

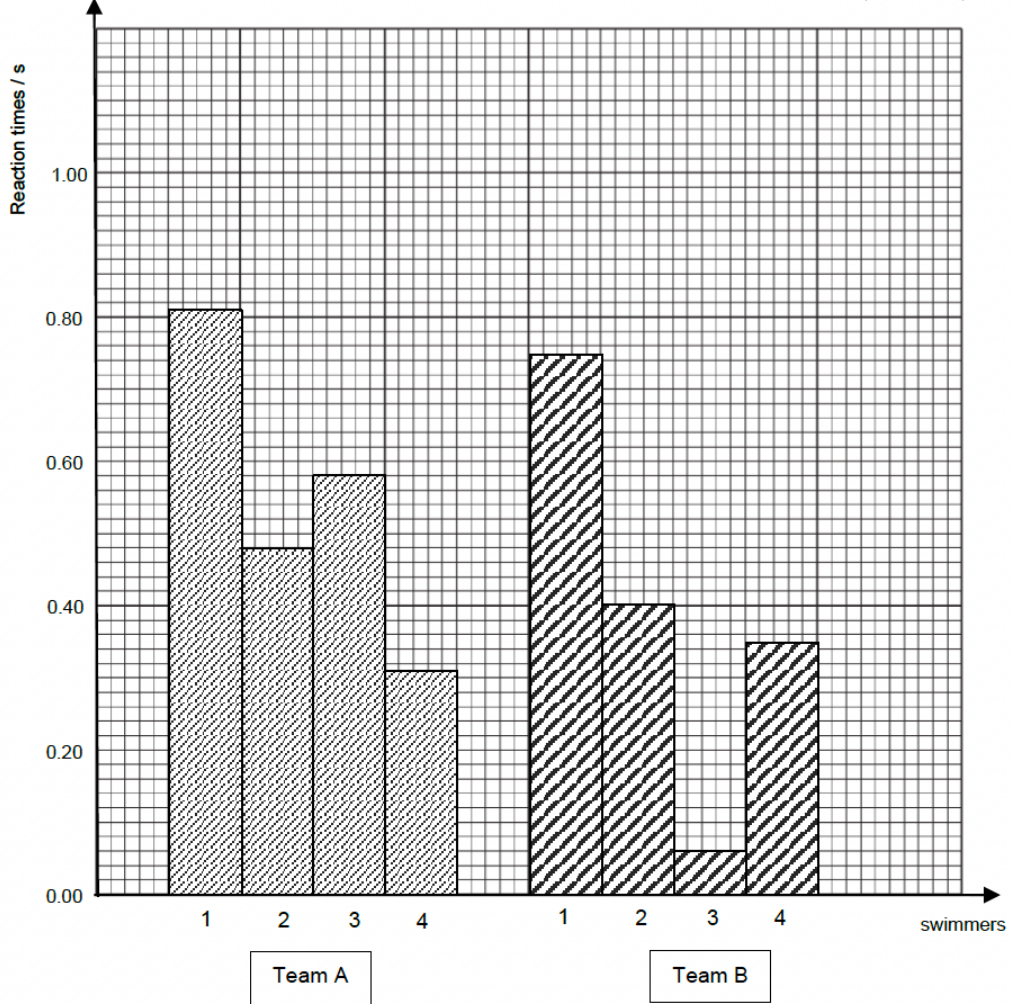
PLMSG 2024 Sec 4 Express Biology Prelim (6093)
Marking Scheme

Paper 2
Section A

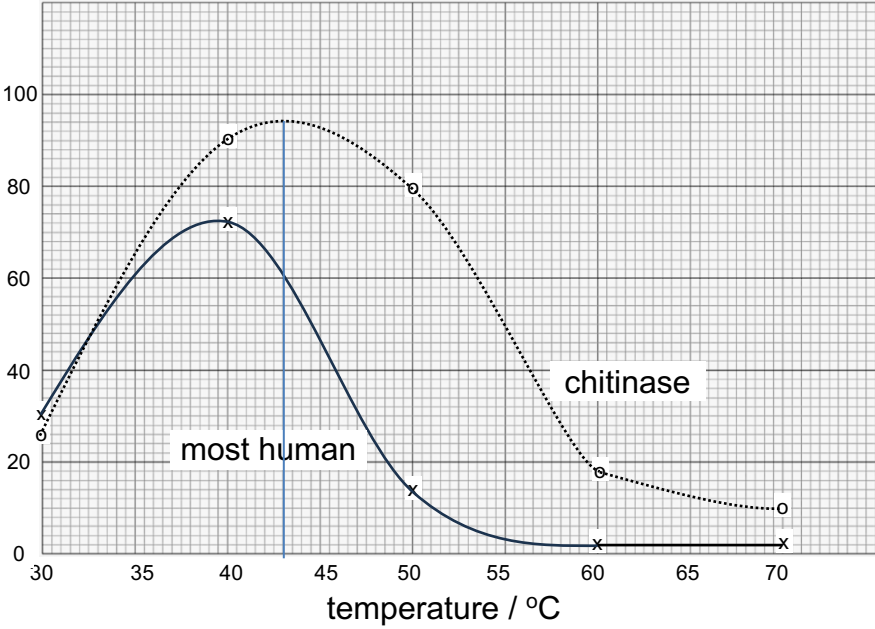
1	a	1, 5, 2, 4 Every 2 correct = 1m	2
	b i	- J receives blood from left ventricle that has a thicker muscular wall, generating a higher pressure - M receives blood from right ventricle, has a less thick muscular wall	1 1
	b ii	- Presence of a larger lumen, reducing pressure - Blood in K and L travelled through capillaries	1 1
	2a	A - Microvilli - Increase surface area to volume ratio for faster absorption of digested food molecules B - Mitochondrion - Undergoes aerobic respiration to release energy for active transport of digested food molecules	1 1 1 1
		- Toxin causes more chloride to be released into the small intestine - Water potential in small intestine is lower than in blood - Net movement of water molecules from blood into small intestine by osmosis	1 1 1
	c(i)	An agent that resembles pathogen, preventing infectious diseases by stimulating white blood cells to produce antibodies quickly.	1
	c(ii)	- More pathogens . diarrhoea/fever in non-vaccinated group + QV - Some vaccinated people did get symptoms so vaccine is not 100% effective + QV	1 1
3	ai	- Increase in temperature increases the K.E of molecules involved in photosynthesis - More effective collision between enzyme and substrate molecules, more E-S complex formed. - Increasing the rate of diffusion of carbon dioxide into leaves, more carbon dioxide available for photosynthesis. - Increases rate of transpiration, more water can be supplied to the leaves for photosynthesis	1 1 1 1
	aii	- Lower concentration of water vapour in the air / steep water vapour concentration gradient between air and intercellular air spaces - Increased diffusion of water vapour of of leaf via stomata - Stomata closes when rate of water loss / transpiration is higher than rate of water absorbed, less carbon dioxide can enter.	1 1 1

	aiii	- Record the difference in concentration of carbon dioxide between air in and out / chamber 1 and 3 / before and after - Divide by time / 15 min	1 1
	b ii	- Carbon dioxide uptake at 35°C is 90 ug per hour per cm² of leaf which is less than carbon dioxide used in leaf - Carbon dioxide is produced by cells during aerobic respiration - Carbon dioxide released by cells also used for photosynthesis	1 1 1
	biii	- Reduces extraction of non-renewable fuels - Temporary removes carbon dioxide - Does not cause further increase in greenhouse effect / global warming - It is a sustainable process	1 1 1 1
4	a	- Ultrafiltration occurs at Bowman's capsule, region 1, where small molecules like glucose, urea and salts are forced out of blood plasma into 1 - Protein molecules are too large to pass through the partially permeable membrane, hence 0 mg per cm³ at 1 - At region 3, loop of Henle, all glucose have been selective reabsorbed back into the bloodstream by active transport, hence 0 mg per cm³ of glucose at region 3 - Selective reabsorption of some salts back into the bloodstream at 3, hence 300 mg per cm³ in 3 as compared to 320 mg per cm³ in 1. - Selective reabsorption of water back into bloodstream at 3, causing urea concentration to increase from 30 mg per cm³ at 1 to 2000 mg per cm³ at 3	1 1 1 1 1
	b	- Drink A - It increases volume of urine - Increase in temperature results in more sweat produced to remove excess heat - More water loss in the form of sweat	1 1 1 1
5	a	- Concentration of PCB increases up the food chain + QV - Concentration is much higher in larger organisms + QV - PCB is non-biodegradable and cannot be excreted, hence will accumulate in the body - Concentration of PCB increases along the food chain, resulting in biomagnification, top consumers having highest concentration of PCB	1 1 1 1
	bi	1985 to 1990	2
	bii	- Monitor populations - Controlling the type of net used / mesh size - Alternative sources of fish - Use of laws to monitor / restrict watch weight - No catch zones / protected areas - Use of fish farms - Closed fishing seasons	Any 2

6	a	D, A, B, E, C, F	1
	b	- Meiosis during gamete production ensure gametes are haploid / only has half the number of chromosomes - So that during fertilisation, fusion of the haploid sex gametes will restore the diploid number	1 1
7	a	- Mutations are found in DNA - Asexual reproduction produces offspring that are genetically identical, so any random mutation will be inherited - Sexual reproduction involves two parents and mutation may only occur in one of the parents - Meiosis does not produce genetically identical cells and hence mutation may only be in some of the gametes	1 1 1 1
	B	parental phenotypes unaffected / (sickle) carrier x unaffected / (sickle) carrier parental genotypes $Hb^A Hb^S$ x $Hb^A Hb^S$ gametes Hb^A , Hb^S x Hb^A , Hb^S offspring genotypes $Hb^A Hb^A$ $Hb^A Hb^S$ $Hb^A Hb^S$ $Hb^S Hb^S$ probability of offspring not having the Hb^S allele 0.25/ 25%/ 1/4	
	c	- A has lowest sickle cell allele but medium number of babies born with sickle cell anaemia while B has the highest birth and highest sickle cell frequency - B supports the statement but A does not support the statement, hence there is no link between births and frequency - Higher frequency may be due to the effect of the population density	1 1 1
8	a	Voluntary	1

	bi	 Reaction times / s 1.00 0.80 0.60 0.40 0.20 0.00 1 2 3 4 1 2 3 4 swimmers Team A Team B	2
	bii	• 1st swimmer from both teams slower / longer reaction time + QV • Mean reaction times for swimmers 2-4 similar + QV	1 1
	c	• Nervous system is faster / hormones slower • Use of nerve impulses via neurones is faster than transport of hormones by blood • Allows faster response to escape from danger	1 1 1
9	a	• Mutation leads to variation where some bacteria is more resistant to antibiotics • Antibiotics kill bacteria that do not have the mutation / not resistant • Bacteria who are more resistant have the selective advantage and will not be killed by the antibiotics • Resistant bacteria will survive, reproduce and pass the resistant gene to the next generation • Bacteria can be transmitted from one person to another through + describe one method	1 1 1 1 1
	b	• Reduce misuse of bacteria / do not use for viral infectio • Ensure people complete the course of antibiotics • Prescribe / use antibiotics only when necessary / use less often • Develop new antibiotics • Use a combination of antibiotics • Rotate antibiotics	Any 3

		Isolate patients with antibiotic resistant infections	
	c	- Antibiotics act on bacterial cell walls but viruses do not have cell walls - Antibiotics break up cell membrane but viruses do not have cell membrane - Antibiotics act on ribosomes, inhibiting protein synthesis but viruses do have ribosomes	1 1 1
10	ai	<u>Sticky ends</u>	1
	aii	- Isolate cry gene with restriction enzyme to produce sticky ends - Cut plasmid DNA with same restriction enzyme to produce complementary sticky ends - Mix cry gene and plasmid, use DNA ligase to seal plasmid with cry gene to form a recombinant plasmid	1 1 1
	b	- Cry gene contains amino acid sequence / base sequence which be be transcribed to form mRNA in nucleus - mRNA moves to cytoplasm and attaches to ribosome - mRNA will be translated at ribosome to form polypeptide / protein	1 1 1
	c	- Mutation will elad to variations where there are caterpillars who are resistant to cry gene and those who are not - Those who are resistant has the selective advantage and will not be killed while those not resistant will die - The resistant caterpillar will survive, reproduce and pass the resistant gene to the subsequent generations	2

9	a	 relative enzyme activity / % temperature / °C chitinase most human • Line (L) – line/curve accepted + identify chitinase/most human either by labelling or including a key; • Axes (A) – labelled and correct orientation + all interval labelled; • Scale (S) – occupy at least 70% of grid + no ODD scale (1.5 box etc) • Points – all plotted correctly	4
	b	• Based on student's graph;	1
	c	• Some of the enzyme are starting to denature and can no longer bind to substrate	1
	d	• Higher optimal temperature for chitinase than most human enzyme + QV • Higher activity for most human enzyme at 25 °C; • Some enzymes are still functioning at high temperature (70-80 °C); + QV Any 2 points OR any valid points stated;	2
	e	• <u>Breaks down dead organic matter</u> and return the <u>nutrients to be used by other organisms (example plants)</u>; • <u>carbon dioxide is released</u> during the breaking down of dead matter and <u>returned to the atmosphere</u>;	2

Section B			
10	a	• Photosynthesis converts light energy from the sun into chemical energy in the form of glucose that is consumed by other organisms along the food chain • Photosynthesis produces oxygen as a byproduct. All aerobic organisms, including humans, rely on oxygen for cellular respiration, a process that releases energy from glucose. • Photosynthesis absorbs carbon dioxide (CO₂) from the atmosphere. This helps regulate atmospheric CO₂ levels, which is crucial for maintaining Earth's climate and preventing extreme greenhouse effects/ global warming • Photosynthesis is a vital component of the carbon cycle, balancing carbon among the atmosphere, biosphere, and geosphere.	3
	b	• During day time when photosynthesis is occurring, stomata is open so that carbon dioxide can enter • Water vapour in the leaf will diffuse out of the leaf into atmosphere via opened stomata	2
	c i	• As wind speed increases from 0 to 30 km/hr, rate of transpiration increases from 5 to 25 au • Increase in wind speed blows the water vapour away from the leaves, increasing water vapour concentration gradient between atmosphere and intercellular air spaces • More water vapour will diffuse out of the leave per unit time / rate of diffusion of water vapour out of leave decreases • As wind speed increases from 30 to 40 km/hr, rate of transpiration decreases from 25 to 10 au • Rate of transpiration / water loss is greater than rate of water absorption/water uptake, stomata will close to prevent excessive loss of water	4
	c ii	• Temperature, light intensity, stomata density, air pressure, humidity; Any 2 for 1 mark	1
11	a	• Condition that <u>causes body to function less effectively</u>; • Can be <u>spread from person to person</u> through various means;	2
	b i	• Prevention: one sexual partner or abstain from sexual intercourse + QV to justify OR • male wear condom + QV to justify OR • don't share instruments that are likely to break the skin + QV to justify OR • go to reliable operators if require services that involve needles + QV to justify OR	3

	b ii	• HIV remained <u>dormant in infected person</u> without symptoms or signs; • Infected person may not be diagnosed immediately hence not knowing true reason of being infected; • Any reasonable explanations;	3
	c	• Affects cell wall (osmotic pressure causing cell to burst) but viruses have not cell wall • Affects ribosomes, inhibit protein synthesis but viruses have no ribosomes • Affects cell membrane (unable to regulate movement of substances) but viruses have no cell membrane • Affects production of nutrients/enzyme (e.g folic acid) but viruses cannot produce nutrients/enzymes	3

END OF PAPER