Question		Answers	Notes	Total	Criterion
1	a	***osmosis – neither – diffusion - diffusion*** two correct responses all responses correct		**2**	A
	b	circulatory system / blood system / transport system/ cardio-vascular system	*do **not** accept cardiac system as it refers to the heart only*	**1**	A
	c	there is a higher oxygen concentration in the air (than in the blood) oxygen moves/diffuses/ passive transport/passive movement from the area of higher concentration to the area of lower concentration ***or*** oxygen moves/diffuses down the (oxygen) concentration gradient		**2**	A
	d	nervous/nerve/neurological system		**1**	A
	e	suitable stimulus linked to sense selected response linked to the stimulus ***Explanation includes any two additional and equally valid points [2 max], for example:*** • route of signal transmission eg receptor to CNS • processing in brain or central nervous system • hormonal response eg adrenalin • signal from CNS to the effector	*allow touch to include pain, pressure, heat and corresponding stimulus* *accept brain in examples of reflexes which involve CNS, reflex alone is not enough to score this mark*	**4**	A

2	**a**	deoxyribonucleic acid / DNA		**1**	A
	b	identical DNA molecules / genes/ chromosomes/ (sister) chromatids are separated (and) are moved to opposite poles of the cell two separate genetically identical cells are formed	*WTTE*	**3**	A
	c	meiosis produces four cells ***and*** mitosis produces two cells meiosis produces haploid/1n cells ***and*** mitosis produces diploid/2n cells ***or*** in meiosis the chromosome number gets halved, ***and*** in mitosis the chromosome number remains the same meiosis produces genetically non-identical cells ***and*** mitosis produces genetically identical cells	*answer must focus on the products of meiosis and mitosis rather than the processes*	**3**	A
	d	***either*** • mutation (which results in…) • translocation ***or*** addition ***or*** deletion ***or*** loss of a part of a chromosome ***or*** • non-disjunction (which is caused by…) • failure of homologous pairs to separate in anaphase ***or*** failure of sister chromatids to separate during anaphase	*accept incorrect references to changes in replication for the first mark*	**2**	A
	e	***First mark:*** One correct use of the term “chromosome” ***second and third mark, either:*** genes are exchanged between (homologous) <u>chromosomes</u> (because of) crossing over ***or*** independent assortment ***or*** separation of (unlinked) genes (resulting from) independent separation of (homologous) <u>chromosomes</u>	*WTTE technical terms are not essential if the meaning is clear for the second and third marking point.* *Ignore incorrect phase*	**3**	D A

		or non-disjunction occurs resulting in an extra chromosome or a reduced number of chromosomes	*ignore incorrect phase*		

3	**a**	***distinguishing feature identified*** Pair 1: different hair colour ***or*** piercings ***or*** Pair 2: skin appearance is different ***or*** different hair colour ***or*** Pair 3: muscles are different	*WTTE*	**1**	A
	b	accept any reasonable factor accounting for the difference identified in part (a)	*ecf from part a*	**1**	A
	c	the features seen in the twins are acquired features/ features acquired during their lifetime only genetic characteristics are inherited/passed on to the next generation ***or*** (the twins') children will receive half of their genes from the other parent so identical genotype could not be acquired the different genotypes leads to different phenotypes	*WTTE*	**2**	A
	d	identical twins are A and C tongue roll is identified as a genetic trait A and C have this trait (so must be twins)	*ORA*	**3**	C

4	**a**	water + carbon dioxide→ glucose + oxygen	*accept reactants and products in any order*	**1**	A
	b	How does temperature affect the time taken for leaf discs to float ***or*** How does temperature affect the rate of photosynthesis?		**1**	B
	c	as temperature increases the leaf discs will rise more quickly (because) increasing temperature increases the rate of reaction (however) the rate of reaction will decrease after a maximum temperature (because) above a maximum temperature <u>enzyme(s)</u> is denatured/destroyed/does not function	*WTTE, accept "the rate of leaf discs floating"," the rate of photosynthesis will increase"* *Word "enzyme" is required here.*	**4**	B

	d	***Independent variable:*** temperature ***How the independent variable is manipulated:*** ***Temperature:*** repeat the experiment at five different temperatures ***Dependent variable:*** time taken for discs to float ***How the dependent variable is manipulated:*** ***Time to float or rate of floating:*** measure time using stop watch ***Control variables [3 max]:*** • type of plant • type of leaf • number of discs • light • volume of water • size of disc • concentration of CO_2 • type of water ***How the control variables are manipulated:*** Accept any reasonable ***and*** correctly linked method for the control of <u>each</u> control variable given	*ecf for manipulation marks for any reasonable variable* *accept "rate of leaf discs floating"* *accept time even if rate is given above*	**10**	B
	e	***Number of trials:*** three or more trials ***Explanation, for example:*** • reduce error • consistency of results • allows statistical analysis		**2**	B

<table>
<tr><td>5</td><td>a</td><td>Number of rows and columns
either
at least five rows and two columns
or
at least two rows and five columns

Label for rows or columns
data or results or values

Labels for columns or rows
wavelength and bubbles

Units
(wavelength in) <u>nm</u> and (bubbles) per minute</td><td>maximum eight rows

maximum eight columns

do not accept ranges of values

ignore an additional column labelled “colour”</td><td>4</td><td>C</td></tr>
<tr><td></td><td>b</td><td><table><tr><th>Distance from the light source / cm</th><th>Average number of bubbles / min</th></tr><tr><td>10</td><td>107</td></tr><tr><td>20</td><td>108</td></tr><tr><td>30</td><td>63</td></tr><tr><td>40</td><td>27</td></tr><tr><td>50</td><td>9</td></tr></table>
one mean calculated correctly

all means calculated correctly

mean given as a whole number</td><td></td><td>3</td><td>C</td></tr>
<tr><td></td><td>c</td><td>Title including reference to independent and dependent variable

At least four data points plotted correctly (x±0, y±2)

Either
x axis:distance and cm</td><td>ecf for incorrect averages from part b

All plotted correctly also scores this mark only, three correctly plotted only does not score here.</td><td>3</td><td>C</td></tr>
</table>

		or y axis: average number of bubbles per minute	*Please check the response box for part 5a. Some candidates may have recorded their axis labels in 5a for technical reasons.*		

6	**a**	average mass increased in both groups after three weeks ***or*** biomass after three weeks increased more for plants that had received more water ***or*** percentage increase is greater for plants that had received more water	*ORA*	**1**	C
	b	in <u>both</u> groups of samples/plants the average mass increased because plants continued to grow/photosynthesis (over the three week period) (which led to the) formation of more biomass/products of photosynthesis stored on leaves ***or*** with more water present photosynthesis could take place at higher rate a higher rate of photosynthesis produced more glucose/sugars more glucose/sugars produced creates a higher biomass	*ORA*	**3**	C
	c	the data supports the hypothesis ***or*** the <u>hypothesis</u> refers <u>to plants not samples</u> so the data is inconclusive	*accept hypothesis is correct/valid only if linked to the data*	**1**	C
	d	***Strength of method, for example:*** any of the controls – same size leaves, temperature, soil, light ten plants used for each volume of water ten trials different conditions gave measurable difference in outcome ***Description of strength, for example:*** (so) data is reliable less variation in data average used to remove individual variation ***Weakness, for example:*** range of volumes of water/only two volumes two different leaves used was plant damaged during leaf sampling		**4**	C

		were leaves taken from same location of plant ***Description of weakness, for example:*** insufficient range of water data to see true trend two data sets are not sufficient to plot a graph if the thickness/composition of the leaves were not similar the biomass would change			

	e	***Any two reasonable improvements (2 max), for example:*** • use a larger range of volumes • use similar sized leaf • use similar colour of leaf • use leaf from similar location ***Any clearly linked explanation of the benefit of <u>each</u> improvement, for example:*** (larger range of volume) sufficient relevant data for a graph/more accurate data (similar leaves) better control less variation in data/more precise data		**4**	C
	f	***Any reasonable modification to this investigation or change in the independent variable, for example:*** • change humidity of surroundings • change soil • change water eg type, pH etc		**1**	C

<table>
<tr>
<td>7</td>
<td></td>
<td>
<table>
<tr><td>• attempts to state a problem or hypothesis
• identifies one variable
• attempts a method for manipulation of variable or collection of data</td><td>1-3</td></tr>
<tr><td>• states a partly valid or unfocused problem
• formulates a testable hypothesis using unconnected scientific reasoning
• identifies two variables
• outlines a method for collecting some relevant data</td><td>4-7</td></tr>
<tr><td>• states a valid or focused problem
• formulates and explains a testable hypothesis using scientific reasoning correctly linked to the problem
• identifies three relevant variables
• describes a method for manipulating variables
• describes a method for collecting sufficient and relevant data linked to hypothesis</td><td>8-11</td></tr>
<tr><td>• states a valid and focused problem
• formulates and explains a testable hypothesis using detailed scientific reasoning correctly linked to the problem
• identifies four relevant variables
• describes a method for controlling variables and gives a reason why control of variables is important
• describes and fully explains a complete method for collecting sufficient and relevant data linked to hypothesis
• gives a valid comment about safety eg in use of CO_2</td><td>12-16</td></tr>
</table>
</td>
<td>16</td>
<td>B</td>
</tr>
</table>

8	**a**	the variety of life/species/plants/animals	*accept diversity in place of variety* *WTTE*	**1**	A
	b	accept any reasonable action including examples given correctly linked description of how this causes loss of biodiversity		**2**	D
	c	correct use of a scientific term eg food chain, food web, trophic level, habitat identifies example of a species lost ***or*** identifies example of a role lost identifies relationship between organism lost and organism(s) affected description of effect on affected organism(s)		**4**	D

9	**a**	food web	*Do **not** accept food chain.* *Accept trophic web*	**1**	A
	b	flowering plant is a producer ***or*** flowering plant provides food for other organisms slug is a decomposer ***or*** slug releases nutrients back into ecosystem from dead organisms	*WTTE*	**2**	A
	c	flowering plant(s) are a food source for the butterfly ***or*** rabbit ***or*** ram the slug is the only decomposer in the food web (so should be protected)	 *WTTE* *answer needs to be clear that the slug is the only decomposer*	**2**	D

<table>
<tr><td>10</td><td>a</td><td>accept any reasonable ecological reason for the importance of seed banks</td><td></td><td>1</td><td>D</td></tr>
<tr><td></td><td>b</td><td>seeds must be collected

seeds must be made dormant

seeds must be stored in condition to preserve them for a long period of time</td><td></td><td>3</td><td>D</td></tr>
<tr><td></td><td>c</td><td>
<table>
<tr><td>• an incomplete statement about the importance of seed banks
• a statement about the responsibility for creating or maintaining seed banks</td><td>1-2</td></tr>
<tr><td>• a complete statement about the importance of seed banks
• a relevant comment about an individual species or an ecosystem
• a statement about the responsibility for creating and maintaining seed banks
• a statement about an economic or political consideration</td><td>3-6</td></tr>
<tr><td>• a complete statement about the importance of seed banks with full justification
• a relevant comment about an individual species and an ecosystem
• an issue about the responsibility for creating seed banks is described
• an issue about the responsibility for maintaining seed banks is described
• an economic or political consideration is described in general terms</td><td>7-11</td></tr>
<tr><td>• a complete statement about the importance of seed banks with full justification
• more than one relevant comment about an individual species
• more than one relevant comment about an ecosystem
• a discussion about the responsibility for creating seed banks with different points of view included
• a discussion about the responsibility for maintaining seed banks with different points of view included
• an economic or political consideration is fully discussed in the context of the question
• a concluding appraisal</td><td>12-17</td></tr>
</table>
</td><td>17</td><td>D</td></tr>
</table>