2020 GCE O Level Biology Suggested Answer

Paper 1

Questions to note: 2, 12, 21, 25

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

Question to note: 9E(b)

Paper 2 (Section A)

1 (a) **State**

A: ovary [1]

B: oviduct [1]

C: cervix [1]

(b) **Place an X on Fig.**

Mark 'X' on oviduct [1]

(c) **Describe**

Peristaltic movement in the wall of the oviduct and the cilia lining the wall of the oviduct sweep the zygote/embryo to the uterus. [1]

The zygote divides by mitosis to form the embryo. [1]

The embryo implants in the uterus lining about 7 days after fertilisation.[1]

(d) (i) **Suggest**

The cilia help to sweep the embryo along the oviduct towards the uterus where implantation can occur [1].

(ii) **State**

Respiratory system [1]

2 (a) **Suggest**

D: DNA replication is taking place during interphase as the mass of DNA in the cell doubles from 8 arbitrary units to 16 arbitrary units [1].

E: Cytokinesis is taking place as the mass of DNA in the cell is halved from 16 arbitrary units to 8 arbitrary units .[1].

(b) (i) **State**

Anaphase [1]

(ii) **State**

Before: Metaphase [1]
After: Telophase [1]

(iii) **Determine and explain**

Haploid number = 3 [1]
Explanation: The cell in the diagram shows 6 sister chromatids which have been pulled apart to opposite poles of the cell forming 6 daughter chromosomes on each end of the pole of the cell[1]. Hence, diploid number of the plant species is 6 and the haploid number is 3, which is half of the diploid number [1].

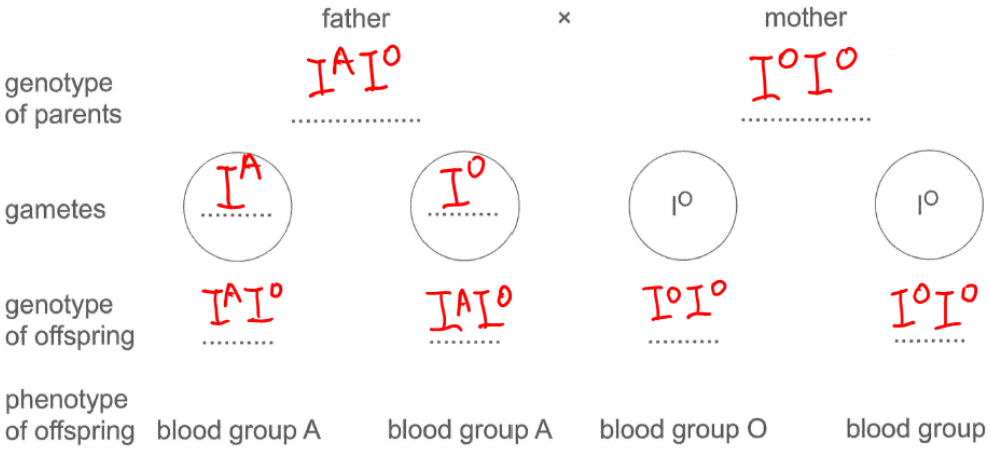
(c) **Describe**

- Crossing over during prophase I and exchanging of homologous segments of DNA between homologous chromosomes results in DNA recombination which leads to variation.
- Independent assortment of chromosomes when pairs of homologous chromosomes line up at random along the equator during metaphase I of meiosis results in variation.
- Random fusion of sperm and egg cell to form a zygote during fertilisation results in variation.

3 (a)

A father and mother have four children. Two children have blood group A and two have blood group O.

Use the relevant symbols for alleles (I^A, I^B and I^O) to complete the genetic diagram.



[3]

(b) **Explain**

Codominance occurs when two alleles controlling a trait both express themselves in an organism. In human blood group, I^A allele and I^B allele are codominant. A person with I^AI^B genotype have both alleles expressed, giving rise to blood group AB [1].

Multiple alleles refers to a gene that consists of more than 2 different type of alleles that controls a specific trait/ phenotype [1]. In human blood group system, there are three alleles, I^A, I^B and I^O which give rise to 4 different blood groups A, B, AB and O. [1].

(c) **Explain**

Discontinuous variation refers to a trait that has clear cut phenotypes with no intermediate forms. They are usually controlled by one or a few genes [1].

(d) **Distinguish**

A gene is a small segment of DNA that controls a specific trait or the production of a particular protein [1] while an allele is an alternative form of a gene/ different form of the same gene [1].

4 (a) **Describe**

The earlier the age when smoking started, the higher the relative death rate in men aged 40 – 60 years old [1].
When regular smoking started around 10 to 14 years old, the relative death rate was 2 arbitrary units. This death rate decreased to 1.25 arbitrary units if the starting age of smoking was delayed to 25 to 29 years old [1].
Non-smokers had half the relative death rate (1 arbitrary unit) as compared to those who started to smoke at 10 to 14 years old [1].

(b) **Suggest**

Occlusion of coronary arteries would narrow the lumen of the coronary arteries, reducing the amount of blood transporting oxygen and glucose to the heart muscle cells [1].

Rate of aerobic respiration in heart muscle cells decreases and less energy is released by cells for muscular contraction of heart muscles [1].

This can cause heart muscle cells to die and lead to heart attack [1].

(c) **Suggest**

Tobacco smoke produces carbon monoxide, which binds irreversibly with haemoglobin in red blood cells, thus decreasing the oxygen-carrying capacity of blood [1].

This causes a lower concentration of oxygen that can be transported from maternal blood to fetal blood [1].

Thus, fetal cells have lower rate of respiration to release energy for cellular growth and development, leading to low body mass [1].

5 (a) **Calculate**

$40.00 \div 0.04 = 1000$ X [1]

(b) **Explain**

The insecticide is non-biodegradable and accumulates in the fatty tissues of the organisms in the food chain [1].

The insecticide is passed along the food chain, increasing in concentration in the bodies of the organisms along the trophic levels from 0.04 ppm in water plants to 40 ppm in fish-eating birds via bioamplification. [1]

Since fish-eating birds are top predators in the food chain, they have accumulated the greatest concentration of insecticides [1]. Thus, these toxic amounts would have killed a larger proportion of the birds.

(c) **Suggest**

Population of small fish decreases at first [1]

Explain

When all the birds die, there will be no more predators to feed on the large fish. This causes an increase in the population of large fish, which will feed on the small fish, decreasing their population.

Over time, the increase in the numbers of large fish will slow down and reach an equilibrium because there would also be competition for food between large fish for the limited numbers of small fish [1].

6 (a) (i) **Explain**

The thick elastic walls help to withstand the high blood pressure in the artery. [1]
The elasticity enables the artery wall to stretch and recoil/ spring back to push blood in spurts along the artery. [1]

(ii) **Suggest**

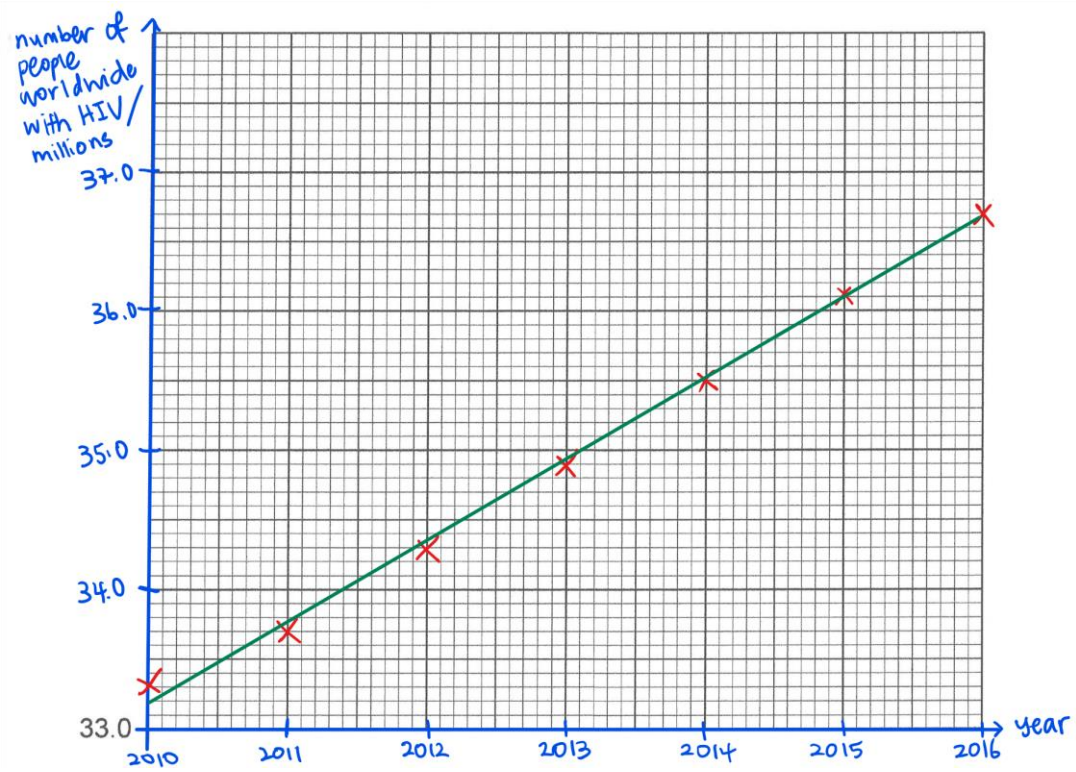
The contraction and relaxation of muscle fibres can cause the dilation or constriction of small arteries/ arterioles[1]. This can help to push blood along the small artery.[1].

(b) **State**

Presence of valves

Paper 2 (Section B)

7 (a) (i) **Plot graph**



1m – correct axes (with units)
1m – best fit line
1m – correct plots
1m – appropriate scale

(ii) **Describe**

The number of people worldwide who had HIV increased linearly [1] from 33.2 million in 2010 to 36.7 million in 2016 [1]. There was a constant steady increase of about 0.6 million people who contracted HIV per year between 2010 and 2016 [1].

(b) **State (any 3)**

- Practice abstinence/ no pre-marital sex
- Keep to one sex partner
- Use of condom
- Use only sterilised instruments (needles etc)
- Do not abuse drugs

8 (a) **Explain**

- Spontaneous mutation took place in the genes of ancestral eucalyptus trees, resulting in genetic variation in offspring and producing different varieties of eucalyptus trees
- Those trees which have genes that codes for traits that causes the organism to be more fire-resistant have higher survival rates.
- When a wildfire occurs, nature selects the trees that have the fire resistant gene to survive.
- Thus more of these fire-resistant trees are able to live to reproductive age and produce more offspring with the favourable fire resistant allele.
- Over thousands or millions of years of this natural selection, fire-resistant trees become more dominant and evolve to be more suited to its environment.

(b) (i) **Suggest**

Artificial selection refers to the selective breeding of plants and animals to produce individuals with desirable traits [1].

(ii) **State**

Animal: cow
Feature: high volume of milk and good quality of meat [1]

Plant: soya bean plant
Feature: seeds that have high oil content [1]

(c) **Suggest**

Example: Development of corn that is resistant to pests (Bt toxin)
1. This genetically modified crop may become toxic or cause cancer to people that consume them.

2. The new proteins in the GM crop may also cause allergies in some people.

3. Genes that code for pest resistance may be passed on to undesirable organisms like weeds, which may lead to the evolution of superweeds.

9 E (a) **Explain**

This individual is a female as she has two X chromosomes [1].
This individual has Down's syndrome [1] as she has an extra chromosome 21 [1].

(b) **Suggest**

Radiation and certain chemicals like tar are mutagenic agents which cause mutation in a cell. When mutation occurs, there is a sudden random change in the structure of a gene or in the chromosome number [1].
This leads to genetic variation and gives rise to new alleles within the population. [1]
Nature selects the individuals with beneficial traits to survive and when they reproduce, they pass it on to their offspring [1].
This leads to the evolution of new varieties and species of organisms after thousands and millions of generations.

(c) **Describe**

- Restriction enzymes are used to isolate the human insulin gene and cut bacterial plasmids to produce sticky ends.
- The insulin gene and plasmids are then mixed with DNA ligase in order to insert the insulin gene and seal it into the plasmid.
- The recombinant plasmids are then mixed with bacterial cells and treated with temporal heat or electric shock so that the bacteria will take up the recombinant plasmids.
- The transgenic bacteria are then cultured in a large fermenter. As bacteria growth and reproduce, they also express the insulin gene and produce human insulin.
- The insulin protein can then be harvested from the bacterial cells and purified for use.

9 O (a) **Compare**

- The number of samples of dead honeybee colonies is consistently higher in the farmland than in the cities for the same number of insecticides.[1]
- In the cities, only 1 to 4 different insecticides can be found in the dead honeybee colonies. On the other hand, the number of insecticides found in the dead honeybee colonies found in the farmland ranges from 1 to 8 different types.[1]
- The number of samples of dead honeybee colonies containing insecticides decrease as the number of different insecticides present increases.[1]

(b) **Suggest**

- In cities, the honeybee colonies are likely to be grown in places in which conditions are highly controlled.
- Use of insecticides are common by farmers in farmlands to kill pests to protect their crops
- More honeybee colonies in farmlands than cities due to presence of crops

(c) **Explain**

Honeybees are part of food chains in the natural ecosystem. When honeybees are poisoned by insecticides and die, it can lead to adverse effects on the natural ecosystem.[1]

Consumers that feed on honeybees have less food to eat. [1]

At the same time, honeybees are important pollinators of flowers. The reduction in their population would result in lower levels of pollination and fertilisation in plant species.[1]

These decrease the population of flora and fauna and leads to a loss in biodiversity. [1]