	GCE A Level H2 Biology					
	9744 Biology November 2021					
1.	N21Q1	В	chloroplast	mitochondrion	ribosome	
			phosphorylation 🗸	oxidation 🗸	translation 🗸	
			polymerisation 🗸	transcription 🗸	replication ×	
			transcription 🗸	reduction 🗸	polymerisation 🗸	
			translation 🗸	phosphorylation 🗸	transcription ×	
			Chloroplast – it contains <i>translation</i> can occur. Th <i>polymerisation</i> reactions. dependent reactions. This Mitochondrion – it contain translation (good to note to Aerobic respiration involve are also several reactions cycle. Passing of electrons of redox reactions: the elect is <i>reduced</i> . (Note that elect though this is not in the que Ribosome – it is the se <i>polymerisation</i> of amino action	circular DNA and 70S rib ne synthesis of mRNA a In photosynthesis, ATP is involves <i>phosphorylation</i> of the circular DNA and 70S rib this even though it is not in s the mitochondrion where that are <i>oxidation</i> by deh s down the electron transp ctron donor is <i>oxidised</i> , whe stron transport chains are a estion.) site of <i>translation</i> and t cids to form polypeptides;	osomes: <i>transcription</i> and nd polypeptides are also is synthesised in the light- of ADP to form ATP. posomes: <i>transcription</i> and in the question) can occur. glucose is <i>oxidised</i> . There hydrogenation in the Krebs ort chain involves a series ereas the electron acceptor also in the chloroplast even the process involves the	
2.	N21Q2	D	According to endosymbios organism. Thus it shows ribosomes and reproduction is not unique to bacteria /	is, mitochondrion was once similarity with bacteria su on by binary fission. The al prokaryotes.	e a bacterial-like single cell uch as circular DNA, 70S pility to synthesise proteins	
3.	N21Q3	D	Consider the features and 1: genome of circular doul viruses and is also a featu 2: enclosed within a protei 3: layer of lipids – this des cell that has a phospholipi 4: replicates only in the cyto parasite which is a feature	select those that are unique ole-stranded DNA – this is re of bacteria n coat – this describes nor cribes the viral envelope, b d bilayer as its cell surface oplasm of a eukaryotic cell of viruses	ue to viruses: a feature of some (not all) n-enveloped viruses but is also true of any other membrane. – this describes an obligate	
4.	N21Q4	A	Only bacteriophage has no enveloped virus and <i>Myco</i> membrane.	o phospholipid while influer bbacterium tuberculosis is	nza virus and HIV are a bacteria with plasma	
5.	N21Q5	D	Alpha (a) Glucose Beta (β) Gl CH ₂ OH H H H H H H H H H H H H H	H H H H H H H H H H H H H H H H H H H	between α -glucose and β - position of the OH group bon-1. For α -glucose, the pow the plane of the ring (on le of the ring as carbon-6), pse, the OH group is above a ring (on the same side of on-6).	

			Options A and B are incorrect as the OH groups cannot be replaced. Option D describes carbon-1 correctly as carbon-1 is attached to O in the ring and the O of the OH group, so it is the carbon that forms bonds with 2 oxygen atoms.
6.	N21Q6	D	For this type of questions, look for things that are inconsistent/incoherent in the options given:
			Option A – Water moves by facilitated diffusion down an electrochemical gradient is incorrect. The correct term should be water potential gradient. Electrochemical gradient is used for charged particles. Option B – H ⁺ moves by active transport down a diffusion gradient is incorrect. Diffusion is passive transport and not active transport. Option – K ⁺ description is incorrect (same as option B). Water moves across the membrane by osmosis, down a water potential gradient. This is a passive process and should not require an ATP-powered pump.
7.	N21Q7	С	Based on the context of the question, the enzyme is able to fluoresce when illuminated with UV light. Changes in shape are able to the change the intensity or the wavelength of the fluorescence.
			To interpret the effect of adding serine and the effect of adding serine + indole to the enzyme – compare the graphs with the graph of enzyme only. For enzyme + serine, the peak fluorescence obtained is higher, showing that serine binds to the enzyme to change the conformation of the enzyme. This supports the idea that an enzyme-serine complex is formed. For enzyme + serine + indole, the peak fluorescence obtained is lower, showing that serine + indole binds to the enzyme to change the conformation of the enzyme. The shape is different from that of enzyme + serine, hence the peak fluorescence is also different. This supports the idea that an enzyme-serine- indole complex is formed.
			For both graphs, the wavelength at which the peak fluorescence occurs is unchanged, so statement 2 is incorrect.
8.	N21Q8	В	The question context says that hormones from the pituitary gland stimulate cells in the mammary glands so the cells become able to secrete milk. Stem cells are unspecialised, so they must first differentiate to become cells that can secrete hormones.
9.	N21Q9	A	The events occur in this order: virus recognises host cell by (statement 3) hemagglutinin in the viral envelope binding to sialic acid receptors on host cell. Then the virus is taken into the cell by endocytosis. Hence, (statement 1) the virus becomes enclosed in an endosome. The endosome then fuses with a lysosome, resulting in (statement 4) a low pH in the endosome. The low pH causes a conformational change in hemagglutinin (statement 5) that changes its binding specificity, such that it brings together the viral envelope and the endosomal membrane. This causes (statement 2) the viral envelope to fuse with the endosomal membrane.
10.	N21Q10	A	This question is on transduction. In stage 2, the 1 st bacterial host is killed, suggesting that this is lytic cycle. New phages are released, including defective phages that have enclosed parts of the bacterial DNA in its capsid head. In stage 3, new phages infect another culture of bacteria. At the end of stage 4, there is no description that the bacteria is killed (unlike in stage 2), suggesting that this is the lysogenic cycle.
			The final result for type 1 bacteriophage produced bacteria showing a range of different characteristics suggesting that different DNA sequences are

11.	N21Q11	С	 introduced. This describes generalised transduction where random sequences from the 1st bacterial host is introduced into the 2nd bacterial host. In contrast, for type 2 bacteriophage, all bacteria show the same characteristics, suggested that the same DNA sequence is introduced. This matches with specialised transduction where specific segments of bacterial chromosome adjacent to the prophage may be wrongly excised and packaged into the defective phage, and transferred to the 2nd bacterial host. For this type of question, consider the options to choose the best one that matches the figure. A: Incorrect as the DNA also has sequences like the promoter, as suggested by the binding of RNA polymerase. B: Incorrect as RNA polymerase (which is a protein) continues to bind to the DNA as it transcribes through the entire section (both coding and non-coding). C: Correct. Grey shaded regions are removed from the pre-mRNA showing that they are introns that are found between coding regions. D: Incorrect as the grey regions (non-coding regions corresponding to introns)
			appear in the pre-mRNA, showing that they are transcribed. Introns are later removed from the pre-mRNA during post-transcriptional modification. Note that for this question, the term intron is used to refer to the non-coding region on the DNA as well as the non-coding region on the pre-mRNA
12.	N21Q12	С	The lack of a nuclear envelope means that transcription and translation cannot be compartmentalised. So as soon as the mRNA is made during transcription in the nucleoid region, the 70S ribosomes can attach to the mRNA for translation purpose.
13.	N21Q13	A	This is the correct order of events: (bullet pt 3) gel electrophoresis – to separate DNA fragments according to size (bullet pt 4) DNA denatured using an alkali solution – to obtain ssDNA that can complementary base pair with ssDNA probes later 3 rd step → (bullet pt 1) DNA transferred to nylon (or nitrocellulose) membrane by capillary action – DNA transferred to membrane needs to be single-stranded. So this step must come after the denaturation step. (bullet pt 5) baked at 80°C for 2 hours in a vacuum – to immobilise DNA on the membrane (bullet pt 2) single-stranded DNA exposed to labelled probes then washed – allow probes to bind and then washed to remove unbound probes
14.	N21Q14	С	Y is prophase Z is late anaphase 1 The chromatin is uncoiled → Incorrect: can clearly see the individual structures / chromosomes, indicating that chromatin has condensed to form chromosomes 2 Chromosomes are visible → Correct (see explanation for statement 1) 3 Sister chromatids are attached at centromeres → Incorrect: Z is late anaphase, sister chromatids already separated and moving towards opposite poles 4 The nuclear envelope is absent → Correct
15.	N21Q15	В	For this type of question, make sense of the information given. It can be useful to summarise in a flow chart. E3F binds to promoter \rightarrow transcription \rightarrow produce protein \rightarrow S phase starts Rb binds to E2F \rightarrow E2F cannot bind to promoter \rightarrow no transcription \rightarrow S phase does not start Cyclin D binds to Rb \rightarrow Rb cannot bind to E2F \rightarrow E3F can bind to promoter Next, assess each of the statements given according to what you understand about the pathway:

			(Statement 1) Mutation causing a change in tertiary structure of Rb can result in Rb being unable to bind to E2F. Hence E2F can continue to bind to promoter to result in the start of S phase. This results in continuous cell division and can cause the formation of a tumour. (Statement 2) Increased production of E2F can cause more transcription of the gene to produce more of the protein to start S phase. This results in increased cell division and can cause formation of a tumour. (Statement 3) Cyclin D binds to Rb to allow E2F to bind to the promoter. This allows for cell division to continue, so the gene for cyclin D cannot be a tumour suppressor gene.
16.	N21Q16	D	Option A is incorrect because the three varieties are pure-breeding, so differences in flower colour must be related to genotypic differences. Option B is incorrect because incomplete dominance suggest that variety 2 has a intermediate phenotype because it is heterozygous. This is not possible since question states that all 3 varieties are pure-breeding – must have 2 of the same allele at each gene and cannot be heterozygous. Option C is incorrect because incomplete dominance describes the relationship between alleles of the same gene, <i>and not between different</i> genes . Option D is correct because transcription factors and differential gene expression can explain why they have different degree of chlorophyll accumulation on the petals and hence different intensity of colours.
17.	N21Q17	D	For this type of question, make sense of the information given. It can be useful to summarise in a flow chart. Enzyme Jmjd1a demethylate H3K9 histone \rightarrow <i>SRY</i> gene transcribed \rightarrow switch on genes to enable development of male characteristics Note that the question is asking about the relationship between the <i>SRY</i> gene and the <i>Jmjd1a</i> gene. It can be useful to note that in cases when the name of the gene is the same as the name of the protein, it is <i>italicised</i> when referring to the gene (<i>Jmjd1a</i> \rightarrow gene) and un-italicised when referring to the protein (Jmjd1a \rightarrow protein). On this basis: Option A is incorrect since <i>Jmjd1a</i> is referring to a gene, whereas the transcriptional activator is a protein. Option C is incorrect since the product of <i>Jmjd1a</i> is referring to a protein, whereas the enhancer is a DNA sequence. Option B is incorrect. Epistasis involves gene interaction, with 2 genes affected one phenotypic trait. <i>Jmjd1a</i> gene which codes for the enzyme to demethylate histones to allow for transcription of <i>SRY</i> gene. Transcription of <i>SRY</i> gene produces an activator protein that can upregulate the genes for development of male characteristics. <i>SRY</i> gene is epistatic to the <i>Jmjd1a</i> gene will result in production of non-functional alteles for the soft protein and the characteristics, even though the functional alleles for the <i>SRY</i> gene are present.
18.	N21Q18	В	The question says "no recombination between the linked genes", so we can assumed that the two genes are completely or tightly linked. Since the F1 all had red flowers and long pollen grains, we can infer these are dominant traits. Let R be the allele for red flower, r be the allele for white flower. Let L be the allele for long pollen grains, I be the allele for round pollen grains. Given both parents pure-breeding:

			Depended shows white flower long collegy yield flower, round college		
			Parental genotypes: white flower, long pollen x red flower, round pollen Parental genotypes: x R++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++ C++C++		
			F1 genotypes: All		
			F1 phenotypes: All red flowers, long pollen grains.		
			Selfing: F1 X F1		
			F1 phenotypes: red flower, long pollen x red flower, long pollen		
			Gametes:		
			F2 genotypes:		
			F2 phenotypes: 1 white, long : 2 red, long : 1 red, round Hence: 36 : 72 : 36		
			Option C is a good distractor. Those who chose C had not considered the effect that linkage between the two genes had.		
19.	N21Q19	С	Students should realise that conclusions can be made based on different levels of significance. The usual probability threshold is $p=0.05$ for a 5% level of significance, where the null hypothesis is rejected if $p<0.05$ and is not rejected if $p < 0.05$		
			For a 1% level of significance, the probability threshold is $p=0.01$. The null hypothesis is rejected if $p=0.01$ and is not rejected if $p>0.01$.		
			$ \begin{array}{c} \text{Optimes is is rejected if } p < 0.01 \text{ and is not rejected if } p < 0.01. \\ \hline \end{array} $		
			corresponds to $0.01 , so at 0.01 probability level, the null hypothesis$		
			S not rejected. Option A is incorrect as the null hypothesis cannot be <i>accepted</i> . Option B is incorrect as p<0.05 for all temperatures, so the null hypothesis is		
			rejected and the deviation from expected 1:1 sex ratio is significant and not due to chance.		
			Option C is correct (see explanation for option B). Option D is incorrect. While chi^2 test can be sensitive to sample size, it does		
	Notocc		not support that the null hypothesis should be accepted.		
20.	N21Q20	A	Blue and red lights are the most effectively utilized wavelengths during plant photosynthesis where oxygen is produced from photolysis of water. Mobile		
			aerobic bacteria which use up oxygen gathers around the blue and red wavelength area where most oxygen is produced		
21.	N21Q21	С	From the light dependent reaction, NADPH and ATP are produced which will be		
			and reduced NADP (3) to reduce GP to G3P and to regenerate RuBP. Carbon		

			fixation which uses up RuBP continue to take place, so (1) is incorrect. This	
			results in an overall decrease in the amount of RuBP.	
22.	N21Q22	В	Y is reduced NAD. NADP is in photosynthesis and not respiration.	
			D is incorrect because during substrate level phosphorylation, the phosphate	
			ADP Pi is not involved	
23.	N21Q23	В	Statement 1 is a true statement as ATP synthase is embedded in the inner	
			mitochondrial membrane. As electrons get transferred down the electron	
			transport chain, H ⁺ is pumped into the intermembrane space generating a proton	
			gradient across in inner membrane (hence statement 2 is also a true statement).	
			Statement 2 is incorrect because ATP is formed when increasis pheephate is	
			added to ADP. The phosphate group is not transferred from a substrate	
			molecule.	
24.	N21Q24	В	W: adenyl cyclase is an enzyme that converts ATP to cAMP.	
			X: cAMP activates Protein Kinase A (X). Protein Kinase A (X) phosphorylates	
			and activates Y.	
			Y: Phosphorylated Y is active and continues in the signal amplification pathway through the phosphorylation cases \rightarrow therefore X is a kinase	
			7. enzyme Z causes active enzyme Y to become inactive by removing the	
			phosphate group. Removal of phosphate is by phosphatase (Z).	
25.	N21Q25	С	This was a challenging question with many candidates selecting option B .	
			Option B is a correct statement, but it provides no explanation as to why a	
			population is considered to be the smallest unit that can evolve and therefore	
			does not answer the question. Option \mathbf{C} answers the question because free	
			populations are discrete units. Free gene flow encompasses the idea of	
			interbreeding and that there is a common gene pool within each population.	
			This allows for evolution to happen as evolution is change in allele frequency in	
			a population and therefore requires a shared gene pool in a population.	
26.	N21Q26	В	A is incorrect because having a more recent common ancestor (<i>C. ibex and C.</i>	
			pyrenaica vs C. ibex and C. nircus) does not mean that they live physically	
			B is correct because time is shown from left to right with left being older in time	
			and right being more recent.	
			Capra hircus	
			(b) COMMANN Capra aegagrus	
			(d) most recent common	
			ancestor of C. Milow Capita Capita Capita	
			C. Mublandi canyman 2	
			ancestory Capra cylindricornis	
			Capra nublana	
			Capra ibex	
			Capra pyrenaica	
			C is incorrect because the genetic difference between C. cylindricornis and C.	
			aegragrus is smaller than C. nubiana and C. pyrenaica because C. cylindricornis	
			and C. aegragrus has a more recent common ancestor in comparison to C.	
			D is incorrect because the monophyletic aroup with the most recent common	
			ancestor of C. hirus and C. nubiana does not include C. pyrenaica.	
27.	N21Q27	D	Preferred hunting location and frequency of echolocation calls - can use the	
			ecological species concept because both give information about the ecological	
			niche of a species.	

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			Mass and colour of hair – can use the morphological species concept because
			Four give montation about the anatomical reactives of the organism.
			Evolutionary relationship as deduced from mitochondrial DNA – can use the
			phylogenetic species concept.
			No information is given about the interbreeding ability to produce fertile, viable
			offspring so we cannot use the biological species concept.
			No information is given about comparison of certain genes so we cannot use the
			genetic species concept
28	N21028	Δ	A is correct as the antigen-binding site of the antibody comprises both the
20.	N2 I Q20	~~~~	heavy chain and the light chain
			D is an incorrect statement as along quitching changes the constant region of
			bis an incorrect statement as class switching changes the constant region of
			the antibody, and not the variable region.
			C is an incorrect statement as new cytokines do not form as a result of
			hypermutation.
			D is an incorrect statement as B cells mature in the bone marrow. T cells
			mature in the thymus.
29.	N21Q29	В	Statement A is not true for safflower which shows fluctuations and increases at
			a point above the level of 2009.
			Statement B is true since dotted line is generally above solid line, but trend
			across the years remains as either the same or lower than that of 2000
			actors the years remains as earlier the same of lower that that of 2009.
			Statement C is not as good an answers as the graph is estimated assuming that
			nutrients and water are adequate. Carbon emissions alone cannot ensure yield.
			Statement D is incorrect as there is no increase in yield.
30.	N21Q30	С	Only the adult female <i>Aedes aegypti</i> mosquito and not the male <i>Aedes aegypti</i>
			mosquito feeds on human blood. The virus is only taken up when the female
			mosquito takes a blood meal from an infected person with the dengue virus,
			hence only stage 1a is possible.