OCR
RECOGNISING ACHIEVEMENT

GCSE

Additional Science B

General Certificate of Secondary Education

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

Mark Scheme for June 2012

Oxford Cambridge and RSA Examinations

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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
	benefit of the doubt
	benefit of the doubt **not** given
	error carried forward
	information omitted
	ignore
	reject
	contradiction
L1	Level 1
L2	Level 2
L3	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)		provide **energy** (1)	1	**allow** for respiration / make ATP / sperm need energy / more mitochondria means more energy (1) **ignore** to swim / fertilise the egg
	(b)		idea of embryo is destroyed / destroys a potential life (1)	1	**ignore** ethical / religious reasons unless qualified
	(c)		offspring (from meiosis) would not be genetically identical / (meiosis) makes sex cells / (meiosis) would reduce number of chromosomes by half / (meiosis) makes haploid cells (1)	1	**ignore** no flowers ORA assume 'it' refers to meiosis not mint reproduction
	(d)		**any three from:** use small pieces of tissue (1) aseptic technique / sterile scalpel / sterile apparatus (1) use of suitable growing medium / nutrients / hormones / amino acids / minerals (1) example of suitable conditions; warm temperature / oxygen / light / carbon dioxide (1)	3	 **ignore** a cell / cuttings / tissue / tissue cuttings **allow** scrapings (of cells) / explant (1) **not** just clean **allow** microbe free (1) **allow** named example e.g. auxin / agar (1) **ignore** sugar solution / rooting powder
			Total	**6**	

Question			Answer	Marks	Guidance
2	(a)		atrium / atria / auricles (1)	1	**ignore** reference to left and right
	(b)	(i)	**any two from:** only one ventricle / fewer chambers / no septum / no dividing wall / not split into left and right (1) size of heart / thickness of wall / muscle is even on both sides (1) no separation of blood from lungs and body (1)	2	**allow** high level answer - mixing of oxygenated and deoxygenated blood (1) **ignore** reference to valves
		(ii)	**any two from:** oxygenated and deoxygenated blood is mixed (1) so body cells receive less oxygen (1) and oxygen concentration gradient in lungs is reduced /AW (1)	2	**allow** less oxygen is sent round body (1) **allow** blood sent to the lungs contains oxygen (1) **allow** idea of pressure e.g. in humans pressure of blood to lungs is different than to body (1) so this heart would mean less pressure to body / pressure in lungs is too high / same pressure to all parts of body (1)
			Total	**5**	

Question			Answer	Marks	Guidance
3	(a)		**[Level 3]** Answer explains clearly that the order of bases on DNA codes for the amino acids in a protein / enzyme **and** it includes the idea that it is a triplet code **or** includes ideas about the role of mRNA and the role of ribosomes. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Answer explains that the (order of) bases in DNA code for amino acids in a protein. **or** answer includes ideas about the role of mRNA **and** the role of ribosomes. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Answer shows some understanding that enzymes are proteins **or** that proteins are made on the ribosomes. 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 B to A*** **Relevant points include:** • four bases are T A G C • complementary base pairs T-A, G-C • sequence of bases in genes determine the order of amino acids • each amino acid is coded for by a sequence of 3 bases • role of mRNA • synthesis occurs on the ribosomes • idea of each gene codes for a protein and enzymes are proteins

Question			Answer	Marks	Guidance
	(b)	(i)	idea that **resistance** is caused by a gene / DNA (1) DNA / gene is moved from the wild plant to the crop plant (1)	2	**not** immune **ignore** chromosomes **allow** the resistance gene is moved from wild to crop plant = (2)
		(ii)	**any one from:** potato might be poisonous / might change taste / might not get as high a yield (1)	1	**ignore** may have side / harmful effects **ignore** causes disease **allow** some people may have allergies / makes people ill (1) **allow** might spread to weeds etc (1) **allow** might be less nutritious (1)
			Total	**9**	

Question			Answer	Marks	Guidance
4	(a)	(i)	12.4 (1)	1	**allow** 12.43 (1) **ignore** 12.5 / 12 / 12.4333333333 / 12.40 /$12.4\dot{3}$
		(ii)	as pH increases to 7 volume of gas increases then above pH 7 volume of gas falls (1) at pH other than 7, enzymes start to **denature** (1)	2	**allow** oxygen output / mean peaks at pH 7 / neutral (1) **allow** catalase works best at pH 7 / neutral (1) **allow** optimum is pH 7 **allow** enzymes change shape at above and below pH 7 (1)
	(b)		12.6 is an anomaly / third result may be too low / one result is **much** lower than the other two (1) may give inaccurate **average** / **average** may be too low (1)	2	**allow** third result is **very** different to first and second (1) **allow** one result is only 12.6 compared to 22.1 and 22.3 (1) **allow** idea that he should have repeated third attempt (1) **allow** discard 12.6 / only use 22.1 and 22.3 (1)
			Total	**5**	

Question			Answer	Marks	Guidance
5	(a)		$\frac{0.90 \times 81}{125}$ = 0.58 (2) but relative molecular mass of zinc carbonate 125 **and** of zinc oxide 81 (1)	2	
	(b)		86% (2) but $\frac{0.50}{0.58}$ x 100 or (actual yield / predicted yield) x 100 (1)	2	**allow** 86.2 (%) / 86.21 (%) 86.0 (%) or 86.206897(%) = (1)
			Total	**4**	

Question			Answer	Marks	Guidance
6	(a)		$Mg + 2HCl \rightarrow MgCl_2 + H_2$ formulae correct (1) balancing (1)	2	balancing mark is conditional on correct formulae **allow** = instead of → **allow** multiples **allow** one mark for correct balanced equation with minor errors e.g. Mg + 2HCl → MgCl2 + H2
	(b)	(i)	54-58(s) (1)	1	
		(ii)	0.75 (cm^3/s) (1)	1	
	(c)		powered magnesium has a greater (surface) area (1) therefore greater frequency of collisions (between magnesium and hydrochloric acid particles) (1)	2	**allow** greater frequency / chance of collisions / more collisions per second / rate of collisions faster / collisions more likely (1) **ignore** just more collisions / more successful collisions **ignore** references to energy of reaction
			Total	**6**	

Question			Answer	Marks	Guidance
7	(a)		7560(J) (2) 100 x 4.2 x 18 (1)	2	mark answer line first allow 151.2 (1)
	(b)		bond making is exothermic / energy given out (1) bond breaking is endothermic / energy taken in (1) more energy is given out than is taken in (1)	3	 the energy required to break the bonds is less than the energy released in making the bonds (3) / aw **ignore** references to number of bonds
			Total	**5**	

Question			Answer	Marks	Guidance
8	(a)		**[Level 3]** Candidates apply their knowledge of drug extraction to that of extraction of morphine from a poppy plant including the main three steps in the procedure. **and** Candidates fully explain why sample B is the most pure. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Answer describes **part** of the procedure for extracting the morphine from the poppy. **and** Sample B is identified as being the most pure. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Answer only refers to two parts of the extraction process **or** identifies B as being most pure with correct reasoning. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science such as repeating the question. Answer not worthy of credit. (0 marks)	6	**This question is targeted at C/D** **relevant points on testing for purity include** • sample B is the most pure • because its melting point is closest to pure morphine **explanation of how to extract morphine from the solid include** • crushing the plant • boiling and dissolving the plant in a solvent or named solvent / solvent extraction • filtering the mixture / evaporation / distillation chromatography some candidates may appreciate that morphine is extracted from a resin that comes from the plant. This is dried and the morphine extracted from the solid residue.

Question			Answer	Marks	Guidance
	(b)		should be made by a continuous process because **any two from:** *because* it is such high demand / commonly used drug (1) low running costs / low labour cost / not so many people need to run plant, *makes* it cheap (1) because so much is made, *so* high set up costs are not an issue (1)	2	answers must be justified no mark for just quoting statements from the table
			any two from: so others can test to see if it works (1) so others can show it is safe (1) so others can develop the drug further / modify the drug (1) lets doctors / patients / pharmacists know about the drug (1)	2	**ignore** let other people know about the drug
			Total	**10**	

Question			Answer	Marks	Guidance
9	(a)		0.45 (s) (3) **but if answer is incorrect** t = 17.68 ÷ [(41 + 37) / 2] (2) OR 17.68 ÷ 39 (2) **but if no mark gained** t = (distance) ÷ average speed t = (distance) ÷ ½ (u + v) OR 17.68 = ½ (41+ 37) x t (1) OR 17.68 = 39 x t (1) OR average speed = 39 (1)	3	**allow** $0.453\dot{3}$ / 0.453 (2) **allow max 1** 17.68 ÷ 41 (1) 17.68 ÷ 37 (1) 0.4312 OR 0.4778 / 0.43 / 0.48 (1)
	(b)		no (no mark) time is less than reaction time ORA (1)	1	**allow** ecf **allow** 0.45 is less than 0.48 (1) **allow** 0.03 secs short (1) **allow** he does not have enough time to react (1) **allow** ball gets to him in less than 0.48 secs (1)
			Total	**4**	

Question			Answer	Marks	Guidance
10	(a)		idea of area under graph = distance travelled (1)	1	**allow** calculation ie ½ x 40 x 3.5 = 70 m **allow** area of triangle (marked W)
	(b)		for **X** = 420 (m) (1) for **Y** = 280 (m) (1) then comparison to conclude distance in **W** is shortest / AW (1)	3	if both calculations are correct but X and Y are not identified award 1 mark **allow** ecf from distance calculations
			Total	**4**	

Question			Answer	Marks	Guidance
11			**[Level 3]** Describes at least one advantage **and** one disadvantage with detailed explanations eg specific reference to effects of named pollutants **and** describes one way effect of cars can be monitored or tested Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Describes at least one advantage **and** one disadvantage with explanations **or** Describes at least one advantage **and** one disadvantage without explanation **and** describes one way cars can be monitored or tested Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Describes at least one advantage **and** one disadvantage. **or** Describes one way cars can be monitored or tested. 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** <u>advantages may include:</u> • lower noise levels / quieter cars • less pollution • less petrol or diesel / oil reserves / fossil fuels used • lower noise levels linked to benefit to society / environment • lower / less CO_2 emissions so less effect on global warming • could improve road safety due to generally lower speeds. • petrol or diesel / oil reserves / fossil fuels which are needed for other things or are fast running out • lower / CO_2 emissions / less greenhouse gases <u>disadvantages may include:</u> • pedestrians can't hear cars • power stations still need to produce electricity • cars can't travel as far / fast • quiet(er) cars could be a danger to pedestrians • electricity produced at a power station and power stations release greenhouse gases • construction of charging points / batteries could add to pollution • electricity production needs fossil fuels • not enough power points to recharge <u>monitoring point may include:</u> • monitoring CO_2 levels to look for a reduction • monitoring noise levels to look for a reduction • comparing results to assess any real benefit check / monitor accident figures for any change.
			Total	**6**	

Question			Answer	Marks	Guidance
12	(a)		correct plotting of all points and an attempt at a line covering the range of points in the table (2) but at least 4 points plotted correctly (1)	2	**allow** +/- ½ square error on all points
	(b)		thinking distance increases linearly with speed / AW (1) braking distance increases at an ever increasing rate / as speed increases braking distance increases at a greater rate than thinking distance (1)	2	**allow** steeper line for braking distance (1) **allow** idea that braking distance increase as speed squared / speed doubles and breaking distance quadruples each time = (2)
	(c)	(i)	repeat measurements (many times) / repeat with different cars and or drivers (1)	1	
		(ii)	repeat tests with different **road surface** conditions / repeat / test with different **weather** conditions (1)	1	**allow** named road surface condition **allow** repeat in rain / snow etc
	(d)		increases stopping distance or time (1) reduces deceleration or acceleration (1) **but** spreading the change of momentum over a longer time or produces a lower rate of change of momentum (2)	2	**allow** makes crash last longer (1) if no other mark is scored **allow** absorbs energy / dissipates energy (1)
			Total	**8**	

Question			Answer	Marks	Guidance
13	(a)		S and T **and** V and W (1)	1	both needed in each part in any order
	(b)		T and V (1)	1	both needed in any order
	(c)		R and S (1)	1	both needed in any order
			Total	**3**	

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