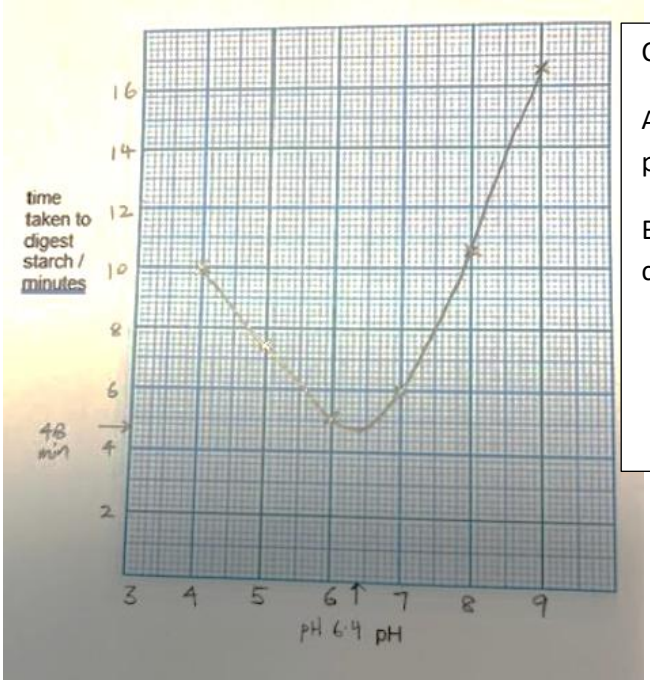
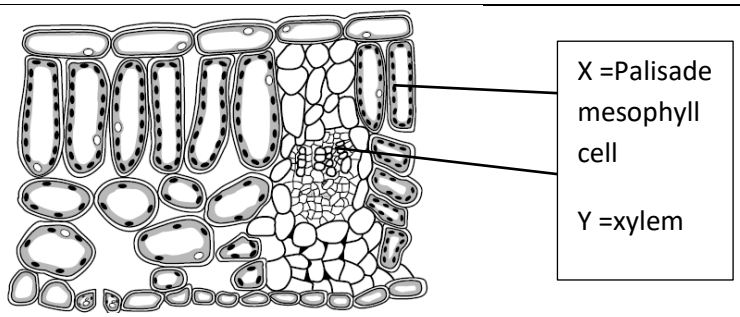
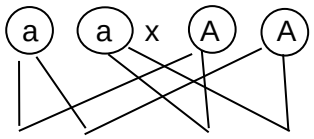
2024 4E SC-Bio 5088 P4 Prelim Exam Marking Scheme

Section A

Qn	Expected Ans	marks	Remarks
1a)	% increase in 0.8%: Working : (8.2-7.5)/7.5 Answer: 0.09333 0.0933 % (3 sign fig)	 1 1	
(b)(i)	rbc in 1.8%: reduced in diameter from 7.5 to 6.0µm 1.8% salt solution has lower water pot than rbc = so water moved out of rbc by osmosis and thus the cell shrunk	 1 1	Poorly done. Data not cited
(ii)	No change in size in 0.9%: water potential of rbc sap is the same as the water potential of 0.9% salt solution.	1	Also accept same salt concentration Water concentration rejected
		5m	
2a	 Coord=1m Accurate pts = 1m Best fit curve =1m		Scale for many students penalised; should not include pH 1-2.
b	Test for starch : add a few drops of iodine solution to starch Result: if starch present, solution turns blue-black. If starch is absent, solution remains yellow/brown.	1 1	
c	Opt pH = read from graph 6.4 (betw pH 6 & 7)	1	Many students did not read from the graph. Cited pH from the table directly not accepted.
d	Starch is digested in the mouth by amylase into maltose. Maltose is digested in small intestine by maltase into glucose	1 1	mention place, enzyme & product
		8m	
3a i)	Heart rate = at rest was 65-66 beats per min but after exercise went up to 110 beats but slowly went back to 68 after few min.	1	Data cited with no units not given credit.

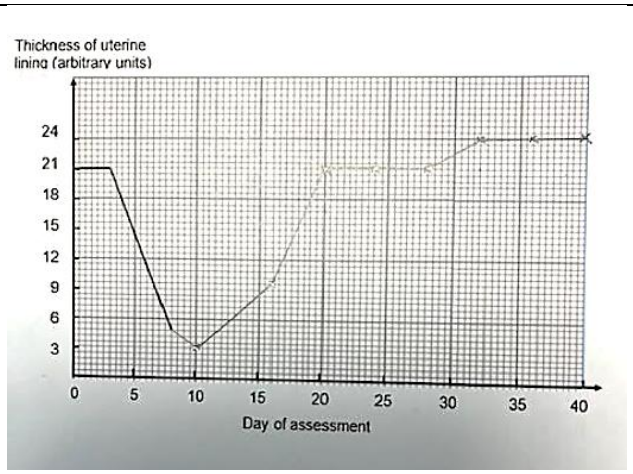
	No. of beats went up bec heart beats faster to send oxygen and glucose quickly to the muscles / muscles need oxygen and glucose for respiration /to provide energy to muscles	1	Common mistake: blood provides energy to the body; blood circulated to the rest of the body (with no mention of the muscles receiving more blood for muscular contractions)
ii)	Percentage of oxygen: slight decrease from 98-99% at rest to about 96% Muscles require oxygen for respiration but lungs not able to get enough oxygen into the bloodstream.	1 1	Almost no student was able to cite the limited capacity of the lungs to obtain sufficient energy to support aerobic respiration. Many students mistakenly wrote that anaerobic respiration kicks in instead of aerobic respiration.
iii)	Faster breathing (increase in breathing rate) OR deeper breathing (depth of breathing)	1	Many cited breathing through nose or mouth (not accepted) without considering how the measure must increase the amount of oxygen supplied.
b	Any 2 of the following: *Emphysema – alveolar wall breaks down = so surface area for gaseous exchange is less*. 1. Pulse rate is usu higher in smokers. They need to pump blood harder to get blood to all parts of body. 2. % oxygen in blood – usu lower than non-smoker. As they are not able to take in maximum oxygen at each breath, oxygen saturation is usu lower.	1 1 1	
		7m	
4a i)		1 1	Many labelled X/Y without the name of the structure or vice versa. They were also some who labelled the chloroplast instead of the palisade mesophyll cell.
ii)	Transpiration	1	
iii)	To prevent any water from evaporating from the soil into the air	1	
b)i)	Least loss: B most loss: A (C B A)	1	
ii)	Plant that lost most water = Plant A The leaves of plant A had more leaves than C and hence, had more stomata for water loss via transpiration. The leaves of plant B were enclosed in a bag that increased the humidity of air. This reduced the water vapour loss of the leaves in B compared to A.	1 1 1	Poorly done question. Candidates cannot see how the answer in 4aii relates to this question part. Many students focused on p/s and respiration instead of the role of transpiration to lose

			water resulting in mass loss.
		8m	
5a i)	Hepatic artery – arrow towards liver; hepatic vein – arrow away from liver	1	Many missed out on this question.
ii)	Hepatic vein	1	
iii)	Gall bladder stores bile	1	Poorly done. Basic recall question.
bi)	1970-1984: Liver cirrhosis mortality increase (130 to 200 cases per million) as alcohol consumption increase (12 to 13) = nearly direct correlation	1	No need data
ii)	1984: alcohol consumption dropped but mortality was still high – took a few years to drop (1988)	1	Many immediately assumed the drop without noticing the high mortality rate.
iii)	Although alcohol is a main risk factor, there are other factors that also affect mortality as there are years when they are not directly correlated. But in gen, there is direct correlation in most years.	1	Any appropriate ans
		6m	
6a i)	Mutation is a random spontaneous change in the gene structure or the number of chromosomes.	1	Poorly done. Candidates clearly did not memorise this definition.
aii)	A gene is <u>a segment of nucleotides on the chromosome</u> [1] which <u>codes for the synthesis of a protein.</u> [1]	2	Most students got this wrong. The terms were highly confused and the lack of clarity in answer suggested a lack of preparation for this topic.
ii)	Mutation caused by: ultraviolet light Alpha, gamma, beta radiation (accept radiation) Chemicals like formaldehyde, tar, lysergic acid, etc	1	Any 1
bi)	H = Aa	1	
ii)	L, M, N	1	All 3
iii)	Parent Genotype aa x AA Gametes cross/ F1 Genotype All Aa F1 phenotype All carriers  Correct	1 1 1 1	Minus 1m if no circle for gametes Max 2m for Punnett Square Students' mistakes include: 1. Incorrect/incomplete genetic diagram 2. Wrong parental genotype 3. Ratio cited as 4: 0 (should be 1 -not penalised)
iv)	0 will suffer from sickle-cell anaemia	1	
		10m	
7a	White blood cells/lymphocytes are able to <u>produce antibodies when stimulated</u> in order to bind to the antigens	3	Students misconceptions include:

	of the pathogens. [1] The pathogens are then clumped together [1], which would be then ingested by the phagocytes through phagocytosis. [1] Also accept: Antibodies can also neutralise the toxins produced by the pathogens.		1. Malaria is a virus. 2. White blood cells contain antibodies. 3. The white blood cells know what to do when they see a pathogen. 4. Antibodies act on bacteria cells only. 5. Confusing antibiotics and antibodies.
b	Through respiratory droplets when an infected person coughs or sneezes and these droplets are inhaled into the respiratory system. [1] Through contact of infected surfaces and subsequently touching of the face and/or eyes. [1]	2	Rejected: Water droplets Many cited contaminated food and water
c	The number of antibodies in the child's blood increased after vaccination and upon infection, the number of antibodies more than doubled. [1] The high number of antibodies allowed the increase in the speed in which the malaria virus is being destroyed [1] hence experiencing milder symptoms.	2	BOD given to increase in number of antibodies. 0 candidates cited data from the diagram.
di	Use of antibiotics is only effective against bacteria and not virus [1], as the antibiotics weakens the cell wall of the bacteria/breaks up the cell membrane of the bacteria/prevents ribosomes from proteins synthesis [1], which the viruses do not have. OWTTE	2	
dii	Creating herd immunity to prevent the transmission to the individuals who are vulnerable and cannot go for vaccination. [1] OWTTE	1	only 1 student cited herd immunity correctly.

Section B

8a	• From the figure, the pyramid of biomass for the food chain follows the shape of a normal pyramid. • The biomass of the tree is the largest of all the organisms within the food chain, and hence is the main provider of energy for all the organisms at the higher trophic levels. • From the figure, the pyramid of numbers has an inversion in its base, as this is due to there being only one singular tree in which the insects feed on. • Following the predator-prey relationship, the number of birds are lesser than the insects and subsequently lesser birds of prey who feed on the birds.	4[1]	Poorly done. Many students simply describe the 2 pyramids with no analysis of relationships between the organisms in the food chain. Many assumed biomass = energy.
b i)	• Increased deforestation has resulted in less trees being able to absorb carbon dioxide from the environment/less able to serve as carbon sinks. • Increased carbon emissions from vehicles and industries due to combustion of fossil fuels has resulted in more carbon dioxide being released.	2[1]	

ii)	<u>At least 2 reference to data – 2[1]</u> • From 0600 to 2000, the photosynthesis rate at 370ppm is lower than that at 550ppm. • The highest rate of photosynthesis at 370ppm is 16umol per m^2 per s while the highest rate of photosynthesis at 550pm is 22 umol per m^2 per s. • Photosynthesis rate increases from 0600 to 1200 as light intensity increases. Photosynthesis rate decreases from 1200 to 2000 as light intensity decreases. <u>Explanation – [1]</u> • The results show that an increase in carbon dioxide concentration brings about an increase in p/s rate, as carbon dioxide concentration is a limiting factor. [1] <u>Prediction – [1]</u> • With a heightened carbon dioxide concentration in the atmosphere, plants in general will be able to benefit from higher photosynthesis and growth rate. [1]	4	Data citing was lacking, a consistent problem in this paper.
		10m	
9ai)			1m – plotting 1m – best fit shape of curve
(ii)	1.Day 10-16: *Day 1-3: thickness = 21 units* *Day 3-8: thickness reduces from 21 to 5 units. Uterus lining breaking down = menstruation* <u>Day 8-10</u>: uterus wall thickness is v low(3 units)= menstruation is on-going but goes a little thicker at day 10 (start of repair) <u>By Day 16</u>: there is increase in uterus lining thickness- uterus wall repaired and thicken = growing and thickening. Oestrogen is produced in ovary = cause the uterus wall to repair and thicken 2. <u>Day 17-40:</u> the uterus wall is thickened and remains thick until day 40. Hormone progesterone is produced in ovary – cause uterus wall to thicken & prepare for implantation. Progesterone also prevent ovulation and further devt of eggs.	1 1 1 1 1 1	Generally reasonably attempted.
b	Pregnant: • Fertilisation takes place in the oviduct (fallopian tube) when the sperm fuses with the ovum to form a zygote. • Embryo will move along the uterus and will embed itself in the uterus lining (called implantation)		Many thought it was the description of the uterine lining post-fertilisation.
		10m	