Diploma Programme
Programme du diplôme
Programa del Diploma

# Markscheme

## November 2016

## Biology

## Standard level

## Paper 2

14 pages

## 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 | | *I. female*: «+» 0.04 «mg» ✓<br>***AND***<br>*II. male*: «–» 0.12 «mg» ✓ | *Both needed.* | **1** |
| | b | | a. height of dam affects the temperature ✓<br>b. high dams tend to cool the water ✓<br>c. low dams tend to warm the water ✓<br>d. pond 5/one pond shows no change/stays the same ✓ | | **2 max** |
| | c | | a. <u>trend</u> lines support «the hypothesis»<br>***OR***<br><u>trend</u> shows a negative correlation shown «between increased temperature and size» ✓<br><br>b. the trend line is shallow / small slope<br>***OR***<br>there is a large amount of scatter at higher temperatures (reducing the certainty)<br>***OR***<br>wide/overlapping ranges so no significant difference «(at» 9°C ) ✓<br><br>c. (hypothesis not supported because) females in water over 10°C have the highest «mean dry» mass ✓ | *Do not credit answers with just numbers.*<br>*Accept "line of best fit" wtte.*<br><br>*Note that it is only the trend line that indicates support.*<br><br>*Words other than "hypothesis not supported" may be used: "as opposed to", "whereas", to express deviation from support.* | **2 max** |

| Question | | | Answers | Notes | Total |
|---|---|---|---|---|---|
| | **d** | | a. both flooding and tree felling increases bat passes/activity / WTTE ✓<br><br>b. flooding has greater/increase on bat passes/activity / WTTE<br>***OR***<br>flooding has the greater impact than tree felling on bat passes ✓<br><br>c. supporting argument from the data ✓ | | **2 max** |
| | **e** | | a. <u>arrow</u> pointing from trout to human ✓<br><br>b. <u>arrows</u> pointing from mayflies to trout <u>and</u> bats ✓ | *Award **[1 max]** if answer does NOT show all 4 organisms.* | **2 max** |
| | **f** | | bats and trout compete for mayflies ✓ | | **1** |
| | **g** | | a. criterion<br>b. reason that beavers damage<br>c. reason that beavers help<br><br>*eg*, a. biodiversity ✓<br>b. if indigenous species are eliminated biodiversity is reduced, then the beavers would be seen as damaging ✓<br>c. if biodiversity increases (due to the engineering of waterways), then beavers could be a benefit ✓ | *Consider criteria something that may be dealt with from a range of perspectives.*<br><br>*Other possible criteria:*<br>*abiotic disturbance*<br>*changes to food webs*<br>*diversity* | **2 max** |

| Question | | | Answers | Notes | Total |
|---|---|---|---|---|---|
| **2.** | **a** | | eukaryotic because nucleus/membrane-bound organelles/named organelle other than ribosome **«***eg*, mitochondria, vesicles**»** internal membranes **«**ER**»/**multicellular ✓ | | **1** |
| | **b** | **i** | mitosis ✓ | | **1** |
| | **b** | **ii** | a. cell cycle is a sequence of stages / cell cycle is $G_1$, S, $G_2$ and mitosis ✓<br>b. (control of the cell cycle) by cyclins/cyclin ✓<br>c. levels of cyclins rise (and fall)/fluctuate during the cell cycle/surge at different times/have to reach a certain concentration ✓<br>d. conditions inside as well as outside the cell affect regulation ✓<br>e. four cyclins/different cyclins to enter different stages of/events in the cell cycle / cyclins regulate the sequence/timing of the cell cycle / cyclins trigger the next stages ✓<br>f. cyclin-dependent kinases / cyclins bind to kinases and activate them ✓<br>g. kinases phosphorylate other proteins ✓<br>h. phosphorylated proteins perform specific functions in the cell cycle ✓ | *The idea of different cyclins acting at different phases must be clear.* | **4 max** |

<table>
<tr><th colspan="3">Question</th><th>Answers</th><th>Notes</th><th>Total</th></tr>
<tr><td>3.</td><td>a</td><td></td><td>(the web of all) the enzyme-catalyzed reactions in a cell/organism<br>OR<br>the totality of an organism’s chemical reactions (consisting of catabolic and anabolic pathways which manage the material and energy resources of the cell) ✓</td><td></td><td>1</td></tr>
<tr><td></td><td>b</td><td></td><td><table><tr><th>process</th><th>anabolism</th><th>catabolism</th></tr><tr><td>photosynthesis</td><td>☑</td><td>☐</td></tr><tr><td>glycolysis</td><td>☐</td><td>☑</td></tr></table></td><td></td><td>2</td></tr>
<tr><td></td><td>c</td><td></td><td>a. «cell respiration is metabolism because» enzymes control the reactions ✓<br>b. energy is released from complex molecules «to make ATP» ✓<br>c. respiration is catabolic (metabolism)<br>OR<br>complex molecules become simpler<br>OR<br>$C_6H_{12}O_6$ to $CO_2 + H_2O$ ✓</td><td></td><td>2 max</td></tr>
</table>

| Question | | | Answers | Notes | Total |
|---|---|---|---|---|---|
| **4.** | **a** | | 32 ✓ | | **1** |
| | **b** | | a. because the chromosome number is not an even number/63 ✓<br>b. (so) cannot divide by two during meiosis/cannot perform meiosis/chromosomes cannot pair up during meiosis ✓<br>c. one chromosome has no homologue/WTTE ✓<br>d. because unlikely to/cannot produce viable gametes/sperm/egg cells ✓ | | **2** |
| | **c** | | a. to be in same species two organisms must have the same genes arranged on the same chromosomes<br>***OR***<br>must have the same number of chromosomes ✓<br>b. members of same species produce fertile offspring and a mule is not fertile ✓ | | **2** |
| | **d** | | non-disjunction ✓ | *Accept description of non-disjunction.* | **1** |

<table>
<tr><th colspan="3">Question</th><th>Answers</th><th>Notes</th><th>Total</th></tr>
<tr><td>5.</td><td>a</td><td></td><td>
<table>
<tr><th></th><th>archaea</th><th>eubacteria</th><th></th></tr>
<tr><td>a.</td><td>DNA with proteins/histones</td><td>DNA with no proteins/histones</td><td>✓</td></tr>
<tr><td>b.</td><td>usually have introns</td><td>seldom have introns</td><td>✓</td></tr>
<tr><td>c.</td><td>cell walls lack peptidoglycan/glycoprotein</td><td>cell walls with peptidoglycan/glycoprotein</td><td>✓</td></tr>
<tr><td>d.</td><td>lipids different/cell membrane with glycerol-ether</td><td>lipids different/cell membrane with glycerol-esters</td><td>✓</td></tr>
<tr><td>e.</td><td>found in extreme environments</td><td>not in extreme environments</td><td>✓</td></tr>
<tr><td>f.</td><td>ribosomes are different (than eubacteria)</td><td>ribosomes are different (than archaea)</td><td>✓</td></tr>
</table>
</td><td>Award [1] for each correct row.<br>Award reasonable distinctions even if not strictly contrasted.</td><td>3 max</td></tr>
<tr><td></td><td>b</td><td></td><td>a. DNA/base sequences (of a gene/genes) ✓<br><br>b. amino acid sequences (in a protein/proteins) ✓</td><td>Do not credit references to morphology.</td><td>2</td></tr>
</table>

## 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. molecules move by <u>diffusion</u> / move down a concentration gradient ✓<br>b. nutrients move into tissues ✓<br>c. gas exchange / Oxygen and carbon dioxide exchange between tissues and blood/capillaries ✓<br>d. (nitrogenous) wastes/excess water move from cells/tissues into blood/capillaries ✓<br>e. hormones leave capillaries in target tissues/to attach to receptors on cells / (endocrine) organs/gland tissues release hormones into the bloodstream ✓ | | **3 max** |

| Question | | | Answers | Notes | Total |
|---|---|---|---|---|---|
| | **b** | | a. arteries and veins have three layers in their walls<br>***OR***<br>walls of arteries and veins have tunica externa, media and intima ✓<br>b. pressure is high in arteries/pressure is low in veins ✓<br>c. arteries receive blood from ventricles/heart / carry blood away from heart ✓<br>d. lumen of artery is small to keep pressure high ✓<br>e. arteries have thick (muscular) walls (with elastic fibres) to withstand pressure ✓<br>f. elastic fibres recoil in response to ventricle/heart contraction ✓<br>g. muscle / elastic fibres help maintain pressure between heartbeats<br>***OR***<br>muscle / elastic fibres help propel blood toward capillary beds ✓<br>h. veins receive blood from capillaries/capillary beds / carry blood to heart ✓<br>i. large lumen of veins so there is less resistance to blood flow ✓<br>j. valves in veins keep blood flowing toward heart/prevent backflow ✓ | | **8 max** |

| Question | | | Answers | Notes | Total |
|---|---|---|---|---|---|
| | **c** | | a. <u>gas exchange</u> ✓<br>b. oxygen <u>diffuses</u> from air to blood and carbon dioxide <u>diffuses</u> from blood to air ✓<br>c. oxygen binds to hemoglobin in red blood cells ✓<br>d. pressure inside/volume of alveoli increases/decreases / air enters/exits alveoli during inspiration/expiration/ventilation ✓<br>e. blood flow through capillaries / concentration gradients of gases/oxygen/$CO_2$ maintained ✓<br>f. type II pneumocytes secrete fluid/surfactant / secretion of surfactant to prevent sides of alveolus adhering ✓ | *Accept answer in a clearly annotated diagram.* | **4 max** |

*(Plus up to **[1]** for quality)*

| Question | | | Answers | Notes | Total |
|---|---|---|---|---|---|
| 7. | a | | a. light energy is the initial energy source for (all) organisms ✓<br>b. producers/autotrophs change light/radiant energy into chemical energy<br>***OR***<br>producers/autotrophs convert/trap light/radiant energy by photosynthesis ✓<br>c. producing $C_6H_{12}O_6$ /sugars/carbohydrates ✓<br>d. carbon/organic compounds used for energy/growth/repair/storage ✓<br>e. compounds/energy pass as food along food chains/trophic levels WTTE ✓<br>f. cellular respiration releases energy as ATP from food ✓<br>g. energy is lost as heat (during cellular respiration) ✓<br>h. loss of energy at each trophic level<br>***OR***<br>only approximately 10% of energy is passed to the next trophic level / 90% is lost at each trophic level ✓<br>i. energy lost in bones/hair when they die/not fully eaten by the next trophic level ✓<br>j. energy lost in feces/urine ✓<br>k. decomposers/saprotrophs remove energy from wastes/bodies ✓<br>l. energy is not recycled ✓ | | **8 max** |

| Question | | | Answers | Notes | Total |
|---|---|---|---|---|---|
| | **b** | | a. by photosynthesis / using energy from light ✓<br><br>b. attached to carbon compounds ✓<br><br>c. phosphates used to make phospholipids/nucleotides/nucleic acids/DNA/RNA/ATP ✓<br><br>d. nitrates are used to make amino acids/proteins/nucleotides/nucleic acids/DNA/RNA/ATP ✓<br><br>e. transported from roots to leaves (in xylem) ✓ | *Other phosphorus-containing metabolites are acceptable if verified.*<br><br>*Other nitrogen-containing metabolites are acceptable if verified.* | **3 max** |
| | **c** | | a. drawn in steps rather than triangle ✓<br><br>b. drawn to scale (should be at least 1/5 of the box below it)<br>***OR***<br>annotated with appropriate numeric values ✓<br><br>c. producer ✓<br><br>d. primary consumer ✓<br><br>e. secondary consumer ✓ | *Award no marks if a drawing has not been made.*<br><br>*"Appropriate numeric values" should indicate scale so accept percentage or numbers.* | **4 max** |

*(Plus up to **[1]** for quality)*