

2025 FHSS 6093 Pure Biology Prelim Paper 2 Mark Scheme

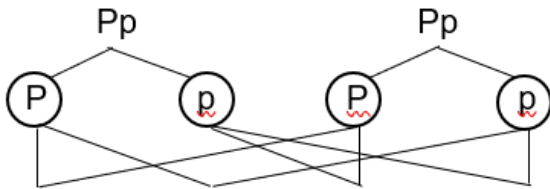
Section A (70m)

Qn		Mark Scheme	Marks	Examiner's Comment
1	a	Chloroplast (reject chloroplasts)	1	Some students ignore the qn's requirement of organelle and wrote chlorophyll
	b	- As light intensity increases from 0 Wm^{-2} to 50 Wm^{-2}, relative rate of photosynthesis increases from 0.0 to 0.8 a.u. (± 0.1) by 0.8 a.u.; - As light intensity increases from 50 Wm^{-2} to 100 Wm^{-2}, relative rate of photosynthesis remains constant at 0.8 a.u. (± 0.1); - As light intensity increases from 100 Wm^{-2} to 455 Wm^{-2}, relative rate of photosynthesis decreases from 0.8 a.u. (± 0.1) to 0.0 a.u. by 0.8 a.u.; - Highest rate of photosynthesis between $50\text{-}100 \text{ Wm}^{-2}$ at 0.8 a.u.;	3	Students who performed poorly failed to provide the full descriptive data with processed data.
	ci	[idea] As light enters water some of it is absorbed hence <u>light intensity decreases as depth increases</u> as light cannot reach the bottom of the sea / ORA - At <u>sea surface</u>, <u>light intensity is likely above 100 Wm^{-2}</u> as <u>rate of photosynthesis is not highest</u>; - Just below sea surface, <u>light intensity is between 50 to 100 Wm^{-2}</u>, therefore <u>rate of photosynthesis is highest</u>; - As <u>depth increases</u>, <u>rate of photosynthesis decreases</u> as there is insufficient light energy for absorption for photosynthesis;	4	Qn is poorly done as most students did not relate Fig. 1.2 and Fig. 1.3
	cii	- Below depth Y, <u>rate of photosynthesis decreases below rate of respiration</u> of Chlorella; <u>Insufficient glucose produced for respiration</u> to <u>release energy for cellular activities / metabolism / survival</u>, leading to cell death;	2	Well done.

2	ai	There will be no change in level 1 and level 2.	1	Poorly done, students failed to appreciate qn context that starch is insoluble hence does not affect water potential
	Aii	Starch is insoluble in water therefore does not affect / has minimal effect on water potential.	1	
	b	- Capillary action - Adhesion and cohesion forces between water molecules with the wall of the tube causes water to rise up the tube.	2	Poorly done. Students not familiar with capillary action and often confuse it with transpiration pull
	c	Solute A must be <u>large</u> enough (so that it cannot pass through the partially permeable membrane).	1	Well done
3	ai	Protease;	1	Well done
	aii	Digest proteins into peptides/polypeptides (reject amino acids)	1	Well done
	b	- Bromelain / enzyme has a narrow optimal pH range / (idea) alkaline water causes pH to deviate from Bromelain optimum pH; - Marinating meat with alkaline water may <u>denature Bromelain</u>, loss of 3D shape of <u>active site no longer complementary to shape of protein</u> hence <u>protein not digested / protein cannot fit and bind / no ES complex formed</u>;	2	Well done
	c	- Fresh pineapple contain active Bromelain which digest gelatin hence jelly is unable to solidify; - Bromelain in canned pineapple has been denatured due to high heat during the canning process;	2	Well done

4	a	Any Two of the following: - pancreatic <u>lipase</u> <u>trypsin</u> / <u>protease</u> - pancreatic <u>amylase</u>	2	Well done
	b	- No lipase produced in mouth and stomach; - Lipid coating can only be digested in the small intestine in the presence of intestinal lipase.	2	Well done
	c	Enzymes only work in solution / when dissolved / in presence of water / inactive when dry;	1	Poorly done. Most students did not appreciate that enzyme only active when hydrated.
	di	Diabetes / diabetes mellitus;	1	Well done
	dii	Any Two of the following: - Insulin injections - reduce carbohydrates intake in diet - regular exercise - AVP (e.g. pancreas transplant) Reject: ref. to organ transplant w/o specific reference	2	Well done
5	a	C, E, F	1	Poorly done. Most students were not cautious in identification of heart components.
	bi	120 mmHg – Systole; 80 mmHg -Diastole	1	Well done
	bii	Any four of the following: - During atrial systole and ventricular diastole; - Muscles in atrium contract and muscles in ventricle relax; - Pressure in atrium greater than pressure in ventricle; - Bicuspid / Atrioventricular valve <u>forced</u> open; - Blood in left atrium / G <u>forced</u> into left ventricle / H	4	Well done

	c	Any three of the following: • <u>Mixing of oxygenated blood and deoxygenated blood</u> between the left and right ventricles; • Oxygen transport becomes less efficient and tissue cells receive less oxygen for aerobic respiration and less energy released; • Heart has to pump harder resulting in fatigue; • Enlarged heart to increase volume of blood pumped to the lungs; • Increased pressure in lungs may cause capillaries in lungs to burst / pulmonary hypertension	3	Most students were only able to achieve credit for the 1 st two points. Most did not elaborate on subsequent consequences.
	d	One mark for each correct interval)	2	Poorly done. Most students were unable to relate data to pressure changes during systole and diastole
6	ai	(E) urethra (F) urinary bladder (G) kidney (H) ureter	2	Well done
	aii	• Tube E carries Semen / seminal fluid / sperm / AVP but Tube H does not;	1	Well done

	b	Presence of glucose/proteins in fluid of diabetic person but absent in non-diabetic person.	1	Well done
	ci	Purple	1	Well done
	cii	- Parental phenotype and genotype correctly represented; - Gametes correctly represented and circled; - Offspring genotype and phenotype correctly represented; - Phenotypic ratio given correctly; Parental phenotype <u>Purple</u> x Purple Parental genotype; Pp Pp Gametes  Offspring genotype; PP Pp Pp pp Offspring phenotype; Purple Purple Purple White Ratio 3 Purple : 1 White	4	Some students represented dominant and recessive allele using different alphabet assignment. This is wrong. During the choice of letter for allele representation, it is suggested that letter chosen should be clearly different for upper and lower case. E.g Q and q Most students did not provide phenotypic ratio to earn the full credit.
	ciii	Mutation;	1	Well done
7	a	Describe: - The indicator turns yellow within 8 minutes for the small hamster whereas the large hamster took 14 minutes / small hamster turns the indicator yellow 6 minutes faster than the big hamster; Explain (Any Three of the following): - This implies that the small hamster releases more carbon dioxide and has a higher rate of respiration; - Small hamster has a larger surface area: volume ratio;	4	Well done for 1 st two points. Most students were unable to score the remaining points to account for higher respiration rate for smaller hamster.

		• Loses heat to the environment faster than big hamster; • Respiration rate higher to generate more heat to maintain its body temperature;		
	bi	• <u>Increased energy demand</u> due to <u>vigorous muscle contraction</u> at higher speed; • <u>Anaerobic respiration</u> occurs in the muscles to <u>release extra / more / additional energy</u> to meet demands of the <u>exercise</u>; OR <u>Insufficient oxygen supply</u> due to <u>limit in breathing and heart rate</u> resulting in <u>anaerobic respiration</u> • <u>Lactic acid formed</u> and accumulated in the body;	3	Well done
	bii	Any Three of the following: • Heart rate remains high to <u>transport lactic acid</u> from muscles <u>to liver</u>; • Increase <u>transport of oxygen</u> to <u>oxidise lactic acid into energy and glucose</u> by liver / <u>oxidises lactic acid to carbon dioxide and water</u>; • So as to <u>repay oxygen debt</u> incurred during the vigorous exercise. • Increase <u>transport of carbon dioxide to lungs</u> to be expelled	3	Well done
8	a	• A vaccine contains an agent that <u>resembles a pathogen</u>, <u>prevents infectious diseases</u> by stimulating <u>white blood cells</u> to quickly produce <u>antibodies</u> when the pathogen invades.	1	Poorly done, most students fail to achieve credit without stating purpose of vaccine to prevent infectious diseases.
	b	• When <u>viral protein</u> is present in the bloodstream, they <u>stimulate white blood cells / lymphocytes</u> to produce <u>antibodies</u> against it. • <u>Antibodies may stay in the blood / plasma</u> for some time / when exposed to the virus, the <u>same antibodies are produced readily / immunological memory by memory cells</u>. • Since <u>antibodies can diffuse</u> from the mother's blood into the <u>foetal blood</u> across the <u>placenta</u>, the antibodies also protect the foetus. Any 2 (max 2) of the following: • The <u>antibodies destroy the virus</u> by <u>attaching to them</u> and causing the <u>surface membrane to rupture</u> OR attaching to viruses, making them <u>unable to bind to the host cell</u>.	Max 4	Most students were only able to achieve partial credits for this qn as they fail to elaborate on the action of the antibodies in the immune response.

		- The antibodies also cause the virus to <u>clump together/agglutinate</u> so that they are <u>easily ingested by phagocytes</u>. - The antibodies <u>neutralizing the toxins</u> produced (act as anti-toxins)		
	ci	- Percentage of people vaccinated increases (over time) + data citation - Greatest increase from 1998-1999 to 2000-2001 + data citation - Lowest increase from 2000-2001 to 2002-2003 + data citation	2	Well done
	cii	Any 2 (max 2) of the following: - Greater public awareness due to public health education - vaccination policy - accessibility of vaccines increased due to lower cost / AVP	2	Well done
	ciii	Virus <u>mutation</u> results in different strains hence new antigens <u>not recognised by antibodies</u> from <u>existing memory cells</u> / <u>gain immunity over new strain of virus</u>.	1	Well done

Section B (10m): Choose One Qn Only

Qn		Mark Scheme	Marks	Examiner's Comment
9E	a	• <u>Transcription</u> in the <u>nucleus</u> synthesised <u>mRNA</u> from DNA; • <u>Translation</u> at the <u>ribosomes</u> synthesised <u>polypeptide</u> from <u>mRNA</u> and subsequently <u>folded</u> and <u>modified into protein</u>;	2	Poorly done. Most students lost marks due to lack of reference to the location of the processes.
	b	• <u>Genetic variations</u> exist within the <u>population</u>; • <u>Organisms with favourable characteristics</u> adapt better to changes in environment, <u>survive to reproduce more offspring</u> [Idea of natural selection] • Alleles resulting in favourable characteristics/traits are passed from parents to offspring. • Over time, populations of the same species separated gather genetic differences resulting in evolution of new species.	4	Well done
	ci	Any Two of the following: • Loss of heat during respiration; • Lost in uneaten body parts; • Lost in undigested materials; • Lost in excretory products;	2	Well done
	cii	• $16 / 10000 \times 100\% = 0.16\%$	1	Well done
	ciii	• <u>Energy</u> that the owls can pass on is <u>insufficient to sustain another trophic level</u> of the food chain;	1	Well done

90	a	- Plotted points accurate; - Correct axes with label and units; 2 lines of best fit (labelled A and B); - Appropriate scale (Reject: odd scale / irregular intervals)	4	Well done for most students. Students who did poorly failed to draw best fit line (pt to pt plot) or lack the label of the graphs or axes
	b	- Increased in urea concentration at first because urea is produced in liver as deamination of excess amino acids still occurs + kidney cannot remove urea; - Blood urea concentration remains relatively constant after 8 hours as no urea was produced once liver was removed; - Urea concentration decreased at first because no urea produced once liver was removed; - Kidney continually excretes urea present in the body as urine until they were removed, hence concentration of urea remained constantly low / slightly decreased.	4	Well done.
	c	- Water potential of blood decreases below norm due to fasting, stimulates (pituitary gland to) release more ADH into bloodstream; - Cells in the wall of collecting duct becomes more permeable to water and more water reabsorbed into blood, returning water potential of blood back to norm.	2	Well done.