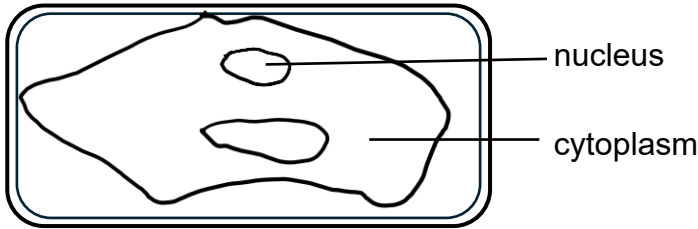


TKGS SEC 4 BIO PRELIM P2 2025
MARKING SCHEME

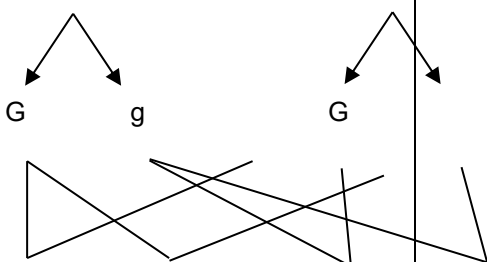
Paper 2 (50 m)

Q		Ans	Mark	Remarks
1	(a)	Temperature of solutions; Particles move faster at higher temperature / cells or cell membrane are destroyed at higher temperature; Duration of experiment; Longer duration allows more time for substances to diffuse; R – size of tissue / type of tissue / freshness of tissue / concentration of solution / volume of solution / container size / humidity / temperature of room / location	2	This was not answered well with poor reference to the question context. Answers were vague and not specific. Explanations were also not specific. For example, temperature of solutions is correct, but students did not explain in relation to kinetic energy of molecules in solution.
	(b)	Active transport; As concentration of oxygen increases from 0 to 20 arbitrary units, rate of potassium ion uptake increases from 7 to 100 arbitrary units; Increased rate of aerobic respiration to release more energy; R – no units in description of data	3	Many answers did not include reference to data. Some data lacked units. Common mistakes include interpreting the main method as diffusion.
	(c)	Discs from the same root tissue will have minimal differences in concentration of K^+ ions; To improve reliability of data; R – improve accuracy / make the experiment fair	2	It is incorrect to write that all discs from the same root tissue have the same concentration / water potential. Reference should be made that the concentration / water potential difference is at a minimum compared to using discs from different root tissues.
	(d)	<i>Drawing of a plasmolysed cell;</i> <i>Correct labelling of nucleus and cytoplasm;</i>	2	Many answers did not include vacuoles. Those that did, the size of

					the vacuoles were too big. A plasmolysed cell's vacuole should be smaller in size.
2	(a)		Urea;	1	This was well answered.
	(b)		Glomerular filtrate has higher water potential than urine; Water molecules are selectively <u>reabsorbed</u> along the tubules; Into the blood; By osmosis;	Max 3	Most answers stated the correct comparison of water potential between glomerular filtrate and urine. Many answers failed to include "reabsorbed", into the blood and by osmosis.
	(c)	(i)	Glomerulus membrane (basement membrane) becomes fully permeable; No longer prevent large molecules e.g. proteins from moving out of the blood; Into Bowman's capsule;	Max 2	Many answers were not specific to link the damaged glomeruli to its partially permeability membrane. Many answers did not interpret that proteins are large molecules. Instead, they explained incorrectly that the proteins cannot be selectively reabsorbed. Many answers also failed to mention that the glomerulus filtrate was first formed in the Bowman's capsule.
		(ii)	Carbon, hydrogen, oxygen, nitrogen; Amino acids;	2	This was well answered.
3	(a)		Proteins in faeces are broken down/decomposed; By bacteria/fungi; Amino acids formed are absorbed into the plant tissues; Amino acids are used to form new protoplasm / any function of proteins;	Max 3	This was not well answered. Majority of answers did not specify the decomposition of protein in faeces into amino acids, so that the amino

			R – proteins are absorbed into the plant and broken down into amino acids.		acids are able to be absorbed into the plant tissues. Proteins are inferred as large molecules, so they are unable to be absorbed into the plant directly. Hence the sequence of writing has to be done right. Majority of answers were correct in the paraphrasing of the word “growth” in the question into the functions of proteins.
	(b)		Nutrient-poor;	1	The reason why the plant benefits from the relationship is due to nutrient-poor soils.
	(c)		Nectar provides glucose; Oxygen in the chamber / enters from the atmosphere via the openings; R – oxygen from photosynthesis	2	This was well-answered with correct reference to the context.
4	(a)	(i)	Stomach; (label + name correctly)	1	This was well answered. Some students labelled without naming, losing all marks from this section.
		(ii)	Small intestine; (label + name correctly)	1	Majority of students made the mistake of answering large intestine. Large intestine function is to absorb water but small intestine function is to absorb nutrients, including water. As small intestine is longer and before large intestine, most of the water is already absorbed in small intestine before reaching large intestine

		(iii)	Rectum; (label + name correctly)	1	Quite a number answered anus or large intestine instead of rectum. Anus is a muscle controlling the release of waste from rectum, large intestine function is to absorb water and mineral salts, not store faeces.
	(b)	(i)	Liver; (correct position + name correctly)	1	Common mistakes: 1. Too small, liver is same size if not larger than stomach 2. Liver is beside and behind the stomach, many students placed the liver too low or too high. Stomach rests directly against the diaphragm, so nothing in abdomen can be higher than the stomach. 3. Pancreas is not related to bile at all.
		(ii)	- breaks up/emulsify large globules of fats into smaller droplets; - increases SA:vol of fats; - faster fat digestion + lipase;	Max 2	Common mistakes: 1. Break down is not the same as break up, break down is for enzyme action and chemical digestion, break up is for physical digestion. 2. Fail to mention faster/higher rate of digestion 3. Fail to mention lipase If this question had more marks, students are also expected to state the products of fat digestion by lipase (glycerol and 3 fatty acids)
	(c)	(i)	Villus;	1	Quite a number of students answered microvilli. Although there is microvilli at the end of that label, what is being labelled is the entire structure, not a

					small part of a cell. Microvilli would be the answer if the diagram was a single epithelial cell instead of wall of small intestine.
		(ii)	- cannot maintain steep conc gradient of digested food substances between lumen and blood; - rate of absorption of digested food substances will be reduced; R – less food absorbed	2	Many students failed to distinguish between (i) and (ii), linking the 2 answers together. Another common mistake was talking about surface area to volume ratio instead of concentration gradient.
5	(a)	(i)	- more black moths are eaten by predators; - black moths are not able to camouflage/blend in with the bark/surrounding; - less black moths survive to reproduce;	3	R: pale moth able to hide/escape from predator (these are behaviours) R: they mutate to adapt to the environment (mutation is random and does not start occurring because of the environment colour)
		(ii)	Increase;	1	
	(b)	(i)	Gg + Gg;	1	
		(ii)	(i) Parental phenotype pale speckled moth pale Parental genotype Gg Gg Gametes g Random fertilisation 	4	R: white R: Punnet's square

			Offspring genotype GG Gg Gg gg Offspring phenotype pale speckled pale speckled pale speckled black Proportion of black moth: 25% Headings; F1 genotype; F1 phenotype; %;		
		(iii)	- a form of gene that exerts its effect/expresses itself in the presence of other alleles / - gives the same phenotype in a homozygous or heterozygous condition;	1	R: any ref to likely / chance R: dominant allele is the gene... R: dominant allele is the trait... Note to candidates: Many candidates have the misconception that the most common allele in a population is the dominant one. This is not true. An example would be the Huntington disease allele in humans. It is dominant, harmful, and less common than the normal, healthy and recessive allele.
6	(a)	(i)	- Increase total cross-sectional area + ref to data in table; - Volume of blood flowing through into capillaries remains the same/blood is split into many small tubes; R – surface area/area	2	Many students wrote the narrow diameter of capillaries will lower the BP which will lower the blood flow rate. In theory, pressure of fluid in narrow tubes is higher as there is more friction against the wall of the tube as fluid passes through it. Although the diameter of an individual capillary is significantly smaller than the diameter of an arteriole/artery, the BP in capillaries is lower than arteries because there are

					vastly more capillaries in the body than there are other types of blood vessels.
		(ii)	- More time for efficient/maximum exchange of substances between blood and tissues;	1	Many students did not refer to the regions where substances are exchanged, ie. blood and tissues. A few students described movement of oxygen molecules from cells to blood and carbon dioxide from blood to cells without applying to the context of the question, ie. skin. Skin cells do not produce oxygen.
	(b)		Low BP / Slow blood flow / Blood flows back to the heart / Smooth blood flow (any 2);; R – Unidirectional blood flow. Blood always and only flows in one direction in the body so there is no mark given to this. It's just like describing blood flows continuously! R – Deoxygenated blood. Pulmonary vein carries oxygenated blood.	2	Some students still think that all veins carry deoxygenated blood.
	(c)	(i)	Lungs;	1	
		(ii)	Aorta;	1	
		(iii)	- fibrinogen cannot be converted to fibrin; - red blood cells cannot be entangled/trapped;	2	Many students got the reactions mixed up. For example, some wrote fibrin is converted to fibrinogen. Some students simply described the whole blood clotting process. R – blood cannot be trapped/entangled

		(iv)	- patients may suffer from massive bleeding / wound cannot heal;	1	R - infection
7	(a)	Photosynthesis;		1	Well answered. Some students misidentified the white bar as the data instead of label.
	(b)	Amount added – Amount removed = 50 – 140 = - 90 billions of tonnes		1	Many students answered 140-50 instead of 50-140. Carbon produced is amount of carbon added to the atmosphere in the context of the data, so it should be calculated as 50-140.
	(c)	- deforestation/cutting down of trees; - less carbon dioxide removed + photosynthesis;		2	Decomposition is rejected as it is carried out by decomposers microorganisms which respire, and this data has already been accounted for. burning of fossil fuels and using cars is already in the data under combustion. Many students also failed to mention photosynthesis as the process responsible for removing carbon dioxide. Key processes must always be named.
	(d)	- plastics broken down to microplastics; - ingested + accumulate in body tissues; - conc increases when animals of higher trophic levels eat organisms with microplastics;		Max 2	Some students mixed up bioaccumulation and biomagnification. Bioaccumulation is within a trophic level, biomagnification occurs across trophic levels. Another common error is failure to mention ingestion/consumption by

Section B (10 m)

9	(a)	- Between 3 am to 10/11 am (approximate); (Ignore if students also write between 7 pm to 10 pm) Either: - blood insulin level is lower than what the body needs; - blood sugar/glucose is not absorbed into the tissues; Or: - amount of insulin the body needs is the <u>highest</u> during this time - the need for insulin is due to the stimulus of high blood glucose / above norm	3	A: 6-9am, 3-9am, any reasonable <u>range</u> of timings. R: singular point in time e.g. 7am. R: insulin used up R: insulin converts glucose...
	(b)	- when blood <u>glucose</u> level is lower <u>than normal</u>; - islets of Langerhans/pancreas secretes more glucagon + blood; - stimulates conversion of glycogen to glucose + liver/skeletal muscle cells; - glucose released into blood OR raises blood glucose level back to normal;	Max 3	Ignore: blood sugar level This pathway is specific to glucose Ignore: "too low" – whose opinion is this? R: glucagon converts... (glucagon is not an enzyme) Note: There is no "excess" glycogen. This is a wrong concept.
	(c)	- transcription + DNA template of insulin is used to form mRNA; - nucleus; - Using base-pairing rule. Give example: Adenine of template strand pairs with uracil of mRNA (accept other examples); - mRNA translated + ribosome; - in cytoplasm;	Max 4	Suggested answer: Two strands of DNA containing the insulin gene separate One strand serves as the template strand to form the mRNA in transcription by complementary base pairing. Adenine on DNA pairs with uracil on mRNA.

			- Base sequence of mRNA determines the sequence of amino acids; - amino acids are joined to form insulin polypeptide/protein;		mRNA exits the nucleus into the cytoplasm Ribosome binds to mRNA and translates the codons into a polypeptide by joining the correct amino acids together.
10	(a)	(i)	amniotic sac/uterus/placenta 1. provides protection against mechanical damage ; 2. provides sterile environment / no entry of pathogens / provides barrier to pathogens ; amniotic fluid 1. allows fetus to move as it grows / stay buoyant / 2. acts as lubrication for movement; 3. maintain temperature of fetus; 4. prevents compression of fetus / acts as shock absorber; placenta prevents mixing of blood between fetus and mother ; allows antibodies from mother to cross to fetus;	Any 2	R – baby. Babies refer to fetus after they are born. The question is about growth of fetus so not born yet R – Amniotic fluid lubricates birth canal. Again, the question is about growth of fetus so not born yet
		(ii)	Umbilical cord/artery transports urea/carbon dioxide to placenta; Urea/carbon dioxide + <u>diffuse</u>; Across placenta; From fetal blood to maternal blood;	Any 3	R – Umbilical cord transports fetal blood to maternal blood. Fetal blood and maternal blood do not mix!!
	(b)	<i>Describe general trend across all age groups:</i> In 1975, fertility rate increases from 0 at 17.5 years old to (range 150-153) units at 28 years old + decreases to 0 unit at 55 years old. In 2010, fertility rate increases from 0 at 17.5 years old to		3	Most students who scored 1 m described the general trend across all groups.

		(range 121-123) units at 28 years old + decreases to 0 unit at 55 years old; <i>Compare the maximum fertility rate in both years:</i> - <u>decline</u> in maximum male fertility rate; - from (range 150-153) in 1975 to (range 121-123) arbitrary units in 2010* <i>Compare the age when males have the highest fertility rate in both years:</i> - age for males to have highest fertility rate has <u>increased</u>; - from 27.5 years old in 1975 to 32.5 years old in 2010*		
	(c)	- to produce gametes with half the number of chromosomes; - so as to restore the original number of chromosomes after fertilisation;	2	Some students described the importance of mitosis. Many students do not know the importance of producing haploid gametes.