quicker process (than growing from seed) (1) can grow plants that are difficult to grow from seed (1) **disadvantage maximum 2 marks:** if plants become susceptible to disease all plants will be affected (1) if plants become susceptible to change in environmental conditions then all plants will be affected (1) lack of **genetic variation** (1)	**3**	 **allow** you get the plant you want (1) **allow** you will get an exact copy (1) **allow** to make lots of plants / to get more plants (1) **ignore** to create large crop **ignore** just easier **ignore** references to cost e.g. more profit / cheap **allow** if one gets a disease then they all will (1) e.g. drought will affect all of them (1) **allow** less opportunity to create new varieties in future / reduced gene pool (1)
	Total	**12**	

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>3 a</td><td>
[Level 3]
Identifies more than one advantage and more than one disadvantage including that dry mass is the best method to use but in this example measuring height/length is the most appropriate.
Quality of written communication does not impede communication of the science at this level.
(5 – 6 marks)
[Level 2]
Identifies more than one advantage and more than one disadvantage including that dry mass is the best method to use.
Quality of written communication partly impedes communication of the science at this level.
(3 – 4 marks)
[Level 1]
Identifies at least one advantage and one disadvantage.
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)
</td><td>6</td><td>
This question is targeted at grades up to A.
Indicative scientific points may include:

<table>
<tr><th></th><th>advantages</th><th>disadvantages</th></tr>
<tr><td>length / height</td><td>easy to measure / quick to measure

causes no harm / does not destroy the individual</td><td>no measure of total amount of living material

different parts grow at different rates

does not measure width / other dimensions</td></tr>
</table>
<table>
<tr><th></th><th>advantages</th><th>disadvantages</th></tr>
<tr><td>wet mass</td><td>all living material is measured

easy to measure human or animal wet mass</td><td>(water) content is variable

trees may be damaged (when digging them up)</td></tr>
</table>
<table>
<tr><th></th><th>advantage</th><th>disadvantage</th></tr>
<tr><td>dry mass</td><td>all living material is measured

most accurate / best method (ignore very accurate)</td><td>involves death of organism</td></tr>
</table>
allow weight for mass throughout
Use the L1, L2, L3 annotations in RM. Do not use ticks.
</td></tr>
</table>

b i	15 (percent per year) (1)	**1**	**answer line takes precedence but if blank look for answer in the table** **allow** answers in the inclusive range of 14.6 to 15.4
b ii	**brain** **A** **reproductive system** **C** **whole body mass** **B** (2)	**2**	**all correct 2 marks** **one or two correct 1 mark**
	Total	**9**	

Question	Answer	Marks	Guidance
4 a	$Mg + 2HCl \rightarrow H_2 + MgCl_2$ correct formulae of reactants and products (1) balancing – dependent on correct formulae (1)	2	**allow** = or ⇌ instead of arrow **allow** any correct multiple e.g. $2Mg + 4HCl \rightarrow 2H_2 + 2MgCl_2$ **not** and or & instead of + **allow** one mark for balanced equation with minor errors of case, subscript and superscript e.g. Mg + 2HCl → H2 + MgCL2
b i	150 (cm^3) (1)	1	**ignore** units **allow** 0.15 **dm^3**
ii	(lumps) have small**er** surface area / have less exposed particles (1) (lumps) have less collisions (per second) (1)	2	**assume answer refers to magnesium lumps** **answers must be comparative** **allow** ora if powder specified **ignore** references to volume **allow** ora if powder specified **allow** lower chance of collisions / less frequent collisions / less successful collisions (1) **allow** collisions less likely for lumps (1) **ignore** references to speed e.g. collisions are slower
	Total	**5**	

Question	Answer	Marks	Guidance
5 a i	hydrogen peroxide = 34 water = 18 **and** oxygen = 32 (1)	1	**all three required** **ignore** any units given
ii	idea that 68 = 36 + 32 (1)	1	**allow** 68 = 68 (1) if answer space is blank, check space in 5a(i) for answer
b	320 (g) (2) **but if answer incorrect then** use of 680/68 **or** idea that 10 x more hydrogen peroxide used **or** 68 grams of hydrogen peroxide makes 32 g of O_2 (1)	2	**allow** full marks for correct answer **allow** 20 (moles of hydrogen peroxide used) (1) **allow** 640 (g) (1)
	Total	**4**	

Question	Answer	Marks	Guidance
6 a	**any one from:** made in small amounts (1) made on demand (1)	1	 **allow** easy to recall / stop faulty batch (1) **allow** have short expiry dates / cannot be stored (1) **allow** make a fixed amount (1) **allow** there is **not** a high demand / there is a low demand (1) **ignore** easy to change / easy to clean **allow** different drugs need to be made throughout the year / idea of seasonal demand (1) **allow** demand is not constant / supply what is needed (1) **allow** made when stored medicine runs low (1) **allow** idea that when lots of a particular medicine is needed it can be made at the same time (1) **ignore** just made any time
b	**any two from:** drug must be pure (1) need to do testing / make sure they are not harmful / make sure they are safe (1) may need expensive starting or raw materials (1) needs (highly) qualified staff (1) needs expensive conditions or equipment (1)	2	 **allow** may be a complex drug (1) **allow** need to do research / needs to be tested on people (1) **ignore** needs to be developed **allow** substances used are expensive / substances are rare (1) **allow** needs a skilled work force / need many staff / labour intensive / high wages (1) **allow** examples of expensive conditions or equipment e.g. needs a lot of electricity / need lots of equipment (1) **ignore** references to time / paying patients

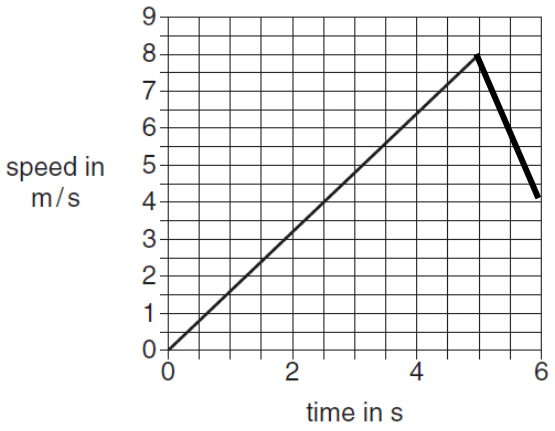
c	no **any two from:** melting point cannot be higher than actual value (1) melting point should be sharp / melting point should **not** be a range / should be a smaller range (1) **D** (is most likely the most pure) (1)	2	**no** marks for no on its own if **yes 0** marks for the question **allow** highest melting point should be 157°C / up to 157°C (1) **allow** melting point **not** exactly 157°C /(in **E** the) melting point is between 2 numbers (1) **allow** so it is **D** (1) **allow D** has a smaller range (2)
	Total	**5**	

Question	Answer	Marks	Guidance
7	**Level 3** **Explains in detail why graphite has a high melting point** **AND** **explains why graphite conducts electricity** **AND** **explains why graphite can be used as a lubricant.** Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **Level 2** **Explains in detail why graphite has a high melting point** **OR** **explains why graphite conducts electricity AND explains why graphite can be used as a lubricant.** Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **Level 1** **Explains why graphite conducts electricity** **OR** **explains why graphite has a high melting point** **OR** **explains why graphite can be used as a lubricant.** 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. (0marks)	6	**This question is targeted at grades up to A*.** **Indicative scientific points may include:** **High melting point due to:** • giant structure / lattice • many bonds (that have to be broken) • strong bonds (that have to be broken) / require a lot of energy to break bonds • covalent bonds (that have to be broken) **Conducts electricity due to:** • mobile electrons / delocalised electrons / free electrons **Lubricant due to:** • layers or sheets can easily slide over each other • graphite is slippery • weak forces or bonds between layers or sheets *Reference to ionic bonds or intermolecular forces or (strong) bonds between layers **to explain melting point** limits the response to level 2* **Use the L1, L2, L3 annotations in RM. Do not use ticks.**
	Total	**6**	

Question	Answer	Marks	Guidance
8 a	62.9 (%) (2) **but if answer incorrect then** percentage yield = [actual yield/predicted yield] x 100 **or** [27.0/42.9] x 100 **or** 0.629 (1)	2	answer must have **three** sig figs award **two** marks for correct answer with no or incorrect working out **allow one** mark for 62.937062937 or 63 or 62.94 if no other working out can be credited
b	48 (%) (2) **but if answer incorrect then** [Mr of desired product/(sum of) Mr of all products] x 100 **or** atom economy = [40/84] x 100 **or** [40/(40 + 44)] x 100 **or** 0.48 (1)	2	award **two** marks for correct answer with no or incorrect working out **allow one** mark for 47.619047619 or correctly rounding e.g. 47.6 or 47.62 if no other working out can be credited

c	**any one from:** to be as sustainable as possible (1) to convert as much reactant into **desired** products (1) to reduce the production of unwanted products (1)	1	 **allow** to be more sustainable (1) **allow** to be as green as possible (1) **ignore** better for the environment **allow** more product to sell (1) **allow** less reactants needed (1) **ignore** high yield / more efficient **allow** to produce less waste **products** (1) **ignore** to produce less waste / references to cost
	Total	**5**	

Question	Answer	Marks	Guidance
9 a	speed (1)	1	if answer line blank allow correct answer indicated in the list
b	A change in direction only. ☐ A change in speed only. ☐ A change in speed, direction or speed and direction. ☑ A change in speed or direction. ☐ (1)	1	more than one answer ticked = 0 marks
c i	5 (m/s) (1)	1	if answer line blank allow correct answer indicated in the list
ii	20 (m) (2) **if answer is incorrect or incomplete then:** 8 X 2.5 **or** [8 x 5]/2 **or** 4 X 5 (1)	2	**allow** 0.5 X 8 X 5 (1)

iii	 **(1)**	1	**ignore** thickness of line, wobbly line etc. and look for the line ending at (6,4)
		6	

Question	Answer	Marks	Guidance
10 a	(idea of a) **different** gravitational field strength (1)	1	**allow** 'gravity' is **different** (1) **but ignore** force of gravity is different / pull of gravity is different **ignore just** force is different **/ just** different gravitational force / **just** different gravitational pull **not** gravitational potential energy / GPE
b	20 (m) (2) **if answer is incorrect or incomplete then:** any correct calculation from the table 76/3.8 **or** 176/8.8 **or** 200/10 **or** 78/3.9 (1)	2	
c	45 (kg) (3) **if answer is incorrect or incomplete then:** $\frac{175}{3.9}$ (1)	3	**allow** 44.9 **or** 44.87 (kg) (2) or **allow** any number of decimal places e.g. 44.87179 (2) or **allow** 0.45 (kg) or 0.449 (kg) or 0.4487 (kg) (1)
	Total	**6**	

Question	Answer	Marks	Guidance
11	**Level 3: (5-6 marks)** **Detailed descriptions of differences in KE at A** **AND** **calculates velocity.** Quality of written communication does not impede communication of science at this level. **Level 2: (3-4 marks)** **Descriptions of differences in KE at A** **AND** **attempts to calculate velocity by using equations.** Quality of written communication partly impedes communication of science at this level. **Level 1: (1-2 marks)** **Description of differences in KE at A** **OR** **attempts to calculate velocity by using equation.** Quality of written communication impedes the communication of science at this level **Level 0: (0 marks)** Insufficient or irrelevant science. Not worthy of credit.	6	This question is targeted up to grade A* **Indicative scientific points may include (but are not limited to) the following:** **differences in KE at A** • Laura has more mass / Kylie has less mass • Laura has more KE / Kylie has less KE • Laura has double the mass • Laura has double the KE • if mass is doubled then KE is doubled • idea that height does not matter for KE / g does not matter for KE • KE depends on velocity or speed / KE depends on mass • Kylie and Laura have the same velocity or speed **allow** weight for mass throughout **ignore** references to momentum **differences given must be as written examples and not just quoting equations** **evidence of a calculation of velocity** • KE = ½ mv^2 • at **A** KE = GPE • ½ mv^2 = mgh • ½ v^2 = gh • v = √ 2gh • v = √2 X 10 X 31.25 • v = 25 (m/s) **allow** (Kylie has KE of) 12 500 (J) or (Laura has KE of) 25 000 (J) as evidence of attempt at calculating velocity **Use the L1, L2, L3 annotations in RM. Do not use ticks.**
	Total	**6**	

Question	Answer	Marks	Guidance
12 a i	(thinking distance) increases (1) from 9 (m) to 18 (m) / by 9 (m) (1)	2	**not** any mention of time e.g. time increases / it takes a longer time **allow** it takes longer (1) **allow** increases 3 (m) for every 10 mph (2) **allow** (thinking distance) **doubles** (2) **if no other mark awarded** **allow** any example of an increase in thinking distance e.g. triples / car does not stop for 73 (m) / car does not stop for 96 (m) (1)
ii	idea that it will crash (into the car in front) (1) as driving within the thinking distance (1) 10 (m) is less than 21 (m) (1)	3	 **allow** too close to the car in front (1) **allow** the idea that thinking distance is greater than the distance between the cars (1) **ignore** references to time **allow** thinking distance is 21 (m) / it needs to be 21 (m) away / the car travels 21 (m) before the brakes are applied / it needs to be another 11 (m) (1) **ignore** the car is only 10 (m) behind **ignore** reference to braking distance / stopping distance

b	**any one risk** idea that they may injure or kill people / motorcyclist / cyclist (1) idea that bull bars may **not** crumple in an accident / bull bars are rigid (1) **any one benefit** reduces injury **to the driver** or **passengers** (of the vehicle fitted with a bull bar) (1) useful when driving on rural roads as an animal may run into the path of the car / protects the car from damage from animals (1)	2	**maximum 1 mark for risk and maximum 1 mark for benefit** **allow** may injure or kill animals (1) **allow** idea that the crumple zone does not work (1) **ignore** minimises impact **ignore** reference to damaging vehicles / increase in mass / increase in fuel/injuries to the driver **ignore** just reduces force on driver
	Total	**7**	

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