

Dunman Secondary School

Subject code: 6093

Level and Stream: Secondary 4 Express

Marking scheme

Exam series: Prelims

Paper 1

1	B	2	B	3	B	4	C	5	D	6	D	7	C	8	B	9	D	10	A
11	C	12	C	13	D	14	D	15	B	16	B	17	D	18	C	19	D	20	D
21	C	22	C	23	D	24	B	25	A	26	D	27	C	28	C	29	C	30	D
31	A	32	C	33	A	34	B	35	B	36	A	37	C	38	A	39	B	40	D

Paper 2

Section A

1 (a) A mitochondria

B Golgi apparatus/Golgi body

2 correct [1]. All correct [2] [1]

(b) With reference to the structures labelled C, D and E, describe the sequence of events that lead to the production of digestive enzymes in this cell.

The nucleus, E contains DNA/gene which codes for the production of proteins/enzymes. [1]

Transcription of the genes occurs in the nucleus to produce messenger ribonucleic acids (mRNAs). [1]

mRNA leaves the nucleus via the nuclear pore, D. [1]

Ribosomes, C carry out translation in the cytoplasm to synthesise the polypeptide chains that will fold into digestive enzymes. [1] [4]

[Total: 6]

2 (a) 0.4 M [1]

(b) The water potential of the cell sap in the beet root cells was higher than the 0.6 M sucrose solution. [1]

Water moves out of the beet root cells into the 0.6 M bathing sucrose solution across the partially permeable cell membrane [1] by osmosis. [1]

The bathing solution becomes less dense than the 0.6 M sucrose solution and floats [1] [4]

(c) Marking points:

Plant cell with no chloroplasts [1]

Plasmolysed cell [1]

Correct labels of cell wall, cell membrane, vacuole [1] [3]

[Total: 8]

- 3 (a) (i) **meiosis** [1]
- (ii) **ovule / anther / ovary** [1]
- (iii) 1 **E** 2 **C** 3 **D** 4 **F** 5 **A** 6 **B** [1]
- (ii) **6** [1]

(b)	C / metaphase I	A / metaphase II
[1]	1. Chromosomes are one either side of the equator.	Chromosomes are on the equator.
[1]	2. Chromosomes are paired.	Chromosomes are not paired.
[1]	3. Centromere are not on the equator.	Centromeres are on the equator.

Correct identification of stages A and C. [1]

Any two marking points [2]

[3]

- (c) **Crossing over occurs during ~~prophase I~~ [1]**

Random assortment occurs during metaphase I and II and anaphase I and II. [1]

[Total: 9]

- 4 (a) **A palisade mesophyll**
- B ~~spongy~~ mesophyll** [1]

- (b) multilayered epidermis **reduces loss of water vapour /evaporation through the cuticle [1]**

stomatal crypts **The leaf has sunken stomata that lie in the grooves of the leaf on the**

lower surface of the leaf / has hairs that trap water vapour diffusing out of the stomata. [1]

This increases the humidity around the stomata and so reduces the rate of transpiration. [1]

[3]

- (c) Describe how sucrose is transported from the leaves to the roots of plants for storage.

Sucrose is transported to the roots of plants via the phloem/sieve tubes [1]

[1]

[Total: 5]

- 5 (a)
1. The basic unit of DNA is the nucleotide made up of a deoxyribose sugar, phosphate group and nitrogenous base.
 2. DNA is made of two polynucleotide strands.
 3. The two polynucleotides are twisted to form a double helix.
 4. There is complementary base pairing of Adenine with Thymine and Guanine with Cytosine [1] Reject A-T and C-G if there is no elaboration on what the letters represent.
 5. DNA strands are held together by hydrogen bonds.
 6. Each polynucleotide strand has a sugar phosphate backbone.

Any three marking points. 1 mark for each marking point. [3]

- (b) Since hydrogen peroxide can result in incorrect changes in the nucleotide or sequence of the bases. / Formation of a new allele. [1] [1]

- (c) The gene for the glowing protein is cut out from the jellyfish chromosome with the gene using a restriction enzyme. [1]

The same restriction enzyme is used to cut the plasmid from a bacterium. [1]

The plasmid is mixed with the DNA fragment containing the gene for the glowing protein and the enzyme DNA ligase. [1]

The recombinant DNA is mixed with the bacteria and heat / electric shock is applied causing pores to appear in the cell surface membrane for the recombinant plasmid to enter. [1] [4]

[Total: 8]

- 6 (a) Any three of the following marking points. [1] for each point

- exercise
- increase in temperature of the surroundings
- increase in metabolism/ increase in respiration
- fever
- ovulation
- wearing more or thicker clothes

All correct [2] Two correct [1] [2]

- (b)
- The sweat glands become more active to increase in the production of sweat [1] the evaporation of the sweat removes latent heat of vaporization. [1]
 - Increased vasodilation in the arterioles increases the blood flow to the capillaries near the surface of the skin [1] which increases the heat loss to the surroundings by radiation, conduction and convection. [1]
 - There is reduced metabolism/respiration [1] to reduce the release of heat. [1]

Any two correct responses and explanations. [4]

- 7 (a) 90% of the energy at each trophic level is lost to the surroundings when energy is transferred from one trophic to another. [1] Energy is lost to the surroundings in the form of heat/undigested materials/excretory products/uneaten body parts [1]

Any two ways of energy loss for 1 mark. [2]

- (ii) Label the arrow from CO₂ in the atmosphere to D with P. [1]

- (b) Define the term *bioaccumulation*.

Bioaccumulation is the process by which certain chemicals are not excreted from the bodies of organisms but accumulate in their bodies. [1]

The chemicals are then passed along the food chains and become concentrated in the bodies of the final consumers. [1] [2]

- (c) Describe how human activities are affecting the carbon cycle.

The burning of fossil fuels releases carbon dioxide into the environment [1]

Deforestation reduces the removal of carbon dioxide from the atmosphere [1].

The decrease in the amount of carbon stored in carbon sinks ~~increases~~ increases the amount of carbon dioxide in the atmosphere [1]

[3]

[Total: 8]

Section B

- 8 (a)

Table 8.1

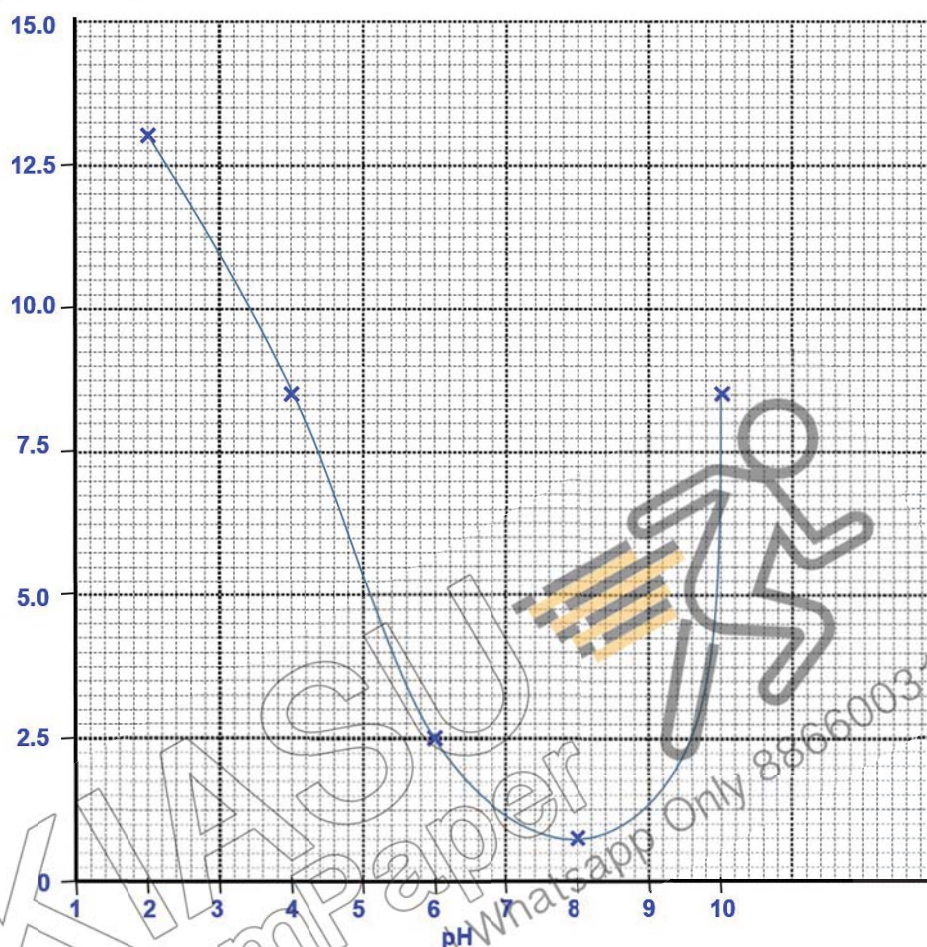
pH	time for the protein to be digested / min		average time for the protein to be digested / min
	student 1	student 2	
2	12.0	14.0	13.00
4	8.0	9.0	8.50
6	2.0	3.0	2.50
8	0.5	1.0	0.75
10	8.0	9.0	8.50

(b) Length of the photographic film/volume of enzyme/ concentration of enzyme/
type of enzyme Any two variables [1]

[1]

(c) Scale [1] Plot [1] Axes [1] Best fit line [1]

Time taken to digest
the protein/min



[4]

(d) As pH increases from pH 2 to pH 8, the time taken to digest proteins decreases from 13.00 min to 0.75 min. [1]

As pH increase from pH 8 to pH 10, the time taken to digest proteins increases from 0.75 min to 8.50 min. [1]

At extreme pH 2 and pH 10, the time taken is longer as the enzyme/trypsin starts to denature and loses the specific three-dimensional shape of its active site [1]

At pH 8, the time taken to digest the protein is the shortest, as it is the optimum pH for the enzyme/trypsin. [1]

[4]

[Total: 10]

- 9 (a) The gene for sugar attraction was mutated [1] and led to variation/ populations/ individuals that are not attracted to sugar. [1]

Those that are not attracted to sugar did not eat the poison and survived. [1]

Those that survive have a higher chance of reproduction to pass on the genes to the next generation. [1] [4]

(b)

In natural selection, nature selects for the varieties that are better adapted to changes in the environment but in artificial selection humans select the varieties of organisms that suit their needs. [1]

In natural selection, the varieties are produced by mutations but in artificial selection, the varieties are produced by selective breeding. [1]

Example, good meat-producing and milk-producing cattle (accept any suitable example of an economically important plant or animal).

Any difference [1]

One example [1]

[2]

- (c) Genes from any plant or animal can be inserted into non-related species or different species. [1]

Genes are carefully selected before transfer into an organism. This reduces the risk of genetic defects being passed on to the offspring. [1]

Genetic engineering uses individual cells which reproduce rapidly in the laboratory in a small container. [1]

More efficient. For example, transgenic salmon grow faster and require less food than ordinary salmon. [1]

[4]

[Total: 10]

10 Either

- (a) In the double circulation of blood, the blood passes through the heart twice in one complete circuit. [1]

Double circulation in humans consists of the pulmonary circulation and systemic circulation. [1]

In the pulmonary circulation the blood flows between the lungs and the heart [1]

Pulmonary arteries carry deoxygenated blood from the heart to the lungs to be oxygenated [1]

Pulmonary veins carry oxygenated blood from the lungs back to the heart [1]

In the systemic circulation the blood is pumped/flows from the heart to the rest of the body and then back to the heart [1]

Oxygenated blood leaves the aorta and is distributed by arteries to all parts of the body except the lungs. [1]

Veins carry blood from all parts of the body back to the right side of the heart. [1]

Any 6 of the marking points

- (b) Structural adaptation of capillary:

The walls of a capillaries is one cell thick. [1]

The endothelium is partially permeable which enables certain substances to diffuse quickly through the capillary walls. [1]

The narrow lumen of capillaries allows red blood cells to move through in a single file [1] lowering the rate of blood flow and increasing the efficiency of exchange of materials between the blood and the tissue cells. [1]

The dense network/repeated branching of capillaries increases the total cross-sectional area. [1] The increase in total cross-sectional area lowers the blood pressure in capillaries, giving more time for the exchange of substances. [1]

Transfer of a named material:

- Dissolved food substances/ oxygen [1] transported from the blood in the capillary across the capillary wall into the tissue fluid by diffusion. [1]
- Metabolic/excretory waste products from cells [1] diffuse into the tissue fluid and then through the capillary walls into the blood. [1]
-

Any 2 marks from structure of capillary and 2 marks from transfer of the named material.

[4]

[Total: 10]

10 Or

- (a) Explain why most living organisms depend on photosynthesis.

Plants are producers/ autotrophs unlike other living organisms [1]

Or

Plants convert light energy in the presence of carbon dioxide and chlorophyll into chemical energy in the form of glucose during photosynthesis [1]

Excess glucose produced is converted into sucrose and transported to the storage organs whereby the sucrose is converted to starch [1].

The glucose produced during photosynthesis can react with nitrates brought to the leaves to form amino acids which will be stored in the plants as proteins [1]

The glucose produced can be converted to fats for storage. [1]

Primary consumers or herbivores obtain their energy/ nutrients by consuming plants [1]

Secondary consumers feed on the primary consumers for food thus depending indirectly on plants for food [1]

Photosynthesis produces oxygen which organisms use when they undergo respiration to breakdown glucose in food to release energy [1]

Any 6 points

[6]

- (b) Explain why increasing the light intensity in which a plant is growing does not necessarily increase its rate of photosynthesis.

There are other limiting factors such as temperature [1] and concentration of carbon dioxide [1]

Temperature above and below the optimum temperature can affect the rate of photosynthesis as enzymes are involved [1]

Insufficient carbon dioxide can affect the rate of photosynthesis as it is a raw material for photosynthesis [1]

[4]

[Total: 10]

