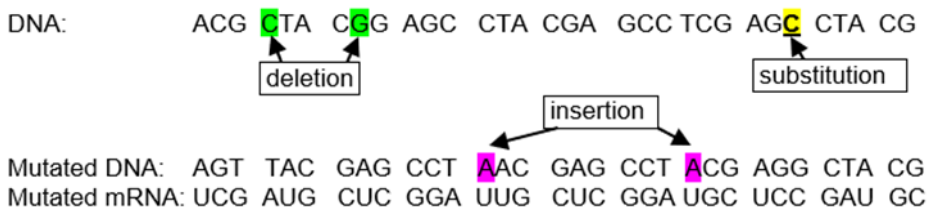
GCE A Level H2 Biology

9744 Biology November 2020

1.	**N20Q1**	C	The three tenets of cell theory are: 1. Cells are the smallest unit of life. 2. All cells come from pre-existing cells. 3. Living organisms are composed of cells.
2.	**N20Q2**	A	A centriole is indeed a hollow cylinder formed by a ring of microtubules. A lysosome is a spherical sac surrounded by a single membrane, not a double membrane. A mitochondrion is a double membrane organelle with the inner membrane folded, rather than enclosing a folded membrane. A ribosome is made up of two different sized subunits (one large and one small). It can be attached to the rER membrane or it can be free.
3.	**N20Q3**	C	Statement 1 is wrong because amylopectin, just like glycogen, is branched. Since we are told that due to the branching enzyme action, the amylopectin is made more soluble than amylose (unbranched), this mean that, equally, the glycogen is also made more soluble. Soluble molecules will always have an osmotic effect in the cell, so statement 3 is wrong. Statement 2 about the molecule being more compact and hence occupies less space and statement 4 about the branching helping the molecule to have more free ends for hydrolysis to break down into glucose faster, are both good properties of glycogen being a suitable storage molecule
4.	**N20Q4**	D	Follow the sequence given in the question, asp-ala-gly-lys Synthesis of polypeptide always occur in the N to C terminus, and NH_3^+ will form peptide bond with COO^- thus it starts with 9 bonded to 7, 6 bonded to 2, 1 bonded to 5
5.	**N20Q5**	B	Haemoglobin Statement 1 is wrong, because Haemoglobin has haem group that contain iron and porphyrin ring Statemnt 4 is wrong, because repeating pattern of 3 type of amino acids is referring glycine X Y of collagen and not Haemoglobin Collagen Statement 3 is wrong, because it is insoluble. It does not have hydrophilic amino acid on it is surface. The R of it amino acids project into the core of it is triple helical structures.
6.	**N20Q6**	C	2,3-BPG functions similar to inhibitor of an allosteric enzyme (note that haemoglobin is not an enzyme). At low concentrations of oxygen, 2,3-BPG has a higher affinity and will bind to haemoglobin, stabilizing it in inactive conformation, oxygen is unable to compete with it for oxygen binding sites. A and B incorrect – carbon dioxide and oxygen do not bind to the same binding site in haemoglobin, in any case it should not cause pH in red blood cell to fall (as stated in statement A). D – statements provide no evidence of any interaction between carbon dioxide and 2,3-BPG
7.	**N20Q7**	D	Enzyme Z is an allosteric enzyme and graph shape should be sigmoidal. In the presence of an inhibitor, the graph should shift to the right, meaning a higher concentration of substrate is required to reach the same rate of reaction compared to when the inhibitor is absent.

8.	**N20Q8**	A	A person with Tay-Sachs cannot break down the gangliosides and therefore the concentration of gangliosides should remain high. The concentration of gangliosides in a normal person should decrease with time. Since the breakdown of gangliosides is an enzyme catalysed reaction, we expect the shape of the graph to have a steep concentration (indicating higher rate of reaction) at first but become more gradual as the amount of substrate (gangliosides) will decrease with time.
9.	**N20Q9**	C	guanine and adenine are purines cytosine, thymine and uracil are pyrimidines
10.	**N20Q10**	B	In semi-conservative DNA replication, the RNA primers at the 5' end of the daughter strands are removed but cannot be replaced with deoxyribonucleotides due to the lack of a 3'OH group for DNA polymerase to bind to. This end-replication problem results in daughter DNA molecules having 3' overhangs.
11.	**N20Q11**	B	Option 1 – Correct. These transcription factors are called general transcription factors which recruit RNA polymerase to the promoter. Option 2 – Correct. These are specific transcription factors known as activators. Option 3 – Correct. Option 4 – Incorrect. The processing of pre-mRNA in eukaryotes (post-transcriptional modifications) occur in the nucleus, but it only occurs after transcription is complete.
12.	**N20Q12**	A	Centromeres and telomeres consist of tandem repeat sequences. Some introns contain short interspersed (non-tandem) repeats.
13.	**N20Q13**	D	cAMP binds to regulator protein (CAP: catabolite activator protein) and activates it. The activated regulator protein (CAP) then binds to the CAP binding site on the promoter. This increases the affinity of RNA polymerase to the promoter. Hence the answer is D. A and C are incorrect. cAMP does not prevent regulator protein (CAP) from binding to promoter and so it does not prevent expression of the lac operon when glucose concentration is high. B is incorrect. cAMP does not activate the inducer (allolactose).
14.	**N20Q14**	A	
15.	**N20Q15**	D	This is anaphase of mitosis. There will be a <u>pair</u> of centrioles at each pole. So eliminate A and C. B is incorrect because the centriole to centriole microtubules (i.e. non-kinetochore microtubules) will elongate as they slide pass each other. So they become longer, not shorter. D is correct as during anaphase the kinetochore microtubules will shorten leading the daughter chromosomes to opposite pole of the cell, led by the centromeres.
16.	**N20Q16**	B	All but statement 4 are supported by the findings.

			Statement 4 is incorrect because it is people whose *JAK2* gene mutates before the *TET2* gene are more likely to go on to develop leukemia. People with mutations in the *JAK2* gene alone are not more likely to develop leukemia than people with mutations in the *TET2* gene.
17.	**N20Q17**	C	C^B DNA need not be replicated to be expressed which rules out option A. C^B DNA is not directly translated, only mRNA is translated so this rules out option B. Only one C^B allele needs to be expressed for its phenotype to be seen as it is a dominant allele – this rules out option D. Correct sequence is that the C^B allele is first transcribed to form C^B mRNA which is then translated to form the enzyme needed to synthesise the pigment melanin.
18.	**N20Q18**	A	Heterozygous black dog (BbDd) crossed with a fawn dog (bbdd) will produce the following offspring: 1 BbDb : 1 Bbdd : 1bbDd : 1 bbdd 1 black dog : 1 grey dog : 1 red dog : 1 fawn dog Hence, probability of getting 2 black puppies is ¼ x ¼ = 0.0625
19.	**N20Q19**	B	Phenotypes must be influenced by genes. Since bushes with white flowers only produce white flowers and not pink or blue, the white flower phenotype is only determined only by genes. However bushes that produce pink or blue flowers depend on the genotype which determines if the flowers are pink or blue at first and they also depend on changing soil pH levels (environment) which can cause the flower colour to change.
20.	**N20Q20**	A	F2 generation results when two heterozygous F1 offspring are crossed with each other. In cross 1, the ratio produced is 3 dark red grains : 1 white grain. This arises when Aa x Aa, where A codes for dark red grains and a codes for white grains. This is an example of monohybrid inheritance involving one gene. In cross 2, the ratio produced is 15 dark red grains : 1 white grain. This arises when AaBb x AaBb and epistasis is involved where the dominant allele A masks the effect of B/b locus and the dominant allele B masks the effect of the A/a locus. Hence, the typical 9:3:3:1 ratio is modified to become 15:1. In cross 3, the ratio produced is 63 dark red to pale pink grains : 1 white grain. This arises when multiple genes are involved in coding for grain colour with each gene having an additive effect on the colour. In addition, environment will also play a part in influencing the grain colour.
21.	**N20Q21**	A	Options B and D were the most frequently selected incorrect answers. Option B is incorrect as respiration is constantly taking place decreasing the amount of carbon in the plant (at pt 3), even though rate of photosynthesis may be zero. Option D is incorrect as rate of photosynthesis is limited by diffusion of carbon dioxide at 2. Region 2 shows high concentrations of internal carbon dioxide, at levels almost equivalent to higher than atmospheric concentrations
22.	**N20Q22**	D	**D** is the only one that explain small yield. ATP synthase is not required in anaerobic respiration so **A** is wrong. **B** and **C** do not explain small yield
23.	**N20Q23**	D	Activated G protein with bound GTP has to bind to adenylyl cyclase in order for it to be activated and catalyse the conversion from ATP to cAMP.

24.	**N20Q24**	B	Uptake of glucose is due to ligand insulin (not glucagon in option 2). It binds to RTK (option 1) causing downstream cellular response such as increasing GLUT4 glucose transporters (option 3) to cell surface in order to increase in glucose intake via facilitated diffusion (option 4).
25.	**N20Q25**	B	The question is asking for explanation for natural selection. Of which 1 and 2 explains natural selection in terms of change in allele frequency and variation due to mutation respectively. Point 3 does not fit the preamble that the tongue length became shorter through the 40 years as the change in length was gradual.
26.	**N20Q26**	C	The clue is that the question starts with, "a species of lizard", which indicates that they are still the same species among the populations on different islands. Hence micro-evolution occurred. Between C and D, C is a better answer.
27.	**N20Q27**	C	Option 4 - Molecular homologies require suitable material, such as nucleic acids or proteins, to be collected and analysed. This is not always present in fossils. So you can only do that for some of the species. For those with fossil evidence, anatomical homologies are used, hence option 1 is used. Option 3 – there is no need to look at biogeography of living tetrapods as their molecular information are easily available.
28.	**N20Q28**	A	Injection of P resulted in a rise in antibody concentration but not T-lymphocyte concentration. This indicates passive immunity where antibodies are transferred to the recipient without the participation of the recipient's immune system. This leaves options A and B as possible answers. Injection Q resulted in a rise in both antibodies and T-lymphocytes, which suggests active immunity where the individual's own immune system is responding. As antibody production is part of the adaptive (specific) immune response, and not the innate (non-specific) immune response, option A is the correct answer.
29.	**N20Q29**	D	Option A - Class switching changes the constant region, not the variable region of the heavy chain. Option B – Class switching refers to DNA rearrangement at the constant gene segment of Ig heavy chain gene locus. The changes at the DNA level would apply to all immunoglobulin molecules produced by the particular B lymphocyte. Option C – Antigen binding is influenced by the antigen-binding site which is not a consequence of class switching. Option D – Different classes of antibodies have different functions and will therefore react with other components of the immune system in different ways.
30.	**N20Q30**	C	1 – this statement can be justified as increase in population cannot account for the huge increase in use of crude oil for energy between 1935 and 1975. 2 – cannot be justified as there are many other factors contributing to the increase on atmospheric carbon dioxide concentration 3 – cannot be justified as this trend can only be observed for use of coal but not crude oil.