



MARKSCHEME

November 2014

BIOLOGY

Higher Level

Paper 2

9 pages

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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⁻¹)
 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 CO₂ concentration lowering greenhouse effect as trees/plants act as a carbon sink/photosynthesis absorbs CO₂ / *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 CO₂ is decreased;
h. less ribulose biphosphate joins to CO₂ to form G3P/glycerate 3-phosphate /PGA phosphoglycerate;
i. *graph showing*: effect of CO₂ 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 CO₂ for photosynthesis to diffuse in;
i. stoma allow O₂ 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 (enucleated) 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)