Munsang College (Hong Kong Island)
Academic Year 2020-2021
Secondary 6 Examination
Biology
Suggested Answers

Paper 1 Section A

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

Paper 1 Section B

1(a) to concentrate the raw materials/ enzymes necessary for the specific reaction that takes place in the organelle OR to increase the concentration of the substances necessary for the reaction that takes place in the organelle
to form a boundary between the organelle and outer environment to allow specific reaction to take place without disturbance (accept reasonable alternatives)

(b) (i) M: granum/ thylakoid (1)
N: infoldings of the inner mitochondrial membrane/ cristae (1)

(ii) The extensive network of thylakoid membranes in organelle A provides a large surface area (1) for the attachment of chlorophyll molecules for efficient light absorption. (1)
The highly folded inner membrane of organelle B increases the surface area (1) for the attachment of enzymes (or carriers) involved in respiration. (1)

(c) (i) Structure P has ribosomes attached on it while structure Q does not. (1)

(ii) Structure Q involves in the synthesis of lipids. (1)
Sex hormone is lipids in nature. (1)
Therefore, a large amount of structure Q is required in sex hormone secreting cells. (1)

2(a) (i) Q, R, P, S (1 or 0)

(b) (i) 12 hours (1)
(ii) interphase (1)
(iii) Any ***two*** of the following: (1 mark each) (2)
- Proteins synthesis (1)
- Duplication of new organelles (1)
- Replication of DNA (1) (Or other reasonable answers)

(c) growth/ repair/ asexual reproduction/ vegetative propagation (1)

3(a) The tying of the pancreatic duct resulted in the backflow of pancreatic juice to the pancreatic tissues that secrete the juice. (1)
Digestive enzymes (e.g. proteases) in the pancreatic juice broke down the pancreatic tissues (1m)
It can be deduced that the islets of Langerhans did not degenerate as the dog did not develop diabetes. (1)

(b) The pancreatic extract contained insulin. (1)
Since Banting and Best were not diabetics / their pancreas could secrete insulin normally, the injection caused their blood insulin level to reach a higher than normal level. (1)
As insulin stimulates the conversion of more blood glucose into glycogen by the liver / uptake of more blood glucose by body cells, the extra insulin would reduce the blood glucose to a low level. (1)
As a result of insufficient blood glucose supply to the brain, Banting and Best felt dizzy. (1)

(c)

Nature of science	Elaboration	
Science is affected by the technology and the types of equipment available at the time.	The development of microscope allowed Langerhans to discover the islets of Langerhans.	1m
Scientists build on the work of other scientists.	Banting and Best knew that the removal of pancreas from a dog can make it diabetic.	1m

4(a) The vaccine contains the COVID-19 antigen (1)
which will stimulates some lymphocytes to form memory cells which recognise the antigen (1)
when the same antigen enters the human body again (1)
they stimulate the memory cells to produce large amount of specific antibodies/ killer T cells within a short period of time (1)
the pathogens are destroyed before they could cause any harm to our body

(b) weakened pathogens may still cause the diseases or it may regain the pathogenic property (1)
while the protein molecules in the vaccine would not develop into pathogens (1)

(c) (i) the codons are universal (1), thus human cells could recognize the instructions and make the relevant protein it encoded

(ii) ribosomes/ tRNA/ amino acids (any two, 1M x2)

(iii) it is not know whether the foreign mRNA will interfere with the normal functioning of the genes in the human genome/ the technique is new and not mature (1) (accept reasonable alternatives)

(d) mRNA is linear in structure while protein molecules can be coiled/ folded or in globular structure (have 1°/ 2°/ 3°/ 4° structure);
mRNA is made of ribonucleotide while protein is made of amino acids;

there are only 4 types of ribonucleotides (A, U, C, G) while there are 20 types of amino acids; the ribonucleotides are joined by phosphodiester bond while amino acids are joined by peptide bond (any 3, 1M x3)
(accept other reasonable alternatives)

5(a) *Mikania* blocks sunlight and thus prevent the plants underneath its coverage from undergoing photosynthesis (1), resulting in death of these plants

(b) the biodiversity of plant community was improved as the number of species increases in 14 months after applying the herbicide (1)
removal of *Mikania* results in better light penetration of the area (1)
allowing establishment of new comers which require high light intensity for photosynthesis and survival/ allowing establishment of sun plants which were unable to thrive due to shading by *Mikania (1)*

(c) (i) plant species X can effectively kill/ suppress the growth of *Mikania* (1) as the biomass of *Mikania* in the experimental groups was consistently less than that of the control groups (1)
it seems that plant species X is specific to *Mikania* and does not inhibit the growth of other plants (1) as the biomass of other plants in the experimental groups was obviously higher than that in the control groups (1)
plant X did not grow to an extent which was out of control and became a weed itself (1)
all these suggest that plant species X is an effective agent for the biological control of *Mikania*
(any 4 points)

(ii) Agree: 或者 specificity
there is no problem of leaching and hence no contamination of nearby water bodies / being non-toxic, there is no problem of bioaccumulation of toxins along the food chain/ there is no problem of development of resistance to plant species X among *Mikania (1)*

6(a) Lactose is a sugar found in milk. (1) → dissolve in water.
The patient lacks lactase, so lactose cannot be digested and it remains in the intestines. (1)
The water potential of the content inside the intestines becomes lower. (1)
As a result, less water is absorbed by osmosis (1)
and watery faeces will form.

(b) Person B has lactose intolerance. (1)
Person B lacks lactase and cannot digest lactose into glucose and galactose.(1)
No glucose was formed or absorbed into his/her blood, so his/her blood glucose level remained unchanged after the ingestion of lactose solution. (1)

7(a) To remove the starch present which will affect the result (1)

(b) Prepare two set-ups:
Add a fixed volume of enzyme X extract and glucose solution to test tube A. (1)
Add a fixed volume of distilled water and glucose solution to test tube B. (1)
Test the contents of the two tubes with iodine solution **at the beginning** and **after one hour.** (1)
Iodine solution turns blue-black in the presence of starch. (1)

8(a) correct drawing of the nucleotide (5C sugar + nitrogenous base + phosphate gp) + antiparallel (1)
correct complementary base paring, A-T/ C-G (0.5)
labels (0.5M x3)

(b) In a new DNA molecule, one strand is conserved from the original molecule, while the other strand is newly synthesized from free nucleotides. (1)

(c) No, although result in generation 1 showed that the newly synthesized DNA is a hybrid/ mix containing half of the N from the original ^{15}N and half of the N from ^{14}N, this can be a result of dispersive replication of DNA/ each individual strand of DNA contains bits of old and new new DNA. (1)

(d) In generation 2, the pattern of two distinct bands were seen
the one at the position same as that in 1st generation means that the old DNA strand made from ^{15}N is conserved and the new strand made with ^{14}N, as a result the weight of DNA is hybrid (1)
the one at the position of ^{14}N means the strand of DNA made with ^{14}N in the first generation is conserved and the new strand made is again made with ^{14}N, as a result, the whole DNA molecule is made up of ^{14}N (1)
if the DNA is replicated in a dispersive way, there will not be two bands (1)

9(a) (i) moss (1) (not accept algae as algae does not belong to kingdom plantae)
(ii) by rhizoids (1)

(b) (i) C (1)
(ii) D (1)
(iii) A and B (1)

10 Similarities: (Max. 2)
- Both are tubular structures / contain a lumen / are hollow (x continuous). (1)
- Both are responsible for the transport of liquid/ water within the organisms. (1)
- The liquids in both structures move in one direction only. (1)
- They both have thick wall (1)
- They can withstand high pressure (blood pressure VS hydrostatic pressure) (1)
- They are branched into smaller structure (artery branches into arterioles, xylem in midrid branches into smaller veins in leaf)

Differences: (any *four* pairs of the following) (Max. 6)

Xylem vessels	Arteries
Transport water and minerals) (1)	Transport blood (1)
Functioning not require energy	Require energy to function (1)
Dead cells	Living cells (1)
No pumping action is required to move the content, depends on transpiration pull to move the content (1) / transport is a passive process	Pressure generated by a pumping organ: heart (1) / active process of transport
Provide support to the organisms	Do not provide support to the organisms (1)
Their walls contain only lignin (1)	Their walls contain muscle and elastic tissue (1)
Cannot regulate the size of lumen	Can regulate the size of vessel by contraction and relaxation of the muscle cells (1)
Lumen surrounded by cells/ lying outside the cells (1)	Lumen is located within the cells whose cell content is totally lost and without end wall (1)

(Or other acceptable answers)
Communication (Max. 3)

Paper 2: Section A

1(a) (i) Skeletal muscles (1)

(ii) increasing blood supply allows oxygen and glucose to be supplied more rapidly to the skeletal muscle cells (1)
for carrying out aerobic respiration at a higher rate to release more energy for muscle contractions. (2)
Also, carbon dioxide can be removed more rapidly from the skeletal muscle cells. (1)

(iii) During exercise, medulla oblongata sends out more nerve impulses via the sympathetic nerve which releases more noradrenaline / stimulates the adrenal gland to release more adrenaline. (1)
This stimulates the SA node and cardiac muscle cells to increase their activity, (1)
thus increasing both the heart rate and stroke volume and hence the cardiac output. (1)

(iv) An increase in blood flow to the skin allows more heat to be lost through conduction, convection and radiation from the skin. (1)
This helps prevent overheating of the body during exercise. (1)

1(b) (i) Ovulation (1)
The level of LH <u>reaches its peak</u> on day 14 which stimulates ovulation to occur. (1)

(ii) The basal body temperature rises suddenly after the level of LH reaches its peak, indicating ovulation has occurred. (1)
Avoid having sexual intercourse around the time of ovulation can prevent fertilization. (1)

(iii) This method only allows one to detect ovulation when there is a rise in the body temperature (1), but it fails to predict the fertile period before ovulation when basal temperature remains steady (1)
The basal body temperature might also be affected by body condition, for example, in times of infection, one could not tell the elevated body temperature is due to ovulation or the diseases. (1)

(iv) A high level of progesterone inhibits the secretion of follicle stimulating hormone (FSH) and LH from the pituitary. (1)
The low level of FSH is not sufficient to stimulate follicular development. (1)
The low level of LH is not sufficient to stimulate ovulation. (1)
As a result, no fertilization takes place.

Paper 2 Section D

4(a) (i) The gene for HGH and the cut plasmids had the same sticky ends with unpair base sequences complementary to each other. (1)
The sticky ends joined together <u>randomly</u>. Thus, some cut plasmids joined with the gene for HGH and some simply ligated to reform the original plasmids. (1)

(ii) Some bacteria picked up the plasmids. They carried the ampicillin resistance gene. (1)
They were able to grow on X and form colonies. (1)

(iii) R (1)
The bacteria in R could not survive on Y. (1)
The tetracycline resistance gene in their plasmids is destroyed (1)
by the insertion of the gene for HGH. (1)

(iv) Pathogens may become antibiotic resistant if they pick up the plasmids. (1)
This may lead to outbreaks of incurable diseases. (1)

4(b) (i) to amplify the amount of DNA segments containing the alleles for analysis (1)

(ii) There were two bands in the DNA fingerprint of individual 2 and only one band in that of individual 4. (1)
Individual 2 possesses two normal alleles. The DNA segments containing the normal allele were cut by the restriction enzyme. Therefore, two bands were produced. (1)
Individual 4 possesses two mutated alleles. The DNA segments containing the mutated allele were not cut by the restriction enzyme as base substitution occurred in the recognition site. Therefore, only one band was produced. (1)

(iii) The DNA fingerprints of individuals 1 and 3 both contained 3 bands, two from the normal allele and one from the mutated allele. (1)
Therefore, individuals 1 and 3 are heterozygous. (1)
From the pedigree, we can see that both individuals 1 and 3 are normal. Since only the dominant allele can be expressed in the heterozygous condition, the mutated allele should be recessive. (1)

(deduction must be based on both DNA fingerprints and the pedigree, if information in the DNA fingerprints is not used, 1 mark will be deducted)

(iv) If the gene is X-linked, males will possess only one allele of the gene because they have only one X chromosome. (1)
Individual 3 is a male and he possesses two alleles of the gene as he has three DNA bands in which 2 of them share same pattern as individual 2 and 1 band is same as individual 4. (1)
The gene is not X-linked. (1)
(deduction must be based on both DNA fingerprints and the pedigree, if information in the DNA fingerprints is not used, 1 mark will be deducted)