Queen's College

Mock Examination 2020 – 2021

Biology Paper 1

Suggested Answers

Paper 1

SECTION A

Question no.	Key	Question no.	Key
1.	A	21.	C
2.	B	22.	D
3.	C	23.	B/C
4.	B	24.	B
5.	D	25.	A
6.	B	26.	C
7.	B	27.	D
8.	C	28.	B
9.	A	29.	D
10.	C	30.	D
11.	C	31.	D
12.	A	32.	B
13.	C	33.	A
14.	D	34.	D
15.	C	35.	C
16.	D	36.	A
17.	A		
18.	B		
19.	B		
20.	A		

General Marking Instructions

1. In order to maintain a uniform standard in marking, markers should adhere to the marking scheme agreed at the markers' meeting.

2. The marking scheme may not exhaust all possible answers for each question. Markers should exercise their professional discretion and judgment in accepting alternative answers that are not in the marking scheme but are correct and well-answered.

3. The following symbols are used:

/	A single slash indicates an acceptable alternative within an answer.
*	Correct spelling required

4. In questions asking for a specified number of reasons or examples etc. and a candidate gives more than the required number, the extra answers should not be marked. For instance, in a question asking candidates to provide two examples, and if a candidate gives three answers, only the first two should be marked.

5. In cases where a candidate answers more questions than required, the answers to all questions should be marked. However, the excess answers(s) receiving the lowest score(s) will be disregarded in the calculation of the final mark.

6. Award zero marks for answers which are contradictory.

7. Where applicable, markers should put a tick (√) against the answer which counts for a point of merit and the aggregated mark awarded for each question should be entered into the mark box of the OSM system in the right-hand side. If no marks are to be given, a cross (X) should be inserted there instead.

Paper 1 SECTION B

Marks

1. (a)

Name of pathogen	Type of pathogen	Disease caused	How pathogen enters body	
Mycobacterium	Bacteria	Tuberculosis	**By (inhaled) air / droplets / in breast milk**	(1)
HIV/Human immunodeficiency virus	**Virus**	AIDS	By having unprotected sex with an infected partner	(1)
Salmonella	**Bacteria**	Food poisoning	**With contaminated food / drink**	(1)
Plasmodium	**Protists**	Malaria	**by mosquitoes (bite)**	(1)

(4)

(b) Any ***one*** of the following sets:

- the warm temperature allows Salmonella to replicate more quickly than at lower temperature, (1)
- to reach infective dose / many bacteria needed to cause food poisoning (1)

OR

- the warm temperature increases enzyme activity of *Salmonella*, (1)
- so that *Salmonella* can grow faster in the warm room than in the refrigerator to cause food poisoning (1) (2)

6 marks

2. (a) (i) the vein* (1) (1)

(ii) · the vein is located nearer to the skin surface for easier donation needle insertion (1) (1)

(b) · squeezing the rubber ball can increase the skeletal muscle contraction near the vein, (1)

· which can increase the blood flow through the vein for blood withdrawal (1) (2)

4 marks

3. (a) · the Blue-footed Booby has bright (blue) foot colour (1)

· which helps it attracts female blue-footed booby / its mate for reproduction (1) (2)

(b) · the bird feed may be deficient in some essential nutrients (carotenoids) present in oily fish (1)

· so the Blue-footed Booby cannot synthesise the blue pigment in its feet (1), leading to the loss of blue pigmentation (2)

4 marks

Marks

4. (a) · the mass of DNA is halved at the end of the cell division (1) (1)

(b) (i) · DNA replicates during the interphase (to prepare for meiotic cell division) (1) (1)

(ii) · the cytoplasm divides into two halves, each with a half of the 5.8 picograms of DNA at the end of telophase II (1) (1)

(c) (i) 11.6 picograms (1) (1)

(ii) PqrS (1)
pQRs (1) (2)

(d) · there are three sets of chromosomes in each gamete-producing cell in Rainbow Trout (1)
· so that the pairing of homologous chromosomes is impossible in prophase I (1)
· therefore the Rainbow Trout which are triploid cannot produce normal haploid gametes for fertilisation (1) (3)

9 marks

5. (a) · the tying of the pancreatic duct resulted in the backflow of pancreatic juice to the pancreatic tissues <u>that secrete the juice / digestive enzymes</u> (1)
· digestive enzymes (e.g. proteases) in the pancreatic juice broke down the pancreatic tissues (1)
· it can be deduced that the islets of Langerhans (the endocrine tissue of the pancreas) did not degenerate as the dog did not develop diabetes (1) (3)

(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)
· insulin stimulates the uptake of <u>more</u> blood glucose by body cells / <u>more</u> blood glucose into glycogen by the liver, (1) the extra insulin would reduce the blood glucose to a low level
· as a result of insufficient blood glucose supply to the brain, Banting and Best felt dizzy (1) (4)

(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.**	(1)
Scientists build on the work of other scientists.	Banting and Best knew that the removal of pancreas from a dog can make it diabetic.	(1)

(2)

9 marks

6. (a) · primary succession* (1)
· there was no biomass of plants indicating the ecological succession stated with a barren rock surface (1) (2)

Marks

(b) (i) · collect all the plants in a designated sample area of 1 m^2 every year using a quadrat (1)
· dry all the harvested plants in an oven at around 100 ^oC until a constant mass is obtained upon repeated weighing (1) (2)

(ii) · the rate of increase in plant biomass during the first 20 years is higher than that after 100 years (1)
· it is because during the first 20 years, the area was occupied by herbaceous plants and shrubs, while after 100 years, trees became the dominant species (1)
· herbaceous plants and shrubs are fast-growing, while trees grow at a slower rate (1) (3)

7 marks

7. (a) · mitochondrial matrix* (1) (1)

(b) (i) · the breakdown of glucose / glycolysis took place in the cytoplasm (1)
· glucose did not take part in the Krebs cycle and oxidative phosphorylation for ATP production in mitochondria / only pyruvate enters the mitochondria for the Krebs cycle and oxidative phosphorylation for ATP production (1) (2)

(ii) · oxygen acted as the final electron acceptor in oxidative phosphorylation for ATP production (1)
· without oxygen, oxidative phosphorylation could not proceed and NAD and FAD could not be regenerated (1)
· without NAD and FAD, the Krebs cycle could not proceed and ATP could not be produced (1) (3)

(c) · when a person exercises for a long period of time, ATP required for muscle contraction is mainly obtained through <u>aerobic</u> respiration (1)
· if the mitochondria cannot function normally, the Krebs cycle and oxidative phosphorylation cannot be carried out to produce ATP (1) for prolonged exercise (2)

8 marks

8. (a) (i) · humans have two sets of chromosomes in their body cells, and there is one allele on each chromosome of a homologous pair (1) (1)

(ii) · gel electrophoresis* (1) (1)

(b) · the 13 base-pair deletion will have the most serious consequences (1)
· it will alter the reading frame as the genetic code is triplet, which will alter all the amino acids in the polypeptide after the point of mutation in translation (1)

Any ***one*** of the following:
· the 21 base-pair deletion will cause 7 amino acids to be lost (1)
· the single base-pair substitution will change one amino acid / cause no change in the polypeptide (1) (3)

<u>Marks</u>

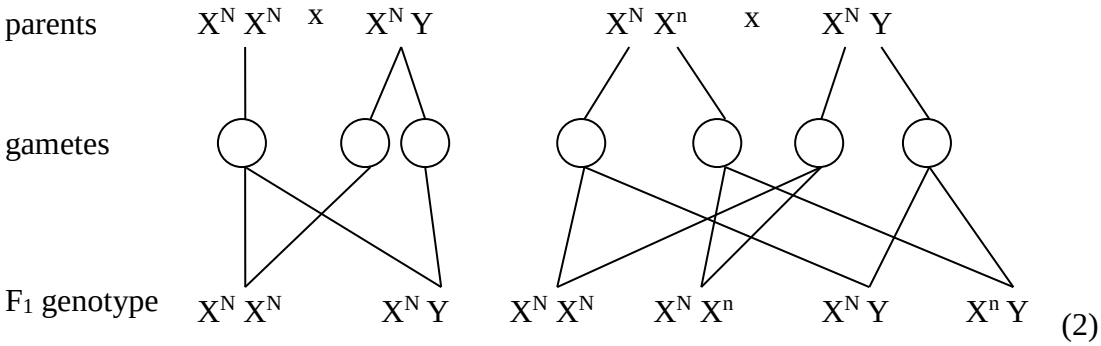
8. (c)
- the allele for exploratory and impulsive behaviours increasing the chance of <u>survival and reproduction / breeding</u> of the individuals carrying this allele (1)
- this allele helped the individuals carrying it to find food / find new resources / make new tools / get mates (1)
- these individuals survived and reproduced to pass the allele to the next generation (1)
- hence, the frequency / proportion of the allele in the population increased over many generations (1) (4)

9 marks

9. (a)
- individual 1 is a female with WAS, hence the WAS allele is not located on the Y chromosome / if the allele for WAS is Y-linked, all the male with WAS should have passed his WAS allele to the all males in the next generation (1) hence, WAS allele is located on the X chromosome
- being the sons of individual 4, individuals 8 and 9 should have received an WAS allele on the X chromosome from her (1)
- individual 4 has at least one allele for WAS on one of her X chromosomes (1)
- being normal, individual has at least one normal on her X chromosome, in heterozygous state, the allele for WAS is masked by the normal allele in individual 4 (1), thus, the allele for WAS is X-linked recessive (4)

(b) Let X^N be the dominant allele for normal character, and
X^n be the recessive allele for WAS (1)

Individual 11 can carry $X^N X^N$ or $X^N X^n$



(2)

Probability =1/2 × 1/4 = 1/8 (1) (4)

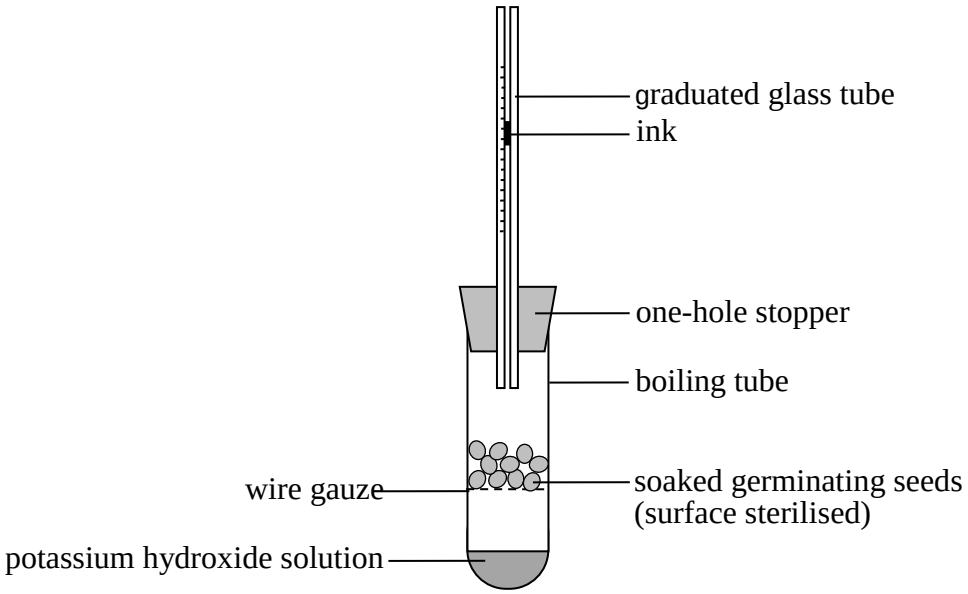
(c)
- it is at a high risk that his cousin has also got the disease allele as they are genetically very close, therefore more likely for their offspring to be homozygous recessive and acquire the disease (1) (1)

9 marks

<u>Marks</u>

10. (a) · in the water, there was not sufficient oxygen, thus the seeds carried out more anaerobic respiration (1)
· the respiratory quotient was higher when more anaerobic respiration was carried out because no oxygen was consumed in anaerobic respiration (1)
· more aerobic respiration was carried out after they were transferred to the soil, where oxygen was sufficient (1) (3)

(b) (i)



workable set-up (W) (1)
any ***four*** labels (L) (graduated glass tube, ink, one-hole stopper, boiling tube, soaked germinating seeds (surface sterilized), wire gauze, potassium hydroxide solution) (1)
germinating seeds not soaked in potassium hydroxide solution (P) (1) (3)

(ii) · record the initial position of the drop of ink in the graduated glass tube, record the final position of the drop of ink after three hours, and calculate the distance moved by the drop of ink (d) (1)
· measure the inner radius of the graduated glass tube (r), and calculate the volume of oxygen taken in (V) by $V = \pi r^2 d$ (1) (2)

8 marks

Marks

11. **A. How gases are exchanged in the placenta** (max. 2)

- oxygen moves from the maternal blood to the embryo's blood, while carbon dioxide moves from the embryo's blood to the maternal blood at the placenta (1)
- the exchange of gases in the placenta is a passive process without the use of external energy along the concentration gradient of gases by diffusion (1)

B. Adaptations of the lungs and the placenta for gas exchange (max. 6)

- numerous air sacs in the lungs and the large number of finger-like embryonic villi in the placenta (1), which provide a large surface area for diffusion of gases (1)
- the epithelia making up the walls of the air sacs are only one-celled thick, and the walls of the embryo's capillaries and the embryonic villi are also very thin (1), which provide a short distance for the diffusion of gases (1)
- there are numerous capillaries surrounding the air sacs, whereas a lot of blood vessels made up of the placenta (1), the blood in these blood vessels transports the gases away readily, hence a steep concentration gradient can be maintained for efficient diffusion of gases (1)
- there are numerous capillaries present on the air sacs and in the embryonic villi of placenta (1), which can allow time for efficient gas exchange by slowing down the blood flow in capillaries / without breaking the thin delicate air sacs and embryonic tissues (1)

C. Effective communication (0-3) max. 3

11 marks

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.