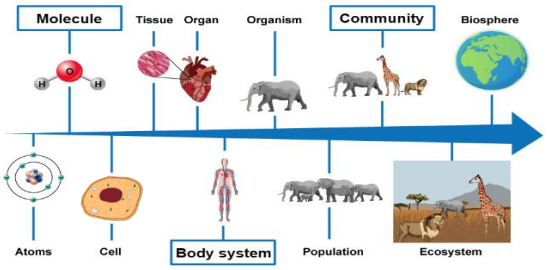
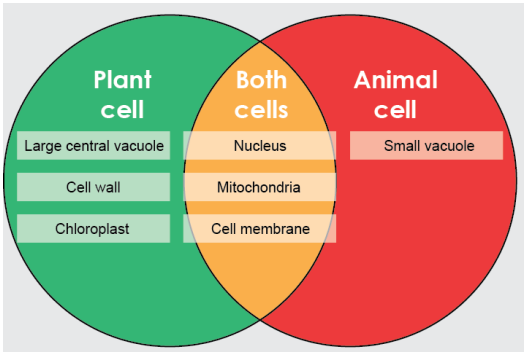
Question		Answers	Notes	Total	Criterion
1	a	 All correct		1	A
	b	 One correct term in each zone All correct	*Award marks separately*	2	A

	c	(Function of mitochondria is to) convert ***or*** produce energy ***or*** produce ATP (From a) source of energy ***Correct use of one of the following terms: (1 max)*** • respiration • ATP • glucose	*WTTE* *Accept powerhouse* *Do **not** accept storage of energy* *For example, accept glucose, protein, sugar, food* *Do **not** accept a general reference to a substance or "calories"*	**3**	A
	d	(Folds give) increase in (surface) area More sites for reactions (energy production) to take place	 *WTTE* *Do **not** accept exchange of materials*	**2**	A
2	a	Growth ***and*** repair ***and*** asexual reproduction	*Do **not** award a mark if more than these three are selected*	**1**	A
	b	***Each pair of statements is listed in the order meiosis and mitosis*** ***Any two points from the following list only (2 max)*** • haploid ***and*** diploid ***or*** 23 ***and*** 46 chromosomes • 4 cells ***and*** 2 cells • (genetically) non-identical ***and*** (genetically) identical • gametes (sex cells) ***and*** somatic cells	*WTTE* *Accept half the number of chromosomes compared to the parent* *Both statements must be explicitly stated*	**2**	A
	c	***Statement of two sources (2 max):*** • sexual reproduction / two parents • mutation • crossing over • random assortment • arrival of new individuals ***Correctly linked statement of how the variation occurs in that source, for example (2 max):*** • new combination of genes from two individuals • change in DNA sequence resulting from external event • exchange of small segments DNA within a chromosome • new combination of chromosomes • new traits brought from a different gene pool	*Award mark for statement of source even if link to variation is not correct*	**4**	A

3	a	Disappearance of a species ***and*** disappearance of many species A correct use of the word "<u>species</u>"	*WTTE* *Accept population for the first marking point only* *Only award the second mark if the first is awarded.*	**2**	A
	b	***One example of a change, for example (1 max):*** • increased predation • habitat reduction • decreased food supply • increased competition • disease • natural disaster • a specific example of human interference ***Correct justification, for example:*** • eaten before they reproduce • insufficient resources for shelter ***or*** camouflage • unlikely to be healthy enough to reproduce • decreased availability of resources • large scale death • any direct link to human interference	*Do **not** award two marks for two examples* *Two marks can be awarded for two correct justifications*	**2**	A
	c	***Any two points, for example (2 max):*** • fur (for warmth) • insulating layer (for warmth) • warm-blooded (control their temperature) • carry their young ***or*** high level of parental care ***or*** give birth to live young • mothers feed their young	*WTTE*	**2**	A
	d	***Any four of the following points (4 max):*** • rabbits are more likely to survive when fur colour matches location (as they are not found easily by predators) • longer survival means greater chance of reproduction • concentration of fur types by location means breeding more likely between similar types • offspring are more likely to have advantageous fur colour • offspring born with disadvantageous fur type less likely to survive	*WTTE*	**4**	A

4	a	**Biotic:** fungi ***and*** microbes ***and*** **Abiotic**: water	*Accept soil in either list*	**1**	A
	b	Water Glucose		**2**	A
	c	Presence of fertilizer	*WTTE*	**1**	B
	d	Height ***or*** colour of leaves ***or*** leaf appearance	*WTTE* *Do **not** accept growth*	**1**	B
	e	**Quantitative data**: numerical ***or*** states example **Qualitative data**: non-numerical ***or*** descriptive ***or*** states example		**2**	B
	f	329.66666667 330	*Accept 329.6(66…) or 329.7 or print of calculator display* *Award **(2 marks)** if only this number is seen*	**2**	C
	g	**Strength:** three trials ***or*** both quantitative and qualitative data recorded **Limitation:** limited range ***or*** two values of IV only ***or*** specific reference to lack of control variables	*Accept two types of data* *Do **not** accept general refs to CV* *Do **not** accept only three trials as a limitation*	**2**	C

<table>
<tr>
<td>5</td>
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<table>
<tr><th></th><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>5 1.V

(Identification of variables)</td><td>Some variables are referred to that are connected to the problem but these may not be explicitly identified</td><td>Independent
or
one control variable is identified</td><td>Independent variable
and
one control variable are identified</td><td>Independent
and
at least two control variables are identified</td></tr>
<tr><td>5 2.H

(Hypothesis)</td><td>Formulates a hypothesis connected to the variables but not explicitly linked to growth, number of plants or rate of growth</td><td>Formulate a testable hypothesis correctly linked to the growth, number of plants or rate of growth (no explanation)</td><td>Formulate a testable hypothesis correctly linked to the growth, number of plants or rate of growth with correct scientific explanation</td><td></td></tr>
<tr><td>5 3.M

(Manipulation of variables/ description of method)</td><td>Attempt at a method but detail is insufficient for manipulation of variables</td><td>Partial method is described with detail sufficient for
IV
and
DV only</td><td>Partial method is described with detail sufficient for IV
and
DV
and
one CV</td><td>Method is described with detail sufficient for
IV
and
DV
and
two CV</td></tr>
<tr><td>5 4.D

(Collection of data)</td><td>Plans to repeat at least three groups of duckweed
or
measures for at least five different light conditions</td><td>Plans to repeat at least three groups of duckweed
and
measures for at least five different light conditions</td><td></td><td></td></tr>
<tr><td>5 5.S

(Safety)</td><td>Any relevant comment relating to safety</td><td></td><td></td><td></td></tr>
</table>
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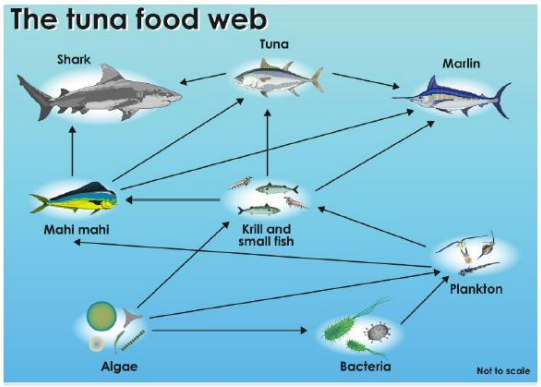
<td>14</td>
<td>B</td>
</tr>
</table>

6	a	1. Collect duckweed plants from pond 2. Select equally healthy duckweed plants 3. Label beakers 4. Measure water from pond into each 500 cm^3 beaker 5. Count initial duckweed plants and place 10 duckweed plants into each of 24 beakers 6. Set the temperature of each water bath 7. Add thermometer to water bath 8. Place lamp facing water bath 9. Place three beakers with samples into each water bath 10. Wait two weeks 11. Count final number of duckweed plants and record values First mark for one label in correct location Second mark for all labels in correct location		**2**	B
	b	***Either add detail to an existing step or specify a control, for example (1 max):*** • measure volume of water • place the lamp at a fixed distance • set the temperature at evenly spaced increments ***or*** ***add an extra step, for example (1 max):*** • stir the pond water before adding the duckweed • allow for time for the temperature in the beaker to reach the temperature in the water bath ***Correctly linked justification to improvement, for example (1 max):*** • ensures constant value of a control variable • the light level is constant • ensures nutrients are equally distributed • duckweed experience constant temperature	*Do **not** accept more trials or shorter temperature increments*	**2**	C

	c	<table><tr><th>Temperature / °C</th><th>Mean number of plants</th></tr><tr><td>7.5</td><td>20</td></tr><tr><td>10.0</td><td>28</td></tr><tr><td>12.5</td><td>40</td></tr><tr><td>15.0</td><td>50</td></tr><tr><td>20.0</td><td>70</td></tr><tr><td>27.5</td><td>80</td></tr><tr><td>30.0</td><td>70</td></tr><tr><td>37.5</td><td>18</td></tr></table> temperature on the *x* axis mean number of plants on *y* axis °C included on *x* axis evenly numbered intervals on both axes two points plotted correctly (± 1 unit) all points plotted correctly (± 1 unit)	*Accept (degrees) Celsius, C*°, (degrees) centigrade	**6**	C
	d	***Trend, any three points (3 max):*** • below 27.5 (°C) the rate of photosynthesis or growth increases with temperature • max rate is at a temp of 27.5 (°C) • after 27.5 (°C) the rate decreases • general description of the trend without values for example the graph is asymmetrical ***or*** increases gradually before max and decreases rapidly after the max ***Explanation, any two reasonable points, for example (2 max):*** • photosynthesis or growth or mitosis increases with temperature controlled by enzymes • chemical reactions increase with temperature • enzymes denature at temp higher than 27.5 (°C) • at higher temp, water is lost through evaporation and this affects availability of water	*ECF from the graph in part c* *WTTE*	**5**	C

	e	Below 27.5 (°C) the increase was proportional ***or*** at the lower temperatures the increase was proportional Above 27.5 (°C) there was a decrease ***or*** the increase was not proportional over the full temperature range The prediction is not supported by the data ***or*** partially supported by the data	*Values are not needed if trends are described correctly* *WTTE, do **not** award the third mark unless at least one of the other marks is awarded.*	**3**	C
7	a	If we add water hyacinth to waste water Then there will be a decrease in a (named) contaminant Because (scientifically correct use of information from the table) eg water hyacinth has been shown to uptake ***or*** store ***or*** remove ***or*** absorb nitrogen ***or*** lead		**3**	B
	b	***Accept any two reasonable suggestions, for example (2 max):*** • temperature • size of test pond/container • contaminants • light	*Do **not** accept anything related to plants as it is the IV*	**2**	B
	c	Poor control of variables, invalid results Different amounts of nitrogen could lead to different growth rates of the water hyacinth ***or*** The starting point of nitrogen concentration is not the same so the final difference may not be due to the water hyacinth		**2**	C
	d	Use a known amount of nitrogen each trial ***or*** Measure the amount of nitrogen at the beginning (so percent change could be calculated)		**1**	C

8	a	***Accept any reasonable suggestion, for example (1 max):*** • over fishing • habitat loss • pollution • increased fish consumption (from human population increase)		**1**	D
	b	***Accept any two reasonable suggestions, for example (2 max):*** • sonar has helped fishermen locate fish • (sonar can therefore) allow fishermen to catch more fish • larger boats have allowed fishermen to catch more fish at one time • GPS has allowed boats to be more accurate at locating fishing areas and tracking fish • Technical use of larger nets such as trawling or dredging or new materials	*Accept radar* *Do **not** accept bigger nets alone*	**2**	D

	c	 ***Identifies the change in an organism if the number of tuna changes, for example (2 max):*** • shark population reduced • mahi mahi population increases • mahi mahi population decreases ***Correctly linked justification for change, for example (2 max):*** • because less food for sharks • because there are fewer tuna to eat the mahi mahi • sharks have to eat mahi mahi rather than tuna ***A correct use of ecologic terminology, for example (1 max):*** • predator • prey • trophic level • consumer • producer • herbivore • carnivore • omnivore • species • population	*Refer to food web for other examples of possible changes* *Change must be clearly stated not just implied* *Do **not** accept food web, organism, or ecosystem*	**5**	D

<table>
<tr><td>9</td><td>a</td><td>An advantage, for example (1 max):
• fish grow faster so reach market sooner
• provides more kg of fish
• less feed required to feed fish

A disadvantage, for example (1 max):
• potentially more expensive
• people may not want to buy GM fish
• do not know the impact of GM organisms on ecosystem</td><td>Do not accept GMOs are not good for human health</td><td>2</td><td>D</td></tr>
<tr><td></td><td>b</td><td colspan="3"><table>
<tr><th></th><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>1. Env

(Environmental Impact)</td><td>States a positive or negative environmental impact</td><td>States a positive and negative environmental impact
or
states a positive or negative environmental impact with justification</td><td>States positive and negative environmental impact with justification for one of these</td><td>States positive and negative environmental impact with justification for both of these</td></tr>
<tr><td>2. Soc/eco

(Social or economic Impacts)</td><td>States a positive or negative social or economic impact</td><td>States a positive and negative social or economic impact
or
states a positive or negative social or economic impact with justification</td><td>States positive and negative social or economic impact with justification for one of these</td><td>States positive and negative social or economic impact with justification for both of these</td></tr>
<tr><td>3. L

(Location)</td><td>States a reasonable location</td><td>States a reasonable location and attempts to justify this using science</td><td>States a reasonable location and justifies this using detailed science</td><td></td></tr>
<tr><td>4. A

(Concluding appraisal)</td><td>Attempts a concluding appraisal</td><td>Gives a concluding appraisal with opinion in general terms</td><td>Gives a concluding appraisal with opinion that includes specific detail</td><td></td></tr>
</table></td><td>14</td><td>D</td></tr>
</table>