



# **MARKSCHEME**

**November 2014**

**BIOLOGY**

**Higher Level**

**Paper 2**

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## Section B

### Extended response questions - quality of construction

- ♦ Extended response questions for HL P2 carry a mark total of **[20]**. Of these marks, **[18]** are awarded for content and **[2]** for the quality of construction of the answer.
- ♦ Two aspects are considered:
  - expression of relevant ideas with clarity
  - structure of the answers.
- ♦ **[1]** quality mark is to be awarded when the candidate satisfies **EACH** of the following criteria. Thus **[2]** quality marks are awarded when a candidate satisfies **BOTH** criteria.

#### **Clarity of expression:**

*The candidate has made a serious and full attempt to answer all parts of the question and the answers are expressed clearly enough to be understood with little or no re-reading.*

#### **Structure of answer:**

*The candidate has linked relevant ideas to form a logical sequence **within** at least two parts of the **same question** (eg: within part a and within part b, or within part a and within part c etc. but **not between** part a and part b or between part a and part c etc.).*

**SECTION A**

1. (a) a. sodium in diet/experiment increased blood pressure (in chimpanzees);  
b. after treatment the chimpanzees showed hypertension/high blood pressure;  
c. after treatment ended blood pressure returned to normal; **[2 max]**
- (b) (i) a. less sodium dissolved in blood makes it hypo-osmotic/less dense;  
b. water leaves blood to tissue decreasing pressure on arteries/lowering blood pressure; **[1 max]**  
*Answers must give a reason.*
- (ii) a. control also decreases, so other factor could be affecting the blood pressure;  
b. continues to decrease to initial concentration of experimental group; **[1 max]**
- (c) thick outer layer of collagen fibres/thick muscle wall (give it strength);  
thick layers of circular/elastic muscle fibres gives it } (*thick alone not sufficient,*  
flexibility to support changes in blood pressure; } *must be qualified*) **[2]**
- (d) women with low sodium diet **[1]**
- (e) a. both decrease;  
b. women decrease more than men from high to low;  
c. men decrease more from high to intermediate (maybe not significant); **[2 max]**
- (f) a. hormones/estrogen in women protect/lower blood pressure;  
b. BMI / adipose tissue;  
c. lifestyle / smoking / drinking; (*must be qualified*) **[1 max]**
- (g) increasing potassium intake tends to lower blood pressure;  
increasing potassium lowers blood pressure more with higher sodium; **[2 max]**
- (h) a. the sodium-potassium pump transports (three) sodium atoms out of the cell and (two) potassium atoms into the cell;  
b. more potassium means more sodium can be sent out of the cells;  
c. a fall in potassium means more sodium is reabsorbed/remains in the cells; **[1 max]**
- (i) a. (first graph shows that) increasing sodium levels increases blood pressure;  
b. (second graph shows that) lowering sodium levels (to one third/50 m mol day<sup>-1</sup>) lowers blood pressure;  
c. (third graph shows) that increasing potassium levels lowers blood pressure even at high sodium intake;  
d. although the data supports the hypothesis, only one study was on humans;  
e. sudden change in diet may lead to extreme drop in blood pressure; **[3 max]**

2. (a) *I*: integral/intrinsic/transmembrane protein / glycoprotein;  
*Protein must be qualified for the mark.*  
*II*: phospholipid (bilayer) / hydrophobic/fatty acid/lipid tail region; [2]
- (b) (i) extracellular matrix/material/region/component [1]  
(ii) support / adhesion / cohesion / movement / communication / recognition [1]
- Answers for (a)(i), (ii) and (iii) must include some explanation for the mark.*
3. (a) (i) decreases CO<sub>2</sub> concentration lowering greenhouse effect as trees/plants act as a carbon sink/photosynthesis absorbs CO<sub>2</sub> / *OWTTE* [1]  
(ii) solar energy reduces greenhouse gas emissions as fossil fuels are not burned lowering the effect / *OWTTE* [1]  
(iii) (through its release/pollution by) methane can enhance the greenhouse effect since it is a greenhouse gas / other valid answer [1]
- (b) (i) *Only credit the first two answers given by the candidate.*  
a. increased immigration;  
b. decreased emigration;  
c. increased birth rate;  
d. decreased death rate;  
e. decrease in predators;  
f. increase in food; [2 max]
- (ii) a. natality and mortality are equal;  
b. immigration and emigration are equal;  
c. shortage of food/resources;  
d. presence of predators;  
e. presence of diseases;  
f. [immigration + birth] = [emigration + death]; } *(this marking point is worth [2 marks])* [2 max]
- Award any valid reason.*
4. (a) *I*: aorta;  
*II*: left ventricle; [2]
- (b) avoid blood backflow / maintains blood flow in one direction [1]
- (c) heart/cardiac muscle contraction is myogenic;  
SAN/pacemaker sends signal for heart to contract;  
nerves control speed of heartbeat;  
adrenalin can accelerate heartbeat; [2 max]

**SECTION B**

5. (a) transport: *eg:* hemoglobin;  
transport of molecules across membrane: *eg:* sodium potassium pump;  
structure: *eg:* collagen;  
catalysis: *eg:* amylase;  
immunity/protection: *eg:* IgA / antibodies (named antibody not required);  
movement: *eg:* myosin;  
regulation/homeostasis: *eg:* insulin;  
binding sites for hormones (named)/neurotransmitters (name not needed); **[4 max]**  
*Accept any other function with a **named** protein.*  
*Only accept the first four stated.*
- (b) a. translation involves initiation, elongation/translocation and termination;  
b. ribosome slides along the mRNA to the start codon;  
c. translation takes place in 5' → 3' direction;  
d. start codon is AUG/ codes for methionine;  
e. tRNA activating enzymes;  
f. link amino acids to a specific tRNA;  
g. ribosome binds the tRNA with the mRNA;  
h. anticodon of tRNA pairs with codon on mRNA;  
i. using complementary base pairing;  
j. second tRNA binds (to the codon) at the adjacent/next binding site;  
k. peptide bond forms between amino acids;  
l. translocation occurs moving the tRNA into the next site;  
m. reference to A, P and E sites;  
n. tRNA that has lost its amino acid detaches;  
o. this proceeds until stop codon is reached; **[8 max]**  
*Allow a clearly drawn correctly labelled diagram.*
- (c) a. different alleles for proteins exist in nature / a gene for a protein shows variations;  
b. selection pressure acts on organisms / change in external environment / example of selection pressure (*eg:* use of antibiotic);  
c. organisms expressing one allele/protein have advantage over those expressing others;  
d. organisms expressing one allele/protein have greater chances of survival / by natural selection the better adapted organisms survive;  
e. organisms expressing one allele/protein can reproduce more / leave more descendants;  
f. expression of the given allele/protein is inherited by these organisms;  
g. population expressing the given allele/protein increases (while the ones expressing the other protein decreases);  
h. after a few generations, the characteristic of the species gradually changes; **[6 max]**

*(Plus up to [2] for quality)*

6. (a) a. chlorophyll is the main photosynthetic pigment;  
b. high levels of absorption in red light and blue light; (*both needed*)  
c. greatest absorption in blue light;  
d. least/low absorption in green light;  
e. green light is reflected;  
f. other pigments absorb other wavelengths/colours; **[4 max]**  
*Allow graph showing the absorption.*
- (b) a. low light intensity affects light-dependent reactions;  
b. fewer electrons are excited / less photolysis occurs;  
c. less NADPH and ATP produced at low light intensities; (*both needed*)  
d. rate-limiting step is the reduction of G3P/glycerate 3-phosphate/  
PGA phosphoglycerate;  
e. *graph showing*: effect of light intensity on rate of photosynthesis; } (*must not start at zero*)  
f. low carbon dioxide concentration affects the Calvin cycle/light-independent stage;  
g. fixation of CO<sub>2</sub> is decreased;  
h. less ribulose biphosphate joins to CO<sub>2</sub> to form G3P/glycerate 3-phosphate /PGA phosphoglycerate;  
i. *graph showing*: effect of CO<sub>2</sub> concentration on rate of photosynthesis; **[6 max]**  
*Note: graphs must have axes clearly and correctly labelled.*
- (c) a. leaf has large surface area for absorption of light;  
b. upper epidermis (thin) allowing light to pass;  
c. (waxy translucent) cuticle to (allow light in and) prevent water loss;  
d. palisade mesophyll contains many (cells with) chloroplasts;  
e. palisade mesophyll close to upper layer to receive more light;  
f. spongy mesophyll contains chloroplasts which allow photosynthesis;  
g. spongy mesophyll (cells loosely packed) allows gaseous exchange;  
h. stoma allow CO<sub>2</sub> for photosynthesis to diffuse in;  
i. stoma allow O<sub>2</sub> produced in photosynthesis to diffuse out;  
j. xylem brings water (for reactions);  
k. phloem carries away products of photosynthesis/sucrose;  
l. guard cells open and close stoma (for gas exchange); **[8 max]**  
*Award marks to an annotated diagram explaining the above points.*

*(Plus up to [2] for quality)*

7. (a) a. prophase – with chromatin condensed/chromosomes visible and nuclear membrane still present/disappearing;  
b. metaphase – chromosomes at the equator with spindle fibres present;  
c. anaphase – sister chromatids migrating to opposite poles with spindle fibres present;  
d. telophase – two nuclei being formed (and nuclear membrane present/reappearing); **[4 max]**  
*Award marks for clear drawings with each stage correctly labelled. Ignore all other labels.*
- (b) a. in multiple alleles there are more than two alleles of a gene;  
b. codominant alleles both affect the phenotype (in the heterozygote);  
c.  $I^A$  and  $I^B$  and  $i$  are the three alleles controlling blood groups;  
d. in ABO blood group  $I^A$  and  $I^B$  are codominant and  $i$  is recessive;  
e. when A and B both present, both are expressed/will give AB;  
f.  $i$  is recessive to both  $I^A$  and  $I^B$  / type A and type B can be heterozygous;  
g. only homozygous/ $ii$  organisms are blood group O;  
h. example of inheritance of blood groups / Punnett square showing inheritance; **[6 max]**  
*Phenotypes must be given for “marking point g” to be awarded.*
- (c) a. (therapeutic cloning) is the creation of an embryo to supply embryonic stem cells for medical use;  
b. transfer of nucleus from somatic cell into an (anucleated) egg;  
c. stimulated by shock to begin cell division;  
*pros:*  
d. stem cells from embryos have greater flexibility;  
e. pluripotent cells can give rise to all cells in the body / new organ could be grown as needed;  
f. no (danger of) rejection of the transplant because the organ DNA would match the patient’s DNA (exactly);  
g. elimination of pain/inconvenience/shortened life span of organ recipient;  
h. would eliminate organ and tissue shortages;  
i. no need for immunosuppressive drugs;  
*cons:*  
j. manipulation/destruction of human embryos not ethically acceptable;  
k. the process of extracting stem cells involves killing the embryo;  
l. many attempts before success is attained; **[8 max]**  
*Award [7 max] if only the pros are addressed.*

(Plus up to [2] for quality)



8. (a) *Award [1] for each of the following clearly drawn and correctly labelled.*
- a. testis – shown as an oval in scrotum;
  - b. epididymis – on testis connecting to the sperm duct;
  - c. sperm duct/vas deferens – leaving the testis;
  - d. urethra – leaving bladder;
  - e. prostate gland – below bladder;
  - f. seminal vesicle – joining sperm duct above prostate gland;
  - g. penis – with erectile tissue;
  - h. foreskin – at the end of the penis; **[4 max]**
- (b)
- a. (at the start) drugs/hormones given to stop ovulation;
  - b. ovarian hyperstimulation / fertility drugs/hormones/named drug injected in mother;
  - c. development of multiple follicles;
  - d. induction of egg maturation;
  - e. retrieval of eggs through (minor) surgery;
  - f. sperm collected (*in vitro*);
  - g. fertilization *in vitro* of egg and sperm;
  - h. (if sperm count is low) intracytoplasmic sperm injection (ICSI) is performed;
  - i. fertilized egg is grown in medium;
  - j. fertilized egg is introduced/implanted in uterus; **[6 max]**
- (c)
- a. transport facilitated by proximity of mother and embryo blood vessel;
  - b. chorionic villi increase surface area for exchange;
  - c. oxygen and food reach embryo;
  - d. carbon dioxide and waste matter carried from embryo to mother;
  - e. immune system of mother protects embryo;
  - f. barrier function as bloods do not mix;
  - g. endocrine function as it secretes hormones;
  - h. human chorionic gonadotropin/HCG prevents degeneration of corpus luteum;
  - i. production of estrogen maintains endometrium;
  - j. estrogen increases mammary gland growth;
  - k. progesterone maintains endometrium;
  - l. progesterone prevents uterine contractions; **[8 max]**

*(Plus up to [2] for quality)*

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