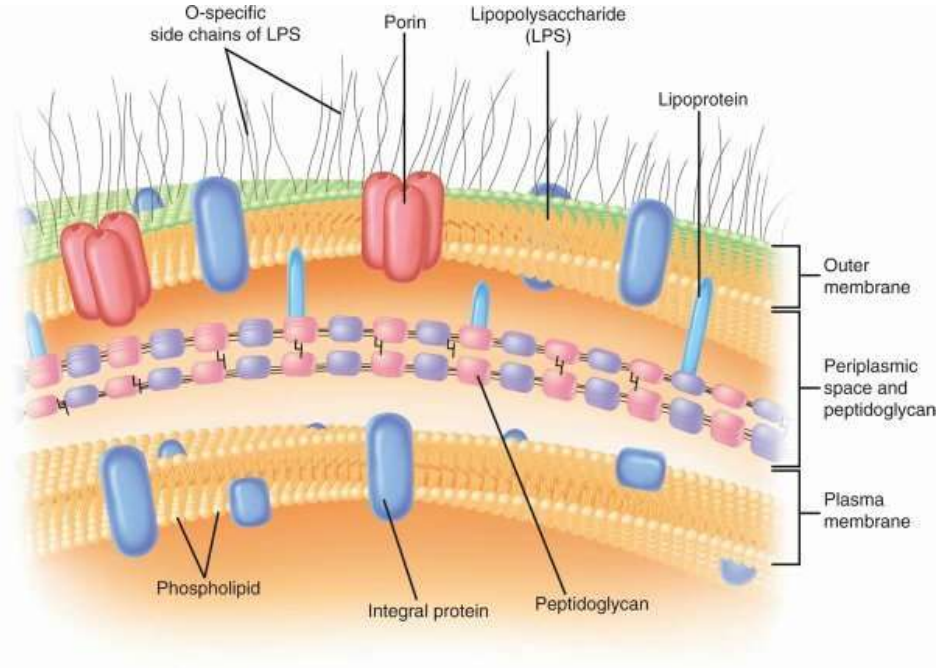
GCE A Level H2 Biology

9744 Biology November 2022

1.	**N22Q1**	C	P – vesicle / secretory vesicle Q- rER R – mitochondrion (double memb) S – Nucleus (double memb)
2.	**N22Q2**	A	X is nucleolus, codes for ribosome 1- True : needs ribosome for translation 2- True : X codes for ribosome 3- False : does not affect transcription 4- False : does not affect replication
3.	**N22Q3**	A	1 – different from Bacteria ; bacteria 2 fatty acid chain 2 – different from bacteria : cell wall made of peptidoglycan 3 – same as bacteria : contains circular DNA 4 – different from bacteria : ester linkage in bacteria 5 – same as bacteria : 70S ribosomes
4.	**N22Q4**	B	Not HIV, as no RNA-dep RNA pol. Not T4, as no envelope Not lamda phage, as no envelope
5.	**N22Q5**	C	Glycerol does not have double bonds, all 2 molecules have OH groups.
6.	**N22Q6**	D	Grey portion of the protein is hydrophobic. Hence will form hydrophobic interaction with the hydrophobic tail of the detergent.
7.	**N22Q7**	A	Pyruvate is the substrate and the substrate concentration decreases with time as more substrate is being converted to product. However, the rate plateaus after a while as other factors may become limiting, e.g. NADH concentration
8.	**N22Q8**	D	A – False; CD34 stem cells are multipotent; only ESCs are pluripotent and found in the ICM of the blastocyst; B – False; iPSCs are derived from differentiated somatic cells not from other stem cells; C – False; Since the Wnt pathway signals bind to GPCRs as stated in the question stem, they are likely to be ligands involved in cell signalling; D – True; CD34 multipotent stem cells which differentiate into a range of limited cell types can switch to form Lgr5 stem cells which can differentiate into other limited cell types via a different pathway. This demonstrates plasticity of stem cells.
9.	**N22Q9**	C	Statement 2 is wrong because not the entire base sequence of tRNA is complementary to that of mRNA - only the anticodon region on tRNA is complementary to the codon region on mRNA; Statement 3 is wrong because the bond formation between tRNA and mRNA is hydrogen bonds formed by complementary base pairing between the anticodon and the codon – it does not depend on the aminoacyl tRNA synthetase enzyme;
10.	**N22Q10**	C	Statement 1 – can occur in both Statement 2 – can occur in prokaryotes but not in eukaryotes Statement 3 – can occur in eukaryotes but not in prokaryotes
11.	**N22Q11**	A	1 – viruses also have genes coding for capsid proteins, etc 2 – viruses have genes coding for virus specific enzymes, e.g. lysozyme, etc

<table>
<tr><td></td><td></td><td></td><td>3 – all genes should have a promoter

4 – since viral DNA genomes can replicate, it should have an origin of replication</td></tr>
<tr><td>12.</td><td>N22Q12</td><td>D</td><td>Option D has the most errors (4)
<table>
<tr><th></th><th>part of bacteriophage that binds to host membrane receptor protein</th><th>host membrane receptor protein that binds to bacteriophage</th><th colspan="2">type of viral DNA that enters host cell</th><th>method of entry of viral DNA to host cell</th></tr>
<tr><td>A</td><td>tail fibres ✓</td><td>CD4 ✗</td><td>double stranded ✓</td><td>linear ✓</td><td>punctures cell surface membrane ✓</td></tr>
<tr><td>B</td><td>tail fibres ✓</td><td>OmpC porin ✓</td><td>single stranded ✗</td><td>circular ✗</td><td>through a channel in the protein receptor ✗</td></tr>
<tr><td>C</td><td>base plate ✗</td><td>OmpC porin ✓</td><td>double stranded ✓</td><td>circular ✗</td><td>punctures cell surface membrane ✓</td></tr>
<tr><td>D</td><td>base plate ✗</td><td>CD4 ✗</td><td>single stranded ✗</td><td>linear ✓</td><td>through a channel in the protein receptor ✗</td></tr>
</table>
Note: OmpC porin – outer membrane porin C allows passive diffusion of small molecules across the outer membrane

</td></tr>
<tr><td>13.</td><td>N22Q13</td><td>D</td><td>Statement 1: Incorrect because transfer of plasmid DNA is from F+ cell to F- cell and not form F- cell to F+ cell as stated in the question.
Statement 2: Incorrect because only 1 strand of the plasmid DNA breaks and not both strands as indicated in the question.
Statement 3: Incorrect because plasmid DNA is not transferred as a closed loop but as a open single strand
Statements 4 and 5 are correct.</td></tr>
<tr><td>14.</td><td>N22Q14</td><td>A</td><td>1 refers to the repressor gene like lac I that codes for an active repressor protein that binds to the operator of the lac operon and prevents the transcription of the lac Z, lac Y and lac A genes of the operon.</td></tr>
</table>

			3 refers to the operator. It regulates the transcription of a genes because as transcription will be determined by whether of not a repressor binds to it. 2 could refer to gene coding for RNA polymerase 4 could be allolactose which binds to the repressor and inactivates the repressor such that it can no longer bind to the operator. Hence, RNA polymerase can initiate transcription of the gene.
15.	**N22Q15**	B	A: incorrect. The gene probes just need to be complementary to part of the target sequence. It can even be artificially synthesized. C: incorrect. DNA fragments are not labelled. It's the probes that are labelled. D: incorrect. Longer gene probes will bind more specifically than shorter gene probes as longer gene probes as more sequences will be complementary. B: If temperatures are too high the gene probes will not anneal to DNA fragments. Any hydrogen bonds that form (if at all) will be broken. If temperature is too low, there could be non-specific binding.
16.	**N22Q16**	C	In order for offspring not to have no α-globin mutant alleles, at least one chromosome from the parent needs to have alleles on both loci of chromosome 16 with no mutations. Then if it combines with another gamete also with no mutations for both the alleles on chromosome 16, then the offspring will have no mutant alleles. Hence option C is possible. In order for offspring to have 4 mutant alleles, option C is a possibility as crossing over occur between the two chromosomes resulting in one chromosome having 2 mutant alleles. So if it combines with another gamete also with mutations on both the alleles on chromosome 16, then the offspring will have 4 mutant alleles and have alpha thalassaemia major.
17.	**N22Q17**	C	A: incorrect as the homologous chromosomes have not paired up yet (i.e.no synapsis) and so crossing over cannot have occurred. So cannot confirm that this is a stage of meiosis. B: incorrect as chromosomes are yet to pair up. So cannot confirm that this is a stage of meiosis. C: correct: homologous chromosomes have not paired up although chromosomes are visible, so this is likely to be mitosis. D: incorrect. Even during prophase 1 of meiosis, chromosomes will be made up of sister chromatids and diploid number of chromosomes will be present. So cannot confirm that this is a stage in mitosis.
18.	**N22Q18**	B	The question indicates that there are 2 homologous pairs of chromosomes. During metaphase of mitosis, all 4 chromosomes line up in a single row and then during anaphase the centromeres divide and the sister chromatids, now called daughter chromosomes move to opposite poles of the cell lead by their centromeres. Y thus represents metaphase of mitosis. By meiosis two the homologous pairs of chromosomes would have separated and each daughter cell would have one member of a homologous pair of chromosomes. Hence each cell should have two chromosomes. During anaphase II of meiosis, the sister chromatids of both chromosomes will separate. Z thus represents anaphase II of meiosis.
19.	**N22Q19**	B	The factor has to explain the differences between the 2 groups. Europe and N America had higher occurance of lower digestive tract cancer compared to Africa and S America - this is due to dietry carcinogens – gut related. Likewise lung cancer is due to airborne carcinogens which can be breathed in and affect lungs. Africa and S America are nearer equator and should have more UV light from the sun but people there have less skin cancer. Hence the reason should be genetic factors.

20.	**N22Q20**	A	Degree of freedom is n-1 = 3-1 = 2 Chi-square value lies between 0.1 and 0.05. Hence it is more than 0.05. There is no significant difference between observed and expected values. A is the best answer.
21.	**N22Q21**	B	A cannot as both parents must have e allele to have yellow B_ee progeny. C cannot as both parents must have b allele to have brown bbE_ progeny. D cannot as the result of the cross will lead to a 1:1:1:1 genotypic ratio. B must be the answer.
22.	**N22Q22**	B	A – Wrong as first ETC is involved B – True. In the absence of NADP, the final electron acceptor in non-cyclic photophosphorylation, non-cyclic photophosphorylation cannot occur. This in order to get more ATP, there needs to be a shift towards cyclic photophosphorylation. C – Wrong as both PSI and PSII needed to produce NADPH needed for Calvin cycle. D – Wrong as it is the inhibition of PSI that prevents cyclic photophosphorylation.
23.	**N22Q23**	D	Link reaction involves oxidative decarboxylation. Phosphorylation only happens in glycolysis, Krebs cycle (substrate level) and also in oxidative phosphorylation.
24.	**N22Q24**	C	A is wrong as a messenger molecule that catalyses intracellular changes refers to a ligand – glucagon and not cAMP. B is wrong as G protein is not a transmembrane protein. The transmembrane protein is the GPCR. C is correct. D is wrong as the transmembrane protein is GPCR, not G protein.
25.	**N22Q25**	C	2 – wrong as natural selection is not random and will not result in random changes in allele frequencies. 3 – wrong as even in large populations, it is very difficult to eliminate harmful recessive alleles due to heterozygote protection.
26.	**N22Q26**	A	Species 4 has the most number of nucleotide base sequences that are different from 2 and 3.
27.	**N22Q27**	D	1 – wrong as allopatric speciation is the result of a physical barrier. 3 – wrong. Alleles can be lost from the gene pool, not genes
28.	**N22Q28**	C	Naïve B cells present antigens to T-helper cells to get activated Naïve T cells recognise antigens presented on peptide:MHC complexes of antigen presenting cells to get activated Fc receptors on macrophages can bind to Fc region of antibodies, enhancing phagocytosis.
29.	**N22Q29**	D	D – correct as changes in the antigens (haemagglutinin and neuraminidase) would render any earlier vaccines to be ineffective.
30.	**N22Q30**	D	A&B – wrong as short-term changes in the timing of budburst could not be attributed to the effect of natural selection on long-lived tree species. C – wrong as reducing the time to hatch once a threshold temperature had been reached would lead to even earlier hatching.