OCR
Oxford Cambridge and RSA

GCSE

Biology A

Unit **A162/02**: Modules B4, B5, B6 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2016

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

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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 the detailed Mark Scheme:

Annotation	**Meaning**
/	alternative and acceptable answers for the same marking point
(1)	separates marking points
not/reject	answers which are not worthy of credit
ignore	statements which are irrelevant - applies to neutral answers
allow/accept	answers that can be accepted
(words)	words which are not essential to gain credit
words	underlined words must be present in answer to score a mark
ecf	error carried forward
AW/owtte	credit alternative wording / or words to that effect
ORA	or reverse argument

Available in scoris to annotate scripts:

	indicate uncertainty or ambiguity
BOD	benefit of doubt
CON	contradiction
	incorrect response
ECF	error carried forward
	draw attention to particular part of candidate's response
NBOD	no benefit of doubt
R	reject
	correct response

L1 , L2 , L3	indicate level awarded for a question marked by level of response
^	information omitted

Subject-specific Marking Instructions

a. Accept any clear, unambiguous response (including mis-spellings of scientific terms if they are *phonetically* correct, but always check the guidance column for exclusions).

b. Crossed out answers should be considered only if no other response has been made. When marking crossed out responses, accept correct answers which are clear and unambiguous.

e.g. for a one-mark question where ticks in the third <u>and</u> fourth boxes are required for the mark:

This would be worth 1 mark.

This would be worth 0 marks.

This would be worth 1 mark.

c. The list principle:
If a list of responses greater than the number requested is given, work through the list from the beginning. Award one mark for each correct response, ignore any neutral response, and deduct one mark for any incorrect response, e.g. one which has an error of science. If the number of incorrect responses is equal to or greater than the number of correct responses, no marks are awarded. A neutral response is correct but irrelevant to the question.

d. Marking method for tick-box questions:

If there is a set of boxes, some of which should be ticked and others left empty, then judge the entire set of boxes.
If there is at least one tick, ignore crosses and other markings. If there are no ticks, accept clear, unambiguous indications, e.g. shading or crosses. Credit should be given according to the instructions given in the guidance column for the question. If more boxes are ticked than there are correct answers, then deduct one mark for each additional tick. Candidates cannot score less than zero marks.

e.g. if a question requires candidates to identify cities in England:

Edinburgh	
Manchester	
Paris	
Southampton	

the second and fourth boxes should have ticks (or other clear indication of choice) and the first and third <u>should be blank</u> (or have indication of choice crossed out).

Edinburgh			✓			✓	✓	✓	✓	
Manchester	✓	×	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	×		✓		✓	✓		✓	
Score:	**2**	**2**	**1**	**1**	**1**	**1**	**0**	**0**	**0**	**NR**

e. For answers marked by levels of response:
i. **Read through the whole answer from start to finish**
ii. **Decide the level** that **best fits** the answer – match the quality of the answer to the closest level descriptor
iii. **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

iv. 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.

Question			Answer	Marks	Additional guidance
1	a	i	all correctly plotted (2 marks) five or six correctly plotted (1 mark)	2	**allow** 1 square error margin **if plotted points are dots, and are invisible**, score marks from line of best fit. **ignore** bar chart points to be plotted: 0.00, 0 0.02, 20 0.04, 28 0.06, 35 0.08, 40 0.12, 43 0.14, 43
	a	ii	continuous, correct and smooth line of best fit, going through all plotted points, including the origin	1	**accept** points joined with straight lines dot-to-dot **accept** 1 square error margin. **if plotted points are dots and are invisible**, score marks if line passes through the correct points on the graph **accept** ecf **do not accept** straight line of best fit
	a	iii	42	1	**accept** 41 – 43 **accept** ecf - correct reading of data from line

Question			Answer	Marks	Additional guidance
	a	iv	**any two from** as carbon dioxide increases (the rate of) photosynthesis/reaction increases **OR** there is a positive correlation; idea that increasing carbon dioxide has no further effect/ rate remains constant/ rate plateaus; because there is another limiting factor / named limiting factor / CO_2 is no longer a limiting factor;	2	 **do not accept** rate of photosynthesis decreases **do not accept** in reverse: as photosynthesis increases, carbon dioxide increases / OWTTE
	a	v	(it is an) outlier / anomalous result / anomaly it does not fit the trend / pattern / line of best fit	2	 **accept** does not fit in **ignore** does not match/look similar to other results
	b		$6H_20$ $C_6H_{12}O_6$	2	**do not accept** H2O, C6H12O6: numbers should be subscript when required. **do not accept** lower case letters

Question			Answer	Marks	Additional guidance
	c		**Level 3 (5-6 marks)** Uses point(s) of information provided alongside biological knowledge. Quality of written communication does not impede communication of the science at this level **Level 2 (3-4 marks)** Uses point(s) of information provided. Quality of written communication partly impedes communication of the science at this level **Level 1 (1-2 marks)** States condition(s) required for growth. 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:** **Conditions** ● temperature ● use heaters/greenhouse (to raise temperature) ● pH (of soil) ● light (intensity) ● use lamps (to increase light intensity) ● water ● minerals /nitrates ● provide fertilisers (to provide minerals) ● carbon dioxide levels should be above that of atmospheric levels ● burn fuels (to produce CO_2) **Using information provided** ● pH (of the soil) 6-8 / neutral ORA ● temperature 28-35°C ORA **Biological knowledge** ● optimising conditions for **enzymes** ORA ● correct idea of limiting factors
			Total	**16**	

Question			Answer	Marks	Additional Guidance
2	a	i	mitochondrion	1	
	a	ii	circular piece of DNA	1	
	a	iii	cell membrane	1	
	b	i	***any two from the following correct parts – max 2 marks*** mitochondria; cell membrane; nucleus or DNA; cytoplasm**;** ***one mark for each correct function - max 2 marks*** (mitochondria) – contain enzymes/proteins / site of **aerobic** respiration / produce ATP; (cell membrane) – allows gases/CO_2/O_2/water/reactants /products to pass through/in and/or out of the cell; (nucleus) – contains DNA/genetic code for **making enzymes** (for respiration); (cytoplasm) – where enzymes are made / site of **anaerobic** respiration;	4	**ignore** 'membrane' on its own **allow** ribosomes the function must be linked to correct structure. **do not accept** contains enzymes for **anaerobic** respiration if cell membrane mark not given, still **accept** correct function. **ignore** substances **accept** proteins instead of enzymes **accept** (ribosomes) site of enzyme/protein manufacture **accept** proteins instead of enzymes **accept** glycolysis/first part of respiration occurs in cytoplasm

Question			Answer	Marks	Additional Guidance
	b	ii	***any three from*** similar shape in methanol and ethanol / tip of methanol and ethanol (which fits into active site) same shape **ethanol** will fit into the <u>active site</u> / has a complementary/similar shape to <u>active site;</u> idea that prevents methanol from binding/ reduces methanol entering active site; methanol is not broken down; idea of reducing the (concentration of) toxic product / harmful substances;	3	 **ignore** 'same shape' on its own **ignore** ethanol has same shape as active site
	b	iii	***one from the following*** (making) bread; (producing) biogas;	1	 **do not accept** alcohol production **accept** sewage (processing) **ignore** biofuel
			Total	**11**	

Question			Answer	Marks	Additional Guidance
3			**Level 3 (5-6 marks)** Correct identification of the two stages where cell division occurs, AND comparison of the two types of cell division to include both similarities AND differences Quality of written communication does not impede communication of the science at this level **Level 2 (3-4 marks)** Correct identification of the two stages where cell division occurs AND identifies characteristics of the two types of cell division Quality of written communication partly impedes communication of the science at this level **Level 1 (1-2marks)** Correct identification of the stages where cell division occurs. 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 A** **Indicative scientific points may include** **Correct identification of the cell division at stages in the frogs life cycle:** • Stage A – meiosis • Stage C – mitosis If Stage B is identified as meiosis or mitosis, alongside A or C, then do not credit A or C (as appropriate). **Comparison of two forms of cell division:** **Similarities** • idea that **both** require DNA replication • idea that **both** require doubling / copying / duplication of chromosomes • cells in **both** will require a growth phase • during growth phase, more organelles will be produced

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Additional Guidance</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>Differences
<table><tr><td>Mitosis</td><td>Meiosis</td></tr><tr><td>One division</td><td>Two divisions</td></tr><tr><td>Idea of 2 daughter cells</td><td>Idea of 4 daughter cells</td></tr><tr><td>Idea that daughter cells genetically identical</td><td>Idea that daughter cells non-identical</td></tr><tr><td>Idea that daughter cells are diploid/2n / sane number of chromosomes as adult / same amount of DNA as adult</td><td>Idea that daughter cells are haploid/n / half number of chromosomes as adult / half amount of DNA as adult</td></tr><tr><td>Produces somatic/body cells</td><td>Produces gametes</td></tr></table>
ignore mention of locations in which mitosis and meiosis take place</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>6</td><td></td></tr>
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Question			Answer	Marks	Additional guidance
4	a		40,037 / 40,000 + 37; 0.09;	2	 0.09 **must** be expressed to two decimal places.
	b		***any one from:*** **majority of / most of / 99.91%** of their genes/chromosomes/genetic information/DNA from the mother and father/parents/sperm and egg/fertilised egg (not the donor); only small percentage of their genes/chromosomes/genetic information/DNA inherited from the donor; idea that most characteristics are coded for by DNA/genes/chromosomes/genetic material **found in the nucleus**;	1	 **ignore** reference to 50% from mother / 50% from father
	c		enzymes	1	**ignore** named proteins / enzymes **accept** structural/structure / functional/function (proteins)

Question			Answer	Marks	Additional guidance
	d		***any three from any category:*** *Consideration of consequences. Examples include:* not enough known (about the impact); DNA in the mitochondria may affect the characteristics of the child / cause complications; may be unsafe / harmful / risky; may cause disability; idea of concerns about where it could lead; likely to be costly / could the money be put to better use; problems caused by having three parents; causes problems for DNA testing; psychological problems; consideration of other consequences; *Consideration of ethics. Examples include:* unethical/morally wrong; is it right to select based on disease/to get rid of genetic disease; child unable to give consent/decide; uncertainty over legal parents/ donor may wish to parent the child / donor is not fully the parent of the children; should only have two parents / people may believe that a child should not have three parents; destruction of an egg cell / nucleus / genetic information / DNA which could have created life; other ethical consideration; *Religious argument. Examples include:* religious reasons / against God's will; other religious argument;	3	**accept** alternative ideas to those on left **ignore** mutations **ignore** 'unnatural' **ignore** reference to embryos **ignore** 'playing God'

Question			Answer	Marks	Additional guidance
	e		**any two from** (1 in 200 is a) **high** number of children affected; (so) less money will be spent treating children with diseases; (so) prevents faulty mitochondria being passed on to offspring/children; (but) **low number** (seriously) affected / **only** 1 in 6,500 / small chance of being (seriously) affected (so it may be) cheaper to treat those affected (than to develop the new technique); (however) idea that money used for the treatment only benefits few people / one disease / could benefit more patients/other diseases; it is worth it even to save one life / improve the quality of life / health;	2	**ignore** reference to religious and ethical arguments **accept** alternative idea that this is a high number in a whole population
	f		**any two from** amino acid **sequence** will be different/ the amino acids coded for will be different; no/different/incorrect protein/enzyme produced; protein/enzyme may not function;	2	**ignore** changes to the production/formation of amino acids
			Total	11	

Question			Answer	Marks	Additional guidance
5	a		**Level 3 (5-6 marks)** Correctly identifies point(s) from four areas. Quality of written communication does not impede communication of the science at this level **Level 2 (3-4 marks)** Correctly identifies point(s) from two areas Quality of written communication partly impedes communication of the science at this level **Level 1 (1-2marks)** Correctly identifies point(s) from one area. Quality of written communication impedes communication of the science at this level **Level 0 (0 marks)** Insufficient or irrelevant science. Answer not worthy of	6	**This question is targeted at grades up to A*** **Identifies part of the neuron affected** ● myelin / fatty sheath **Identifies role of the part of the neuron affected** ● **insulation/ insulating** (from neighbouring cells) ● (presence) increases speed of transmission of **electrical/nerve impulse** ● (idea of) prevents **electrical/nerve impulse** being lost/interference **Impact on transmission** ● (idea of) (less sheath so) less insulation ● (idea of) slower/reduced/weakened/no transmission of **electrical/nerve impulse** **Possible effect on individual** ● (idea that) motor neuron leads to a muscle / effector ● could affect movement/reactions/ coordination ● could affect walking, grip, facial expressions, involuntary movement ● Accept any sensible effect **ignore** reference to damaged neurons

Question			Answer	Marks	Additional guidance
	b		63,900,000 ÷ 100,000 / 639; So 1 in 639 (people are affected) / 1:639;	2	**award 2 marks for the correct answer** **accept** any correct ratio **ignore** 639:1 / 640:1 **accept 1 mark max for either** 64,000,000 ÷ 100,000 OR 1:640
	c	i	***any two from the following;*** mice stem cells may not work in humans / mice stem cells have different DNA/genes/genetic information/genotype/chromosomes; humans may reject the mice cells; animal rights issues/ethics concerning use of animals;	1	**ignore** alleles / mutations
	c	ii	***any one from the following;*** *(Bone marrow) (no mark) because:* idea that bone marrow belongs to the individual (so cells will be the same) / umbilical cord stem cells do not belong to the individual; constantly produced / always available; *(Umbilical cords from babies) (no mark) because:* fewer ethical concerns; extracting bone marrow is hard/difficult/dangerous; umbilical cords would otherwise be discarded; bone marrow (from other adults) rejected; no need to find a matching donor;	1	**ignore** reference to ability of stem cells to differentiate.
			Total	**10**	

Question			Answer	Marks	Additional guidance
6	a		***any two from the following:*** second(ary) stimulus; (secondary stimulus) is associated with primary stimulus/first stimulus/original stimulus; (secondary stimulus) triggers response; (secondary stimulus) is unrelated to the final response; a form of learning / learned response / trained response; idea that it increases chance of survival;	2	 **ignore** references to unqualified stimulus **accept** dog associates bell with food/reward **accept** bell triggers salivation **ignore** taught response
	b		neurons are in a fixed pathway; reflexes do not involve conscious thought;	2	
	c		Amy	1	**accept** any clear indication of correct answer
	d		stepping / grasping / sucking	1	**accept** any **newborn** reflex e.g. Babinski's reflex/ tonic neck reflex/ rooting/ startle/ moro/ gasping/ suckling/ crying/ bradycardic response (swimming under water without breathing)/ curling feet
			Total	**6**	

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