Suggested Answers

Diocesan Girls' School

Mock Examination (2021 – 2022)

Secondary : 6 Subject : Biology Paper : 1A, 1B & 2

2022 HKDSE MOCK EXAM
BIOLOGY PAPER 1
SECTION A

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

SECTION B

Question 1 (3 marks)

(a) D
(b) B
(c) C

Question 2 (6 marks)

(a) (i) Circle the region of elongation below the tip of the coleoptile (1)
(ii) The sections should be obtained from the region where auxins stimulate cells (1) to elongate/ increase in length (1).
(b) $\frac{(13.0 - 10.0) - (12.0 - 10.0)}{(12.0 - 10.0)}$ X 100% = 50% (2 marks)
(c) Repeat the experiment with more auxin concentrations between 10^{-1} and 10 ppm (1).

Question 3 (8 marks)

(a) Water and blue dye solution were absorbed into the roots in the left and right compartments in set-up I respectively (1).
Each xylem vessel in a leaf vein is continuous from the root (1).
Different xylem vessels in the roots transports the water or blue dye solution to different leaf veins (1).
In set-up II, without absorption of water or any solution into the roots in the right compartment/exposed to air (1), blue dye solution (absorbed into the roots in the left compartment) was laterally transported between xylem vessels (1) to reach all leaf veins.
(b) Correct outline of xylem vessels in the two vascular bundles (1)
(c) It provides support (1) with the rigidity of the thickened/lignified cell wall (1) of its cells.

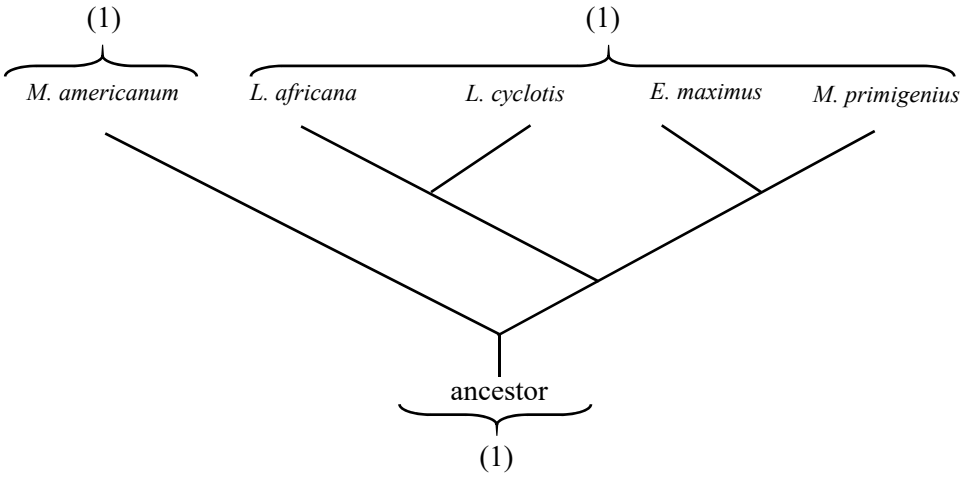
Question 4 (13 marks)

(a) 0.5 each X 6

Domain	Eukarya (0.5)
Kingdom	Animalia
Phylum (0.5)	Chordata
Class	Mammalia (0.5)
Order (0.5)	Proboscidae
Family	Elephantidae
Genus	*Elephas* (0.5)
Species	*(E.) maximus* (0.5)

(b) (i) Genetic variation existed in the elephant population and individuals have difference in length of trunk (1).
Individuals with longer trunk can reach for and obtain more food than those with shorter trunk (1), so they have a higher chance of survival and reproduction (1).
The proportion of elephants with longer trunk increases in subsequent generations (1).
(ii) Organisms change their characters in response to environmental changes/ Acquired characters can be passed on to offspring or subsequent generations (1).

(c) (i) Correct phylogenetic relationship and format of the evolutionary tree
(The genus name and species epithet in handwritten scientific names should be underlined separately.)



(ii) Species with closer phylogenetic relationship have less difference between the base sequences in their common genes (1) because they evolve from their common ancestral species with fewer mutations (1).

Question 5 (8 marks)

(a) Granum/ grana (1)
(b) Most of the structure X from plant A is thicker than that from plant B (1). The density of structure X in plant A is higher than that in plant B (1) or the width of structure X in plant A is longer than that in plant B.
(c) Plant A is grown under low light intensity (1). It is because photochemical reactions take place at structure X (1). The thicker/ higher density of structure X holds more chlorophyll to increase the chance of absorbing light to drive the photochemical reactions (1) which can supply more ATP and NADPH for Calvin Cycle/ light-independent reactions (1) to ensure high photosynthetic rate even at low light intensity (1).

Question 6 (10 marks)

(a) Influenza viruses spread through droplets when infected people cough, sneeze or talk (1)/ air borne/ spread by direct contact with the secretions of infected persons.
(b) Vaccine contains the antigens of the influenza virus which stimulate certain lymphocytes to differentiate into memory cells for that particular antigens (1). On the second exposure to the same antigen (1). These memory cells differentiated into specific B-lymphocytes/ specific T-lymphocytes (1) which are capable of producing a large amount of antibodies in a short time/ killer T cells within a short time (1).
(c) Influenza viruses undergo mutation frequently which lead to emergence of new strains from time to time and at irregular intervals (1). Memory cells developed previously cannot recognize the antigens of the new strain (1). Thus the existing vaccine becomes ineffective (1).
(d) (i) Influenza is caused by virus which cannot be destroyed by antibiotics (1).
(ii) It may lead to an increase in resistant bacterial strains (1).

Question 7 (11 marks)

(a) (i) Low dietary intake of vitamin D (1) or low exposure to or absorption of UV light (1).
(ii) The low level of vitamin D in the body hinders the regulation of the metabolism/ absorption of calcium (1) which is important in bone formation (1).
(iii) X-rays (1). It can reveal bending of bones (1)/ calcium loss in bones or blood tests which show the low levels of calcium in blood.

(b) (i) Individual 1 being affected must be homozygous recessive for this disease and pass the recessive allele on X chromosome to her daughter individual 4 (1). Being normal, individual 4 must have a dominant allele for the normal character on the other X chromosome (1). Hence, the genotype of individual 4 is heterozygous (1).
(ii) Individual 3 is a male without rickets, his only X chromosome must have the dominant allele for normal character and pass to his daughter individual 10 (1). Individual 10 can receive a X chromosome with or without the recessive allele for rickets from her heterozygous mother individual 4 (1), therefore, individual 10 can be heterozygous or homozygous dominant (1).

Question 8 (14 marks)

(a) The higher the BMI value, the higher the severity of obesity (1). The high BMI shows that the individual's body weight greatly exceeds the normal or desirable range for a person's height (1) and therefore more seriously overweight and obese.

(b) (i) The BMI increased with saturated fat diet in individuals with all types of FTO gene genotypes (1). This indicates that saturated fat intake will increase the severity of obesity independent of the FTO gene (1). The BMI increased markedly with saturated fat diet in individual with two FTO^T alleles (1). However, the BMI of this individual was comparable to those with other types of genotype when unsaturated fat diet is followed (1). This indicates that FTO gene will only affect obesity when there is a high saturated fat intake/ the effect of saturated fat diet on obesity will be magnified by the presence of two FTO^T alleles (1).
(ii) If an individual is identified to possess two FTO^T alleles of FTO gene in genetic testing, he can alter his diet with less saturated fat to reduce the risk of obesity (1). He can also increase his physical activity to increase the mobility of the body fat/ energy expenditure, thus reduce the amount of fat stored in the body (1).
(iii) To conduct the investigation with a greater sample size (1)/ group of individuals of another gender/ different age groups to check if similar trends/ patterns can be observed (1).

(c) The surgery reduces the size of stomach (1). Therefore, the obese patient will feel full with less food taken in (1). If the energy input is less than the energy used, the fat reserve will be mobilized to produce energy (1).

Question 9 (11 marks)

Transfer of gamete (max. 5 marks)

- Human transfer male gametes into the female body directly (1) by inserting penis into the female vagina (1). Plant transfers male gametes indirectly into the female reproductive part by releasing pollen grains to the environment (1), the male and female reproductive parts in plants are separated during the transfer of gametes (1). The pollen grains are carried by different external agents such as wind or insects to reach the female reproductive part of plant (1).
- The human male gametes show active movement by swimming up the vagina/uterus to reach the ovum in oviduct (1) while that of plant move passively by the development of pollen tube along the style to carry them towards the ovule (1).
- The tissue of female reproductive part, style, is digested during the transfer of male gametes in plants while no digestion of human tissue is involved in gamete transfer in humans (1).
- The contraction of the muscular wall of uterus facilitates the transfer of male gametes in the female human body while the female reproductive organ in plants is not actively involved (1).

Adaptation to achieve sexual reproduction (max: 3 marks)

- A large number of male gametes are produced to increase the chance of successful fertilisation (1) to overcome the loss/ death of male gametes during transfer (1).
- Male gametes are relatively smaller than female gametes to enhance the movement/ easier to be transferred (1) or pollen tube and water medium e.g. semen and vaginal secretion are produced to aid the transfer of male gametes to over the problem of desiccation of the gametes (1)/ distance separating male and female gametes (1).
- Female gametes are larger in size and less in number so that more food reserve is available for the embryo development (1).

Effective communication (0-3)

Mark award for communication:

Mark	Clarity of expression and relevance to the question	Logical and systematic presentation
3	• Answers are easy to understand. They are fluent showing good command of language. • There is no or little irrelevant material.	• Answers are well structured showing coherence of thought and organisation of ideas.
2	• Language used is understandable but there is some inappropriate use of words. • A little irrelevant material is included, but does not mar the overall answer.	• Answers are organised, but there is some repetition of ideas.
1	• Markers have to spend some time and effort on understanding the answer(s). • Irrelevant material obscures some minor ideas.	• Answers are a bit disorganised, but paragraphing is evident. Repetition is noticeable.
0	• Language used is incomprehensible. • Irrelevant material buries the major ideas required by the question.	• Ideas are not coherent and systematic. Candidates show no attempt to organise thoughts.

BIOLOGY PAPER 2

Question 1 (a)

(i) It is because the rate of anaerobic respiration increases when the running speed increases (1) to supply more additional amount of energy to the skeletal muscle cells (1) to meet the increased energy demand to maintain the increased running speed (1). More and more lactic acid is produced from the increased rate of anaerobic respiration (1) and its accumulation results in the increase in the blood lactic acid concentration.

(ii) Curve Y shows that the blood lactic acid concentration begins to increase rapidly at a running speed higher than that of curve X (1). Therefore, training can increase lactate threshold (1) so that the runner can maintain a higher speed of running for a longer time in the race before he becomes fatigued (1).

(iii) More sympathetic nerve impulses are sent to the SA node (1) for faster and stronger contraction of heart (1) that increases the heart rate and stroke volume (1) for rapid supply of more blood to the muscles for continuous contraction (1) or more sympathetic nerve impulses are sent to the intercostal and diaphragm muscles for faster and stronger contractions that increases the breathing rate and depth/ ventilation rate for rapid gas exchange or loading of oxygen to the blood.

Question 1 (b)

(i) During work, the contraction of muscles generates a large amount of heat in the body (1) The thermoreceptors in hypothalamus detect the increase in body temperature (1) or the body gain heat from the environment and the thermoreceptors in skin detect the increase in skin temperature. Heat loss centre in the hypothalamus is stimulated to send out nerve impulse (1) to cause vasodilation of the arterioles near skin surface to increase the blood flow to promote heat loss (1) / to increase sweating to promote heat loss.

(ii) Relative humidity (1). A similar high air temperature and inadequate water drunk on day 1 did not increase his core body temperature (1).

(iii) As sweat could not evaporate efficiently at the higher relative humidity on day 3 (1), less heat was lost from the body through sweating (1). As a result, there is a net gain of heat which lead to the increased core body temperature.

(iv) Overheating/ heatstroke may be resulted (1).

Question 2 (a)

(i) The corneal stem cells can divide and differentiate into normal corneal cells in the woman's eye (1) to replace the damaged/clouded corneal cells (1). The clouded cornea turned clear to allow light to pass through it to enter the eye/ reach the retina (1) to restore her vision.

(ii) No need to wait for a suitable donor (1)
No risk of rejection **if** the patient's own cells are used to create iPS cells (1)

(iii) iPS cells are derived from adult cells which are of unlimited supply (1).
Using iPS cells derived from adult cells does not have any ethical issue while obtaining embryonic stem cells involves destruction of embryos, which can be unethical (1).

Question 2 (b)

(i) (1) Restriction enzyme Z (1) is used because **cutting the chromosomes** from nitrogen-fixing bacteria with Z can produce the **DNA fragment containing** the *nif* genes and gene for antibiotic Q resistance **in the recombinant plasmid** (1).
(2) The plasmid obtained from *Agrobacterium* must also have the cut site of the restriction enzyme. (1)

(ii) Cut the chromosomes from nitrogen-fixing bacteria and the plasmids obtained from *Agrobacterium* with the same restriction enzyme/ restriction enzyme Z (1).
Join the DNA fragments (containing the *nif* genes and gene for antibiotic Q resistance) from the chromosomes of nitrogen-fixing bacteria and the cleaved plasmids from *Agrobacterium* using DNA ligase to produce recombinant plasmids (1).
Culture the recombinant plasmids with *Agrobacterium* to allow the *Agrobacterium* to pick up the recombinant plasmids/ Introduce the recombinant plasmids into *Agrobacterium* (using a gene gun or other suitable methods) (1) to produce the transformed *Agrobacterium*.

(iii) (1) *Agrobacterium* can infect cells of the crop plants (1) to transfer the genes in the plasmid to the **genome** of the crop plant **cells** (1).
(2) Growing *Agrobacterium* on agar plates containing antibiotic Q allows identification of transformed *Agrobacterium* that have picked up recombinant plasmids containing the *nif* genes (and the gene for antibiotic Q resistance) (1).
Growing *Agrobacterium* on agar plates containing antibiotic P allows identification of transformed *Agrobacterium* that have picked up recombinant plasmids containing the gene coding for a protein that inhibits an essential enzyme in crop plant (and the gene for antibiotic P resistance) (1).
Only the *Agrobacterium* that can grow on agar plates containing antibiotic Q but not on agar plates containing antibiotic P should be selected to transfer the *nif* genes into/ infect the crop plant cells (1).

(iv) Increase crop yield (1)
Save money/labour/time from adding nitrogen fertilizers (1)