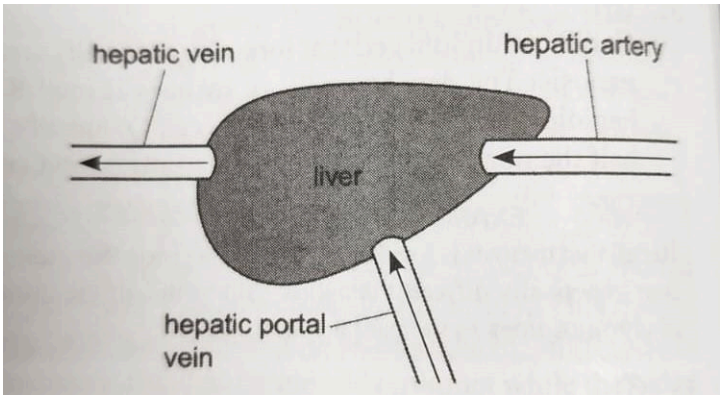


Section A			
Qn No	Answer	Mark	Feedback
1(a)	Haemoglobin pigment in RBC binds to oxygen to transport oxygen in the form of oxyhaemoglobin around the body. RBC has no nucleus - to ensure that there is more room for haemoglobin, maximising the amount of oxygen transported RBC is also biconcave - to increase the surface area to volume ratio of the cell to ensure oxygen can diffuse in and out of cell at a higher rate.	1 1 1	This question was generally well answered by all candidates with good linking of a structure to its correct function. Weaker responses referred to haemoglobin 'transporting' oxygen rather than binding to oxygen or referred to the cells as being 'concave' rather than biconcave. The lack of a nucleus was also often linked to providing more room for oxygen, rather than more room for haemoglobin.
1(b)(i)	Suggest: The person is likely to feel fatigued or breathless easily. Explain: As the person has a lower oxygen saturation of blood than normal, the muscle cells may not receive enough oxygen for aerobic respiration to release energy. Thus, muscle cells may also undergo anaerobic respiration and the person will feel fatigued or breathless with continued physical activity.	1 1 1	Most responses correctly described how breathing or heart rate would be affected or described tiredness. Many went on to explain that less oxygen would be delivered to the muscles or cells for aerobic respiration. Stronger responses suggested the need for anaerobic respiration. Weaker responses gave a more generalised description of less oxygen delivered to the 'body', or just referred to 'respiration' without specifying aerobic respiration. The term 'cellular respiration' was often used without reference to 'aerobic' or 'anaerobic'. Some also tried to explain how walking up stairs would alter the reading on the oximeter.

1(b)(ii)	Pulmonary vein It transport blood directly from lungs right after gaseous exchange has occurred, thus, is highest in oxygen concentration.	1 1	Most candidates answered this well and could justify their choice. Good answers were often succinct. Some candidates mistook the pulmonary artery for the pulmonary vein.
1(c)	Carbon dioxide: transported from body cells to be excreted at the lungs during exhalation. White blood cells/ lymphocytes/ phagocytes/ antibodies	1 1	The reason for transport of carbon dioxide was not well expressed by some candidates who did not mention the lungs, excretion, or exhalation.
2(a)(i)	palisade mesophyll	1	
2(a)(ii)	vacuole	1	
2(a)(iii)	nucleus/ mitochondrion/ Golgi apparatus/ endoplasmic reticulum/ ribosome	1	
2(b)	Suggest: Chloroplasts would migrate towards the top of the cell, and pack closely together Explain: to maximise absorption of light by chlorophyll in low light intensity which is a condition for light-dependent stage of photosynthesis to occur	1 1 1	Almost all candidates understood the need for light energy to be absorbed by chlorophyll. Most went on to correctly relate this to photosynthesis. Weaker responses mistakenly thought that chloroplasts would migrate to the top of the leaf or to the epidermis, rather than within the cell, or that they would spread out so as not to overlap each other.

2(c)	Water moves from xylem to adjacent cells and into the palisade mesophyll cells in the leaf by osmosis; Down a water potential gradient, through the partially permeable cell membrane; Carbon dioxide diffuses into the intercellular air spaces, through the stomata; a down concentration gradient; Carbon dioxide dissolves in the thin film of water on the surface of mesophyll cells; Before diffusing into the cytoplasm of the mesophyll cells down a concentration gradient;	1 1 1	
3(a)	long, pendulous filament; anthers protrude out of flower;	1 1	Focus your answer on stamen only
3(b)(i)	Carbon Hydrogen Oxygen	1	Reject: Nitrogen (only found in proteins)
3(b)(ii)		1	

	White flour generally contains less indigestible carbohydrate than brown flour. (trend) WRF has 2.2g less than BRF (manipulate data) WWF has 8g less than BWF White flour generally contains less fat than brown flour. WRF has 1.4g less than BRF WWF has 1.5g less than BWF	1	This question proved challenging for some candidates. Most candidates had the right idea but did not give a clearly stated difference between named types of flour, instead relying on lists of quoted figures, expecting the figures to indicate 'less' or 'more' without being stated.
3(b)(iii)	Add water to the flour, and mix. Decant mixture, and use the solution for the protein test. To 2cm³ of sample, add 2 cm³ of sodium hydroxide solution. Add copper(II) sulfate solution dropwise, shaking after every drop. Sample turns violet if proteins are present, and remains blue if proteins are absent.	1 1	The test and positive colour were well known. Only occasionally was Benedict's reagent named and even then, the correct positive colour for protein was commonly described. A few candidates mixed up the tests and suggested heating Biuret reagent.
3(c)	Decrease in size and number = decrease in total surface area to volume ratio for absorption of digested food substances Reduced absorption of digested food substances such as glucose and amino acids into bloodstream, and fats into lacteals More digested food substances may be egested due to impaired absorption → leading to nutrient deficiencies (affects peristalsis/ absorption)	1 1 1	Most candidates were able to state that absorption would be reduced as the surface area for absorption was reduced. Only the stronger responses gave further detail, such as stating specific nutrients that would be absorbed (into the bloodstream or lacteals) or egested without absorption.

4(a)(i)	 The diagram shows a cross-section of a liver. A hepatic vein is on the left, a hepatic artery is on the right, and a hepatic portal vein is at the bottom. Arrows indicate the direction of blood flow: away from the liver in the hepatic vein and hepatic artery, and towards the liver in the hepatic portal vein.	2	This was generally answered well by most candidates. The most common error was to show the blood in the hepatic portal vein flowing away from the liver.
4(a)(ii)	hepatic vein	1	
4(b)(i)	Population size in each area may differ significantly thus using the total number of men as compared to ratio/percentage will result in unreliable/inaccurate results.	1	Several candidates correctly identified that the population sizes could be different. Weaker responses made suggestions about the 'figures being too large to fit on a graph'.
4(b)(ii)	A: number of cases increased sharply from 1960 to 1978, from 38 per 100 000 men to 64 per 100 000 men then decreases sharply from 1978 to 2000 to 36 per 100 000 men B: number of cases increased continuously from 1960 to 2000 from 7 per 100 000 men to 27 per 100 000 men	1 1 1	Many candidates tried to support comparisons with data but several missed that the figures were 'per 100 000', or attempted to manipulate the figures incorrectly (e.g. 500 000 cases in B in 1960).

4(b)(iii)	Better education on effects of long-term alcohol consumption/ Increased alcohol tax leading to decreased consumption/ Better health treatments for liver disease	1	This was well answered. Some candidates mistakenly gave a reason for alcohol consumption increasing and a few mentioned reasons why people gave up smoking.
4(b)(iv)	Any two from: 1. Increased reaction time / slower reaction time 2. Reduced self-control 3. Shrinkage of brain volume 4. Poor motor coordination	1	A wide variety of correct effects were mentioned. The most common incorrect answer was 'decreased reaction time', where the candidate could have been confusing it with 'slower reaction time'.
4(c)(i)	The organ where the hormone binds to and exert its effects to carry out a response		
4(c)(ii)	Glucagon is a hormone secreted by the islets of Langerhans in pancreas into the bloodstream when the blood glucose concentration drops below normal. When bound to receptors in liver cells, glucagon promotes/stimulate the breakdown of stored glycogen to glucose. And conversion of amino acids/fats into glucose. Glucose is released into the bloodstream, increasing blood glucose concentration back to normal.	1 1	The most common misconception was that glucagon itself was directly converting the glycogen to glucose rather than stimulating the conversion.

5(a)	temperature/ pH of sewage	1	
5(b)		4	
5(c)	Microorganisms contain DNA (genetic material) which contains genes, with each gene made up of sequences of nucleotide bases. These bases are arranged in triplets (codons), where each triplet codes for a specific amino acid. Different microorganisms have different sequences of triplets in their genes, leading to the production of different amino acid sequences, and therefore, different enzymes.	1 1 1	This was challenging for most candidates. They tended to ignore the context of the question and write what they knew about DNA structure or generally described protein synthesis.
Section B			
6(a)(i)	Size and scale Axes with units (x-axis: year y-axis: global natural rubber production in million metric tonnes (MMT)) Points plotted correctly, allow 1 misplot Bars equal width and equal width apart	1 1 1 1	Most candidates were able to demonstrate their skills in providing well-constructed bar charts. Suitable scales were mostly used and chosen to make plotting the points clear. A small proportion of candidates connected the

			bars or drew a line graph.
6(a)(ii)	percentage increase $= (12.5 - 6.8)/6.8 \times 100\%$ $= 83.82$ $= 83.8 \%$	1 1	
6(b)	With rainforest being replaced with a single species of plant, plant biodiversity is reduced → extinction of species dependent on the natural forest ecosystem, animal biodiversity is also reduced Lower plant density as crops are spaced further apart than natural forest → less effective as a carbon sink as compared to a rainforest → higher temperatures	1 1 1 1	Strong responses gave succinct accounts that covered a range of consequences. Weaker responses often repeated points unnecessarily or gave accounts that centred on one or two consequences.
6(c)	phloem (tissue)	1	
7(a)	afferent arteriole is wider/ larger than efferent arteriole high hydrostatic pressure in glomerular capillaries for ultrafiltration to occur efficiently capillary wall/ Bowman's capsule wall are partially permeable, allowing only small molecules e.g. glucose, amino acids to pass through but not large molecules e.g. plasma proteins, blood cells to pass through for ultrafiltration	1 1 1 1	
7(b)	presence of blood in urine presence of plasma proteins in urine	1 1	

7(c)(i)	Maintenance of a relatively constant internal environment within narrow limits Stimulus that deviates from the normal condition → Corrective mechanism returns body back to normal condition	1 1	
7(c)(ii)	Kidneys regulate blood water potential with the influence of ADH to produce more or less urine	1	
8E(a)(i)	Any two from: 1. More alveoli in non-smoker than long-term smoker 2. Average size of an alveolus is much larger in long-term smoker 3. More holes/ pores in alveolar walls in long-term smoker	1 1	Most candidates could see a relevant difference but did not give a precise description. The most common omission was to describe the 'alveoli', rather than the 'walls of the alveoli' as having 'holes'. Only stronger responses described there being 'fewer' or 'larger' alveoli or recognised that they had a smaller surface area. Some suggestions were not visible from the photos, e.g. inflammation and lost elasticity.
8E(a)(ii)	Decrease in number/ increase in average size of alveoli decreases SA:V, decreasing rate of gaseous exchange between alveoli & capillaries Holes/ pores in alveolar walls will cause air to leak out of the lungs, decreasing lung elasticity and volume of air that can be inhaled in each breath Emphysema will result, where less oxygen will diffuse into the	1 1 1	Many candidates made the link to less gaseous exchange at the alveoli, and even more understood consequences on breathing, heart rate or tiredness. Some candidates gave an explanation about less oxygen in the body rather than in the blood or did not state that it needed to be delivered to the cells for aerobic respiration.

	blood to be supplied to body tissues – _heart issue Lack of oxygen leads to breathing difficulties/ wheezing/ breathlessness/ fatigue	1	
8E(b)	Consuming too much carbohydrates leads to increase in blood glucose for prolonged periods, increasing the risk of type 2 diabetes. Consuming too much carbohydrates with lack of exercise causes excess to be converted to fat. Consuming too much fat and high body fat increases risk of atherosclerosis. Atherosclerosis can lead to less oxygen and glucose being supplied to cardiac muscle, increasing risk of heart attack when cardiac cells die. Heart is not able to effectively pump blood around the body, which may lead to brain and body cells being deprived of oxygen and glucose.	1 1 1 1	This question was usually well answered by those candidates who recognised the health focus of the question as they covered a range of health issues. Weaker responses did not specify the location of the fatty deposits, although they could describe the general consequences of this.
8O(a)	The lens focuses light onto the retina by refracting (bending) light rays. It changes shape, becoming thinner or thicker, to adjust the focal distance in a process called accommodation. This allows for clear vision of objects at different distances, ensuring sharp and focused images are formed on the retina.	1 1 1	This was generally well answered. Candidates appreciated that the lens could change shape for accommodation. A common error was to use 'reflect' instead of 'refract'.

8O(b)(i)	Cataract being a cloudy patch would affect the clarity of the lens, blocking light from entering the eye, reducing light refracted on retina. Image is dimmer. Cataract reduces the elasticity of the lens, resulting in the lens not able to become thinner or thicker optimally during accommodation reflex. Image may be blurred. Cataract causes light rays to be dispersed. Refraction of light rays by then lens will not be optimal, and not focus sharply on retina. Image may be blurred.	1 1 1	Candidates correctly stated the effect of the cataract blocking light from entering the eye but fewer stated that it would not reach the retina. Many candidates knew that the image produced would be blurred, but fewer talked about the image being dimmer.
8O(b)(ii)	A higher percentage of 42.9% of people with diabetes developed cataracts compared to 15.7% of people without diabetes developing cataracts. Diabetes may lead to an increased chance of developing cataracts, as shown by the 27.2% increase. Limitations 1. The sample size between the two groups of people is significantly different. People with diabetes only make up about 10% of the sample size of people without diabetes. 2. There could be other factors that could be causing the formation of cataracts, that are unaccounted for e.g. genetic background, other health conditions.	1 1 1 1	Most candidates were able to establish a link between diabetes and the development of cataracts and could support it by calculating percentages for comparison. Identifying limitations proved more difficult but several candidates recognised that the sample sizes were not the same. Improvements were suggested but not required by the question.