



GCSE (9-1)

Biology A (Gateway Biology)

J247/03: Paper 3 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2019

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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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Annotations available in RM Assessor

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
	Benefit of doubt given
	Contradiction
	Rounding error
	Error in number of significant figures
	Error carried forward
	Level 1
	Level 2
	Level 3
	Benefit of doubt not given
	Noted but no credit given
	Ignore

Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
✓	Separates marking points
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
()	Words which are not essential to gain credit
—	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

Subject-specific Marking Instructions

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

J247-03

Mark Scheme

June 2019

The breakdown of Assessment Objectives for GCSE (9-1) in Biology A:

	Assessment Objective
AO1	Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
AO2	Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.
AO2.1	Apply knowledge and understanding of scientific ideas.
AO2.2	Apply knowledge and understanding of scientific enquiry, techniques and procedures.
AO3	Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.
AO3.1	Analyse information and ideas to interpret and evaluate.
AO3.1a	Analyse information and ideas to interpret.
AO3.1b	Analyse information and ideas to evaluate.
AO3.2	Analyse information and ideas to make judgements and draw conclusions.
AO3.2a	Analyse information and ideas to make judgements.
AO3.2b	Analyse information and ideas to draw conclusions.
AO3.3	Analyse information and ideas to develop and improve experimental procedures.
AO3.3a	Analyse information and ideas to develop experimental procedures.
AO3.3b	Analyse information and ideas to improve experimental procedures.

For answers to Section A if an answer box is blank ALLOW correct indication of answer e.g. circled or underlined.

Question			Answer	Marks	AO element	Guidance
1			C	1	2.2	
2			B	1	2.1	
3			A	1	1.1	
4			C	1	1.1	
5			C	1	1.1	
6			D	1	1.1	
7			C	1	2.1	
8			B	1	1.2	
9			D	1	1.1	
10			A	1	1.1	
11			B	1	1.2	
12			B	1	2.2	
13			C	1	2.1	
14			C	1	1.1	
15			B	1	2.1	

J247-03

Mark Scheme

June 2019

Question			Answer	Mark	AO Element	Guidance
16	(a)		blood travels through pump/heart twice ✓ on full circuit around body ✓	2	1.1	ALLOW idea that there are two pumps / idea that blood is pumped twice ALLOW idea that blood passes separately to lungs and body
16	(b)		bird ✓ bird has 4 chambered heart ✓ bird has double circulation ✓	3	2.1	If bird is not ticked or bird not selected in answer, then zero for question ALLOW bird has heart with 4 sections/compartments/named four chambers ALLOW description of double circulation
16	(c)	(i)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 4 award 2 marks $25\,000 \div 5800 = 4.3$ ✓ $= 4$ (nearest whole number) ✓	2	2.2 1.2	ALLOW ECF mark for correct rounding if calculation is incorrect
16	(c)	(ii)	Any two from: muscles need more energy / more ATP / more respiration ✓ muscles need more oxygen / more carbon dioxide to be removed / more glucose / to avoid anaerobic respiration / to avoid lactic acid production ✓ other organs not needed (in exercise) ✓	2	3.2a	need to include only one comparative word e.g. more, to be able to score the first two marking points, e.g. muscles need more oxygen for energy = 2 marks ALLOW to remove more heat ALLOW other organs not prioritised / blood diverted from other organs

Question	Answer	Mark	AO Element	Guidance
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J247-03

Mark Scheme

June 2019

17	(a)		alcohol / ethanol and carbon dioxide ✓	1	1.1	ALLOW either order ALLOW correct formulae
17	(b)		Any two from: alcohol produced in yeast (not humans) / ORA ✓ lactic acid produced by humans (not yeast) / ORA ✓ carbon dioxide produced by yeast (not humans) / ORA ✓	2	1.1	If any incorrect product is stated, then max 1 mark. If yeast or humans are not stated assume answer refers to yeast IGNORE reference to oxygen debt / ATP production
17	(c)	(i)	sucrose ✓	1	3.2a	
17	(c)	(ii)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 12 award 2 marks 6.0 ÷ 0.5 ✓ = 12 ✓	2	2.2	
17	(c)	(iii)	glucose ✓	1	3.2a	
17	(c)	(iv)	(Yeast B) doesn't ferment fructose ✓ (Yeast B) produces some fermented products ✓	2	3.1a	ALLOW (Yeast B) does not use up fructose / fructose levels decrease slightly / fructose levels remain high / higher yield of fructose / fructose levels remain constant ALLOW reverse arguments for Yeast A DO NOT ALLOW fructose is produced ALLOW fermented products increased DO NOT ALLOW fermented products produced from fructose DO NOT ALLOW produces high levels of fermented products IGNORE fermented product level stays the same / less fermented product than A

Question			Answer	Mark	AO Element	Guidance
18	(a)		iodine (molecules) moved into bag / through membrane ✓ starch (molecules) cannot move through membrane / out of the bag ✓ starch molecule are large / iodine molecule are small / starch molecules larger than iodine / ORA ✓	3	2 x 3.2a 2.1	ALLOW iodine moved into starch solution DO NOT ALLOW iodine moved by osmosis through membrane ALLOW starch cannot diffuse through membrane DO NOT ALLOW starch cannot move by osmosis through membrane ALLOW iodine smaller than pores in membrane/ORA✓
18	(b) *		Please refer to the marking instructions on page 5 of this mark scheme for guidance on how to mark this question. Level 3 (5–6 marks)	6	3 x 1.1 3 x 2.1	AO1.1 Demonstrates knowledge and understanding of scientific ideas to explain how low levels of Na⁺ affects the blood

J247-03

Mark Scheme

June 2019

Question			Answer	Mark	AO Element	Guidance
			Detailed explanation of how low levels of Na⁺ affects the blood and how this can affect cells. AND Explains the effect of blocking ADH and suggests how this can correct the condition. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (3–4 marks) Explains how low levels of Na⁺ affects the blood or how this can affect cells AND explains the effect of blocking ADH or suggests how this can correct the condition OR Explains how low levels of Na⁺ affects the blood and how this can affect cells. OR Explains the effect of blocking ADH and suggests how this can correct the condition. <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1–2 marks) Describes how low levels of Na⁺ affects water potentials. OR Describes the effect of blocking ADH. <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i> 0 marks <i>No response or no response worthy of credit.</i>			- blood is hypotonic / less concentrated / higher water potential AO2.1 Applies knowledge and understanding of scientific ideas to explain how low levels of Na⁺ affects cells - water enters cells by osmosis / as cells are more concentrated / lower water potential than the blood - cell membrane becomes overstretched / lysis may happen / cells will burst AO1.1 Demonstrates knowledge and understanding of scientific ideas to explain the effect of blocking ADH - blocking ADH makes the kidney tubule less permeable/less water reabsorbed - blocking ADH increases the volume of water lost from the body/present in urine / urine becomes more dilute AO2.1 Applies knowledge and understanding of scientific ideas to suggest how blocking ADH can correct the condition - blood concentration is increased / water potential lowered / water would move out of cell / water will not move into cells - eventually blood and cells are isotonic/same concentration/same water potential/same sodium ion concentration
18	(c)	(i)	suitable best-fit curve ✓	1	2.2	DO NOT ALLOW obvious double lines or lines drawn with ruler
18	(c)	(ii)	answer should match where curve of best fit crosses X axis on candidates own line of best fit	1	3.2a	ALLOW +/- half a small square ie +/- 0.02 from intercept on candidates graph

J247-03

Mark Scheme

June 2019

Question			Answer	Mark	AO Element	Guidance
18	(c)	(iii)	0.6 (mol/dm ³) ✓	1	2.2	
18	(d)		meristem ✓	1	1.1	ALLOW cambium

Question			Answer	Mark	AO Element	Guidance
19	(a)	(i)	progesterone ✓	1	2.1	
19	(a)	(ii)	any two from oestrogen / FSH / LH ✓	1	1.1	

J247-03

Mark Scheme

June 2019

19	(b)		Any four from: treatment contains oestrogen / progesterone / both oestrogen and progesterone ✓ inhibits LH ✓ prevents ovulation ✓ inhibits FSH ✓ prevents egg maturing ✓ thickens mucus ✓	4	1.1	ALLOW inhibits LH which controls ovulation = 2 marks ALLOW inhibits FSH which matures eggs = 2 marks ALLOW produces mucus
19	(c)		glucagon ✓	1	1.1	
19	(d)	(i)	(person) C ✓	1	3.2a	
19	(d)	(ii)	insulin is produced/released / insulin level is high ✓ idea that ability to control glucose levels is reduced ✓	2	2.1	mark independently of (d)(i) ALLOW idea that body is resistant to insulin
19	(e)		embryonic stem cells are able to differentiate into any cell / totipotent / adult stem cells are limited / pluripotent ✓ therefore insulin producing cells are easier to develop from embryonic stem cells/adult stem cells are not ✓	2	1.1 2.1	IGNORE adult stem cells are already specialised ALLOW difficult to locate adult stem cells IGNORE embryonic stem cells can repair all parts
19	(f)		gibberellins breaks seed dormancy / elongation of shoots ✓ ethene stimulates fruit ripening ✓	2	1.1	ALLOW stimulates flowering / fruit development / fruit growth / seed formation / germination / growth of shoots DO NOT ALLOW fruit ripening ALLOW dropping of leaves/fruit / stimulates fruit maturation

Question			Answer	Mark	AO Element	Guidance
20	(a)		digital balance/scales / electronic balance/scales ✓	1	1.2	ALLOW analytical balance/scales / scientific balance/scales ✓ IGNORE balance/scales unqualified / sensitive scales

J247-03

Mark Scheme

June 2019

20	(b)	(i)	no chloroplasts / no chlorophyll / no leaves ✓ they cannot photosynthesise ✓	2	2 x 2.1	DO NOT ALLOW chlorophyll removed by alcohol no chlorophyll/chloroplasts/leaves to allow photosynthesis = 2 marks
20	(b)	(ii)	Any two from: include a thermostat ✓ keep the temperature constant/at optimum ✓ control the humidity ✓ circulate air inside the cabinet / keep well ventilated / give a supply of carbon dioxide ✓	2	3.3a	IGNORE include insulation ALLOW increase humidity/water vapour IGNORE water the plants ALLOW give a supply of oxygen
20	(c)		FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 4×10^{-2} (mm) award 2 marks 0.04 ✓ $= 4 \times 10^{-2}$ (mm) ✓	2	2.2	 ALLOW correct variations of standard form
20	(d)		increased resolution / high magnification / sub-cellular structures visible ✓ (can only be done on) dead material / thin sections only / gives 2-D / expensive (equipment) / possible distortion of material in preparation / less mobile / preparation takes longer/is more complex / (only) black and white images ✓	2	2.2	IGNORE clearer/sharper/more detailed images / can see small cells

Question			Answer	Mark	AO Element	Guidance
21	(a)	(i)	<u>understanding has increased because:</u> wider range of recording/scanning techniques / technology has developed ✓	4	3.1b	ALLOW named examples eg CAT, EEG / description of the techniques

J247-03

Mark Scheme

June 2019

Question			Answer	Mark	AO Element	Guidance
			improved accuracy of measurement ✓ maximum three from: <u>problems existing:</u> difficulties in getting individuals for case studies ✓ may cause harm to patients ✓ interpreting data from case studies is very complex ✓ ethical issues with experimenting on (live) animals / killing/harming animals for experimentation ✓			ALLOW map brain function with more accuracy ALLOW people reluctant to give consent / need many cases to draw reliable conclusions IGNORE consent is needed ALLOW may cause cancer in patients ALLOW Interpreting brain function/information is difficult / several areas may be involved in a specific function. IGNORE unethical to study the brain
21	(a)	(ii)	Any two from: to inform other scientists (who might be working on the topic) ✓ to see if other scientists can replicate the work/ to have it peer reviewed ✓ to allow recognition for their work ✓	2	1.1	ALLOW communicate scientific rationale/methodology for investigations / share ideas with other scientists / allow other scientists to develop work ALLOW check/prove/reproduce results IGNORE to let people know / to spread it more widely / to make it be accepted as fact
21	(b)	(i)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 0.05 (metres per second) award 3 marks Conversion of 32(nm) to 3.2×10^{-8} (metres) ✓ $3.2 \times 10^{-8} \div 6.4 \times 10^{-7}$ ✓	3	1.2 2.2 x2	ALLOW ECF from first making point

Question			Answer	Mark	AO Element	Guidance
			= 0.05 (metres per second) ✓			ALLOW 5 x 10 ⁻²
21	(b)	(ii)	(in Alzheimer's,) neurotransmitter/it takes longer to diffuse/move (across the synaptic gap) ✓ communication between areas of the brain takes longer / idea that brain function less co-ordinated / idea that making decisions takes longer / idea that reactions are slower / takes longer to comprehend / lack of concentration ✓	2	2.1 3.2a	ALLOW in healthy people the speed (of diffusion) is faster / in Alzheimer's the speed (of diffusion) is slower need to score first marking point to score this marking point

Question			Answer	Mark	AO Element	Guidance
22	(a)	(i)	Any two from: <u>transcription</u> ✓ DNA (template) used to code for/make mRNA ✓ mRNA nucleotides/bases used to synthesis a mRNA molecule / mRNA nucleotides/bases pair with DNA nucleotides/bases ✓	2	1.1	
		(ii)	Any two from: <u>translation</u> ✓ mRNA attaches to ribosome ✓ tRNA is a carrier molecule for amino acids / tRNA/carrier molecule brings (correct) amino acids into place / tRNA reads the triplets on the mRNA ✓	2	1.1	ALLOW each triplet code on tRNA/carrier molecule is specific for an amino acid. DO NOT ALLOW amino acids are made
22	(b)	(i)	small traces of DNA can now be replicated (using PCR) ✓ PCR makes enough DNA to profile / PCR makes enough DNA to match with suspects ✓	2	2.1	IGNORE single copy of DNA Small traces of DNA can be replicated using PCR so that it can match to suspects = 2 marks DNA can be replicated using PCR so that there is enough to match to suspects = 2 marks
22	(b)	(ii)	S phase / DNA replication ✓	1	2.1	ALLOW DNA duplication / IGNORE synthesis unless qualified
22	(c)	(i)	Any two from:	2	2.1	

			check on heredity ✓ look for genetic disorders /identify health risk factors ✓ idea of choosing correct medication / genomics ✓ to confirm a person’s identity ✓			ALLOW establish family tree / find relatives ALLOW specified health risk factor
22	(c)	(ii)	avoid being identified for a crime / avoid high insurance costs / reluctance of employers to offer jobs / remain unaware of family history/genetic disorders / idea of dislike of sharing personal details / privacy (reasons) ✓	1	3.1a	ALLOW do not want to be found by lost relatives ALLOW against the Human Rights Act

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