

Pure Biology 6093
Set III — Answer Key

Paper 1

1	2	3	4	5	6	7	8	9	10
C	C	D	C	B	B	B	D	C	C
11	12	13	14	15	16	17	18	19	20
D	B	D	B	D	A	D	A	D	D
21	22	23	24	25	26	27	28	29	30
D	B	C	B	B	C	D	D	C	D
31	32	33	34	35	36	37	38	39	40
B	D	D	D	B	C	A	C	A	C

Paper 2

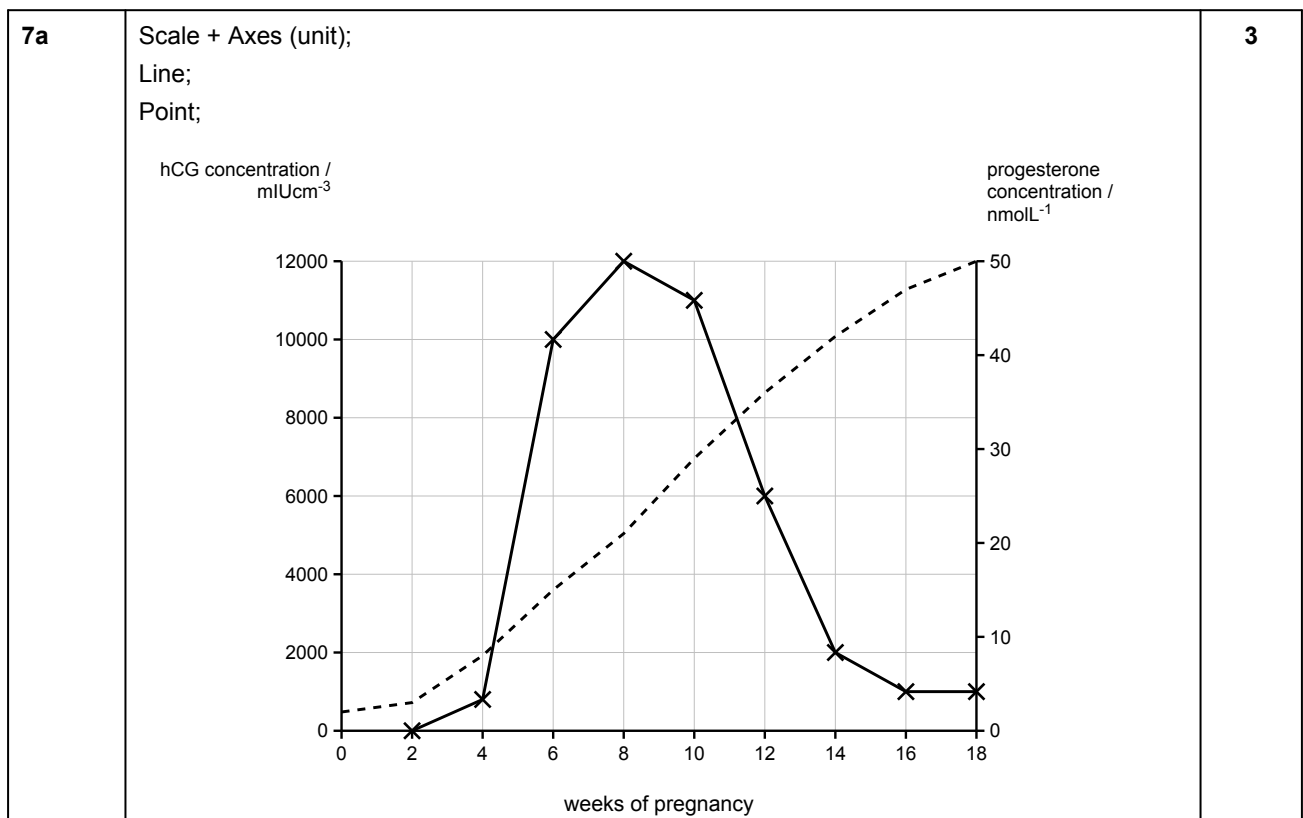
1a	E rough endoplasmic reticulum F mitochondrion G nucleus 2 correct 1m, 3 correct 2m	3
1b	Chemical substance produces by endocrine gland; transported in the bloodstream to its target organs where it exert its effect;	1 1
1c	- Increased blood glucose concentration above set point stimulates (β cells of) islets of Langerhans of the pancreas to increase insulin secretion; - Insulin travels in bloodstream to liver / muscles; - Stimulating increased uptake of glucose & conversion of glucose to glycogen; - Decreasing blood glucose to set point (A: 70-100 mg/dm³)	1 1 1
1d	Spray is less invasive than skin injections / doesn't have to pierce through the skin; Spray is faster acting than tablets + diffuses directly into blood; Proteins in the tablets might be denatured from proteases in the digestive system;	Any 1
2a	cellulase	1
2b	ensure no net movement of water molecules into the cells / AW; prevent the cells from increasing in volume and bursting / AW;	1 1
2ci	As light intensity increases at first, rate of photosynthesis increases as light intensity is the limiting; at high light intensities, rate of photosynthesis remains constant / reaches maximum / no longer increases; showing that light intensity is no longer limiting ;	1 1
2cii	(651-394)/394 x 100%; minus 1m if not 2sf (65.22);	2
2ciii	enzymes involved in photosynthesis denature; photosynthesis to stop / wilting / leaves fold up / stem droops;	1 1

3ai	– Wall is made up of a single layer of cell to reduce diffusion distance, so that gases exchange between the alveoli and the bloodstream can take place quickly – Close proximity of the alveoli to the blood capillary to reduce diffusion distance for faster rate of gases exchange	1 1
3aii	– Biconcave in shape, increasing surface area to volume ratio for faster diffusion of oxygen into the cell – No nucleus to have more space to contain more haemoglobin to carry more oxygen	1 1 (max 1)
3bi	– Thick layer of mucus (smoker) – Cilia paralysed (smoker) – Smaller air space (smoker)	1 1 1 (max 2)
3bii	Irritants / Tar	1
3biii	Unable to remove the bacteria trapped in the mucus; Mucus build up and result in persistent coughing and breathing difficulties and lung infections	1 1

4a	The right ventricle in the fetus contains mixed blood / blood has a higher concentration of oxygen while the right ventricle in an adult contains deoxygenated blood; The foramen ovale allows oxygenated blood from the umbilical vein to mix with the deoxygenated blood from the vena cava;	1 1
4b	As the cross-sectional area of the vessel increases / when branching occurs, the blood pressure in the vessel decreases, slowing blood flow through the body tissues; There is more time / longer duration for the blood to flow through the tissue, increasing the efficiency of exchange of substances such as oxygen and nutrients between the capillaries and the tissues;	1 1
4c	The mothers blood <u>plasma</u> contains <u>antibodies a</u> while the surface of the <u>red blood cells</u> of the fetus has <u>antigen A</u>. When <u>antibodies a</u> comes into contact with <u>antigen A</u>, <u>agglutination / clumping</u> occurs;	1 1

5ai	Allele is an alternative form of the gene. Heterochromia is an alternative form for the eye colour gene.	1
5aii	1, 5, 7, 9, 15, 16;	1
5aiii	1 heterochromia : 1 no heterochromia; (rej: 50%) 13 is homozygous recessive / 13 has no dominant allele for heterochromia / 13 has only recessive alleles; 7 is heterozygous / 7 has 1 dominant and 1 recessive allele;	1 1 1
5aiv	the expected ratio is a mathematically calculated value that is true for large sample sizes only. Since dog 9 and 10 only has 2 children (small sample size) the observed ratio does not have to be the same as the expected ratio	1
5bi	Codon for heterochromia is GCA different to GGC in normal dogs; Different amino acid formed + different protein formed in eye colour;	1 1
5bii	Mutation;	1

6ai	As altitude increases, both atmospheric pressure and oxygen concentration decrease; Correct comparative data quote of altitude and atmospheric pressure or oxygen concentration, with units; Non-linear decrease; Decrease in oxygen concentration proportionate to decrease in atmospheric pressure;	1 1 1 1 (max 2)
6aii	-34kPa	2
6b	Lower atmospheric pressure / oxygen concentration • Lower concentration of / less / oxygen in, alveolar / inspired / inhaled air; • Decreased, diffusion / concentration gradient; • Between alveolus and capillary (ref to concentration gradient); • Less oxygen enters capillaries / the blood; • So fewer molecules of oxygen combining with haemoglobin;	1 1 1 1 1 (max 3)
6ci	Greater concentration of red blood cells (through pulmonary capillaries per unit time) Increases the percentage of red blood cells to the total blood volume; Increases carbon dioxide / bicarbonate ions concentration (to increase heart and breathing rates);	1 1 1 (max 1)
6cii	More red blood cells flowing to the lungs (per unit time); To maximise oxygen uptake from alveoli / takes in more oxygen / compensates for lack of oxygen; More blood pumped through the systemic circulation to the rest of the body; Compensates for the lowered plasma volume	1 1 1 (max 2)



7b	From week 2 to 8, hCG concentration increased sharply from 0 mIUcm ⁻³ to 12000 mIUcm ⁻³	1
	From week 8 to 16, hCG concentration decreased sharply from 12000 mIUcm ⁻³ to 1000 mIUcm ⁻³	1
7c	Placenta is formed;	1
	Take over the role of secreting progesterone;	1
7d	hCG is small enough to pass through the basement membrane	1
	hCG is degraded into smaller subunits in the kidney	1 (max 1)
7e	Insufficient amniotic fluid – to provide the developing fetus with support and cushioning before birth, making the developing fetus susceptible to physical injury; – act as a shock absorber making the developing fetus susceptible to physical injury; – to function as an incompressible layer surrounding the developing fetus, causing the fetus to be susceptible to physical injury; – insufficient space to move about resulting in underdeveloped muscles;	
8a	– random / spontaneous mutations resulted in variation between the population of reindeers in the North and South;	1
	– selection pressure : due to difference in habitat / availability of food + provide ref. from table;	1
	– reindeer that is darker / lighter / ability to forage for food are at selective advantage in North / South;	1
	– able to survive and reproduce to pass down beneficial genes to offspring;	1
	– over time / many generations the populations evolved into the 2 subspecies separately ;	1
	– geographical separation due to ice sheet ;	1
		(max 4)
8bi	generate high hydrostatic pressure within the glomerulus;	1
	to force plasma / small molecules / fluid out of the Bowman's capsule during ultrafiltration ;	1
8bii	presence of thick muscular walls;	1
8biii	salt lowers / decreases blood water potential, causing more anti-diuretic hormone (ADH) to be secreted by hypothalamus / released by pituitary gland;	1
	cells of walls of collecting duct become more permeable ;	1
	more water is reabsorbed back into the blood capillaries surrounding the nephron;	1
9ai	– concentration of PCBs increases up the food chain;	1
	– concentration is much higher in larger organisms;	1
	– great increase between herring and porpoise;	1
	– herring / porpoise at the top of food chain have a range of concentrations;	1
	– use data to make comparison between two trophic levels;	1
		(max 5)
9aai	– animals at higher trophic levels live longer;	1
	– eat many of the animals below them in the food chain;	1
	– non-biodegradable, unable to be broken down and store and build up in the fatty tissues of the organisms	1
	– bioaccumulation	
9b	– 90% of energy is lost through heat during respiration, excretory products	1
	– Only 10% is transferred to the next trophic level	1
	– Too little energy left in the last trophic level to support another trophic level	1

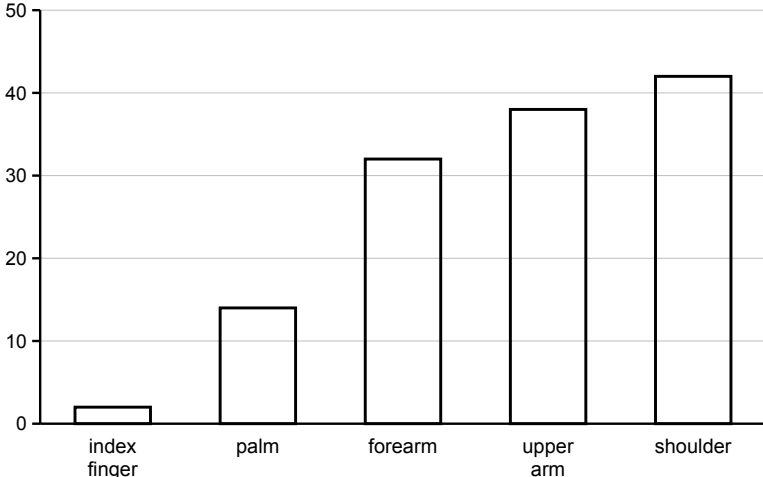
9c	– Monitoring and protecting the species / habitat; – Education; – Captive breeding programme; – Zoos / wildlife parks; – Law to ban hunting	Any 1
10a	Parent plant produces runners which allow a new daughter plant to grow close by. (genetic composition) Daughter plants are genetically identical to parent plant. Sexual reproduction allows genetically different / genetically dissimilar offspring to be produced. This is advantageous as it allows a larger proportion of offspring to survive in a range of environments / prevents a single disease from wiping out the whole population.	1 1 1 1
10b	Humidity – less than 0.2%, light intensity more than 50 AU	1
10c	The lower the humidity, the steeper the concentration gradient of water vapour between the intercellular air spaces and the surrounding air. Water vapour diffuses out of the stomata faster so there is a higher rate of water loss. The higher the light intensity, the higher the rate of photosynthesis in the guard cells. The higher rate of photosynthesis causes faster accumulation of glucose within the guard cells, lowering their water potential. Water molecules enters the guard cells by osmosis causing them to be turgid. This results in the stomata opening wider and hence, the rate of water loss will be higher.	1 1 1 1 1

Paper 3

1ai	50.0, 50.0	1
aii	Prediction : 1. As concentration of sodium chloride solution increases, the angle of bend of the potato increases. Reason : 2. As the concentration of sodium chloride solution increases, the water potential of the sodium chloride solution decreases as compared to the potato cells. 3. Increase in net movement of water molecules from potato cells outwards into the sodium chloride solution 4. via osmosis Reject: diffuse 5. Increased plasmolysis of potato cells causing potato to be more flaccid (aw)	1 Max 2

a iii	6. CH (column heading) - Column heading <u>with UNITS</u> 7. D (data) - Different angle of bend each conc of sodium chloride (Angle of bend cannot be more than 90°) 8. T (trend) – 10% is the highest angle of bend & 0% (distilled water) is the lowest angle of bend 9. P – angle of bend to whole number Example: <table><thead><tr><th>concentration of sodium chloride solution / %</th><th>angle of bend / °</th></tr></thead><tbody><tr><td>10.0</td><td>30</td></tr><tr><td>7.5</td><td>25</td></tr><tr><td>5.0</td><td>20</td></tr><tr><td>2.5</td><td>10</td></tr><tr><td>0.0</td><td>6</td></tr></tbody></table>	concentration of sodium chloride solution / %	angle of bend / °	10.0	30	7.5	25	5.0	20	2.5	10	0.0	6	1 1 1 1
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10.0	30													
7.5	25													
5.0	20													
2.5	10													
0.0	6													
a iv	Based on student results (tally with angle of bend for 7.5% sodium chloride solution)	1												
a v	7.5% ; Accept range between known values	1												
a vi	10. When placed against the protractor, pressure exerted on each piece of potato tissue may be different / inconsistent. 11. The potato tissue is difficult to hold and measure. 12. Potato pieces were NOT immersed in sodium chloride for the same duration / inconsistent incubation time. 13. Containers not covered and evaporation may have affected the concentration of the NaCl that the potato were immersed in. 14. The widths / cross sectional area of the potato tissue varies slightly when cutting 15. Measuring cylinder which was used for measuring volume of distilled water and sodium chloride is imprecise. R. fluctuations in temperature	Max 2.												
a vii	16. Increase the number of concentrations of sodium chloride ; 17. Use a stabiliser or support for bottom of potato to reduce movement ; 18. Measure the change in mass rather than angle of bend ; 19. Carry out the test for each potato piece separately ; 20. Carry out repeat or replicate and calculate the mean ;	Max 2												
a viii	Take precaution when handling the knife when cutting the potato.	1												

b	Independent variable : Temperature (5 different temp with regular intervals) ;	1				
	Dependent variable : Angle of bend / % of mass difference ;					
	List at least 2 Control variable :	1				
	• same concentration of (sodium chloride) solution ; • volume of solution used for each replicate ; • length / volume / surface area of potato tissue ; • time taken for each potato tissue to be immersed ;	1				
	Method : • describe method of maintaining the temperature described (eg. using a thermostatically regulated water bath) ; • (if measuring mass) take mass of potato tissues using an electronic balance ; • place potato tissues in equal volume of solution for equal duration ; • dry off the potato cylinder with a paper towel before taking the angle of bend / mass ; • At least two repeats for each temperature, taking the mean ;	1				
ci	Solution : iodine solution;	1				
	Positive test result : iodine solution turns from yellow / brown to blue black;	1				
cii	Lines : clear, continuous, unbroken link with no shading ;	1				
	Size: at least half the space provided ;	1				
	Detail : double line showing cell wall + minimum of five starch grains around perimeter of cell ;	1				
	Label : one starch grain labelled ;	1				
ciii	*Check after printing Length of AB = ~10mm ;	1				
	Actual length = $\frac{100}{800} = 0.125$	1				
	Round off to 2 sf → 0.013 (0.011 – 0.014) mm ;	1				
2ai	index finger and thumb same number of ticks (±1) must follow trend [1]				2	
	palm less sensitive than finger [0.5]					
	wrist less sensitive than finger [0.5]					
	Distance between two points	end of index finger	end of thumb	palm		wrist
	20	✓	✓	✓		✓/x
	15	✓	✓	✓		x
10	✓	✓	✓	x		
5	✓	✓	x	x		
2aii	Index finger / thumb answer is consistent with candidate's results				1	

2bi	1. Scale: linear scale with 0 at origin for mean minimum distance graph and at least half of grid is used [1] 2. Axes: both axes fully labelled with units on distance axis [1] 3. Plotting of data: all data correctly plotted ± 1 mm [1] 4. Graph: all drawn bars are of equal width with gaps between the bars [1] mean minimum distance detected as two points / mm  <table><caption>Data for Bar Chart: Mean minimum distance detected (mm)</caption><thead><tr><th>Body Part</th><th>Mean minimum distance detected (mm)</th></tr></thead><tbody><tr><td>index finger</td><td>~2</td></tr><tr><td>palm</td><td>~14</td></tr><tr><td>forearm</td><td>~32</td></tr><tr><td>upper arm</td><td>~38</td></tr><tr><td>shoulder</td><td>~42</td></tr></tbody></table>	Body Part	Mean minimum distance detected (mm)	index finger	~2	palm	~14	forearm	~32	upper arm	~38	shoulder	~42	4
Body Part	Mean minimum distance detected (mm)													
index finger	~2													
palm	~14													
forearm	~32													
upper arm	~38													
shoulder	~42													
2bii	to make results more reliable / improve reliability [1] if student mentions accuracy, mark will not be awarded.	1												
2biii	prevent seeing / knowing how many points being tested [1] so that touch is the only sense being tested [1]	Max 1												
2biv	ensure same area of each section of arm / shoulder tested [1] same pressure / force exerted on skin / time points in contact with skin [1] toothpicks of equal sharpness / same surface area [1]	Max 1												
2bv	different areas of skin have <u>different numbers of receptors</u> [1] (touch) receptors <u>closer together</u> in more sensitive areas / hands [1] fingers / hand involved in manipulating / handling objects [1] reject: – different number of sensory neurone, – different thickness of skin (receptors are in all layers of skin – epidermis, dermis to differentiate light vs deep pressure)	2												