

# Markscheme

November 2025

Biology

Standard level

Paper 2

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### Subject Details: Biology SL Paper 2 Markscheme

Candidates are required to answer **all** questions in Section A and **one** out of **two** questions in Section B. Maximum total = **50 marks**.

1. Each row in the “Question” column relates to the smallest subpart of the question.
2. The maximum mark for each question subpart is indicated in the “Total” column.
3. Each marking point in the “Answers” column is shown by means of a semicolon (;) at the end of the marking point.
4. A question subpart may have more marking points than the total allows. This will be indicated by “**max**” written after the mark in the “Total” column. The related rubric, if necessary, will be outlined in the “Notes” column.
5. An alternative word is indicated in the “Answers” column by a slash (/). Either word can be accepted.
6. An alternative answer is indicated in the “Answers” column by “**OR**”. Either answer can be accepted.
7. An alternative markscheme is indicated in the “Answers” column under heading **ALTERNATIVE 1** etc. Either alternative can be accepted.
8. Words inside brackets ( ) in the “Answers” column are not necessary to gain the mark.
9. Words that are underlined are essential for the mark.
10. The order of marking points does not have to be as in the “Answers” column, unless stated otherwise in the “Notes” column.
11. If the candidate’s answer has the same “meaning” or can be clearly interpreted as being of equivalent significance, detail and validity as that in the “Answers” column then award the mark. Where this point is considered to be particularly relevant in a question it is emphasized by **OWTTE** (or words to that effect) in the “Notes” column.
12. Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.
13. Occasionally, a part of a question may require an answer that is required for subsequent marking points. If an error is made in the first marking point then it should be penalized. However, if the incorrect answer is used correctly in subsequent marking points then **follow through** marks should be awarded. When marking, indicate this by adding **ECF** (error carried forward) on the script.
14. Do **not** penalize candidates for errors in units or significant figures, **unless** it is specifically referred to in the “Notes” column.

## Section B

### Extended response questions - quality of construction

- ◆ Extended response questions for SLP2 carry a mark total of **[16]**. Of these marks, **[15]** are awarded for content and **[1]** for the quality of the answer.
- ◆ **[1]** for quality is to be awarded when:
  - ◆ the candidate's answers are clear enough to be understood without re-reading.
  - ◆ the candidate has answered the question succinctly with little or no repetition or irrelevant material.
- ◆ It is important to judge this on the overall answer, taking into account the answers to all parts of the question. Although, the part with the largest number of marks is likely to provide the most evidence.
- ◆ Candidates that score very highly on the content marks need not necessarily automatically gain **[1]** for quality (and *vice versa*).

**Section A**

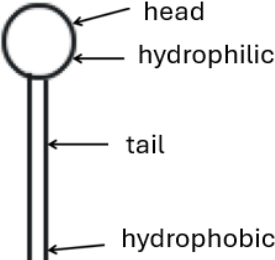
Question		Answers	Notes	Total
1.	a	<p>a. on day 7 there is reduced (total surface) area of lesional skin;</p> <p>b. reduced (total surface) area of lesional skin with skin plaques;</p> <p>c. lesional skin is reducing on the arms;</p>	<p><i>Accept converse for Day 0 throughout.</i></p> <p><i>Accept 'bigger/smaller lesions/plaques'.</i></p> <p><i>Accept Skin free of lesion increase as vice versa of mark point a.</i></p> <p><i>Accept mention of % or proportions as long as they are linked e.g. is bigger is smaller etc.</i></p> <p><i>Do not accept 'fewer lesion/plaques'.</i></p>	<p><b>2</b> <b>max</b></p>
1.	b	<p>a. measure the lesional area (and the total area of the back);</p> <p>b. find/calculate the percentage/proportion of the back affected (by lesions);</p> <p>c. calculate/compare the (percentage) change between Day 0 and Day 7;</p> <p>d. use a (statistical) test to assess if the difference between groups is significant;</p>	<p><i>Can accept references to changes in unaffected area as a method (mark points a, b and c).</i></p> <p><i>b. is about calculations of coverage of affected areas.</i></p> <p><i>c. is about calculations comparing affected area between day 0/at start/before and day 7/at the end/after.</i></p>	<p><b>2</b> <b>max</b></p>

Question		Answers	Notes	Total
1.	c	<p>a. low reliability as only five/very few males/small sample size studied;</p> <p>b. low reliability as no control/no men without treatment;</p>	<p><i>Do not accept 'low' unqualified but must be included for a mark/s.</i></p> <p><i>Do not accept reference to not enough data without mentioning what data is being referred to.</i></p> <p><i>Ignore references to <b>validity</b>, e.g. 'only males studied' / 'only the area of skin on the back studied' or 'only 7 days'.</i></p>	<p><b>1</b> <b>max</b></p>
1.	d	3.75 (%);	<i>Accept range between 3.7 and 3.8</i>	<b>1</b>
1.	e	0.8 (%);	<p><i>Allow values between 0.7 and 0.9 (%) inclusive.</i></p> <p><i>Can accept negative values.</i></p>	<b>1</b>

Question		Answers	Notes	Total
1.	f	<p>(as a control) to compare the amount of expression of genes in normal and lesional skin</p> <p><b>OR</b></p> <p>(as a control) to compare the amount of expression of WMT5A and IL24 in normal and lesional skin</p> <p><b>OR</b></p> <p>(as a control) to compare the %/number/amount of fibroblasts (expressing the genes) in normal and lesional skin</p> <p><b>OR</b></p> <p>to make sure that the drug doesn't harm/have side effects in normal skin;</p>	<p><i>Do not accept 'as a control' unqualified nor reference just to lesions or just to treatment / comparisons is between unaffected and lesions</i></p>	1

Question		Answers	Notes	Total
1.	g	<p>a. decrease in (mean) fibroblast (that over express the gene) percentages from Day 0 to Day 7;</p> <p>b. treatment does not eliminate/stop over expression (of genes/WNT5a and IL24)</p> <p><b>OR</b></p> <p>unaffected tissue does not over express (genes/WNT5a and IL24);</p> <p>c. probability that the difference between (mean) fibroblast percentages between lesional tissue on Day 0 and Day 7 occurred by chance is less than 0.05/5%</p> <p><b>OR</b></p> <p>probability that the difference between (mean) fibroblast percentages between lesional and non-lesional tissue on Day 0 occurred by chance is less than 0.001/0.1%</p> <p><b>OR</b></p> <p>the difference between (mean) fibroblast percentages of lesional tissue (on day 0 to Day 7) is <u>statistically</u> significant;</p>	<p><i>Do not accept decrease in lesions or decrease in fibroblasts alone (must refer to percentage/amount).</i></p> <p><i>For b. accept OWTTE</i></p>	<p><b>2 max</b></p>

Question		Answers	Notes	Total
2.	a	<p>a. DNA has complementary base pairs;</p> <p>b. cytosine pairs with guanine therefore 35.2 % is % of cytosine and guanine;</p> <p>c. adenine pairs with thymine so <math>(100 - 35.2)</math> 64.8 % is adenine and thymine (and half of this is thymine 32.4%);</p>	<p><i>Allow A, T, C, G instead of names of bases.</i></p> <p><i>Accept alternative numerical calculations e.g. use 50% as the base (i.e. C and T must be 50%).</i></p>	<b>2 max</b>
2.	b	polymerase chain reaction;	<i>Accept PCR.</i>	<b>1</b>
2.	c	<p>a. DNA contains deoxyribose and RNA contains ribose;</p> <p>b. DNA contains thymine and RNA contains uracil;</p>	<p><i>For a. accept 'DNA contains deoxyribonucleotides and RNA contains ribonucleotides'.</i></p> <p><i>Full names of bases must be used for credit.</i></p>	<b>2</b>

Question		Answers	Notes	Total
3.	a	proteins/glycoproteins/glycolipids are found throughout the phospholipids;	<p><i>OWTTE</i></p> <p><i>It must be clear that the molecules are embedded/ included in the layer. Names of molecules alone are not enough for the mark.</i></p>	1
3.	b	<p>a. full structure of the phospholipid labelled i.e. head/phosphate <b>AND</b> tail/fatty acid/lipid <b>AND</b> the drawing must have two fatty acids;</p> <p>b. head labelled as hydrophilic/mixes with water <b>AND</b> at least one of the two tails labelled as hydrophobic/doesn't mix with water;</p>	<p><i>Example:</i></p>  <p>The diagram shows a phospholipid molecule consisting of a circular head and two parallel tails. Arrows point from the labels 'head', 'hydrophilic', 'tail', and 'hydrophobic' to their respective parts of the molecule.</p> <p><i>Accept labels from marking points a. and b. on the diagram.</i></p> <p><i>If a plasma membrane with the correct phospholipid structure labelled correctly is acceptable.</i></p>	2

Question		Answers	Notes	Total
3.	c	<p>a. diffusion will occur if (oxygen) concentrations inside and outside the cell are different / there is a concentration gradient;</p> <p>b. increased concentration of oxygen outside of cell will increase rate of uptake/net movement into the cell / the higher the concentration gradient the faster the rate of uptake;</p> <p>c. no more net movement when oxygen concentrations are equal inside and outside the cell</p> <p><b>OR</b></p> <p>eventually a plateau in concentration will occur/concentrations reach an equilibrium;</p>	<p><i>b. accept converse.</i></p> <p><i>b. refers to rate of diffusion, and not to direction of movement</i></p>	<b>3</b>

Question		Answers	Notes	Total
4.	a	<p>a. diaphragm flattens <b>OR</b> volume inside the thorax/chest increases;</p> <p>b. pressure inside the thorax/chest/lungs decreases (below atmospheric pressure);</p> <p>c. air enters lungs to equalise the pressure <b>OR</b> air enters lungs moving from high to low pressure;</p>	<p><i>For c. do not accept just "air enters the lungs" without an explanation.</i></p>	<p><b>2 max</b></p>
4.	b	<p>(external) intercostal (muscles);</p>	<p><i>Do not accept "internal" intercostal muscles. If the answer refers to both "internal and external" intercostal muscles (without any clarification on the role of each), then it is considered a contradiction, award no marking point.</i></p>	<p><b>1</b></p>

Question		Answers	Notes	Total
4.	c	<p>a. moistens the inside wall/surface of the <u>alveoli</u> (for gas exchange);</p> <p>b. reduces surface tension (inside alveoli);</p> <p>c. prevents (alveoli) walls/surfaces sticking together</p> <p><b>OR</b></p> <p>helps to prevent collapse of the lungs;</p> <p>d. enhances (alveolar) expansion of lungs</p> <p><b>OR</b></p> <p>allows the inflation of lungs after birth;</p>	<p><i>For c. (second strand) accept alveoli.</i></p>	<p><b>2</b> <b>max</b></p>

Question		Answers	Notes	Total
5.	a	uses light/external sources (chemicals) as an energy source to make complex carbon/organic compounds (from simple/inorganic molecules);	<p><i>Do not award a mark if it is clear candidates are referring to organic “food” being used as an energy source.</i></p> <p><i>Do not award a mark if the definition refers to making food alone, a reference to complex carbon/organic compounds is needed.</i></p> <p><i>Accept OWTTE</i></p>	1
5.	b	<p>a. decomposers are bacteria/fungi /invertebrates;</p> <p>b. break down dead organic matter / faeces;</p> <p>c. release/recycle minerals/nutrients (into the environment);</p>	<p><i>For b. there MUST be a reference to the matter being dead / deceased etc. but we can accept other clear references.</i></p> <p><i>Do not accept reference to recycling carbon alone as this is not a unique property of decomposers.</i></p>	2 max
5.	c	<p>a. energy is lost between trophic levels as heat/metabolism/10% (or less) is transferred (accept converse);</p> <p>b. length of food chains varies / number of trophic levels in the food chains vary;</p> <p>c. some animals / herbivores may be able to digest (more) plant material/ cellulose/ parts of their food such as skin or bones than other animals;</p> <p>d. some animals are different in size / are more active;</p> <p>e. use more energy (to keep warm or cool) than others/are warm or cold blooded;</p>		3 max

Question		Answers	Notes	Total
5.	d	<p>a. <u>methane</u> production (by cows) is a greenhouse gas;</p> <p>b. deforestation (to provide land for grazing) reduces carbon dioxide removal from the atmosphere by photosynthesis</p> <p><b>OR</b></p> <p>burning of trees (to provide land for grazing) produces carbon dioxide;</p> <p>c. greenhouse gases (carbon dioxide/CO<sub>2</sub>/methane) lead to the enhanced greenhouse effect/global warming ;</p> <p>d. cattle farming releases more greenhouse gases than plant-based crops;</p>	<p><i>b. is referring to CO<sub>2</sub>, do not accept deforestation/burning alone.</i></p>	<p><b>2 max</b></p>

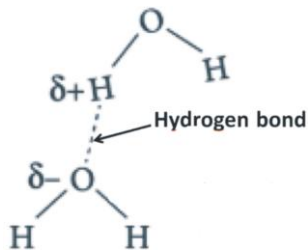
**Section B**

**Clarity of communication: [1]**

*The candidate's answers are clear enough to be understood without re-reading. The candidate has answered the question succinctly with little or no repetition or irrelevant material.*

Question		Answers	Notes	Total
6.	a	a. soluble (in water/blood) <b>SO</b> it is easily transported; b. glucose is (easily) oxidised/used to produce ATP in (cell) respiration; c. has high energy bonds/energy rich / is a source of (chemical) energy; d. energy/ATP is used in muscle contraction/active transport/any correct biological answer; e. can be polymerized (by condensation) <b>SO</b> can be stored; f. can be converted into glycogen/starch/cellulose; g. polymers easily broken down so energy/glucose can be released;	For b. do not accept Glucose "produces" energy alone  For e. accept descriptions of polymerization	5 max
6.	b	a. use of pesticides/insecticides (which may kill/harm pollinators); b. urbanization; c. loss of habitat/change of land use (monocultural/intensive farming practices); d. use of herbicide or removal of "weeds" reducing food sources; e. introduction of alien species;	For a. or d. the mention of a specific pesticide or herbicide would be ok.	3 max

Question		Answers	Notes	Total
6.	c	<p>a. variation exists within a species / OWTTE;</p> <p>b. mutation generates variation/new alleles;</p> <p>c. meiosis/sexual reproduction generates variation (new combinations of alleles);</p> <p>d. example of flower’s trait to be selected for in this context;</p> <p>e. (natural selection is caused by) selection pressures / changes in the environment / due to competition for pollinators / pollination;</p> <p>f. flowers that have an advantageous characteristic attract more insects;</p> <p>g. (plants with attractive flowers are) more likely to be pollinated/reproduce;</p> <p>h. pass on the new allele / combination of alleles/<u>heritable</u> trait;</p> <p>i. allele frequency increases over many generations;</p> <p>j. eventually different populations of this species can no longer produce fertile offspring/new species formed;</p>	<p><i>For d. Award anywhere in response and allow examples including bright petals / enclosed anthers / enclosed stigma / sticky pollen. Also accept suggestions such as odour / colour that is particularly attractive to bees.</i></p> <p><i>For g. to j. Accept converse – i.e. individuals without the advantageous characteristic are less likely to reproduce and pass on their alleles, so alleles conferring a disadvantage are selected against.</i></p> <p><i>For g. do not accept survival.</i></p>	7 max

Question		Answers	Notes	Total
7.	a	<p>a. (at least) two water molecules drawn that each show three atoms joined by single covalent bonds (H–O–H);</p> <p>b. V-shaped arrangement of water molecule(s);</p> <p>c. dashes or dots that join water molecules between O on one molecule and H on another;</p> <p>d. labelled 'hydrogen / H bond' shown joining a hydrogen of one molecule and the oxygen of another;</p> <p>e. delta/<math>\delta</math> + <b>and</b> delta/<math>\delta</math> - signs on both O and H to indicate polarity of the molecule as shown in the notes;</p>	<p>Example:</p>  <p>[Source: © International Baccalaureate Organization 2025]</p> <p>For e. the idea of partial charge in description is acceptable.</p>	4 max
7.	b	<p>a. pure water is hypotonic/lower solute concentration/more dilute to the cell/ more water molecules per volume;</p> <p>b. water enters the cells by <u>osmosis</u>;</p> <p>c. moves through aquaporins/through cell membrane;</p> <p>d. swelling/lysis/bursting/increasing size/increased activity pumping water out (contractile vacuoles) of animal cell;</p> <p>e. swelling/increased turgidity/develop turgor pressure in plant cell;</p> <p>f. <u>plant</u> cells wall resists/prevents bursting / withstands (turgor) pressure;</p>	<p>Ignore references to water potential.</p> <p>For d. and e. in each case it must clear what kind of cell is being referred to animal or plant.</p> <p>For f. allow OWTTE.</p>	4 max

Question		Answers	Notes	Total
7.	c	<p><b>MAX 5</b> for transpiration (marking points a,b,c,d,e,f,g,h)</p> <ul style="list-style-type: none"> <li>a. transpiration is the loss of water from (the surface of) the leaf / through stomata;</li> <li>b. loss of water by evaporation from cell walls in leaf cells causes water to be drawn from neighbouring/other cells;</li> <li>c. lost water drawn out of the <u>xylem</u>/creates transpirational pull;</li> <li>d. transpiration pull/tension draws water <u>up</u> the xylem;</li> <li>e. cohesion is <u>hydrogen</u> bonding between water molecules;</li> <li>f. cohesion (of water molecules) ensures a continuous column of water;</li> <li>g. adhesion of water is (hydrogen bonding) between water and other polar molecules;</li> <li>h. (adhesion is involved) in capillary action in soil/in plant cell walls/lignin;</li> </ul> <p><b>Max 3</b> for xylem adaptation (for marking points i,j,k,l)</p> <ul style="list-style-type: none"> <li>i. xylem (vessels) lack cell contents for unimpeded flow;</li> <li>j. xylem (vessels) have lignified walls to withstand tensions;</li> <li>k. xylem (vessels) have incomplete or absent end walls for unimpeded flow;</li> <li>l. xylem (vessels) have pits/pores/gaps for entry and exit of water;</li> </ul>	<p><i>For i. Look for descriptions of structures or lack of structures, do not credit the cell is dead alone as this is not a functional adaptation.</i></p>	<p><b>7 max</b></p>