

GCSE (9–1)

**Combined Science A (Biology) A (Gateway
Science)**

J250/08: Paper 8 (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.

The breakdown of Assessment Objectives for GCSE (9-1) in Combined Science 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			A	1	2.2	
2			C	1	2.2	
3			C	1	2.1	
4			A	1	2.1	
5			B	1	2.2	
6			C	1	1.1	
7			B	1	1.1	
8			A	1	1.1	
9			B	1	2.2	
10			B	1	1.1	

BLANK PAGES MUST BE ANNOTATED TO SHOW THEY HAVE BEEN SEEN

Question			Answer	Mark	AO element	Guidance
11	(a)		(sun)light (intensity) / air movement / temperature / rain ✓	1	1.1	ALLOW windy conditions ALLOW salt concentration/water content of soil ALLOW humidity / heat / moisture IGNORE Sun / climate change / root length IGNORE soil pH / soil type DO NOT ALLOW rate of photosynthesis
11	(b)	(i)	photosynthesis ✓	1	1.1	
11	(b)	(ii)	decomposition ✓	1	1.1	
11	(c)	(i)	For Any one from: idea that there is a rise over the last 20 000 years/recently ✓ levels now are the highest ever (in last 160 000 years) ✓ Against Any one from: but there have been (big) fluctuations ✓ idea that levels have decreased before ✓ similar levels 120 000 years ago ✓	2	3.1b	ALLOW any number in range 0 to 40 000 for 'recently' ALLOW comparison that uses correct data e.g. present day there is 345(ppm) 160 000 years ago (only) 200(ppm) ALLOW before present day levels were (much) lower ALLOW has increased before and decreased ALLOW shown variation in past / hasn't increased consistently

Question			Answer	Mark	AO element	Guidance
11	(c)	(ii)	increase in/more carbon/carbon dioxide released/produced (into the atmosphere) ✓ decrease in/less carbon/carbon dioxide removed (from atmosphere) ✓ BUT carbon/carbon dioxide is being released/produced (into the atmosphere) faster than it is removed ✓✓	2	3.2a	must be comparative, IGNORE just 'large amounts' / 'lots' IGNORE just 'levels of carbon/carbon dioxide have increased' BUT ALLOW 'levels of carbon/carbon dioxide going into the atmosphere have increased' IGNORE references to ozone ALLOW there is more carbon/carbon dioxide being released/produced (into the atmosphere) than removed ✓✓
11	(c)	(iii)	Max. one from: increased use/burning fossil fuels (releasing CO₂) ✓ deforestation / removing plants/trees ✓ Max. two from: reduction of biodiversity ✓ species may become extinct/die out ✓ due to loss/destruction of habitats ✓	3	1 x 2.1 2 x 3.1a	ALLOW named fossil fuel IGNORE unqualified examples e.g. more cars ALLOW species disappear IGNORE just 'animals and plants die' ALLOW examples of habitat destruction e.g. less Arctic ice
11	(d)		breed the shiny leaved plants that give the highest yields ✓ OR breed shiny leaved plants with plants that give high yield ✓ THEN choose/grow/clone offspring that have the shiniest leaves and highest yield ✓	2	2.1	

Question		Answer	Mark	AO element	Guidance
12	(a)	Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. Level 3 (5–6 marks) Describes in detail how evolution occurs to include most of the ideas about mutations, variation and survival of the fittest. AND Identifies links between <i>Australopithecus afarensis</i> and <i>Homo sapiens</i> seen in diagram. <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) A basic description of how evolution occurs. AND Identifies links between <i>Australopithecus afarensis</i> and <i>Homo sapiens</i> seen in diagram. OR Describes in detail how evolution occurs to include most of the ideas about mutations, variation and survival of the fittest. <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) Attempts a description of how evolution occurs. OR Identifies links between <i>Australopithecus afarensis</i> and <i>Homo sapiens</i> seen in diagram. <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant clear.</i>	6	4x 1.1 2 x 3.1a	AO1.1 Demonstrates knowledge and understanding of scientific ideas - natural selection occurs - mutations cause change in genes/DNA/chromosomes - idea of variation within the species - idea of adaptations to changes in the environment - ideas about survival of the fittest - adaptations passed onto next generation in genes - changes occur over millions of years - new species form AO3.1a Analyse information and ideas to interpret and evaluate - diagram shows skulls are similar in structure / examples of how the skulls are similar e.g. similar ridge over eye socket - diagram shows change in structure / size of skull /examples of how the skulls has changed e.g. skull became more rounded (over time) - idea that diagram shows the progression of evolution from <i>Australopithecus afarensis</i> and <i>Homo sapiens</i> via <i>Homo habilis</i> and <i>Homo erectus</i> IGNORE references to loss of lower jaw

Question			Answer	Mark	AO element	Guidance
			0 marks <i>No response or no response worthy of credit.</i>			
12	(b)	(i)	Any two from: differences/similarities (between species) found in DNA ✓ provides information on an organism's evolutionary relationships / evolutionary history ✓ enables phylogenetic tree / evolutionary tree construction ✓	2	1.1	ALLOW differences/similarities (between species) found in genes IGNORE just 'compares DNA' ALLOW DNA allows us to see characteristics that have been passed down generations due to evolution ALLOW able to see evolutionary links between species by comparing DNA ALLOW can compare DNA to link them to a (common) ancestor IGNORE just 'grouped by ancestors' BUT ALLOW for two marks idea that the more similar the DNA of different species the closer they are related / ORA ALLOW organisms can be grouped/classified using their DNA/genes ALLOW ideas that DNA has enabled more species to be separated / new species identified IGNORE classification systems are based on DNA
12	(b)	(ii)	DNA (sequences) is a code ✓	2	2.1	ALLOW higher level answers e.g. triplet of bases on the DNA is a codon / DNA has bases that form a triplet code

Question			Answer	Mark	AO element	Guidance
			DNA sequences/codes (between organisms) can be compared ✓			ALLOW similar genes (between organisms) can be identified
Question			Answer	Mark	AO element	Guidance
13	(a)	(i)	Any two from: visual identification of symptoms ✓ (check for) HIV antibodies ✓ HIV antigens (and antibodies) ✓ WBC count ✓	2	1.1	ALLOW doctor/medical diagnosis ALLOW examples of visual symptoms e.g. tired / swollen lymph nodes / fever (lasting more than 10 days) / night sweats / weight loss / purple spots / rash / mouth ulcers / (cold) sores / flu like symptoms ALLOW NATs test or nucleic acid tests If no other mark ALLOW 'blood test'
13	(a)	(ii)	Any four from: (HIV) virus invades/enters/infects white blood cells ✓ idea that white blood cells can no longer do their job ✓ no/less antibodies (for TB) are made ✓ (TB) bacteria/pathogen able to survive ✓	4	2.1	IGNORE stops immune system fighting off disease ALLOW (HIV) virus invades/enters/infects T- cells/lymphocytes/WBC IGNORE just 'attacks the white blood cells' ALLOW white blood cells can no longer protect the body from pathogens / white blood cells are destroyed/damaged ALLOW HIV weakens immune system/OR DO NOT ALLOW red blood cells ALLOW people without HIV can make antibodies ALLOW (TB) bacteria/pathogens not killed/destroyed

Question			Answer	Mark	AO element	Guidance
			(TB) bacteria/pathogen will multiply/reproduce ✓ number of bacteria increase to levels that cause death ✓			BUT (TB) bacteria/pathogens not killed/destroyed by WBC ✓✓
13	(b)		idea of using the condom / 'femidom' / barrier method ✓ idea of prevents the mixing of (bodily) fluids ✓	2	2.1	ALLOW no (bodily) fluids/semen/pathogen /HIV/blood pass into the body IGNORE no sperm/disease/infection pass into the body / stops bacteria IGNORE prevents sperm reaching egg IGNORE references to direct contact
13	(c)	(i)	Any three from: contains a dead / weakened / harmless form of the virus ✓ antibodies are made by WBC ✓ the antibodies/memory cells remain / are still present ✓ antibodies are made quicker / more antibodies are made if exposed to HIV ✓	3	1.1	ALLOW pathogen/antigens/HIV IGNORE bacteria IGNORE small amount of the virus/weakened dose of disease IGNORE antitoxins / antivirals ALLOW idea that memory cells remember the virus ALLOW antibodies are made when exposed to HIV to prevent AIDS developing
13	(c)	(ii)	antivirals ✓	1	1.1	ALLOW antiretroviral therapy (ART) ALLOW pre-exposure prophylaxis (PrEP) IGNORE antibiotics

Question			Answer	Mark	AO element	Guidance
14	(a)	(i)	provide or contains minerals/nutrient/nitrates ✓	1	1.1	ALLOW provide or contains nitrogen ALLOW other named minerals e.g. phosphate /potassium/ammonium (nitrate) DO NOT ALLOW carbon/ammonia
14	(b)	(i)	less contamination / there maybe bacteria on the rim of the bottle / you only get the bacteria you want ✓ idea that more even spread of bacteria on the jelly / will be able to transfer smaller quantity of bacteria / control the amount you add / not flood the agar jelly ✓	2	3.3a	ALLOW prevent/minimise infection IGNORE stops bacteria from the air ALLOW idea that it prevents spilling bacteria on bench ALLOW idea of not too many bacteria put onto plates / more precise application
14	(b)	(ii)	only microbes that grow well at 25°C will be present ✓ less risk of growing microbes that live at human body temperature ✓	2	3.3a	ALLOW stop/slows the growth of bacteria that have optimum growth at 37°C ALLOW slows down the growth of bacteria harmful to humans ALLOW bacteria that grow at 37°C are harmful (to humans) ALLOW prevents growing conditions for human pathogens If no other mark ALLOW 37°C is (human) body temperature

Question			Answer	Mark	AO element	Guidance
14	(c)		FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 8×10^{-3} (mm) award 2 marks $\frac{20}{2500}$ ✓ $= 8 \times 10^{-3}$ (mm) ✓	2	2.2	ALLOW answers using 21 $/ 8.4 \times 10^{-3}$ ✓✓ ALLOW for one mark $0.008 / 0.0084$ (mm) ✓ $2/2500 = (0.0008) = 8 \times 10^{-4}$ (mm) ✓ $2.1/2500 = (0.00084) = 8.4 \times 10^{-4}$ (mm) ✓ ALLOW evidence of incorrect answer calculated using 20 or 21 and 2500 converted to standard form for one mark (mm) i.e. $20 \times 2500 = (50\ 000) = 5 \times 10^4$ (mm) ✓ $2500/20 = (125) = 1.25 \times 10^2$ ✓ $21 \times 2500 = (52\ 500) = 5.25 \times 10^4$ (mm) ✓ $2500/21 = (119) = 1.19 \times 10^2$ ✓
14	(d)	(i)	FIRST CHECK THE ANSWER ON ANSWER LINE $(1:)100\ 000$ ✓	1	2.2	ALLOW $(1 \times) 10^5$
14	(d)	(ii)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 2.9×10^6 (CFU per ml) award 2 marks $29 \times 100\ 000$ ✓ $= 2.9 \times 10^6$ (CFU per ml) ✓	2	2.2	ALLOW ECF $29 \times$ answer to (d)(i) with correct answer in standard form scores two marks e.g. $29 \times 6 = 174 = 1$ mark $29 \times 6 = 1.74 \times 10^2 = 2$ marks ALLOW for one mark $2900000 / 29 \times 10^5$ ✓ MAX one mark if answers are rounded to whole numbers

					e.g. 3×10^6 scores one mark ✓
Question			Answer	Mark	AO element Guidance
15	(a)	(i)	stem cells ✓	1	1.1 ALLOW undifferentiated cells IGNORE germinal epithelium cells / non specialised cells IGNORE diploid
15	(a)	(ii)	germinal epithelium are diploid or contain 46 chromosomes but sperm are haploid or contain 23 chromosomes ✓	1	1.1 ALLOW sperm have half (that of germinal epithelium)
15	(b)		stage 1 idea of pairs of chromosomes being separated / chromosome number is halved ✓ stage 2 chromosome is pulled apart or split ✓	2	ASSUME first description is stage one and second description stage 2 1.1 ALLOW DNA replication takes place / idea chromosomes are copied ALLOW haploid cells form ALLOW high level answers e.g. crossing over occurs IGNORE chromosomes are doubled / chromosomes split DO NOT ALLOW mitosis / a diploid cell is formed 2.1 ALLOW cells form with half the amount of DNA ALLOW high level answers e.g. chromatids are pulled apart DO NOT ALLOW a diploid cell is formed IGNORE mitosis
15	(c)		outside temperature is lower than 37°C / outside temperature is lower than body temperature / outside keeps testes cooler / ORA ✓ (so) <u>enzymes</u> active sites are not changed ✓	2	2.1 ALLOW human body is higher than 35°C / human body is too hot IGNORE just 'the body temperature is 37°C' 1.1 ALLOW idea that <u>enzymes</u> don't denature / ORA

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