Sacred Heart Canossian College
Mock Examination (2020-2021)
S6 Biology – Marking Scheme

Paper 1

Section A: Multiple-choice Questions (36 marks)

1	A
2	B
3	C
4	A
5	D
6	B
7	B
8	C
9	D
10	B

11	A
12	C
13	A
14	A
15	C
16	A
17	D
18	A
19	C
20	D

21	B
22	C
23	D
24	C
25	D
26	B
27	C
28	D
29	A
30	A

31	D
32	D
33	C
34	B
35	C
36	D

Section B: Conventional Questions (84 marks)

1. B (1)
   A (1)
   C (1)

Total: 3 marks

2. Activation of AMPK results in the decrease in the amount of malonyl-CoA produced (1) since the conversion of acetyl-CoA to malonyl-CoA is inhibited.
   Therefore, more fatty acids will be transported into the mitochondrion (via CPT1) (1)
   It promotes the oxidation/breakdown of fatty acids (in the mitochondrion) by respiration to release energy during exercise (1)

Total: 3 marks

3. (a) * capillary (1)
   (b) Q has a biconcave (disc) shape (1) which provides a large surface area to volume ratio for the diffusion of oxygen across the cell membrane. (1) or
   Q has a disc shape (1) which provides short distance for the diffusion of oxygen across the cell membrane. (1)
   (c) pancreas → vena cava (1/2)→ heart (1/2)→ pulmonary artery(1/2)→ lung (1/2)

Total: 5 marks

4. (a) Classification X: *L. mackloti* and *L. olivaceus* have a more recent common ancestor /are more closely related with each other (than with *L. papuana*) (1)
   Classification Y: *L. mackloti* and *L. papuana* have a more recent common ancestor /are more closely related with each other (than with *L. olivaceus*) (1)
   (b) Comparison of the DNA sequence /amino acid sequence of the same protein (1)
   (c) (i) Genus (1)
   (ii) Scientists having the same set of data may not arrive at the same conclusions (1)

4. (d)

Domain
Kingdom (Given)
Phylum
Class
Order

(1/2 x4)

Total: 7 marks

5. (a) To prevent the occurrence of <u>osmosis</u> (1) which might cause <u>chloroplasts</u> (no mark for "cell") to <u>burst/shrink</u> (1)
   (b) To show that DCPIP was not decolourised by light/was unaffected by light (1) [ignore: comparison with other tubes]
   To show that chloroplast was the only factor required (for the decolourisation of DCPIP) (1)
   (c) The colour of DCPIP solution <u>changed from blue to colourless</u>/DCPIP solution was decolourised. (1)
   Reason: DCPIP was <u>reduced by electrons/hydrogen</u> (do not accept H^+) (1)
   emitted from <u>chlorophyll molecules / water</u> during light-dependent reactions (1)

Total: 7 marks

6. (a) The mixture in X <u>turned colourless faster</u> than Y meaning that its <u>pH dropped</u> <u>more quickly</u> (1)
   This was due to the presence of bile salts caused the <u>emulsification of lipids</u> into small droplets (1)
   This <u>increased the surface area</u> of lipids for lipase to act on. (1)
   <u>Fatty acids/Digested products</u> were <u>formed at a faster rate</u>. (1)
   (b) Sodium hydrogencarbonate provides <u>an alkaline medium/neutralise the acidic chyme from the stomach</u> (1)
   such that the <u>enzymes in the small intestine</u> can work <u>under their optimal pH</u> (which is alkaline) (1)
   At favourable pH, the shape of the active site fits the susbstrate/ binds more readily with the substrate for the catalytic action.(1) or
   Otherwise, enzymes will be <u>denatured</u> and <u>lose their (catalytic) function</u>/ the <u>active site</u> of an enzyme will be <u>altered</u> and the substrate can no longer fit (1)
   (c) Bile contains <u>brown/coloured/bile pigments</u> which are produced from the breakdown of haemoglobin. (1)
   These pigments <u>cannot enter the intestine</u> due to <u>blockage of the bile duct</u> by the gallstones (1) and therefore the faeces become very brown pale in colour.

Total: 9 marks

7. (a) The female has 3 chromosomes number 13/an extra chromosome 13(1)
   (b) During <u>meiosis</u>, <u>non-disjunction</u> occurs (1)
   or
   During <u>meiosis I</u>, a pair of <u>homologous chromosomes fails to separate</u> (1)
   or
   During <u>meiosis II</u>, a pair of <u>sister chromatids fails to separate</u> (1)

Resulting in an extra chromosome (1) found in a gamete/sperm/egg/ovum that formed the zygote after fertilisation. (1)
All somatic cells in this female are derived from the zygote (with an extra chromosome 13) by mitotic cell division/mitosis (1)

(c) Some oxygenated blood flows from the aorta into the pulmonary artery/ There is mixing of deoxygenated blood with oxygenated blood in the pulmonary artery (1)
which results in less oxygenated blood flowing out through the aorta (1)
Therefore, less oxygen is delivered to cells/tissues/organs/named organs etc. (1)
Tissue/organ does not develop properly or tissue dies/organ stops functioning (1)
which leads to early death

Total: 9 marks

8. (a) The artificial pancreas has more than one component but the pancreas functions as one organ for the regulation of blood glucose /
The insulin released from the pump needs to diffuse across the skin barrier to the blood but the pancreas releases insulin directly into the blood /
The control device needs a program to calculate the correct insulin dose required but the pancreas does not /
The components of the artificial pancreas can generate wireless signals but the normal pancreas does not/generates chemical signals (hormones)/
The artificial pancreas does not regulate the secretion of glucagon but the normal pancreas does
Any 4 (4 marks)

(b) The amount of insulin injected will be more accurately calculated and controlled by the control device and the pump/ Human error can be avoided/The artificial pancreas is fully automatic so it is more suitable for elderly people who may not know how to do injection or any reasonable answer (1)

(c) The antigens on the donated organ stimulate T lymphocytes (1)
The T lymphocytes proliferate and differentiate into killer T cells (1)
which damage the cells of the donated organ (1)
[ignore memory cells/B cells/antibodies]

Total: 8 marks

9. (a) When phloem is removed with the ring of bark, the translocation away from the branch will be stopped (1)
More food/ organic nutrients/sugar (1) produced by the leaves on the branch (1)
will be transported to/ stored/ accumulated in fruit X (1)
to support its growth to a larger size (1)

(b) Fruit X will reach the size of fruit Z first (1)
because it is on the branch with more leaves for the production of food by photosynthesis (1) [ignore: sharing of nutrients by Y and Z]

(c) Roots depend on the leaves for food supply/cannot carry out photosynthesis (1)
Removal of the bark from the main trunk of the tree will stop the translocation of food / organic nutrients/sugar from the leaves to the roots (1)
The tree will eventually die when the root cells starve/ are deprived of food (1)
[no mark if Ss only mention the tree will die]

(d) The fruit is fleshy (1) which can attract animals to eat it. (1)
The seed is likely to be discarded/egested with faeces (1) at a certain distance from the mother plant.

Total: 13 marks

10. (a) B (1)
    (b) To increase the surface area for packing more neurones (1)
    (c) The cranium (do not accept the skull) provides a hard covering to mechanically protect the brain. (1) (do not accept if Ss only write "protect the brain")
    The cerebrospinal fluid acts as shock absorber. (1)
    (d) (i) photoreceptors/light sensitive cells/rod and cone cells → optic nerve→ optic centre of the cerebrum/sensory area of the cerebrum/ cerebral cortex (1/2x2)
    (ii) When he touched the objects with his left hand, the skin receptors/mechanoreceptors were stimulated and nerve impulses were transmitted to the sensory area (for touch) in the right cerebral hemisphere (1)
    Nerve impulses from sensory area (for touch) sent nerve impulse to the association area (for touch) in the right cerebral hemisphere (1) for the person's recognition of the object
    However, the nerve impulses from the sensory area (for touch) in the right cerebral hemisphere could not reach the association area for speech on the left side of the cerebral hemisphere due to the surgery (1)
    No nerve impulse could reach the motor area for speech (1) and thus the person could not verbally name the object

Total: 9 marks

11. *8 marks for content and 3 marks for logical presentation and clarity of expression.*

Procedures of gel electrophoresis:

- The DNA sample is cut using restriction enzymes into small fragments (1)
- It is then loaded into the well of an agarose gel (1)
- Voltage is applied across the gel tank (1)
- DNA fragments will be separated according to size (1)
- Specific stain is added to the DNA so to make the DNA bands visible (1) in a DNA fingerprint

Application in parentage test:

DNA fingerprints of the child, the mother and the man (1) are produced and compared. (1)

If the DNA fingerprint of the child carries only bands that match with those from the DNA fingerprint of the mother or this man, then he is the biological father (of the child). (1)
or
If the DNA fingerprint of the child carries any band(s) that do/does not match with the man's or the mother's bands, then he is not the biological father. (1)

Total: 8+3 marks