

Markscheme

May 2022

Biology

Standard level

Paper 2

12 pages

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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.

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.

Section A

| Question | | | Answers | Notes | Total |
|----------|---|----|--|---|-------|
| 1. | a | i | body temperature increases with ambient temperature / positive correlation; | <i>Since direct can be either -/+, no credit for direct correlation alone</i> | 1 |
| 1. | a | ii | humans maintain/regulate a constant body temperature at different ambient temperatures/maintained by homeostasis; | | 1 |
| 1. | b | i | As ambient temperature increases, the sloth spends more time with limbs spread OR as ambient temperature increases the sloth spends less time curled in a ball OR as ambient temperature rises, the posture changes from 1 to 6; | | 1 |
| 1. | b | ii | a. less surface area is exposed when curled up OR more surface area is exposed when all limbs spread; b. curled position prevents heat loss/provides warmth OR stretched out position allows more heat loss/body cooled; | | 2 max |
| 1. | c | | as body mass increases daily energy use increases OR positive correlation / positive logarithmic relationship / increasing by factor of 10; | | 1 |
| 1. | d | | the daily energy use of the sloth is low (for its body mass compared to other mammals); | <i>OWTTE</i> | 1 |
| 1. | e | | a. (X may represent the sloth) because the sloth/S and X have a similar body mass; b. sloth does not use much energy because its locomotion is slow; c. insufficient information is provided to identify X; d. another mammal could occupy X; | | 2 |
| 1. | f | | May; | | 1 |

(continued...)

(Question 1 continued)

| Question | | Answers6 | Notes | Total |
|----------|---|--|---|-------|
| 1. | g | a. food intake rises as daily temperature increases / positive correlation; b. the lowest food intake corresponds to the lowest temperature; | | 2 |
| 1. | h | a. the sloth will be more active at higher temperatures as it takes in more food for energy; b. as temperature rises, the sloth uncurls to dissipate/lose heat; | <i>Reason required</i> | 1 |
| 1. | i | a. mammals have mammary glands; b. produce milk for their offspring; c. bodies covered in hair/fur; | <i>Characteristic must be exclusive to mammals If more than one answer, use the first one given</i> | 1 max |

| | | | | |
|----|---|--|--|-------|
| 2. | a | 20; | | 1 |
| 2. | b | a. increase in temperature/heat; b. change of pH; c. salt; d. heavy metals; | | 1 max |
| 2. | c | a. changes the shape of the (active site) of the enzyme; b. substrate would be unable to attach to the enzyme/active site; c. slows the enzyme activity / prevents reaction/catalysis from proceeding; | | 2 |

| Question | | Answers | Notes | Total |
|----------|---|--|--|-------|
| 3. | a | 0.87; (accept values between 0.8 and 0.9) | | 1 |
| 3. | b | short-term reading could show global temperatures falling while the trend is rising OR fluctuations from year to year may not show long-term trend; | | 1 |
| 3. | c | a. short wave radiation from sun passes through atmosphere / is not absorbed by CO ₂ ; b. infrared/long wave (radiation) / heat emitted from/released from (surface of) Earth; c. CO ₂ in the atmosphere absorbs infrared/long wave (radiation)/heat / cannot pass through the greenhouse gases; d. this results in warm/increased temperatures on Earth/global warming; | <i>Do not accept "reflected" for mpb</i> | 3 max |
| 4. | a | 0.5/50 %; | | 1 |
| 4. | b | a. hemophilia is X-linked/sex-linked/carried on the X chromosome; b. females have two X chromosomes OR males only have one X chromosome; c. hemophilia is caused by a recessive allele; d. (trait) must be on both alleles to be expressed OR females would require the allele on both X chromosomes to have the disease OR females can be carriers when allele is only on one chromosome; | | 3 max |

| Question | | Answers | Notes | Total |
|----------|---|--|---|--------------|
| 5. | a | 0 mV; (<i>accept answers in the range of - 10 mV to +10 mV</i>) (<i>Units required</i>) | | |
| 5. | b | sodium channels (start to) open OR depolarization/axon begins to depolarize OR action potential occurs; | <i>Reject pumping of ions</i> | 1 |
| 5. | c | Na ⁺ /sodium ions diffuse into the axon (in the first part/half of <i>t</i>); K ⁺ /potassium ions diffuse out of the axon (in the second half/part of <i>t</i>) | <i>Do not accept the name of the element without indication that it is an ion</i> | 2 |
| 5. | d | a. impulses pass to another neuron at a <u>synapse/across synaptic gap/cleft</u> ; b. (depolarization causes) Ca ²⁺ /calcium ions to diffuse into the (presynaptic) neuron/axon; c. depolarization (of presynaptic neuron) causes release of a neurotransmitter OR neurotransmitters diffuse across the synapse; d. (neurotransmitters) bind to receptors on postsynaptic neuron/membrane; e. (if the threshold potential is reached) an action potential occurs/sodium gates open (in the postsynaptic neuron); | | 3 max |

Section B

Clarity of communication: [1]

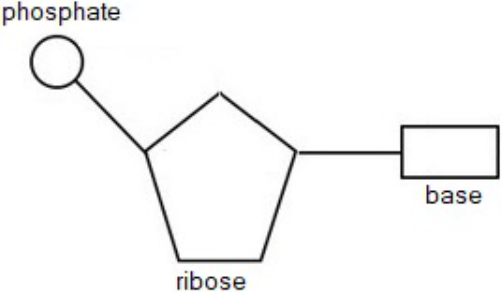
The candidate's answers are clear enough to be understood without re-reading. The candidate has answered the question succinctly with little or no repetition or irrelevant material.

| Question | | Answers | Notes | Total |
|----------|---|--|---------------------------------|-------|
| 6. | a | a. unspecialized/undifferentiated stem cells can divide / differentiate along different pathways; b. (stem cells are accessible as they) come from embryos/bone marrow/umbilical cord blood/adult tissue; c. (stem cells) can regenerate/repair diseased/damaged tissues in people; d. valid specific example; e. drugs can be tested on stem cells (in laboratories to see if they are harmful); | | 3 max |
| 6. | b | a. leaf cells contain chloroplasts; b. light is absorbed by chlorophyll (in chloroplasts); c. other pigments absorb different wavelengths; d. light energy is used in photosynthesis; e. (light is needed) to combine water and carbon dioxide/fix carbon dioxide; f. carbon compounds/organic compounds/glucose/starch/carbohydrate are produced; g. blue and red light is absorbed; h. perform photolysis OR split water molecules; | Wavelengths accepted for mpg | 5 max |

(continued...)

(Question 6 continued)

| Question | | Answers | Notes | Total |
|----------|---|--|---|---------------------|
| 6. | c | <p>Platelets: [3 max]</p> <p>a. damage/cuts to blood vessels causes platelets to be activated;</p> <p>b. the platelets release clotting factors;</p> <p>c. initiates cascade of reactions</p> <p>OR</p> <p>fibrinogen is converted to fibrin;</p> <p>d. forms a mesh over the damaged area;</p> <p>e. prevents pathogens from entering the body;</p> <p>Phagocytes: [3 max]</p> <p>f. phagocytes/phagocytic white blood cells in the blood travel to the site of infection;</p> <p>g. (phagocytes) squeeze between the capillary cells;</p> <p>h. (phagocytes) engulf/ingest/take in pathogens;</p> <p>i. the pathogen is digested/broken down by/within the phagocyte;</p> <p>Lymphocytes: [3 max]</p> <p>j. lymphocytes recognize a particular fragment/antigen of a pathogen;</p> <p>k. (lymphocytes) release antibodies;</p> <p>l. (antibodies) provide specific immunity;</p> <p>m. memory cells provide rapid response giving long-term immunity (to pathogens previously recognised);</p> <p>n. antibodies destroy pathogens;</p> | <p><i>ECF may be applied when candidates use white blood cells in place of specific terms</i></p> | <p>7 max</p> |

| Question | | Answers | Notes | Total | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------|--|--|--|---------|---------|----|----------------------------------|-------------------------------|----|-------------------|---------------------|----|-------------------------------|---------------------------------|----|--|--|----|----------------------------------|------------------------------------|----|---|---|----|---------------------------------------|--|----|---|---|-------------|-------|
| 7. | a | <p>a. ribose drawn as a pentagon and labelled; b. base linked correctly (to C1) of ribose and labelled; c. phosphate linked correctly (to C5) of ribose and labelled;</p>  | <p>Award [2 max] if more than one nucleotide drawn. "Sugar" alone is insufficient.</p> | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7. | b | <table border="1"> <thead> <tr> <th></th> <th>Mitosis</th> <th>Meiosis</th> </tr> </thead> <tbody> <tr> <td>a.</td> <td>occurs in/produces somatic cells</td> <td>occurs in/produces sex cells;</td> </tr> <tr> <td>b.</td> <td>one cell division</td> <td>two cell divisions;</td> </tr> <tr> <td>c.</td> <td>produces two (daughter) cells</td> <td>produces four (daughter) cells;</td> </tr> <tr> <td>d.</td> <td>daughter cells identical to parent cell / does not produce genetic variation</td> <td>daughter cells differ from parent cell / produces genetic variation;</td> </tr> <tr> <td>e.</td> <td>produces cells for growth/repair</td> <td>produces gametes/for reproduction;</td> </tr> <tr> <td>f.</td> <td>chromosome number stays the same/2n/diploid</td> <td>chromosome number is halved/1n/haploid;</td> </tr> <tr> <td>g.</td> <td>pairing of chromosomes does not occur</td> <td>homologous chromosomes join together/pair;</td> </tr> <tr> <td>h.</td> <td>no exchange of material between chromosomes/no crossing over;</td> <td>exchange of material between chromosomes/crossing over;</td> </tr> </tbody> </table> | | Mitosis | Meiosis | a. | occurs in/produces somatic cells | occurs in/produces sex cells; | b. | one cell division | two cell divisions; | c. | produces two (daughter) cells | produces four (daughter) cells; | d. | daughter cells identical to parent cell / does not produce genetic variation | daughter cells differ from parent cell / produces genetic variation; | e. | produces cells for growth/repair | produces gametes/for reproduction; | f. | chromosome number stays the same/2n/diploid | chromosome number is halved/1n/haploid; | g. | pairing of chromosomes does not occur | homologous chromosomes join together/pair; | h. | no exchange of material between chromosomes/no crossing over; | exchange of material between chromosomes/crossing over; | Distinguish | 5 max |
| | Mitosis | Meiosis | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| a. | occurs in/produces somatic cells | occurs in/produces sex cells; | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| b. | one cell division | two cell divisions; | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| c. | produces two (daughter) cells | produces four (daughter) cells; | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| d. | daughter cells identical to parent cell / does not produce genetic variation | daughter cells differ from parent cell / produces genetic variation; | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| e. | produces cells for growth/repair | produces gametes/for reproduction; | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| f. | chromosome number stays the same/2n/diploid | chromosome number is halved/1n/haploid; | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| g. | pairing of chromosomes does not occur | homologous chromosomes join together/pair; | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| h. | no exchange of material between chromosomes/no crossing over; | exchange of material between chromosomes/crossing over; | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

(continued...)

(Question 7 continued)

| Question | | Answers | Notes | Total |
|----------|---|---|---|--------------|
| 7. | c | a. antibiotics can (generally) kill/destroy bacteria; b. some bacteria show variation/antibiotic resistance; c. variation/resistance is due to a random mutation; d. resistant bacteria are not killed/destroyed by the antibiotic OR bacteria without the mutation die; e. (resistant) bacteria have a selective advantage / unequal success; f. the bacteria with this variation/resistance reproduces/multiplies; g. mutation/gene is passed on to the offspring / the offspring will be resistant to the antibiotic; h. resistant bacteria become more common; i. bacteria have evolved to be resistant to the antibiotic; | <i>Award 6 Max if pathogen is used instead of bacteria throughout the answer with no mention of bacteria.</i> | 7 max |
