Higher

GCSE

Biology B Twenty First Century Science

J257/03: Breadth in Biology (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2024

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.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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.

MARKING INSTRUCTIONS

PREPARATION FOR MARKING

RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Online Training*; *OCR Essential Guide to Marking*.
2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are available in RM Assessor.
3. Log-in to RM Assessor and mark the **required number** of practice responses (“scripts”) and the **required number** of standardisation responses.

MARKING

1. Mark strictly to the mark scheme.
2. Marks awarded must relate directly to the marking criteria.
3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 50% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.
4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the RM Assessor messaging system.

5. Work crossed out:

   a. where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks

   b. if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.

7. There is a NR (No Response) option. Award NR (No Response)

   - if there is nothing written at all in the answer space
   - OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
   - OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question.

   Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

8. The RM Assessor **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**

   If you have any questions or comments for your Team Leader, use the phone, the RM Assessor messaging system, or email.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:

Read through the whole answer from start to finish, using the Level descriptors to help you decide whether it is a strong or weak answer. The indicative scientific content in the Guidance column indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance. Using a 'best-fit' approach based on the skills and science content evidenced within the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer.

Once the level is located, award the higher or lower mark:

The higher mark should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.

The lower mark should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.

In summary:

The skills and science content determines the level.

The communication statement determines the mark within a level.

11. 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

12. 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

13. **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 Biology B:

	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.

Question			Answer	Marks	AO element	Guidance
1	(a)	(i)	Idea that the distance between the lamp and pondweed/(boiling) tube is altered ✓ (Count) the number of bubbles produced by the plant over a set/stated period of time ✓ **Any one from** Idea that will control or keep the same:- (Piece/type/species/size/length) pondweed ✓ External light sources ✓ Temperature ✓ Carbon dioxide concentration ✓ Volume/stated volume of water ✓ pH of water ✓	3	1.2	**ALLOW** stated distances **ALLOW** change the intensity of the bulb/lamp/light source **IGNORE** amount of light **ALLOW** time how long it takes to count stated number of bubbles **IGNORE** ref to rate unqualified **IGNORE** record the speed of the bubbles **ALLOW** use same mass/volume/concentration of sodium hydrogen carbonate **ALLOW** use the same light bulb/lamp if this is not what has been changed
		(ii)	**Any two from** Idea that bubbles/gas/oxygen enters/is collected in the syringe/equipment **OR** bubbles/gas/oxygen can't escape ✓ Idea that syringe/equipment measures volume (of gas/oxygen) ✓ Bubbles have different sizes/vary in volume ✓ Idea of counting errors of bubbles ✓ Rate can be calculated as volume over time ✓	2	3.3b	**IGNORE** references to reliable / accurate / precise Must be clear that that the gas is going into the syringe/equipment not the boiling tube **IGNORE** air/names of gas if incorrect **ALLOW** the syringe measures the volume of gas/oxygen = 2 marks

Question			Answer	Marks	AO element	Guidance
	(b)		Section **A** ✓	**1**	**3.1a**	

Question			Answer	Marks	AO	Guidance
2	**(a)**		A population ✓	**1**	**1.1**	
	(b)		2 ✓ 3 ✓ 3 ✓	**3**	**2.1**	
	(c)		**First check the answer in table / on answer line** **If answer = 91.5% award 3 marks** 75 ÷ 82 / 0.914(63415) ✓ 0.91463415 x 100 / 91.4(63415) ✓ to 3 sig figs = 91.5% ✓	**3**	**2.1**	**ALLOW** 91.4 (and any correct evaluated number) for 2 marks **ALLOW** if MP1 is not awarded, credit any number below 1 multiplied by 100. **ALLOW** an incorrect evaluated number correctly rounded to 3 sig figs
	(d)	**(i)**	Biuret ✓	**1**	**1.2**	**ALLOW** sodium hydroxide and copper sulfate
		(ii)	Fatty acids ✓ Glycerol ✓	**2**	**1.1**	
		(iii)	Ratio of 67.5:50 / 50 ÷ 50 = 1 ✓ 67.5 ÷ 50 = 1.35 ✓	**2**	**1.2**	**ALLOW** 50 ÷ 1 = 50 **ALLOW** 1 x 50 = 50 **ALLOW** 1.35 x 50 = 67.5 **ALLOW** 67.5 ÷ 1.35 = 50

Question			Answer	Marks	AO	Guidance
3	(a)	(i)	receptors ✓ hypothalamus ✓ muscles ✓ shivering ✓	4	1.1	
	(b)		(Method) Sweating✓ (Explanation) **Any two from** (Humid environment) idea that the air is moist/there is lots of water (vapour) ✓ Less water/sweat will evaporate/won't evaporate as fast/will evaporate slower ✓ Less heat from skin (transferred) ✓	3	2.1	**IGNORE** use of water to cool the body **ALLOW** idea of making skin wet **IGNORE** no water/sweat will evaporate **ALLOW** idea of less diffusion of water into the surroundings
	(c)		Enzymes ✓ **Any one from** (Enzymes) require an optimum temperature for (chemical) reactions ✓ (Enzymes) denature at high temperature ✓ (Enzymes) enzymes are less active at low temperature ✓	2	1.1	**ALLOW** named reactions e.g respiration, digestion **ALLOW** enzymes work best at 37^{o}C(in the human body) in place of optimum temperature **IGNORE** enzymes denature at low temperatures

Question			Answer	Marks	AO	Guidance
4	(a)		Idea that water leaves through the stomata✓ (Applying grease to both sides of the leaf prevents wilting because it) reduces water loss / less evaporation/diffusion of water from the leaf ✓	2	1 x 1.1 1 x 2.1	**IGNORE** water enters the leaf through the stomata **ALLOW** transpiration
	(b)		**Any one from** (Stomata are located on both surfaces of the leaf) Idea that wilting occurs when grease is applied to only the upper surface and only the lower surface ✓ most wilting occurs when no grease is applied to either surface ✓ no wilting when both surfaces covered, but wilting when leaf 1 and leaf 2 had one surface covered ✓ **AND** (More stomata are located on the lower surface of the leaf) There is more wilting when the upper surface is covered than when the lower surface is covered ✓	2	3.1b	**ALLOW** water loss for wilting **ALLOW** there is more wilting from Leaf 2 than Leaf 1 **ALLOW** When there was only grease on the lower surface the leaf only wilted slightly but when there was only grease on the upper surface the leaf wilted significantly = 2 marks
	(c)		Xylem ✓	1	1.1	**IGNORE** phloem, stem

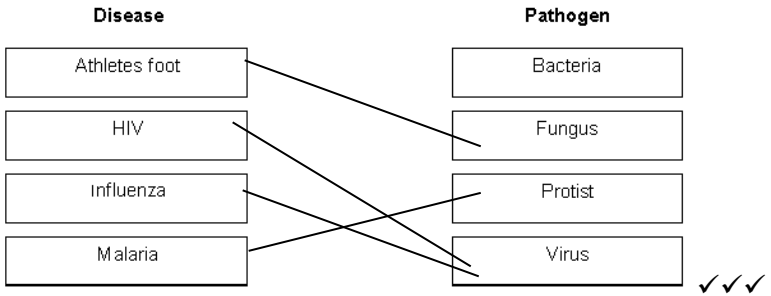
Question			Answer	Marks	AO	Guidance
5	(a)		Gene mutation/mutation of DNA ✓	1	1.1	**ALLOW** change in nucleotide/base sequence (of DNA) **ALLOW** genetic mutation
	(b)		survive ✓ reproduce ✓ allele ✓	3	2.1	**ALLOW** reproduce if not used for the second space **DO NOT ALLOW** survive
	(c)		(Charles) Darwin **AND** (Alfred) Wallace ✓	1	1.1	
	(d)		**Any one from** Does not fit with their beliefs✓ Unaware of/do not understand of the evidence ✓ Interpret the evidence differently ✓ Idea that they cannot observe (evolution) in real time✓	1	1.1	**ALLOW** any sensible suggestion

Question			Answer	Marks	AO	Guidance
6	(a)		**Any two from** (Hormonal system response is…) Slower ✓ Longer lasting✓ Idea of wider ranging/less targeted ✓ Via the blood not via nerves/neurons ✓ Via hormones not electrical/nerve impulses ✓	2	1.1	**ALLOW ORA** throughout **ALLOW** chemicals for hormones
	(b)		Pituitary gland✓ Kidney tubules✓	2	1.1	
	(c)		Water will move into cells ✓ By osmosis ✓ Idea that cells will swell/burst ✓	3	1.1	**ALLOW** water is absorbed by cells **ALLOW** lyse/lysis/bloated

Question			Answer	Marks	AO	Guidance
7	(a)	(i)	(Fine) focussing/refraction of light onto retina ✓	1	1.1	**ALLOW** fovea **ALLOW** converges light
	(b)	(i)	(The stem cells) differentiated/become specialised/switch genes on/off (to become lens cells) ✓ (Divided by) mitosis ✓	2	2.1	
		(ii)	**Any one from** Idea that the initial trial performed only used 12 babies/small sample size ✓ Idea that there is no information on how their sight was after 3 months/longer term ✓ Consequences if procedure doesn't work long term e.g cataracts may return/lens may not form/ trial procedure could cause long term damage ✓ Procedure was a trial – idea that this may carry a greater risk ✓ (Ethics) parents feel their babies are too young to be used in trials/to have trial procedures used on them✓	1	2.1	**ALLOW** any sensible suggestion **ALLOW** idea that stem cells may differentiate into the wrong type of cells **IGNORE** general risks of surgery unless qualified as long term **IGNORE** harmful/side effects/dangerous if unqualified

Question			Answer	Marks	AO	Guidance
8	(a)	(i)	**Any one from** Vomit ✓ Faeces/stool/excrement✓ Blood ✓	1	2.1	**ALLOW** saliva, mucus, (tissue/cell) sample from the digestive system or named digestive system organ **IGNORE** body fluid unqualified, urine, excretion
	(b)		**Any one from** Idea to increase the number of bacteria/ to grow colonies of bacteria ✓ To make sure there are sufficient bacteria (to test on)/ will not run out of bacteria to test on ✓ **Any one from** Idea that different/multiple/repeat tests may need to be carried out on the sample✓ Idea that with more bacteria samples are easier to analyse✓	2	1.1	**IGNORE** mitosis **ALLOW** reproduce, binary fission, produce clones **ALLOW** Idea that something may go wrong with original sample or testing method or additional samples from patient not needed
	(c)		**Any two from** Place the slide on the stage **and** select the lowest/smallest (magnification) objective lens ✓ Use the coarse/fine (focussing knob) to focus the image/make image clearer ✓ Change to higher (magnification) objective lens and refocus✓ **AND** The bacteria/cells will be pink (if they are *Salmonella)* ORA✓	3	**2 x 1.2** **1 x 3.2b**	**ALLOW** x4 objective lens

Question			Answer	Marks	AO	Guidance
	(d)		**Any one from** Idea that aseptic technique will kill other bacteria ✓ To prevent culturing of/contamination (of the sample) by other pathogens/bacteria/microorganisms ✓ Idea that it prevents cross contamination between (patients') samples ✓ Idea that it will protect those working with the bacteria/undertaking the procedure ✓ Idea that results/diagnosis will not be affected by contamination✓	**1**	**1.1**	**ALLOW** only the sample of bacteria you require is cultured
	(e)	**(i)**	Fast/quick✓	**1**	**1.1**	**ALLOW** Only 1 parent needed / don't need to find a mate **ALLOW** requires less energy **IGNORE** genetically identical unqualified **ALLOW** idea that all offspring have advantageous trait
		(ii)	Lack of <u>genetic</u> variation/diversity ✓	**1**	**1.1**	**ALLOW** all genetically identical **ALLOW** idea that all offspring will be prone to the same disease **ALLOW** idea that all offspring have the same disadvantageous trait/inherited disease

Question			Answer	Marks	AO	Guidance
9	(a)	(i)	B E A D C✓✓✓	3	1.1	E directly before A = 1 mark A directly before D = 1 mark D directly before C = 1 mark **ALLOW** BEDAC for 1 mark
	(b)	(i)	 ✓✓✓	3	1.1	All 4 for 3 marks 3 correct for 2 marks 2/1 correct for 1 mark
	(c)	(i)	Eastern and Southern Africa ✓	1	2.2	
		(ii)	**Any two from** Less education/awareness on (HIV) transmission/ prevention✓ Less access to/use of (named) barrier contraception/more unprotected sex ✓ Higher population ✓ Idea of more infections from blood products✓ Idea of less availability of HIV screening ✓	2	3.2a	**ALLOW** any sensible suggestion **ALLOW** sexual health screening **ALLOW** Idea of less access to pre exposure prophylaxis drugs e.g. PrEP **IGNORE** vaccination
		(iii)	Idea that some people may not have been tested/have no symptoms/ reluctant to be tested ✓ Idea that (reliable) data is not recorded/reported/regularly updated (by the country/government) ✓	2	3.2a	**ALLOW** people may lie about tests/don't want to share confidential information
		(iv)	More susceptible/likely to get (other/named) diseases/other (named) diseases may be more severe ✓	1	3.2b	**ALLOW** idea of reduced immune response/develop into AIDS

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO</th><th>Guidance</th></tr>
<tr><td>10</td><td>(a)</td><td></td><td>Any two from
Africa is now predicted to be higher than in previous prediction✓

Asia (without China and India)/India/China/Latin America/Europe/ are now predicted to fall, where they were previously predicted to level out✓✓

In 1975 no populations were predicted to fall but in 2020, 5 were predicted to fall ✓

North America is now predicted to be higher than in the previous prediction✓

Asia (without China and India) was predicted to be highest in 1975 but now its Africa ✓

Total population projection (for 2100) made in 2020 is higher than projection made in 1975 ✓</td><td>2</td><td>3.1a</td><td>ALLOW any correct differences

<table><tr><th></th><th>1975</th><th>2020</th></tr><tr><td>Asia</td><td>2.50</td><td>2.25</td></tr><tr><td>Africa</td><td>2.20</td><td>4.25</td></tr><tr><td>India</td><td>1.90</td><td>1.45</td></tr><tr><td>China</td><td>1.45</td><td>1.10</td></tr><tr><td>L America</td><td>1.20</td><td>0.70</td></tr><tr><td>Europe</td><td>0.90</td><td>0.65</td></tr><tr><td>N America</td><td>0.35</td><td>0.50</td></tr><tr><td>Oceania</td><td>0.05</td><td>0.10</td></tr></table>
ALLOW data quotes to identify differences
ALLOW 0.1+/- for data quotes</td></tr>
<tr><td></td><td>(b)</td><td></td><td>Any one from

Development of new monitoring and recording methods✓
Changes in population data can happen regularly✓

Changes population data can be caused by medicine/healthcare/economics✓
Named events could affect populations ✓
Idea that it allows resource/future planning ✓</td><td>1</td><td>2.1</td><td>ALLOW any sensible suggestion

ALLOW birth/death rate changes/additional data becomes available

ALLOW food security if qualified by the needs/size of population</td></tr>
</table>

Question			Answer	Marks	AO	Guidance
	(c)		**Any two from** Population changes ✓ Changing diets ✓ New pest / pest population changes✓ New disease / disease outbreak / disease control✓ Change in genetic variation✓ Change in biodiversity ✓ Resistance/lack of resistance to insecticides/pesticides/fungicides ✓	**2**	**1.1**	**ALLOW** invasive species **ALLOW** competition **ALLOW** selective breeding/artificial selection **IGNORE** GM crops
	(d)	(i)	Genes code for proteins ✓ (If other genes/DNA are present) other proteins will be made by the plant✓	**2**	**2.1**	**ALLOW** idea that inserting other genes/DNA could result in undesirable/unknown/unexpected characteristics/phenotypes/effects in rice **ALLOW** idea that inserting other genes/DNA could have unknown/undesirable effects on consumer/people
		(ii)	**Any one from** To get many/more/spare copies (of the gene)✓ In case the gene does not insert into the plasmid/host ✓ Increase the chances of the plasmid taking the gene in ✓	**1**	**2.1**	**ALLOW** idea that repeated attempts to insert the plasmid may be needed
		(iii)	Plasmid/bacterium✓	**1**	**2.1**	
		(iv)	Idea plant needs to be adapted/survive in the local environment/conditions ✓	**1**	**3.2a**	

Question			Answer	Marks	AO element	Guidance
11	(a)	(i)	The idea that (a condition caused by a dominant allele) will be more common (in population/kittens) / condition caused by a recessive allele will be less common (in population/kittens)✓ (Only) need one dominant allele/heterozygous (to have the condition)/a recessive disorder requires two recessive alleles/homozygous alleles / dominant when present will always be expressed (the phenotype)✓	2	2.1	**ALLOW** a dominant allele makes the condition more likely in a population **DO NOT ALLOW** a dominant allele makes an individual more likely to have a condition/ a dominant allele is more likely to be expressed **ALLOW** If one/both parent(s) is heterozygous for a condition then more kittens/offspring are likely to be born with the condition = 2 marks **ALLOW** If one parent is homozygous dominant for a condition then all kittens/offspring will be born with the condition ORA = 2 marks
	(b)	(i)	(Male) dd and (female) Dd gametes ✓✓ Offspring dd,dd, Dd and Dd in Punnett square ✓ Indication which of the offspring would have PKD ✓	4	3 x 2.1 1 x 2.2	If identifies male and female or uses XX and XY the gametes must be correct **ALLOW** another letter in place of D, d **ECF** for incorrect gametes in Punnett square **ALLOW** 50%/0.5 have PKD (or correct percentages from their Punnett square)
		(ii)	**First check the answer in table / on answer line** **If answer = 0.25 award 2 marks** 0.5 x 0.5 ✓ = 0.25 ✓	2	2.2	**ALLOW ECF** from their b(i) for both marking points if working shown. **ALLOW** correct fractions or 50% **ALLOW** any correct fractions or 25%

Question			Answer	Marks	AO element	Guidance
	(c)		**Any one from** So the cats can be treated✓ Idea to help prevent breeding cats with PKD in future ✓ Financial reasons✓	**1**	**3.1a**	**ALLOW** Any sensible suggestion **IGNORE** ethical unqualified
	(d)		19✓	**1**	**2.1**	

Need to get in touch?

If you ever have any questions about OCR qualifications or services (including administration, logistics and teaching) please feel free to get in touch with our customer support centre.

Call us on

01223 553998

Alternatively, you can email us on

support@ocr.org.uk

For more information visit

ocr.org.uk/qualifications/resource-finder

ocr.org.uk

Twitter/ocrexams

/ocrexams

/company/ocr

/ocrexams

CAMBRIDGE
UNIVERSITY PRESS & ASSESSMENT

OCR is part of Cambridge University Press & Assessment, a department of the University of Cambridge.

OCR operates academic and vocational qualifications regulated by Ofqual, Qualifications Wales and CCEA as listed in their qualifications registers including A Levels, GCSEs, Cambridge Technicals and Cambridge Nationals.

OCR provides resources to help you deliver our qualifications. These resources do not represent any particular teaching method we expect you to use. We update our resources regularly and aim to make sure content is accurate but please check the OCR website so that you have the most up-to-date version. OCR cannot be held responsible for any errors or omissions in these resources.

Though we make every effort to check our resources, there may be contradictions between published support and the specification, so it is important that you always use information in the latest specification. We indicate any specification changes within the document itself, change the version number and provide a summary of the changes. If you do notice a discrepancy between the specification and a resource, please contact us.

Whether you already offer OCR qualifications, are new to OCR or are thinking about switching, you can request more information using our Expression of Interest form.

Please get in touch if you want to discuss the accessibility of resources we offer to support you in delivering our qualifications.