GCE

Biology A

H020/02: Depth in biology

AS 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.

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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.

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.

   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 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 SEEN 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 **1(c)(ii)** and **5.**

11. Annotations available in RM Assessor

Marking Annotations

Annotation	Use
BOD	Benefit of Doubt
CON	Contradiction
	Cross
ECF	Error Carried Forward
GM	Given Mark
	Extendable horizontal wavy line (to indicate errors / incorrect science terminology)
I	Ignore
	Large dot (various uses as defined in mark scheme)
	Highlight (various uses as defined in mark scheme)
NBOD	Benefit of the doubt not given
	Tick
^	Omission Mark
BP	Blank Page
L1	Level 1 answer in Level of Response question
L2	Level 2 answer in Level of Response question
L3	Level 3 answer in Level of Response question

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.

Question			Answer	Mark	AO	Guidance
1	(a)		*any two **I** marks and matching **R** marks:* *If an I mark is just missed (e.g. for **I1** answer says weight instead of mass) can still give the matching reason mark **R1*** **I1** same, number / size / mass / volume (of pieces) ✓ **R1** to control / same, <u>surface area</u> ✓ **I2** pieces from same beetroot **OR** pieces from same, part / depth / variety, of beetroot ✓ **R2** to control / same, pigment concentration ✓ **I3** rinse / wash / wipe / dry, pieces ✓ **R3** to remove pigment released by, cutting / cell damage ✓ **I4** use, one / new, flask / tube, per, temperature / repeat ✓ **R4** to, test effect of / get absorbance for, one / single, temperature ✓	**4 max**	AO 3.3	**ALLOW** cubes / discs / cylinders / strips / rectangles / chips / samples / beetroot, for 'pieces' throughout **ALLOW** betalain for 'pigment' throughout **I1 ALLOW** cork borer cylinders of same length **I1 IGNORE** weight for 'mass' **R1 ALLOW** same, surface area to volume ratio / SA:V **ALLOW I1** 'same <u>surface area</u>' **+ R1** '<u>surface area</u> affects rate of pigment loss' for 2 marks **I2 ALLOW** plant for 'beetroot' **I2 ALLOW** species for 'variety' **R2 ALLOW** *idea of* pigment concentration varies / AW **R3 ALLOW** to avoid artificially high absorbance reading **I4 ALLOW** add pieces when temperature reached **I4 ALLOW** different / new / fresh, pieces for each, temperature / repeat **R4 ALLOW** so pieces experience a single temperature / so pieces not affected by previous temperature **OR** as used / old, pieces damaged by high temperatures / AW
1	(b)		<u>temperature</u> ✓	**1**	AO 3.3	**DO NOT ALLOW** room temperature
1	(c)	(i)	**1** linear scales using half of grid or more **AND** *x* axis labelled <u>temperature (°C)</u> **AND** *y* axis labelled (mean) <u>absorbance (%)</u> ✓ **2** points plotted correctly for <u>mean</u> absorbance ✓ **3** all points joined with curved line ✓	**3**	AO 2.4	**1 ALLOW** solidus before unit (instead of brackets) **2 ALLOW** to **<u>±</u>1** small square **2 IGNORE** figures plotted from trial 1, 2 or 3 **2 DO NOT ALLOW** bars **3 DO NOT ALLOW** ruled lines between points **3 ALLOW** one data point outside of curved line of best fit **3 IGNORE** line extended beyond first or last point **3 ALLOW ECF** for data plot from trial 1, 2 or 3

1	**(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:*** *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):* ○ *award the higher mark where the Communication Statement has been met.* ○ *award the lower mark where aspects of the Communication Statement have been missed.* • ***The science content determines the level.*** • ***The Communication Statement determines the mark within a level.***			
			Level 3 (5–6 marks) Full and detailed description of how the phospholipids in the cell membrane are affected by temperature, causing the structure of the plasma membrane to become disrupted with reference to the results between 20ºC and 70ºC. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** A detailed description of how the phospholipids in the cell membrane are affected by temperature, causing the structure of the plasma membrane to become disrupted with reference to the results between 20ºC and 70ºC. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** A description of some of the effects on phospholipids in the cell membrane of either high or low temperature with reference to the results between 20ºC and 70ºC. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** *No response or no response worthy of credit.*	**6**	AO 1.2 AO 2.3 AO 3.1	**Indicative points may include:** **Explanation of results** At 20ºC, membrane intact / impermeable / least permeable At, low temperature / 30ºC / 40ºC / 50ºC, pigment escapes Through gaps between (moving) phospholipids As temperature increases kinetic energy increases More, phospholipid movement / gaps Membrane becomes more permeable More, pigment loss / betalain release / colour in flask Higher absorbance figure Graph curves upwards At high temperature / 60ºC / 70ºC, membrane disrupted Phospholipid, arrangement / bilayer, breaks down / melts Membrane, leaky / very permeable Large increase in, pigment loss / betalain release / AW Large increase in absorbance figure Graph curves up more steeply **Structure of phospholipids** Phosphate (and glycerol) head (Two) fatty acid / hydrocarbon, tails **Properties of phospholipids** Heads, are hydrophilic / face out / face aqueous medium Tails, are hydrophobic / face inwards / in centre of bilayer Phospholipids form bilayer Form barrier to, water / water-soluble molecules **IGNORE** ref. proteins / cholesterol

1	**(d)**		**1** percentage / absorbance / mean, higher ✓ **2** water / ice, expansion, breaks / damages, membrane **OR** ice crystals, puncture / damage, membrane ✓	**2**	AO 3.3	**1 DO NOT ALLOW** absorption for 'absorbance' **1 ALLOW** ORA percentage / absorbance / mean, lower, for first experiment / in table

Question			**Answer**	**Mark**	**AO**	**Guidance**
2	**(a)**	**(i)**	**1** (named) protein, synthesis / made ✓ **2** (named) organelle, replication / synthesis ✓ **3** energy stores increase ✓ **4** (replicated / new) DNA checked for errors ✓ **5** DNA repair ✓	**1 max**	AO 1.2	**1** e.g. tubulin **2** e.g. mitochondria **2 ALLOW** G2 checkpoint to ensure enough organelles **3 ALLOW** G2 checkpoint to ensure enough energy stores
2	**(a)**	**(ii)**	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 3 award 1 mark** 3 ✓	**1**	AO 2.2	**ALLOW** answer given on **Fig. 2.1** **ALLOW** an answer anywhere between 2 and 4

2	**(a)**	**(iii)**	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 18 (mm year^{-1}) award 2 marks** $\frac{110 - 21}{6 - 1}$ **OR** $\frac{89}{5}$ ✓ 18 ✓	**2**	AO 2.2	**ALLOW** data from **any pair of years** to calculate growth rate (change in *y* axis ÷ change in *x* axis). E.g. working & answer **OR** correct answer alone for **2 marks** **ALLOW** answer given to 3 significant figures as shown (**2 marks**) If answer given to more than 3 sig. fig. **max 1 mark** **ALLOW ECF** from candidate's 2(a)(ii) figure for year 0 **ALLOW** calculations from variant *y* axis readings as shown: e.g. (yrs 6 and 1) 110 – 20.5 = 89.5 and 89.5 ÷ 5 = 17.9 **OR** 109.5 – 21 = 88.5 and 88.5 ÷ 5 = 17.7 109.5 – 20.5 = 89 and 89 ÷ 5 = 17.8

year	0	1	3
1	$\frac{21 - 3}{1}$ = 18.0		
3	$\frac{56 - 3}{3}$ = 17.7	$\frac{56 - 21}{2}$ = 17.5	
6	$\frac{110 - 3}{6}$ = 17.8	$\frac{110 - 21}{5}$ = 17.8	$\frac{110 - 56}{3}$ =18.0

year	length (mm)
0	2 or 4
1	20.5
3	56.5
6	109.5

<table>
<tr><td>2</td><td>(b)</td><td>(i)</td><td>(position / arrangement, of) chromosomes visible ✓</td><td>1</td><td>AO 2.7</td><td>ALLOW chromosomes, different colour to cytoplasm / contrast with rest of cell / show up / stand out, for ‘visible’
ALLOW to, identify / distinguish, chromosomes
ALLOW ORA ‘otherwise we could not see chromosomes’
ALLOW chromatids / genetic material / DNA / chromatin, for ‘chromosomes’</td></tr>
<tr><td>2</td><td>(b)</td><td>(ii)</td><td>chromosomes lined up at, equator / metaphase plate ✓</td><td>1</td><td>AO 3.1</td><td>ALLOW middle (of cell) for ‘equator’
ALLOW pairs of sister chromatids for ‘chromosomes’</td></tr>
<tr><td>2</td><td>(b)</td><td>(iii)</td><td>all columns with informative headings ✓

stages of mitosis in correct order ✓</td><td>2</td><td>AO 3.2</td><td>IGNORE data in table.

<table>
<tr><td rowspan="2">Stage (of mitosis)</td><td colspan="3">Number of cells (counted)</td></tr>
<tr><td>Student 1</td><td>Student 2</td><td>Student 3</td></tr>
<tr><td>Prophase</td><td>3</td><td>5</td><td>2</td></tr>
<tr><td>Metaphase</td><td>1</td><td>0</td><td>5</td></tr>
<tr><td>Anaphase</td><td>3</td><td>4</td><td>0</td></tr>
<tr><td>Telophase</td><td>0</td><td>1</td><td>3</td></tr>
</table>
OR

<table>
<tr><td rowspan="2">Student</td><td colspan="4">Number of cells (at stage of mitosis)</td></tr>
<tr><td>Prophase</td><td>Metaphase</td><td>Anaphase</td><td>Telophase</td></tr>
<tr><td>1</td><td>3</td><td>1</td><td>3</td><td>0</td></tr>
<tr><td>2</td><td>5</td><td>0</td><td>4</td><td>1</td></tr>
<tr><td>3</td><td>2</td><td>5</td><td>0</td><td>3</td></tr>
</table>
ALLOW Trial / test, for ‘Student’
ALLOW Amount for ‘Number’
ALLOW Phase for ‘Stage’
ALLOW student 1, student 2, student 3 on left in 2nd table</td></tr>
</table>

2	**(c)**		*any three similarities from:* **S1** chromosomes consist of two (sister) chromatids ✓ **S2** chromosomes / chromatids, condense ✓ **S3** nuclear, envelope / membrane, breaks down ✓ **S4** centrioles move to opposite, poles / ends of the cell ✓ **S5** spindle (fibres) form(s) ✓ *any three points unique to meiosis (differences):* **D6** meiosis has, prophase 1 and 2 / two prophases ✓ **D7** homologous chromosomes pair / bivalents form / synapsis occurs, in prophase (1) ✓ **D8** crossing over occurs / chiasma(ta) form, in prophase (1) ✓ **D9** in prophase 2 chromatids are genetically different ✓	**4 max**	AO 2.5	**S2 ALLOW** nucleolus disappears **S4 ALLOW** centrosomes for 'centrioles' **D8 DO NOT ALLOW** crossing over between sister chromatids

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>AO</th><th>Guidance</th></tr>
<tr><td>3</td><td>(a)</td><td>(i)</td><td>glycosidic (bond) ✓
hydrolysis OR water, added / needed ✓</td><td>2</td><td>AO 1.1</td><td>IGNORE numbers
DO NOT ALLOW condensation / water produced
ALLOW description
OH joins, one sugar / galactose, and H joins, the other / glucose (plus O from glycosidic bond)</td></tr>
<tr><td>3</td><td>(a)</td><td>(ii)</td><td>1 (undigested) lactose lowers the water potential ✓

2 water enters (the large intestine) by osmosis ✓</td><td>2</td><td>AO 2.6</td><td>1 ALLOW bacteria break down the lactose so, (unabsorbed) glucose / galactose, lower ψ
2 ALLOW down ψ gradient for ‘osmosis’</td></tr>
<tr><td>3</td><td>(b)</td><td>(i)</td><td>1 more than one, C=C / double bond (between carbons) ✓
2 more than one, kink / bend ✓
3 fewer H atoms ✓</td><td>1 max</td><td>AO 1.1</td><td>1 ALLOW has double bond<u>s</u> (between carbons)
2 ALLOW has, kink<u>s</u> / bend<u>s</u></td></tr>
<tr><td>3</td><td>(b)</td><td>(ii)</td><td>1 (yes because) both fall 2006-2012 / 2006-2016 / 2002-2012 / 2002-2016✓

2 (no because) 1994-2002 / 1994-2006 / 2012-2016, hypercholesterolemia rises but (CVD) deaths fall / two factors show opposite trends OR
2002-2006 / 2012-2016 /1994-2016, hypercholesterolemia does not change but (CVD) deaths fall OR
no positive correlation in 1994-2006 and 2012-2016 ✓

3 <u>%</u> hypercholesterolemia figure and CVD deaths figure <u>per 100 000 people</u> for two named years ✓

4 correlation does not (necessarily) imply causation ✓
5 other (named) factor affects death rate (from CVD) ✓</td><td>3 max</td><td>AO 3.4</td><td>ALLOW (22-44 year olds / people) with high blood cholesterol / with the condition, for ‘hypercholesterolemia’
MPs 1 and 2 IGNORE single years (look for ranges)

<table><tr><th>time frame</th><th>change in % hypercholesterolemia in 20-44 age group</th><th>change in CVD deaths per 100 000</th></tr><tr><td>1994 → 2002</td><td>13 → 16</td><td>270 → 220</td></tr><tr><td>2002 → 2006</td><td>16 → 16</td><td>220 → 185</td></tr><tr><td>2006 → 2012</td><td>16 → 12</td><td>185 → 150</td></tr><tr><td>2012 → 2016</td><td>12 → 13</td><td>150 → 145</td></tr></table>
3 ALLOW hyperchol. figures <u>±</u>2 and CVD figs <u>±</u>10
3 ALLOW processed figs e.g. 2006-2012 CVD decreases by 35

5 e.g. obesity, physical inactivity, alcohol use, nicotine use, other (named) dietary factors, other (named) health problems, medical treatment, statins</td></tr>
</table>

3	**(c)**		**1 (A)** it is not atrioventricular node (AVN), it is sino-atrial node (SAN) ✓ **2 (B)** atrioventricular valve doesn't open, it closes ✓ **3 (B)** the pressure in the aorta doesn't fall, it rises ✓ **4 (C)** semilunar valve doesn't open, it closes ✓	**3 max**	AO 3.4	**ALLOW max 1 mark** for 2 errors identified without corrections **OR** for 2 corrections without errors **OR** for 1 error + 1 (different) correction **2 ALLOW in B** it is not the atrioventricular valve that opens it is the semi-lunar valve **4 ALLOW** it is not the semi-lunar valve that opens it is the, atrioventricular / bicuspid / mitral, valve

Question			Answer	Mark	AO	Guidance
4	**(a)**	**(i)**	phagocyte / neutrophil ✓	**1**	AO 1.1	**ALLOW** (non-human) macrophage **IGNORE** leucocyte / white blood cell
4	**(a)**	**(ii)**	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 14 or 15 (µm) award 2 marks** 14mm ÷ 950 = 0.0147mm ✓ 0.0147 x 1000 = 15µm ✓	**2**	AO 2.8	**ALLOW** answer given to **3 significant figures for 2 marks** e.g. 13.7 / 14.2 / 14.7µm If answer given to **more than 3** sig. fig. **max 1 mark** **ALLOW** (13 000 ÷ 950) = 13.7µm **for 2 marks** **ALLOW** (13 500 ÷ 950) = 14.2µm **for 2 marks** If final answer incorrect **award 1 mark** for **two clearly shown** correct steps in working (other than 1 plus 4). **IGNORE** crossed-out working. **steps in working:** **1** (diameter with units =) 13 / 13.5 / 14mm **OR** 1.3 / 1.35 / 1.4cm **2** divide by 950 **3** convert **EITHER** original diameter **OR** answer to µm (mm → µm x 1000, cm → µm x 10 000) **4** round to 2 significant figures
4	**(a)**	**(iii)**	made up of different cells / not made up of different tissues ✓	**1**	AO 1.1	**IGNORE** differentiated cells **ALLOW** two or more named blood cells for 'different'

4	**(b)**	**(i)**	<u>artificial active</u> (immunity) ✓	**1**	AO 1.1	
4	**(b)**	**(ii)**	**1** low shallow hump labelled 'primary' first and higher steeper hump labelled 'secondary' later ✓ **2** primary starts at 5-10 days and secondary at 25-28 days ✓	**2**	AO 2.1	**1 IGNORE** timing **1 ALLOW** curve that plateaus and does not come back down **2 ECF** missing label
4	**(b)**	**(iii)**	**1** (memory cells) divide to form plasma cells ✓ **2** plasma cells, produce / release, antibodies (rapidly) ✓ **3** antibodies, bind to / disable / destroy, antigen / virus ✓	**2 max**	AO 1.2 AO 2.1	**3 ALLOW** pathogen for 'virus'
4	**(c)**		**1** phagocyte engulfs pathogen in a, vesicle / phagosome / endosome ✓ **2** lysosomes combine with, phagosome / vesicle / endosome ✓ **3** (lysosyme) enzymes, break down / digest / destroy, pathogen ✓	**3**	AO 1.1	**1 ALLOW** encloses / traps / captures / AW for 'engulfs' **1 ALLOW** vacuole for 'vesicle' **2 ALLOW** fuse with / join to / attach to / bind to, for 'combine' **3 IGNORE** combat / fight / attack, for 'destroy' **3 DO NOT ALLOW** lysozymes for 'enzymes'
4	**(d)**	**(i)**	**1** CO_2 + water form carbonic acid ✓ **2** carbonic acid dissociates giving, H+ / protons ✓ **3** H^+ / protons, bind to Hb ✓ **4** so CO_2 can be carried as HCO_3^- ✓	**2 max**	AO 2.5	
	(d)	**(ii)**	**1** more CO_2 during exercise so curve shifts to right ✓ **2** at same $_PO_2$ Hb has a lower % saturation of oxygen ✓ **3** so oxygen, dissociates / is released, from Hb more readily ✓ **4** more oxygen (provided / needed) for, muscles / aerobic respiration ✓	**2 max**	AO 1.2 AO 2.5	**2 ALLOW** haemoglobin's affinity for oxygen is decreased **4 ALLOW** to help supply sufficient oxygen to muscles

Question	Answer	Mark	AO	Guidance
5*	***Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.*** ***In summary:*** *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):* o *award the higher mark where the Communication Statement has been met.* o *award the lower mark where aspects of the Communication Statement have been missed.* • ***The science content determines the level.*** • ***The Communication Statement determines the mark within a level.***			
	Level 3 (5–6 marks) A full and detailed account of the changes that take place during inspiration and the similarities and differences between the apparatus and the ventilation system in mammals, including correct reference to volume and pressure changes. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** A detailed account of the changes that take place during inspiration, and some of the similarities and differences given between the apparatus and the ventilation system in mammals. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** An account of some of the changes that take place during inspiration. Must mention at least one correct comparison with the apparatus in and the ventilation system in mammals. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** *No response or no response worthy of credit.*	**6**	AO 1.1 AO 2.1 AO 2.3	**Indicative points can include:** **How used:** **Pull down, elastic sheet / button, at base to make balloons expand** + Models diaphragm muscle contracting / diaphragm flattening **Volume in bell jar, gets bigger / increases** + Models thorax volume increase **Pressure in bell jar, gets lower / decreases** + Models thorax pressure decrease **Air pressure outside now higher than in bell jar** + Models higher pressure outside lungs **Air pushed into balloons / balloons fill** + Models air, pushed into / inflating, lungs **Appropriateness:** + Glass tubing represents trachea + Two balloons to model two lungs + Elastic sheet represents diaphragm – Sides of bell jar cannot change shape – Cannot model rib cage, expanding / moving up and out – Cannot model contraction of external intercostal muscles **IGNORE** expiration, elastic sheet stretching **DO NOT CREDIT** steps in **model** or mammal process in reverse sequence (+ = similarity, – = difference)

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>AO</th><th>Guidance</th></tr>
<tr><td>6</td><td>(a)</td><td>(i)</td><td>(look larger) to, scare / deter, predators ✓
protection ✓</td><td>1 max</td><td>AO 1.1</td><td>IGNORE attract mates / camouflage</td></tr>
<tr><td>6</td><td>(a)</td><td>(ii)</td><td><u>Uraba</u></td><td>1</td><td>AO 1.1</td><td></td></tr>
<tr><td>6</td><td>(a)</td><td>(iii)</td><td><table><tr><th>Taxonomic description</th><th>Hierarchical position</th></tr><tr><td>Phylum Arthropoda</td><td>2</td></tr><tr><td>Order Lepidoptera</td><td>4</td></tr><tr><td>Kingdom Animalia</td><td>1</td></tr><tr><td>Class Insecta</td><td>3</td></tr></table>✓</td><td>1</td><td>AO 2.1</td><td></td></tr>
<tr><td>6</td><td>(b)</td><td></td><td>1 (pale and) dark / colour difference, due to, genetic variation / (different) alleles / (random) mutation ✓

in, industrial / polluted / urban / lichen-free, area:
2 pale, selected against / eaten / less likely to survive OR dark, selected for / not eaten / more likely to survive ✓

3 (more) dark, reproduce / pass on <u>allele</u> / pass on mutation OR fewer / no, pale, reproduce / pass on their <u>allele</u> ✓

4 <u>frequency</u> of <u>allele</u> for, dark colour increases / pale colour decreases ✓</td><td>4</td><td>AO 1.2
AO 2.1</td><td>1 look for statement

ALLOW REVERSE ARGUMENTS
in, non-industrial / unpolluted / rural / lichen-rich, area:
2 pale, selected for / not eaten / more likely to survive OR dark, selected against / eaten / less likely to survive

3 (more) pale, reproduce / pass on their <u>allele</u> OR fewer / no, dark, reproduce / pass on <u>allele</u> / pass on mutation
4 <u>frequency</u> of <u>allele</u> for, pale colour increases / dark colour decreases</td></tr>
<tr><td>6</td><td>(c)</td><td></td><td>1 not closely related / no (recent) common ancestor / evolved separately, as,
in different (named) families OR
live / evolved, in different parts of the world ✓

2 adapted / evolved, similarly / for same niche / for soil, as, both have / share, streamlined shape / modified fore limbs / velvety fur / diet of grubs and worms ✓</td><td>2</td><td>AO 1.2
AO 2.6</td><td>1 ALLOW different (named), countries / continents for ‘parts of the world’

2 ALLOW developed to suit, same environment / same diet / soil, for ‘adapted similarly’ idea</td></tr>
</table>

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