



# **MARKSCHEME**

**May 2014**

**BIOLOGY**

**Standard Level**

**Paper 2**

9 pages

## Section B

### Extended response questions - quality of construction

- ♦ Extended response questions for SL 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)  $10.0 - 8.0 = 2 \text{ mg CO}_2 \text{ dm}^{-2} \text{ hr}^{-1}$  (*units needed*) [1]  
 Accept answers in the range of  $(1.9-2.1) \text{ mg CO}_2 \text{ dm}^{-2} \text{ hr}^{-1}$  to  $2.1 \text{ mg CO}_2 \text{ dm}^{-2} \text{ hr}^{-1}$ .  
 Do not accept negative values in the final answer.
- (b) (i) net photosynthesis of control is always greater than plants exposed to UV;  
 UV causes a sharp drop in net photosynthesis (after day 3) while control rises slightly/remains the same;  
 UV does not affect the net photosynthesis (rises slightly) between day 1 and day 3 while control drops slightly in same period; [2 max]
- (ii) the rate of respiration of control is less than plants exposed to UV;  
 respiration rate increased in the UV exposed plants early/days 1 to 2 / little change occurred as the experiment progressed/days 4 and 7 while control plants remain more stable/slightly decrease;  
 there are more fluctuations/variability/increases and decreases in the respiration rate of the UV exposed plants than in control plants; [2 max]
- (c) production of  $\text{O}_2$ ;  
 increase/change in biomass; [2]  
 Accept alternate valid techniques for measuring photosynthetic rate eg starch production.
- (d) (greater) decrease in (net) photosynthesis / decrease in oxygen production / less  $\text{CO}_2$  uptake;  
 slower growth / reduced (rate of) biomass production;  
 (slightly) more respiration; [2 max]
- (e) net photosynthesis for unshaded plants always greater than the shaded / unshaded was always more than  $10 \text{ mg CO}_2 \text{ dm}^{-2}$  while shaded was always less than  $10 \text{ mg CO}_2 \text{ dm}^{-2}$ ;  
 (overall) both decreased with increasing UV doses/(overall) negative relationship;  
 net photosynthesis reduced more for shaded than unshaded plants;  
 as UV increases there was greater fluctuation in the response of unshaded plants than in shaded; [2 max]
- (f) increase the greenhouse effect (as UV decreases photosynthesis) so there is less uptake of  $\text{CO}_2$  / more accumulation of  $\text{CO}_2$  in the atmosphere / *OWTTE* [1]
- (g) plants affected most near the poles/have lowest photosynthesis;  
 because more UV there (has greatest impact);  
 because lowest light intensity (has greatest impact); [2 max]

2. (a) (i)  $\left(\frac{11\text{mm}}{2\mu\text{m}} = \frac{11000}{2} =\right)(\times)5500$  [1]

Accept answers in the range of  $(\times)5000$  to  $(\times)6000$ .  
Award the mark for correct answer only.

(ii)  $\left(\frac{43(\text{mm})}{11(\text{mm})} \times 2 \text{ or } \frac{43(\text{mm})}{5500} = 0.0078\text{mm}\right)$  [1]

7.8  
Accept answers in the range of 7.0 to 8.8 (um).  
Award the mark for correct answer only.

(b) (i) (rough) endoplasmic reticulum [1]

(ii) synthesis/modification and transport of proteins [1]  
*Synthesis of proteins for export is sufficient.*  
Do not accept ECF of the organelle named in (b)(i).

(c) the greater the volume the smaller the ratio of surface area to volume / *OWTTE*;  
rate of production of heat/waste/carbon dioxide/oxygen consumption is a function of its volume;  
smaller cells are more efficient at exchanging materials / rate of exchange of heat/waste/nutrients is a function of its surface;  
ratio limits the size of a cell; [2 max]

(d) break down/hydrolyse glycogen to glucose to be used in glycolysis/cell respiration;  
breakdown glucose to pyruvate to enter Krebs cycle/CAC/mitochondrion;  
breakdown pyruvate to carbon dioxide and water in the mitochondrion (to obtain a large yield of ATP); [2 max]

3. (a) *filicinophyta* [1]

(b) *porifera* [1]

4. (a) father:  $X^H Y$ ;  
 mother:  $X^H X^h$ ; [2]  
 Do not accept alternate notations for alleles in (a), ECF for notations will only apply to parts (b) and (c), eg  $X^c X^c$ .

(b)

<b>gametes</b>	$X^H$	$X^h$
$X^H$	$X^H X^H$	$X^H X^h$ ;
Y	$X^H Y$	$X^h Y$ ;

Award [2] for a correctly drawn Punnett square showing correct alleles and sex-linkage.  
 Award [1 max] for a correctly drawn Punnett square showing ECF (ie no sex-linkage).  
 Accept only alternative correct notations for the alleles/genotypes for ECF.  
 correct offspring; [2]

(c)

	sons		daughters	
<b>ratio of genotypes</b>	50% of sons $X^H Y$	50% of sons $X^h Y$	50% of daughters $X^H X^H$	50% of daughters $X^H X^h$
<b>phenotypes</b>	normal	hemophiliac	normal	normal/partial sufferer

Award marking point a. for an answer that gives the above genotypes in a 1:1:1:1 ratio, eg 25% : 25% : 25% : 25%.  
**Genotypes must be included for marking point a.**  
 Accept genotypes written in phenotype's row as a clarification (between brackets).  
 Accept only alternative correct notations for the alleles/genotypes for ECF.  
 Do not accept "carrier" as phenotype for  $X^H X^h$ . [2]

**SECTION B**

Remember, up to TWO “quality of construction” marks per essay.

5. (a) deoxyribose, phosphate and base/named base properly labelled and linked;

all four bases labelled as Adenine,  
Thymine, Cytosine, Guanine;

} (full names required for any base  
drawn. Do not award marks for  
the letters alone)

sugar labelled and shown as a pentagon;

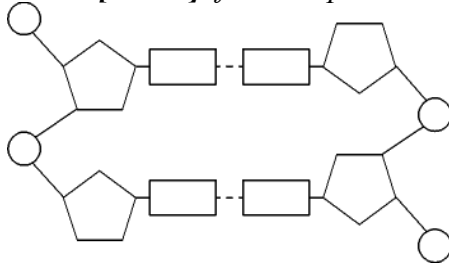
covalent/phosphodiester bonds correctly labelled;

complementary base pairing between A-T and C-G;

H-bonds correctly labelled; (correct number of bonds not required)

correctly shows two antiparallel sugar-phosphate strands/backbones with linkages between phosphates and sugars connected through bases; (phosphate and simple names such as sugar and base are acceptable labels. They must be given at least once) **[5 max]**

Award **[2 max]** if no complementary double stranded molecule drawn.



(b) an example of stem cells are obtained; } (eg bone marrow / cord blood / inner cell  
mass of embryo / embryonic stem cells)

stem cells retain their capacity to divide;

they are unspecialized/undifferentiated;

have the ability to differentiate/specialize (along different pathways) / are multipotent/pluripotent/totipotent;

during differentiation/specialization some genes are expressed and some are suppressed;

example of disease; (eg leukemia / heart disease / diabetes / other possibility)

example of therapeutic use; } (eg leukemia – patient’s bone marrow cells (are killed  
and) replaced with the stem cells)

(therapeutic) treatments can now use (adult) stem cells (eg adipose tissue, wisdom teeth);

**[5 max]**

- (c) (genetically modified organisms are) organisms where characteristics are altered/changed by addition or removal of a gene;  
reference to the specific gene transferred to the host organism;  
verifiable example of genetic modification; (*eg BT- corn/other valid examples*)  
universal genetic code (allows genes to be transferred between species);  
gene transfer involves splicing genes into a suitable vector/host DNA;  
after placed in host, host cells are cloned;

*potential benefits:*

1st potential benefit; (*eg increased yields/productivity*)

2nd potential benefit; (*eg allows for the introduction of a characteristic that wasn't present within the gene pool (selective breeding could not have produced desired phenotype)*)

i. 3rd potential benefit; (*eg less use of chemical pesticides*)

*Specific potential benefits must be related to the named examples.*

*harmful effects:*

1st harmful effect; (*eg possibility of cross pollination*)

2nd harmful effect; (*eg could have currently unknown harmful effects / toxin may cause allergic reactions*)

3rd harmful effect; (*eg reduces genetic variation/biodiversity*)

*Specific harmful effects related to the named examples.*

**[8 max]**

*Do not accept general or vague statements about ethical concerns (eg humans changing species/playing god).*

*Award [7 max] if both potential benefits and harmful effects are not addressed.*

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

6. (a) hormone binding sites;  
immobilized enzymes;  
cell adhesion;  
cell-to-cell communication/cell recognition;  
channels for passive transportation;  
pumps for active transport; **[4 max]**
- (b) genetic code consists of codons of base triplets;  
mRNA is complementary to the DNA strand;  
mRNA carries information (transcribed) from the DNA gene;  
translation occurs in a ribosome;  
mRNA attaches to the (small subunit of the) ribosome;  
has specific codons;  
each (codon) codes for one amino acid;  
tRNA matches its anticodons with the codons of mRNA;  
by hydrogen bonds between complementary bases;  
each tRNA carries a specific/OWTTE amino acid;  
the amino acids are attached to each other by condensation reactions/peptide bonds;  
the process is repeated;  
forming polypeptides; **[8 max]**  
*Do not accept answers suggesting anticodons carry amino acids.*
- (c) antibodies are produced by (B) lymphocytes;  
many types of lymphocytes exist in the body;  
each recognizes one specific/OWTTE antigen (from foreign body);  
antigen binds to (proteins in plasma membrane of) specific lymphocyte;  
activates the lymphocyte;  
(lymphocytes) clone (through mitosis);  
to produce many identical lymphocytes;  
which secrete the specific/OWTTE antibody against the antigen;  
that are proteins made through translation/protein synthesis; **[6 max]**

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



7. (a)

	salivary amylase	pancreatic amylase
source	salivary glands;	pancreas;
substrate	starch;	starch;
products	maltose;	maltose;
optimum pH	6.2–7.0/slightly acidic/neutral;	7.0–8.0/slightly basic/alkaline;

[4 max]

*The source, substrate, products and optimum pH must refer to the named amylase.*

- (b) (original) source of energy in a food chain is from (sun)light;  
 captured by plants/autotrophs/producers/first trophic level;  
 by means of photosynthesis/converted to chemical energy/organic compounds;  
 plants use part of energy for own energy requirements/lost through cell respiration;  
 consumers use energy for own requirements from organisms in previous trophic level;  
 energy travels between trophic levels/producer to 1st consumer/1st consumer to 2nd consumer/2nd consumer to 3rd consumer;  
 not all material is assimilated/consumed / not digested / lost in feces / OWTTE;  
 only a small amount of energy/(approximately) 10–20% is passed between trophic levels / most/80–90%/a large amount of the energy of a trophic level is lost (and not transferred);  
 loss of energy from organisms in form of heat;  
 energy is not recycled in an ecosystem (but nutrients are);

[6 max]

*Award any of the above marking points in a correctly annotated diagram.*

- (c) pancreatic cells monitor the blood glucose concentrations;  
 alpha and beta cells are in the islets of Langerhans;  
 negative feedback mechanisms;  
 send hormones (through bloodstream) to target organs;  
 if too high,  $\beta$  cells (in pancreas) produce insulin;  
 insulin stimulates liver/muscle cells to take up glucose;  
 glucose is converted into glycogen (stimulated by insulin); *(do not award this marking point where it is stated that insulin directly converts glucose)*  
 lowering blood glucose level;  
 other cells are stimulated to absorb glucose and use it in cell respiration;  
 if glucose levels too low,  $\alpha$  cells (in pancreas) produce glucagon;  
 glucagon stimulates liver/muscle cells to break down glycogen; *(do not award this marking point where it is stated that glucagon directly breaks down glycogen)*  
 and release glucose into the blood;  
 raising the blood glucose level;

[8 max]

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