OCR
RECOGNISING ACHIEVEMENT

GCSE

Biology A

General Certificate of Secondary Education

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

Mark Scheme for June 2012

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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.

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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	draw attention to particular part of candidate's 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.

eg 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, eg 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, eg 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.

eg 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.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td><u>retina</u> (1)</td><td>1</td><td>reject eyeball</td></tr>
<tr><td></td><td>(b)</td><td></td><td>
<table>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>The light stimulus was connected to a secondary stimulus.</td><td>✓</td><td>(1)</td></tr>
</table>
</td><td>1</td><td>accept any clear indication of a correct response, eg cross if no ticks shown or shaded box

if more than 1 response = 0 marks</td></tr>
<tr><td></td><td>(c)</td><td></td><td>axon/fibre/dendrite
slowly/slower/slow (1)</td><td>1</td><td>2 correct responses = 1 mark
responses must be in correct order</td></tr>
<tr><td></td><td>(d)</td><td>(i)</td><td>any two from:
few/only two or three neurons involved;
has few synapses;
does not have to go to brain (and back);
shorter distance;
you do not have to think about it/involuntary;</td><td>1</td><td>2 correct responses = 1 mark

accept is an unconscious action
ignore automatic</td></tr>
</table>

Question			Answer	Marks	Guidance
		(ii)	**(Level 3)** Response must include **most stages** in the reflex arc and references to different aspects of damage impact. Quality of written communication does not impede communication of the science at this level. (5–6 marks) **(Level 2)** Response must include **some stages** in the reflex arc and **one correct reference** to damage impact. Quality of written communication partly impedes communication of the science at this level. (3–4 marks) **(Level 1)** Response includes at **least one stage** in the reflex arc and includes **one correct reference** to damage impact. There may be limited use of specialist terms. 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 A*** **Indicative scientific points may include:** **Reflex arc:** • stimulus detected by receptor • impulse created (at receptor) • impulse travels from receptor to sensory neuron • order of sensory, relay and motor neurons • correct reference to synapses • travels along relay neuron (in spinal cord) • travels along motor neuron/nerve • ends with effector/muscle • named example of effector action eg muscle contraction/leg straightens • brain not involved **Impact of damage:** • reflex arc is not affected by the damage • damage above the point where reflex arc takes place • impulse transmission up to/down from brain is blocked • ascending/sensory pathways/neurons and/or descending/motor pathways/neurons *in spinal cord* cut/damage/severed **Use the L1, L2 and L3 annotations in Scoris, do not use ticks.**
			Total	**10**	

Question			Answer	Marks	Guidance
2	(a)		<table><tr><td></td><td></td><td></td></tr><tr><td>To release energy for the transmission of impulses.</td><td>✓</td><td>(1)</td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr></table>	1	**accept** any clear indication of a correct response eg cross if no ticks shown or shaded box if more than 1 response = 0 marks
	(b)		chemicals only released from first neuron (1) receptors only found on second neuron/other side (1)	2	OWTTE **reject** messages **accept** transmitter on one side **accept** correctly-labelled diagrams
	(c)	(i)	(only) trial **B** (1) because the (average/mean) dose was greater than 10 mg (for 5 days)/average value is 16.4 (1)	2	OWTTE **accept** more than the amount needed for the drug to be effective/more than the minimum needed (for dose to have an effect) **accept** reverse argument ie insufficient dosage in trial A/average values is 7.6
		(ii)	(more impulses will be transmitted because) there is more serotonin in the synapse/serotonin is not taken back into the (first) neuron/serotonin not reabsorbed (1)	1	**credit** idea that 'rate' of transmission will increase **accept** idea that impulses will be transmitted more easily **accept** not absorbed = not reabsorbed **reject** idea that 'speed' of impulses will change

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td></td><td></td><td>(iii)</td><td>
<table>
<tr><td>Carry out each trial for a shorter period of time.</td><td></td><td></td></tr>
<tr><td>Carry out the trials using female patients only.</td><td></td><td></td></tr>
<tr><td>Compare the drug against a placebo.</td><td>✓</td><td>(1)</td></tr>
<tr><td>Decrease the dose of drug in the second trial.</td><td></td><td></td></tr>
<tr><td>Give the participants other drugs at the same time.</td><td></td><td></td></tr>
<tr><td>Use more than one patient.</td><td>✓</td><td>(1)</td></tr>
</table>
</td><td>2</td><td>accept any clear indication of a correct response eg crosses if no ticks shown or shaded boxes

if more than 2 responses – deduct 1 mark for each additional response</td></tr>
<tr><td></td><td>(d)</td><td></td><td>any two from:

correct technique used eg brain damaged patients/electrical stimulation/MRI scans/CAT scans; (1)
many other patients could benefit from the outcome; (1)
patients have rights/may not be able to give (informed) consent/the patient may be harmed; (1)</td><td>2</td><td>OWTTE

accept TMS (transcranial magnetic stimulation)/EEG (electroencephalography)/PET (positron emission tomography)/brain surgery (must be qualified)/dissection of brain from dead person</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>10</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
3	(a)		4 (1)	1	
	(b)	(i)	negative correlation/rate of reaction drops as temperature increases **and** then the rate levels off/rate is zero at temperatures higher than 68/70 °C (1)	1	OWTTE **accept** correct references to the data to support the explanation **accept** rate slows down and then stops at 70 °C = 1 mark **accept** rate slows down and then no reaction after 70 °C = 1 mark
		(ii)	(increasing) temperature causes enzyme (molecule) to change shape/be denatured (1) substrate/molecule no longer fits (so well) into active site/no enzyme-substrate complex formed (1) so enzyme cannot catalyse/speed up the reaction/the rate decreases (1)	3	OWTTE **accept** correct references to the lock and key model **reject** enzyme dies/killed **ignore** enzyme does not work any more
	(c)		pH changes the shape of the active site (which affects the rate of reaction) (1)	1	**accept** another correct factor eg concentration of substrate/enzyme molecules, if explanation is appropriate **accept** denatured
			Total	**6**	

Question			Answer	Marks	Guidance
4	(a)		yellow purple (1)	1	2 correct responses = 1 mark responses **must** be in correct order
	(b)		*any three from:* limited/reduced photosynthesis (due to fabric mesh); (1) respiration continues at the same rate; (1) CO_2 removed (by photosynthesis) equals CO_2 added (by respiration); (1) rate of photosynthesis equals rate of respiration; (1) no change in CO_2 levels; (1)	3	OWTTE **ignore** references to light available **ignore** photosynthesis stops **ignore** reference to CO_2 levels are balanced/constant
	(c)		temperature (1)	1	**ignore** water **reject** heat
	(d)		*any two from:* plant/leaf will have adapted to low light/dark conditions; (1) may have more chloroplasts/chlorophyll; (1) will be more efficient at/better at/quicker **photosynthesis**; (1)	2	OWTTE **accept** used to = adapted to **accept** fast rate/increased level = quicker (rate of photosynthesis)
			Total	**7**	

Question			Answer	Marks	Guidance
5	(a)	(i)	glucose (AND) ethanol + carbon dioxide;	1	1 mark for complete **word** equation **ignore** formulae **accept** "alcohol" for ethanol
		(ii)	(left hand side) $C_6H_{12}O_6 + 6O_2$; (right hand side) $6CO_2 + 6H_2O$;	2	1 mark for each side of the equation = 2 marks formulae **must** be exactly as shown in answer box **but** order can be reversed **within** right hand side and within left hand side
	(b)	(i)	cell wall mitochondrion/mitochondria	1	both correct = 1 mark **must** be in correct order **ignore** reference to 'cellulose' for cell wall response

Question			Answer	Marks	Guidance
		(ii)	**(Level 3)** Response must include **most structures** with reference to their functions and to **both forms** of **respiration** (qualified), as appropriate. Quality of written communication does not impede communication of the science at this level. (5–6 marks) **(Level 2)** Response must include **some structures** with reference to their functions and to **at least one** of the two forms of **respiration** (qualified). Quality of written communication partly impedes communication of the science at this level. (3–4 marks) **(Level 1)** Response must include at least **one named structure** with reference to its function and to respiration (qualified) **OR** correctly identifies the sites of aerobic and anaerobic respiration. There may be limited use of specialist terms. 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 may include:** **cell membrane:** • cell membrane oxygen passes into cell • oxygen used for aerobic respiration • cell membrane carbon dioxide passes out of cell (freely) • carbon dioxide released from aerobic/anaerobic respiration • cell membrane alcohol/ethanol passes out of cell • alcohol/ethanol released from anaerobic respiration **cytoplasm:** • **cytoplasm** contains enzymes for reactions • (these reactions) are anaerobic/aerobic respiration • **cytoplasm** is the site of enzyme/protein synthesis • enzymes used for anaerobic/aerobic respiration **mitochondria**: • **mitochondria** contain enzymes for reactions • (these reactions) are aerobic respiration **nucleus:** • **nucleus** contains genetic code/DNA for production of enzymes/proteins • (these enzymes/proteins) needed in respiration • aerobic respiration needs all structures • anaerobic respiration does not use mitochondria **Use the L1, L2 and L3 annotations in Scoris, do not use ticks.**
			Total	**10**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>6</td><td>(a)</td><td></td><td>
<table>
<tr><td>are produced by mitosis.</td><td>✓</td></tr>
<tr><td>can switch off any gene during development of the embryo.</td><td>✓</td></tr>
<tr><td>contain different genes to those found in the specialised cells.</td><td></td></tr>
<tr><td>contain half the number of chromosomes found in the zygote.</td><td></td></tr>
</table>
</td><td>2</td><td>accept any clear indication of a correct response eg crosses if no ticks shown or shaded boxes

if more than 2 responses – deduct 1 mark for each additional response</td></tr>
<tr><td></td><td>(b)</td><td></td><td>
<table>
<tr><td>The patient will contain DNA from another person.</td><td>✓</td></tr>
<tr><td>Embryonic stems cells may be larger than the patient’s cells.</td><td></td></tr>
<tr><td>Donated embryonic stem cells may be rejected by the patient’s body.</td><td></td></tr>
<tr><td>Embryos may be destroyed to collect the embryonic stem cells.</td><td>✓</td></tr>
<tr><td>Scientists and doctors must decide who receives the embryonic stem cells.</td><td>✓</td></tr>
<tr><td>The donated embryonic stem cells may not survive in the body of the patient.</td><td></td></tr>
</table>
</td><td>2</td><td>3 correct responses = 2 marks
2 correct responses = 1 mark
1 correct responses = 0 marks

accept any clear indication of a correct response eg crosses if no ticks shown or shaded boxes

if more than 3 responses – deduct 1 mark for each additional response</td></tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td></td><td>(c)</td><td></td><td>
<table>
<tr><td>DNA feature</td><td colspan="4"></td></tr>
<tr><td>number of strands</td><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>number of different types of bases</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>arrangement of bases between the strands</td><td>fours</td><td>pairs</td><td>single</td><td>triplets</td></tr>
<tr><td>shape of molecule</td><td>circular</td><td>cube</td><td>helix</td><td>sheet</td></tr>
</table>
</td><td>1</td><td>must show all 4 correct responses = 1 mark

if more than 4 responses = 0 marks</td></tr>
</table>

Question	Answer	Marks	Guidance
(d)	**(Level 3)** Response includes a clear reference to coded message, mRNA in cytoplasm/ribosome involved in protein synthesis and link between sequence of bases with order of amino acids (on protein). Quality of written communication does not impede communication of the science at this level. (5–6 marks) **(Level 2)** Response also includes DNA **held** in nucleus and/or mRNA **leaves** nucleus. Quality of written communication partly impedes communication of the science at this level. (3–4 marks) **(Level 1)** Response includes reference to the **coded message/genetic code/bases,** on **DNA**/**mRNA** (*accept RNA = mRNA at this level*). There may be limited use of specialist terms. 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 A*** **Indicative scientific points may include:** **Features of DNA:** • DNA remains/located in the nucleus • DNA holds the code (for protein synthesis) • genetic code is a series of bases • four types of bases = A, T, C and G • the bases always pair in the same way • DNA is a double helix • the two strands of DNA are held together by pairs of bases • DNA unzips to form (template for) mRNA **Feature of mRNA involvement:** • mRNA synthesised from exposed/unzipped DNA • mRNA leaves the nucleus • mRNA carries coded message out to the cytoplasm • protein synthesis (can now) takes place in the cytoplasm (accept ref. to ribosome = cytoplasm) • the order of bases in mRNA is linked to the type of amino acid put into the protein (accept ref. to triplet code = order of bases) • the order of amino acids determines the particular type of protein **Use the L1, L2 and L3 annotations in Scoris, do not use ticks.**
	Total	**11**	

Question			Answer	Marks	Guidance
7	(a)	(i)	light from above allows the auxin to be **evenly distributed**; auxin promotes/stimulates plant growth/cell division/cell elongation **and so** the shoot grows straight/grows upwards/without curvature;	2	OWTTE **ignore** reference to no shading-effect
		(ii)	**suggested result/appearance:** the seedlings appear to be straight/start to curve in the opposite direction; **explanation:** light from one side causes auxin to collect on the shaded side **and so** the shoot grows/cells elongate (more) on the shaded side (and curves);	2	OWTTE **ignore** face/turn (the other way) **accept** bend/lean
	(b)		**No because…** *any two from:* other plants grow differently to cress; (1) light (from the sun) changes position throughout each day in the garden; (1) other (competitive) plants will grow in the garden; (1) most factors vary outdoors (eg temperature/moisture/light intensity); (1) predators will be present in the garden (eg slugs/birds/etc); (1) cress seedlings observed for only 48 hours/plants in garden grown for longer than 48 hours; (1) **Yes because …** sun moves across the garden each day/plants follow the sun; (1)	2	no marks for saying 'no'; credit only given for supporting reasons OWTTE **accept** sun not always out/darkness at night time no marks for saying ‘yes’; credit only given for supporting reasons if yes with an explanation = 1 mark max
			Total	**6**	

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