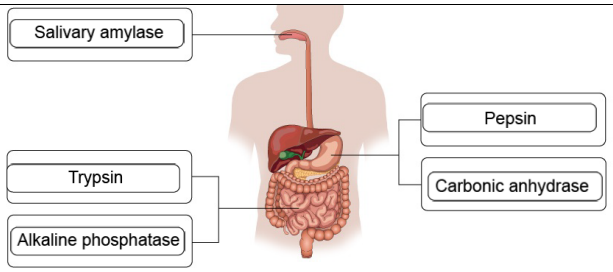
Question		Answers	Notes	Total	Criterion
1	a	Organisms of the same species that live in the same area		1	A
	b	reference to survival of the fittest these organisms (with beneficial traits/characteristic survive to) reproduce (so the frequency of) the particular trait/characteristic increases in the population	*WTTE* *Accept "black" or "grey" for trait ORA*	3	A
	c	 the colour of the lichen ***or*** tree ***or*** background changed black moths were camouflaged increased survival (from predation) produced offspring with same colour that survived ***or*** increase in frequency of black moths (from reproduction)	*If colour is not specified, assume they are referring to black moths. Award **MAX 2 marks** if candidate refers to moths being stained or WTTE.* *Do **not** accept change in "environment"* *No ORA for this marking point* *ORA*	4	A
	d	the dark trait is hidden by the grey trait/allele ***or*** the trait/allele is not expressed in heterozygous individuals only homozygous recessive individuals would express the trait/allele correct use of the term heterozygous/Bb/Gg/Ww ***or*** homozygous/bb /gg/ww ***or*** allele	 *Accept "carrier"* *Do **not** accept "gene", accept any letters in genotype*	3	A D

2	a	***First two marks any two responses from the list:*** • animals eat plants • animals produce CO_2 (during respiration) • plants use CO_2 (for photosynthesis) • CO_2 is produced when animals ***or*** plants decay ***Third mark connecting animals and plants in the carbon cycle:*** linking carbon from animals to plants ***or*** correctly linking photosynthesis with respiration ***or*** CO_2 produced when animals decay is used by plants		**3**	A
	b	***An example of a human activity affecting CO_2, for example:*** • burning fossil fuels ***or*** industrialization ***or*** cars • burning of trees • (intensive) cattle rearing • deforestation. ***A global impact of these activities, for example*** • decreased carbon stored underground • increased carbon in the atmosphere ***or*** (dissolved) in the ocean • climate change ***or*** global warming ***or*** increase in greenhouse gases • emissions decrease pH ***or*** increase acidity of oceans (so change carbonate levels) ***A further point from either list***	*Do **not** accept refs to volcano as this is not a human activity* *Accept CO_2 or CH_4 as greenhouse gases*	**3**	A

3	a	Meiosis		**1**	A
	b	each parent has different genetic material/traits/genes/alleles half of the genetic material of the offspring comes from each parent combination of genetic material leads to a new individual	*WTTE* *Only accept "crossing over" in relation to gametes*	**3**	A
	c	**Key**: Follicle stimulating hormone (FSH) Progesterone Luteinising hormone (LH) Estrogen one in correct position two in correct position all four in correct position		**3**	A
	d	***Accept any reasonable suggestion, for example:*** • more than one egg could mature • could lead to twins or multiple developing embryos/fetuses • causes hypersecretion of estrogen	*Do **not** accept any effects of estrogen, only FSH*	**1**	A

4	a	 one in correct location two in correct location three in correct location all five in correct location	*Accept enzyme in either position at each location*	**4**	C
	b	How does <u>pH</u> affect ***and*** the rate of colour change ***or*** How does <u>pH</u> affect ***and*** time taken for colour change ***or*** How does <u>pH</u> affect ***and*** rate of reaction	*Do **not** accept how fast does the colour change without reference to pH* *Accept "Does …" do **not** accept "Why …"* *Can accept "rate of reaction" for this mark*	**1**	B
	c	***Independent variable*** pH ***Dependent variable*** time (for colour change) ***Control variables (any two):*** • amount of lactose/substrate • surface area of lactose/substrate • amount of enzyme/lactase • volume of water • concentration of enzyme solution • temperature • type of enzyme.	*Do **not** accept rate **or** rate of reaction*	**4**	B

	d	***range:*** not relevant to human body the number of values of independent variable is not sufficient ***or*** there are not five values of independent variable number of trials is not sufficient ***or*** a minimum of three trials is needed		**3**	C

5	a	lactase		**1**	A
	b	***y axis:*** time for colour change (/s) unit included with *y* axis label all numbers (in boxes) given in evenly spaced increments on both axes ***Plotting points*** four points plotted correctly all points plotted correctly	 *Plotting ±1 square using the candidate's scale* ***1 mark*** *for four correct,* ***2 marks*** *for all seven correct*	**5**	C
	c	g dm^{-3}	*Accept g/dm^3* ***or*** *gl^{-1}* ***or*** *g/l* ***or*** *g per dm^3*	**1**	C
	d	 the time for colour change decreases as the concentration increases ***or*** the colour changes more quickly when the concentration is high ***or*** there is a negative/inverse trend linking increase in concentration to faster rate more lactose is interacting with enzyme (molecules) at a certain point, the time of colour change starts to plateau all of the (active sites of) enzyme molecules are being used ***A correct use of the one of the terms in the list somewhere in the response:*** active site, substrate, lactase, increasing rate of reaction	 *Do* ***not*** *accept inversely proportional, exponential* *Accept "reacting"* *WTTE*	**6**	C
	e	valid at the lower concentrations (because) time of colour change is decreasing not valid at higher concentrations (because) all the (active sites) are being used (so) the hypothesis is partly valid	*Accept references to numbers throughout* *Accept a reference to increasing speed or rate.*	**5**	C

	f	more trials/repeats reduce experimental error ***or*** make the data more reliable ***or*** extend the range of concentration to give a clearer indication of the trend ***or*** use of spectrometer ***or*** colorimeter to give time for consistent colour change	*Second marking point must be correctly linked to the first to score* *Do **not** accept "more accurate", "use more precise equipment"*	**2**	C
	g	change the concentration of the enzyme/lactase ***or*** change the volume of the enzyme solution (as this gives more active sites)	*Do **not** accept "change the enzyme"* *Do **not** accept "add water" unless they link this to changing the concentration of the enzyme solution*	**1**	C

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<tr><td>Variables (V)</td><td>Some variables are referred to that are connected to the problem but these may not be explicitly identified</td><td>Independent or dependent variable and one control variable are identified</td><td>Independent variable and dependent variable and one control variable are identified</td><td>Independent, dependent and at least two control variables are identified</td></tr>
<tr><td>Hypothesis (H)</td><td>Outlines a simple hypothesis or research question</td><td>Formulates a testable hypothesis linked to the independent and dependent variables with no explanation
or
formulates a (non-testable) hypothesis with correct scientific explanation</td><td>Formulates a testable hypothesis correctly linked to the variables (no explanation)</td><td>Formulates a testable hypothesis correctly linked to the variables with correct scientific explanation</td></tr>
<tr><td>Manipulation of IV (IV)</td><td>Reference to the IV being changed</td><td>Less than five stated values of the independent variable</td><td>At least five stated values of the independent variable</td><td></td></tr>
<tr><td>Method (M)</td><td>Attempt at a method but detail is insufficient for another student to follow</td><td>Partial method is described but detail is insufficient for another student to follow</td><td>Method correctly connected with the IV is described with some details of equipment, measurements or units and could be followed by another student</td><td>Method correctly connected with the IV is described with details of equipment, measurements and units that could be followed by another student</td></tr>
<tr><td>Sufficient data (D)</td><td>Mentions more than one trial</td><td>Specifies at least three trials</td><td></td><td></td></tr>
<tr><td>Safety (S)</td><td>Any relevant comment relating to safety</td><td></td><td></td><td></td></tr>
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7	a	***First mark: any two factors from the list:*** • light • water • nutrients • CO_2. ***Second mark:*** all of the four factors on the list above **only**	 *Award **2 marks** if all factors are selected*	 **2**	A A
	b	one factor linked to the process of photosynthesis ***or*** respiration a correct use of the term photosynthesis ***or*** respiration	*Accept reference to any metabolic process for the first mark.*	**2**	A D

8		***Any five points from the following list*** ***Similarities*** • both types of farming maximize space for growing crops • both types of farming improve light available for crop growth • both types of farming improve the water supply to crops ***Differences*** • ***Light:*** terracing relies on natural light ***and*** light in vertical farming can be controlled • ***Water:*** terracing relies on climate ***or*** is not controlled ***and*** vertical farming reuses waste water ***or*** is controlled • ***Soil:*** terracing reduces soil erosion ***and*** vertical farming has no soil erosion • ***Nutrients:*** terracing relies on nutrients in soil ***or*** nutrients can be depleted ***and*** nutrients can be controlled in vertical farming	*Similarities and differences must be explicitly linked* *Accept references to flooding or drainage only when linked to plants or crops.*	**5**	D

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<tr><td>Change in the landscape (C)</td><td>An incomplete statement of a change in the landscape</td><td>A correct statement of a change in the landscape</td><td>A description of one change in the landscape</td><td>A description of more than one change in the landscape</td></tr>
<tr><td>Scientific justification linked to need of plant (S)</td><td>An attempt at a scientific justification of the changes to the landscape</td><td>Scientific justification of one change to the landscape</td><td>Scientific justification of more than one change to the landscape</td><td></td></tr>
<tr><td>Advantages and disadvantages to the environment (AD)</td><td>An attempt at a statement of an advantage or disadvantage</td><td>A complete statement of an advantage or a disadvantage</td><td>A complete statement of an advantage and a disadvantage</td><td>A complete statement of more than one advantage and more than one disadvantage</td></tr>
<tr><td>Impacts (I)</td><td>A statement of an economic or a social impact</td><td>A description of an economic or a social impact</td><td>A detailed description of an economic or a social impact</td><td></td></tr>
<tr><td>Appraisal (A)</td><td>A concluding appraisal</td><td></td><td></td><td></td></tr>
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