



GCE

Biology A

H420/03: Unified biology

A Level

Mark Scheme for June 2022

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.

© OCR 2022

H420/03

Mark Scheme

June 2022

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:

Where a candidate has crossed out a response and provided a clear alternative then the crossed-out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed-out response where legible.

Rubric Error Responses – Optional Questions

Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM assessor, which will select the highest mark from those awarded. (The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)

Multiple Choice Question Responses

When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate). When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses

When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only one mark per response)

Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. (The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)

Short Answer Questions (requiring a more developed response, worth two or more marks)

If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

Longer Answer Questions (requiring a developed response)

Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional

H420/03

Mark Scheme

June 2022

judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

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.

Level of response questions on this paper are **3cii** and **4c**.

















H420/03

Mark Scheme

June 2022

11. Annotations available in RM Assessor

Marking Annotations

Annotation	Use
	Benefit of Doubt
	Contradiction
	Cross
	Error Carried Forward
	Given Mark
	Extendable horizontal wavy line (to indicate errors / incorrect science terminology)
	Ignore
	Large dot (various uses as defined in mark scheme)
	Highlight (various uses as defined in mark scheme)
	Benefit of the doubt not given
	Tick
	Omission Mark
	Blank Page
	Level 1 answer in Level of Response question
	Level 2 answer in Level of Response question
	Level 3 answer in Level of Response question

H420/03

Mark Scheme

June 2022

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

Annotation	Meaning
/	alternative and ALLOWable 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 ALLOWed
()	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.

Question		Answer	Mark	AO	Guidance
1	(a)	(R) opsonin ✓ (S) <u>agglutinin</u> ✓ (T) anti-toxin ✓	3	2.5	ALLOW R = opsonisation / opsonising ALLOW S = IgM / agglutin / agglutinin / agglutination / agglutinating / agglutinator ALLOW T = neutralisation / neutralising IGNORE detoxifying
1	(b)	autoimmune ✓	1	2.1	ALLOW autoimmunity
1	(c)	<i>in the heart disease ECG</i> <i>idea of</i> QRS (complex) closer together ✓ <i>idea of</i> inconsistent gaps between, QRS / ventricular systoles ✓ <i>idea of</i> more / no clear, P waves / atrial systoles ✓ <i>idea of</i> no clear, T (peak) / diastole ✓	2 max	2.1	Assume answer refers to the heart disease ECG unless otherwise stated. Ora for <i>in the normal heart ECG</i> e.g. ventricular systoles closer together / more QRS waves / higher heart rate / more heart beats / tachycardia e.g. irregular heart beat / arrhythmia e.g. atria contract more often / <u>atrial fibrillation</u> / more / larger, P peaks / atrial systoles / no gap between P and Q IGNORE 'no P wave' e.g. no clear T section / T peaks are different sizes / no gap between, T and P / S and T IGNORE 'no T wave' / 'T wave more frequent'
1	(d)	(i) more adenylyl cyclase ✓ on, cell surface / plasma, membranes ✓ more, cAMP / second messenger, produced ✓ <i>idea of</i> adrenaline has <u>greater</u> effect on heart cells ✓ <i>idea of</i> improved contraction of, cardiac muscle / heart ✓	2 max	2.5	ALLOW more, adenylyl / adenylylate, cyclase / enzyme e.g. increases responsiveness to, adrenaline / noradrenaline e.g. greater heart rate / increased contraction IGNORE 'improved heart function' alone as in question stem IGNORE 'heart pumps blood more efficiently'

H420/03

Mark Scheme

June 2022

1	(d)	(ii)	virus / viral vector ✓ liposome ✓	1 max	1.2	ALLOW plasmid / yeast artificial chromosome / YAC IGNORE 'injection' unqualified
1	(d)	(iii)	<i>idea of</i> to share knowledge (with other scientists) ✓ <i>idea of</i> to allow validation of new knowledge ✓	1 max	2.1	e.g. allow others to repeat the procedure / others can compare results with their own IGNORE 'peer review with other scientists' / 'to prevent bias' unqualified e.g. to ensure the integrity of scientific results / check if results are reproducible / to evaluate the results
2	(a)	(i)	(X) (T or B) lymphocyte ✓ (Y) neutrophil ✓	2	2.3	ALLOW T cell / B cell / T helper cell / T killer cell / T regulator cell ALLOW phagocyte
2	(a)	(ii)	flattened / biconcave (shape), to increase surface area (to volume ratio) ✓ no, nucleus / organelles, to give (more) space for haemoglobin ✓ flexible, to increase surface area in contact with <u>capillary wall</u> / to squeeze through <u>capillaries</u> ✓ small, for short diffusion pathway / to fit through <u>capillaries</u> ✓ transport proteins in plasma membrane, to allow chloride shift ✓ high concentrations of carbonic anhydrase (inside cells), to allow transport of carbon dioxide / described ✓	2 max	1.1 2.1	IGNORE concave ALLOW few organelles so more haemoglobin can be in the cell IGNORE to give (more) space for oxygen 'cells are small and flexible to fit through capillaries' = 2 marks

H420/03

Mark Scheme

June 2022

2	(a)	(iii)	<p>FIRST CHECK ON ANSWER LINE If answer = 13 award 2 marks</p> <p>10 mm / 800 (= 0.0125mm) ✓ 0.0125mm x 1 000 (= 12.5µm) ✓</p>	2	2.8	<p>ALLOW 12.5 for 2 marks ALLOW answer to more than 3 s.f. for 1 mark</p> <p>ALLOW ECF if incorrect measurement of cell W with units used but divided by 800 for 1 mark or measurement of cell W with units correctly converted to µm for 1 mark</p> <p>ALLOW 0.01m / 800 (= 0.0000125m) and 0.0000125m x 1 000 000 (= 12.5µm)</p> <p>ALLOW 1cm / 800 (= 0.00125cm) and 0.00125 x 10 000 (= 12.5µm)</p> <p>If candidate measures cell W as 9.5 mm ALLOW 12 / 11.9 for 2 marks and 11.88/11.875 for 1 mark If candidate measures cell W as 10.5 mm ALLOW 13 / 13.1 for 2 marks and 13.13 / 13.125 for 1 mark</p>
2	(b)	(i)	<p>digests / hydrolyses / destroys / kills / breaks down, pathogens ✓</p>	1	1.1	<p>IGNORE 'get rid of pathogens' IGNORE ref to antigens ALLOW ref to parasites / damaged cells / tumour cells / old cells / old organelles for 'pathogens' DO NOT ALLOW 'engulf pathogens'</p>
2	(b)	(ii)	<p>FIRST CHECK ON ANSWER LINE If answer = 2×10^{-5} award 2 marks</p> <p>$1.3 \times 10^{-21} / 6.5 \times 10^{-14} = 2 \times 10^{-8} \text{ (mol cm}^{-3}\text{)}$ ✓ $2 \times 10^{-8} \text{ (mol cm}^{-3}\text{)} \times 1000 = 2 \times 10^{-5} \text{ (mol dm}^{-3}\text{)}$ ✓</p>	2	2.2	<p>ALLOW 0.00002 for 2 marks</p> <p>ALLOW 'x 1000' seen anywhere in the answer</p>
2	(b)	(iii)	<p>(-log 0.00002 =) 4.7 ✓</p>	1	2.2	<p>This mark is for a correct calculation, therefore ALLOW ECF from part (ii) if the pH value calculated is given to 2 sig figs, even if outside the normal pH range, including correctly calculated negative values</p>

H420/03

Mark Scheme

June 2022

2	(b)	(iv)	B ✓	1	3.1	<p>Apply ECF from part (iii) ALLOW B if calculated pH is less than 7 ALLOW A if calculated pH is greater than 7 ALLOW C if calculated pH is 7. ALLOW B if no pH calculation given in (iii) ALLOW answer if shown on table if no answer given on answer line</p>
2	(c)		<p><i>step 1 add crystal violet</i> <i>step 2 add iodide solution</i> <i>step 3 add alcohol / ethanol</i> <i>step 4 add safranin</i></p> <p>All steps in correct order ✓✓ 3 steps in correct order ✓</p>	2	3.3 3.4	<p>ALLOW iodine for iodide</p>
2	(d)	(i)	<p><i>L = artery because</i></p> <p>small(er), diameter / lumen ✓</p> <p>thick(er) layer of, (smooth) muscle / elastic tissue / elastin ✓</p> <p><i>idea of lumen is more open</i> ✓</p> <p>tunica intima / endothelium, folded ✓</p>	2 max	2.1	<p>DO NOT ALLOW mark points if L identified as vein or not identified at all</p> <p>ALLOW narrow(er) lumen</p> <p>ALLOW greater proportion of, muscle / elastic tissue / elastin (than veins) ALLOW thick(er) tunica media / thick(er) wall</p> <p>ALLOW 'less flattened' than veins</p>
2	(d)	(ii)	collagen ✓	1	2.1	

H420/03

Mark Scheme

June 2022

3	(a)		<p>D: select stem with no flowers / remove flowers from stem ✓ E: <i>idea of</i> encourage root growth / reduce water loss ✓</p> <p>D: remove most leaves / reduce leaves to 1-4 / cover with a plastic bag ✓ E: <i>idea of</i> reduce, water loss / transpiration ✓</p> <p>D: (use) aseptic techniques / sterilise equipment / sterilise stem ✓ E: <i>idea of</i> stop, infection / contamination ✓</p> <p>D: use propagator / propagation box / greenhouse ✓ E: <i>idea of</i> control, (optimum) temperature / humidity / moisture ✓</p> <p>D: do not overwater compost ✓ E: <i>idea of</i> to allow air, to reach roots / for root respiration ✓</p>	3 max	3.3	<p>Explanations (E) can be awarded only with a correct Description (D) mark. Max 2 for descriptions alone</p> <p>e.g. more energy for roots to grow</p> <p>DO NOT ALLOW 'stops water loss'</p>
3	(b)	(i)	10^{-5} (mol dm ⁻³) ✓	1	2.8	ALLOW answers in range 9×10^{-6} to 1×10^{-5} (mol dm ⁻³)
3	(b)	(ii)	repeat measurements (for that concentration) ✓	1	2.7	IGNORE 'repeat the experiment' unqualified

H420/03

Mark Scheme

June 2022

3	(b)	(iii)	<p><i>Apical shoots</i></p> <p>at high(er) auxin concentrations / from 10^{-9} (to 10^{-4} mol dm⁻³) , apical growth / apical dominance is, stimulated / increased ✓</p> <p>(apical shoot growth) peaks at 10^{-5} (mol dm⁻³) ✓</p> <p><i>Idea of</i> very high concentrations of auxin inhibit apical (shoot) growth ✓</p> <p><i>lateral shoots</i></p> <p>at low(er) auxin concentrations / from 10^{-11} (to 10^{-7} mol dm⁻³), lateral (shoot) growth is , stimulated / increased ✓</p> <p>at high(er) auxin concentrations / above 3×10^{-7} (mol dm⁻³), lateral (shoot) growth is inhibited ✓</p>	3 max	3.1	<p>IGNORE units throughout</p> <p>ALLOW any value within this range.</p> <p>IGNORE 'as auxin concentration increases apical growth increases' without ref to 'high / higher auxin concentration' or correct data quote</p> <p>e.g. apical (shoot) growth is inhibited at 10^{-3} (mol dm⁻³)</p> <p>ALLOW any value within this range.</p> <p>'at high auxin concentrations, apical dominance is greatest and lateral shoot growth is inhibited' = 2 marks (mp1 and 5)</p>
3	(c)	(i)	mm h ⁻¹ or cm h ⁻¹ or mm d ⁻¹ or cm d ⁻¹ ✓	1	3.3	<p>ALLOW 'day' for 'd' 'hour' for 'h'</p> <p>DO NOT ALLOW s / secs/ seconds /min / minutes</p> <p>ALLOW '/' for ⁻¹</p> <p>IGNORE 'per'</p> <p>DO NOT ALLOW use of both ⁻¹ and '/' together</p>

H420/03

Mark Scheme

June 2022

3	(c)	(ii) Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. In summary: <i>Read through the whole answer. (Be prepared to recognise and credit unexpected approaches where they show relevance.) Using a 'best-fit' approach based on the science content of the answer, first decide which of the level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer.</i> <i>Then, award the higher or lower mark within the level, according to the Communication Statement (shown in italics):</i> <ul style="list-style-type: none"> ○ award the higher mark where the Communication Statement has been met. ○ award the lower mark where aspects of the Communication Statement have been missed. <ul style="list-style-type: none"> • The science content determines the level. • The Communication Statement determines the mark within a level. 			
		<p>Level 3 (5-6 marks) Comprehensive outline of a valid experimental method, including details of all three types of variable, and statistical analysis for the investigation.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p>Level 2 (3-4 marks) The answer contains detailed reference to variables and statistical analysis for the investigation.</p> <p><i>There is a line of reasoning with some structure. The information presented is relevant and supported by some evidence.</i></p> <p>Level 1 (1-2 marks) The answer contains brief reference to a variable or statistical analysis for the investigation.</p> <p><i>The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.</i></p> <p>0 marks No response or no response worthy of credit.</p>	6	3.3 3.4	<p>Indicative scientific points may include (but are not limited to):</p> <p><i>AO3: To develop and refine practical design and procedures</i></p> <p><i>Experimental method</i></p> <p><i>Validity</i></p> <ul style="list-style-type: none"> • Details of sample sizes and repeats • Details of group design (e.g. two groups: one without additional gibberellin, or several groups receiving different gibberellin concentrations, plus a control group) • Details of gibberellin application <p><i>Variables</i></p> <ul style="list-style-type: none"> • Details of control variables (e.g. plant/seedling size, water availability, light, temperature) • Details of the independent variable (varying gibberellin concentrations) • Details of the measurement of the dependent variable (measurement of stem length)

H420/03

Mark Scheme

June 2022

						<p>Statistical analysis</p> <ul style="list-style-type: none"> • Idea of identifying anomalies • Mean calculations • Standard deviation • Statistical testing (e.g. t-test if two groups are used, or Spearman's rank/Pearson correlation test if a range of concentrations are used)
3	(d)	<p>ethene , promotes / AW , fruit ripening ✓</p> <p>concentration of ethene / stage of apple development , needs to be known ✓</p> <p><i>idea that</i> use of ethene to ripen fruit (normally) needs controlled conditions ✓</p> <p>ethene is a gas AND <i>idea that</i> it will not be effective outside ✓</p> <p>ethene promotes fruit dropping (therefore apples may fall to the ground and be damaged) ✓</p>	3 max	3.2	<p>ALLOW ethene promotes fruit maturing</p> <p>ALLOW using too much ethene may make the apples too ripe / ethene will affect different fruits at different rates (due to varying stages of development or time of year used)</p> <p>e.g. ethene is usually applied at a particular temperature e.g. ethene should be applied in closed conditions e.g. ethene should be released gradually</p> <p>e.g. ethene gas would diffuse away in the air and not land on the fruit IGNORE ' spraying a gas would be ineffective'</p> <p>ALLOW ethene promotes (fruit) abscission IGNORE leaf abscission</p>	

H420/03

Mark Scheme

June 2022

4	(a)	(i)	<p>large surface area to volume ratio ✓</p> <p><i>idea that</i> it can obtain all required substances (largely) through diffusion ✓</p> <p>low metabolic rate ✓</p>	1 max	2.1	<p>IGNORE small size</p> <p>e.g. 'diffusion pathway is short' / 'diffusion alone is sufficient'</p>
4	(a)	(ii)	<p>closed / described ✓</p> <p>single / described ✓</p>	2	2.1	
4	(b)		<p><i>idea that</i> sponges produce, genetically identical offspring / clones ✓</p> <p><i>idea that</i> shark offspring will not be, genetically identical / clones ✓</p> <p>shark offspring have alleles from only, the mother / one parent ✓</p> <p>(but) crossing over / independent assortment, (in meiosis) creates, new allele combinations / genetic variation ✓</p>	max 3	3.2	<p>e.g. offspring of sponges share same, DNA / genome / genetic material</p> <p>IGNORE 'similar DNA'</p> <p>'only sponges, produce clones of themselves / share same DNA' = 2 marks</p> <p>ALLOW 'shark offspring have, DNA / genetic material, only from the mother'</p> <p>IGNORE 'changes the DNA'</p>

H420/03

Mark Scheme

June 2022

4	(c)	<p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p><i>In summary:</i> <i>Read through the whole answer. (Be prepared to recognise and credit unexpected approaches where they show relevance.) Using a ‘best-fit’ approach based on the science content of the answer, first decide which of the level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer. Then, award the higher or lower mark within the level, according to the Communication Statement (shown in italics):</i></p> <ul style="list-style-type: none"> <i>o award the higher mark where the Communication Statement has been met.</i> <i>o award the lower mark where aspects of the Communication Statement have been missed.</i> <p>• The science content determines the level. • The Communication Statement determines the mark within a level.</p>			
		<p>Level 3 (5-6 marks) Detailed descriptions of both embryo splitting and somatic cell nuclear transfer.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p>Level 2 (3-4 marks) A detailed description of one method and an outline of the other method.</p> <p><i>There is a line of reasoning with some structure. The information presented is relevant and supported by some evidence.</i></p> <p>Level 1 (1-2 marks) A detailed description of either embryo splitting or somatic cell nuclear transfer OR outlines of both methods</p> <p><i>The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.</i></p> <p>0 marks No response or no response worthy of credit.</p>	6	1.2	<p>Indicative scientific points may include (but are not limited to):</p> <p><i>Embryo splitting / artificial twinning / embryo twinning</i></p> <ul style="list-style-type: none"> • Sperm taken from a male (with desired traits) • Artificial insemination or IVF • Embryo splitting • Incubation in a lab • Implantation into a surrogate • Offspring are clones of each other <p><i>Somatic cell nuclear transfer</i></p> <ul style="list-style-type: none"> • Nucleus removed from a somatic cell • Enucleation of an egg • Electrofusion • Embryo is transferred into a surrogate • Offspring are clones of the original somatic cell

H420/03

Mark Scheme

June 2022

5	(a)	<p>(cell / nuclear / mitochondrial / chloroplast) membrane(s) ✓</p> <p>protease ✓</p> <p>alcohol / ethanol ✓</p>	3	1.2	<p>Mark the first answer in each space</p> <p>ALLOW nuclear envelope</p> <p>ALLOW named protease e.g. pepsin / trypsin</p>
5	(b)	<p>few gene loci studied ✓</p> <p><i>idea of</i> small sample sizes (within each population) ✓</p> <p><i>idea that</i> the two measures show different patterns of results ✓</p>	2 max	3.1 3.2	<p>Mark as continuous prose</p> <p>ALLOW 'only 23 gene loci studied'</p> <p>e.g. 'only 6 trees sampled in population A'</p> <p>IGNORE ref to different sample sizes in each population</p> <p>ALLOW descriptions such as 'B has the joint highest diversity based on polymorphic loci but only the third highest based on heterozygosity'.</p>
5	(c)	<p>FIRST CHECK ON ANSWER LINE If answer = 150 award 2 marks</p> <p>$150/600 = 0.25$ (q^2) square root of $0.25 = 0.5$ (q) ✓ $p = 1 - 0.5 = 0.5$ $p^2 = 0.5^2 = 0.25$ $0.25 \times 600 (= 150)$ ✓</p>	2	2.2	<p>ALLOW 0.25 for 1 mark</p> <p>ALLOW 1 mark for any 2 correct steps of process</p> <p>Step 1 $150/600 = 0.25$ (q^2) ALLOW ECF for steps 2 -5</p> <ol style="list-style-type: none"> 2. Find square root of q^2 (q) 3. Subtract figure(q) from 1 (p) 4. Multiply $p \times p$ (p^2) 5. (p^2) \times 600

H420/03

Mark Scheme

June 2022

6	(a)	<p><i>Similarities</i></p> <p>(both) use enzyme that cuts DNA ✓ (both) change base, sequence / order, in the organism ✓</p> <p><i>idea that</i> they both result in the production of a new polypeptide ✓</p> <p><i>differences</i></p> <p>no , gene / DNA , insertion in (this method of) CRISPR ✓</p> <p>no, marker genes / ligase / bacterial cells / vector, used in CRISPR ✓</p> <p><i>idea that</i> traditional genetic engineering is illegal in humans ✓</p>	4 max	2.5	<p>DO NOT ALLOW 'both use restriction enzymes' DO NOT ALLOW 'both change bases' alone (as this implies base substitution)</p> <p>Ora for genetic engineering</p> <p>ALLOW no donor organism in CRISPR ALLOW no deletion in genetic engineering / DNA insertion only in genetic engineering / DNA deletion only in CRISPR</p> <p>ALLOW needs an RNA guide sequence in CRISPR IGNORE 'plasmids / restriction enzymes, only in genetic engineering' IGNORE 'Cas9 only in CRISPR' (because they are mentioned in the question stem)</p>																								
6	(b)	<table border="1" data-bbox="344 1002 1137 1353"> <thead> <tr> <th data-bbox="344 1002 573 1126">Ion</th> <th data-bbox="573 1002 696 1126">Has a negative charge</th> <th data-bbox="696 1002 860 1126">Binds to haemoglobin</th> <th data-bbox="860 1002 1016 1126">A product of the dissociation of carbonic acid</th> <th data-bbox="1016 1002 1137 1126">Involved in the chloride shift</th> <th data-bbox="1137 1002 1227 1126"></th> </tr> </thead> <tbody> <tr> <td data-bbox="344 1126 573 1198">Hydrogen</td> <td data-bbox="573 1126 696 1198"></td> <td data-bbox="696 1126 860 1198">✓</td> <td data-bbox="860 1126 1016 1198">✓</td> <td data-bbox="1016 1126 1137 1198"></td> <td data-bbox="1137 1126 1227 1198">✓</td> </tr> <tr> <td data-bbox="344 1198 573 1270">Hydrogencarbonate</td> <td data-bbox="573 1198 696 1270">✓</td> <td data-bbox="696 1198 860 1270"></td> <td data-bbox="860 1198 1016 1270">✓</td> <td data-bbox="1016 1198 1137 1270">✓</td> <td data-bbox="1137 1198 1227 1270">✓</td> </tr> <tr> <td data-bbox="344 1270 573 1353">Chloride</td> <td data-bbox="573 1270 696 1353">✓</td> <td data-bbox="696 1270 860 1353"></td> <td data-bbox="860 1270 1016 1353"></td> <td data-bbox="1016 1270 1137 1353">✓</td> <td data-bbox="1137 1270 1227 1353">✓</td> </tr> </tbody> </table>	Ion	Has a negative charge	Binds to haemoglobin	A product of the dissociation of carbonic acid	Involved in the chloride shift		Hydrogen		✓	✓		✓	Hydrogencarbonate	✓		✓	✓	✓	Chloride	✓			✓	✓	3	1.1	<p>AWARD one mark per correct row</p>
Ion	Has a negative charge	Binds to haemoglobin	A product of the dissociation of carbonic acid	Involved in the chloride shift																									
Hydrogen		✓	✓		✓																								
Hydrogencarbonate	✓		✓	✓	✓																								
Chloride	✓			✓	✓																								

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](https://twitter.com/ocrexams)

 [/ocrexams](https://twitter.com/ocrexams)

 [/company/ocr](https://www.linkedin.com/company/ocr)

 [/ocrexams](https://www.youtube.com/ocrexams)



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

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored. © OCR 2022 Oxford Cambridge and RSA Examinations is a Company Limited by Guarantee. Registered in England. Registered office The Triangle Building, Shaftesbury Road, Cambridge, CB2 8EA.

Registered company number 3484466. OCR is an exempt charity.

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.