

GCE O Level Biology 6093

Answer Scheme

2020

Paper 1

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

Paper 2

Section A

Qn	Answer	Remarks
1(a)	A: ovary B: oviduct C: cervix	Incorrect answers for C: Uterus/ vagina
(b)	Cross placed at the fallopian tubes/ oviduct	
(c)	The fertilised egg, also known as the zygote moves along the fallopian tube towards the uterus. It undergoes mitosis to form a ball of cells called an embryo. Once it reaches the uterus, the embryo implants itself into the uterine lining and develops into the fetus.	Incorrect ans referred to implantation of the zygote and ref to meiosis. Extra details on fertilisation/ hormones and fetal development were not necessary.
(d)(i)	Its hair like structures sweep the developing embryo towards the uterus for implantation.	
(ii)	Respiratory system	Weaker responses referred to a specific organ eg. Trachea instead of a system. Incorrect ans confused cilia with villi and referred to digestive system.
2(a)	D each chromosome is, duplicated / replication / doubled / copied into sister chromatids ; E chromosomes/ sisters chromatids have divided/ separated into 2 separate cells/ cytokinesis;	Weak answers only stated what they could see in the graph.
(b)(i)	anaphase	
(ii)	Before metaphase After telophase	
(iii)	Haploid number 3 The figure shows 12 chromosomes formed from 6 sister chromatids that had separated during anaphase. Thus the diploid number is 6 and the haploid number is half of that which 3 chromosomes.	
(c)	Crossing over of homologous chromosomes during prophase results in variation as it produces a new combination of alleles in the chromatids.	The stages were not required, but some responses incorrectly assigned these processes to the wrong stage.

	During independent assortment in metaphase I, depending on how the homologous chromosomes pair up, different combinations of chromosomes in the gametes can be produced. Such variations in gametes and the random fusion of male and female gametes during fertilisation leads to unique diploid DNA combinations leads to variation in the zygote.	
3(a)	Father x mother Genotype of parents $I^A I^O$ $I^O I^O$ Gametes I^A I^O I^O I^O Genotype of offspring $I^A I^O$ $I^A I^O$ $I^O I^O$ $I^O I^O$	
(b)	Codominance Occurs when both alleles are equally expressed in the heterozygous condition. For example a person of AB phenotype had both I^A and I^B alleles in his genotype. Multiple alleles Occurs when a gene for a particular trait exists in more than two alleles. For example, the gene for blood type is controlled by three different alleles, both I^O, I^A and I^B.	The alleles for the blood types must be stated and it should be clear in multiple alleles that they are alleles of the same gene or locus.
(c)	Discontinuous variation refers to traits/ characteristics that are controlled by one or a few genes and have few distinct types with no intermediates. These characteristics/ variation is also not affected by the environment and is only determined by inheritance of alleles.	Weak answers only made reference to the feature being unaffected by the environment.
(d)	Gene is a segment of DNA, where the sequence of nucleotides codes for the production of a specific polypeptide that is responsible for a particular characteristic/ trait. Alleles are alternative forms of a gene that results in variations of a characteristic/ trait/ gene. They	

	occupy the same relative position in a pair of homologous chromosomes.	
4(a)	As the age of smoking decreases, the relative death rate increases. At the starting age of 10-14, the death rate is 2 times more than a non smoker. At the starting age of 25-29, the death rate decreases to 1.25 times that of a non smoker. There is a significant decrease in the death rate of 0.45 units between the starting age of 20-24 and 25-29.	Strong answers showed analysis of the data instead of just quoting data from the graph.
(b)	When the coronary arteries are occluded, The lumen of the coronary arteries are narrowed or completely blocked. This reduces blood flow to the heart muscles. The heart muscle cells receive less oxygen and glucose, resulting in reduced aerobic respiration. Less energy is released and may cause death of the heart muscle cells leading to muscle damage and a heart attack.	Good answers focus on the effects of the cardiac/ heart muscle. Weaker responses focused on why the arteries became blocked, or the effects of artery blockage on the whole body.
(c)	Carbon monoxide in cigarette smoke binds to haemoglobin. This reduces the oxygen carrying capacity of the red blood cells. Less oxygen is transported to the fetus, resulting is reduced aerobic respiration and thus less energy released for growth of cells. This leads to low body mass in the baby.	
5(a)	$40/0.04 = 1000$	
(b)	The insecticide is a toxic chemical that cannot be broken down and is not excreted from the bodies of organisms. The insecticide is stored in the cells of the organisms and accumulates. This is called bioaccumulation. The water plants take in the insecticides and stores it in its cells. The small fish eat the plants and accumulates the insecticide in its cells. The small fish is eaten by large fish which is eaten by the fish-eating birds.	

	The insecticide is passed down the food chain and become concentrated in the bodies of the final consumers by bioaccumulation. The concentration of insecticide which is toxic in the birds are the highest, thus resulting in the higher proportion deaths.	
(c)	If all the fish-eating birds die, the population of large fishes will increase as the predator has been removed. This will lead to a drastic decrease in the numbers of small fishes as more of them will be eaten by the increased numbers of large fishes and the small fishes may not be able to reproduce quickly enough to replace the decrease in numbers.	
6(a)	The elastic layer allows the artery to maintain and withstand the high blood pressure by constricting and dilating the lumen.	
(ii)	It helps to withstand the high blood pressure and prevent the vessel from bursting. Contraction and relaxation of the muscle fibres allow for the constriction and dilation of the lumen which controls the flow and pressure of blood and allows blood to be re directed such as in temperature regulation in the skin.	Some incorrectly stated that with reduced size of the lumen, blood pressure in small arteries would be even higher than in large arteries and consequently answered in terms of the ability to withstand high pressure.
(b)	It contains semi lunar valves.	Incorrect answers referred to tricuspid or bicuspid

Section B

No.	Answer	Marks	Comments
7 (a)(i)	Scale Axes Plot Points Best fit line	4	Some responses did not draw a correct line of best fit. A common error was not having a balance of data points on either side of the line.
(ii)	As the year progressed from 2010 to 2016, the number of people worldwide who had HIV increased from 33.2 million to 36.7 million;; Between 2011 and 2016, there was an increase in 0.6 million people per year; The increase in number of people was proportional to time/year;	3	1 mark for correct trend 1 mark for correct figures quoted Stronger performing candidates compared or manipulated the data rather than simply quoting a series of data values, e.g. reference to the increase of 0.6 million per year.
(b)	Any 3 Keep to one sex partner; Practice abstinence / do not have sex; Use a condom when having sexual intercourse; Do not abuse drugs as drug addicts tend to share needles and needles can be contaminated with the virus; Do not share instruments that can break skin and get contaminated with blood; Make sure needles used in acupuncture, ear-piercing or tattooing are sterilised;	3	
8 (a)	Among the eucalyptus trees, there exists genetic variation due to random mutation;	5	Most responses made a correct

	This gives rise to trees that are able to survive fires better – such as thicker barks / stronger root system to anchor trees / fire-resistant barks / AVP; Fire acts as the selection pressure; Whereby when a fire breaks out in a forest of eucalyptus trees, the trees that are better able to survive the fires are at selective advantage; They survive the fire and pass on their alleles to their offspring; Over a long period of time, there will be more trees that possess the alleles that enable them to survive fires;		reference to mutation or natural selection, but few linked mutation to genetic variation in the population. Many went on to discuss the ‘survival of fire-resistant trees’ and the ‘reproduction’ of the resistant variety. However, several responses did not use specific scientific terms, for example, reference to fire acting as a ‘selection pressure’ rather than there being more fire-resistant individuals.
(b) (i)	Artificial selection is the deliberate breeding of organisms with desirable traits by humans;	1	Definitions of artificial selection often omitted critical features such as the involvement of humans or the idea that those organisms selected had beneficial characteristics.
(ii)	Name of animal: Hybrid Cows Feature: They are able to produce a lot of milk and good meat; Name of plant: Soya bean plants Feature: These plants produce seeds with high oil content and are resistant to disease;	2	Weaker responses incorrectly referred to genetically engineered or genetically modified organisms or gave an example which was not economically important.
(c)	Named example: Genetically modified salmon that matures in half the time; genetically modified cows that produce more milk Implication 1: Threat to human safety when consumed; No comprehensive, long-term studies have been carried out to ascertain the potential dangers of consuming GM salmon; Implication 2: Upset the balance of the ecosystem; GM salmon, when released into the wild, might affect food chains in unpredictable ways / reduce the population of wild salmon drastically;	2	Most responses did not give a specific named animal example of genetic engineering or gave plant examples and merely listed the general social and ethical implications which could be applied to any example.

	Implication 3: Animal rights concerns – ill treatment / suffering of animals in captivity and /or during the process of genetic engineering; Implication 4: Religious concerns – some religious do not agree in the consumption of GM animals or modification of organisms' DNA; Altering one's genes and changing one's genetic makeup goes against many religious and cultural beliefs		General social and ethical issues to note: 1. Threat to human safety 2. Threat to environment 3. Exploitation of animals for genetic engineering
9 E (a)	This individual is a female, as there are 2 X chromosomes; This individual also suffers from Down's syndrome; As she has 3 chromosome number 21 / She has an extra chromosome 21;	3	
(b)	Radiation and chemicals are known as mutagens; They cause mutations to DNA, which results in new alleles being formed in the population; Therefore, when there is an appropriate selection pressure, individuals with the beneficial allele will be at selective advantage; Resulting in that individual surviving to reproductive age to produce offspring with the same beneficial allele; This then increases the frequency of that beneficial allele in the population, leading to evolution;	3	Candidates found this a challenging question. Most responses recognised that radiation and chemicals cause mutations, but did not develop this idea any further. Many candidates confined their responses to humans and only described the effects of a mutation, such as the development of cancers and genetic conditions such as Down syndrome and sickle cell anaemia, without any reference to how evolution in a population might happen. Few responses used correct terminology to describe that individuals with a beneficial allele would be selected for, which would increase the frequency of that allele in the population.

(c)	The human insulin gene is first isolated by cutting it out using restriction enzymes that create sticky ends; The insulin gene is then inserted into a vector / plasmid that has been cut with the same restriction enzyme, generating the complementary sticky ends; DNA ligase is added to join the 2 DNA fragments together; The recombinant plasmid (with insulin gene inserted) is then inserted into bacteria using heat shock or electic shock; Bacteria with the recombinant plasmid is then identified, isolated, then grown in fermenters; Each bacteria is able to produce human insulin protein via transcription and translation, which is then extracted and purified for use in medical biotechnology;	4	Most responses did not refer to large scale culturing of the bacteria in a fermenter or that the expression of the insulin gene would result in the production of insulin protein which would then be harvested.
OR (a)	Similarity: For both cities and farmland, the most number of dead honeybee colonies contained only 1 insecticide; Differences: In cities, only up to 4 different insecticides were present in dead honeybee colonies while in the farmland, up to 8 different insecticides could be found; In the farmland, there were more samples of dead honeybee colonies containing insecticides than in cities;	3	
(b)	More rampant use of insecticides in farmland as compared to cities; because there are more insects in farmland areas, leading to farmers using more insecticides to try to get rid of the insects. Insects in farmland areas may be more resistant to certain insecticides, leading farmers to using a wider variety of different insecticides to try to get rid of the insects; Farmlands are closer to the wild, where there might be more insects as compared to urban cities;	3	
(c)	Insecticides are non-biodegradeable and cannot be excreted / they may be transferred to the honey that the bees are making; The insecticide will then be consumed by humans as they eat the honey made by these bees; The insecticide may be passed to the flowers that are visited by the bee; Bioaccumulation can occur whereby the concentration of the insecticide increases as we move along the trophic levels;	4	