Paper 2
Section A (80 marks)

<table>
<tr><th>Qn</th><th>Answer</th><th>Marks</th><th>Markers' Report</th></tr>
<tr><td>1(a)</td><td><u>Long and narrow</u> protrusion/extension;
To increase <u>surface area to volume ratio</u> for <u>absorption/diffusion</u>;</td><td>[1]
0.5m each</td><td>Function is not for exchange of substances</td></tr>
<tr><td>1(b)</td><td>51/1.6= x31.9</td><td>[1]</td><td>Many candidates do not know that 1cm = 10mm</td></tr>
<tr><td>1(c)</td><td><table><tr><th></th><th>Structure 1</th><th>Structure 2</th></tr><tr><td>glucose</td><td>Diffusion and active transport</td><td>NA</td></tr><tr><td>Amino acids</td><td>Diffusion and active transport</td><td>NA</td></tr><tr><td>Fatty acids</td><td>NA</td><td>diffusion</td></tr></table></td><td>[2]</td><td>Any mistakes minus 0.5m</td></tr>
<tr><td>2(ai)</td><td>0.6:1</td><td>[1]</td><td></td></tr>
<tr><td>2(aii)</td><td>As SA:VOL ratio decreases rate of diffusion decreases (or vice versa);
Use figures with correct units (mms-1 for rate) to illustrate trend;
The larger the plant, the lower the SA:V ratio;
Plants cannot rely on diffusion to absorb nutrients (will require to carry out active transport)</td><td>[2]
0.5m each</td><td></td></tr>
<tr><td>2(b)</td><td>First student's answer;
The student considered the SA:V ratio than the length of the cube only.</td><td>[2]
1m each</td><td>Also accepted:
The first student divided the answer by 2 as distance has to be to centre of cube rather than whole length of side/
Student assumed diffusion occurs (across whole cube) from whole length of one side;</td></tr>
</table>

Qn	Answer	Marks	Markers' Report
3(a)	Blurred vision/delayed speed of reaction/increased reaction time/impaired judgement/slower reflex actions	[1]	Any one
3(b)	184mg per $100cm^3$	[1]	
3(c)	Alcohol dehydrogenase produced by the liver; Will catalyse; the breakdown of alcohol into acetaldehyde; then further into compounds used for respiration	[2] 0.5m each	
3(d)	Extend line using ruler until it reaches the dotted line; Read off time on dotted line	[1] 0.5m each	**Ideal answer:** 9.12am Each small box is 24 minutes
4(a)	Double circulation means blood passes through the heart twice in one circulation; Pulmonary circulation and systemic circulation; blood flows out through pulmonary artery to capillaries in lungs; blood flows out through aorta to arteries to body and returns to heart through veins;	[2] 0.5m each	In description, reference must be made to Figure 4.1 – at least 1 part of circulatory system from the figure must be explicitly named Need to mention that blood from capillaries flows **back to the heart**
4(b)	Oxygen molecules combine with haemoglobin in red blood cells; To form oxyhaemoglobin; When muscles in wall of left ventricle; contract / undergo ventricular systole; The pressure in the left ventricle increases; and becomes higher than aorta; aortic valve opens; (semilunar valve – 0m) blood flows through hepatic artery to liver; oxygen in blood diffuses; from red blood cell into plasma into tissue fluid and into liver cells;	[Max 4] 0.5m each	Description should only start from point at which oxygen is forced out of left ventricle of the heart, and not from left atrium / lungs.

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<tr><td>4(ci)</td><td><table><tr><th>tissue fluid</th><th>blood</th></tr><tr><td>only phagocytes present</td><td>presence of blood cells e.g. RBC and WBC (lymphocytes)</td></tr><tr><td>absence of plasma proteins</td><td>presence of plasma proteins</td></tr></table></td><td>[2]
1m each</td><td>complete point to point comparison: 1m
*Note: tissue fluid is <u>not</u> plasma; plasma relates to the liquid component of blood, while tissue fluid refers to that outside the blood vessels and surrounding tissue cells.</td></tr>
<tr><td>4(cii)</td><td><u>Higher</u> pressure at arterial end;
forces blood plasma out through capillary wall;</td><td>[1]
0.5m each</td><td></td></tr>
<tr><td>5(a)</td><td>A: trachea/windpipe
B: diaphragm</td><td>[1]
0.5m each</td><td>wrong spelling 0m</td></tr>
<tr><td>5(bi)</td><td>partition walls between alveoli (C) will break down;
decreased surface area for gaseous exchange;
lungs lose elasticity and becomes inflated with air;
person will suffer from wheezing and breathlessness/ have difficulty breathing</td><td>[2]
0.5m each</td><td></td></tr>
<tr><td>5(bii)</td><td>- more than 3 breaths taken;
- each breath is shallower</td><td>[1]</td><td>Since lungs are inflated with air, the starting volume of air in the lungs should be higher than normal.</td></tr>
<tr><td>5(c)</td><td>Tar/Irritants;
<u>paralyse cilia</u> found on D (epithelium);
dust particles trapped in the mucus cannot be removed;
block airways</td><td>[2]
0.5m each</td><td>D is not the cilia.</td></tr>
<tr><td>6(ai)</td><td>Fluid P: glomerular <u>filtrate</u>
Fluid Q: urine</td><td>[1]
0.5m each</td><td>Many candidates fail to understand requirement of question and name the part of nephron or sweat.</td></tr>
</table>

Qn	Answer	Marks	Markers' Report
6(aii)	glucose present in fluid P because it is a small; molecule; will be forced out during **ultra**filtration; no glucose in fluid Q because they have been selectively **re**absorbed;	[2] 0.5m each	Many candidates gave long-winded answers about the other components in the filtrate while missing out on GLUCOSE.
6(bi)	to prevent blood from clotting/coagulating Any reference to agglutination/ RBC clumping – 0m	[1]	Agglutination occurs in presence of antibodies; not applicable in this situation
6(biii)	dialysate **does not contain** any metabolic waste products; dialysate flow is opposite direction of blood flow; to generate a **steep** concentration gradient; ensure **faster diffusion** of waste products; tubing is long and coiled; increase SA:V ratio for the fast diffusion of waste products; tubing is partially-permeable; to retain large molecules, only allowing small waste products to diffuse out	[2] 0.5m each	Function of dialysis is to remove urea from the blood, not to replenish lost mineral salts, hence focus should not be on salt concentration. If partially-permeable property mentioned then focus should be on the fact that it retains large molecules and allows only small molecules to diffuse out
7(ai)	Cross pollination; because from different plant/ different plot of land	[1]	Some candidates were careless and stated wind/insect pollination, which is the MODE of pollination.
7(aii)	offspring produced may have inherited beneficial qualities from **both** parents [1] more varieties of offspring can be produced/more genetic variation; hence greater chance of survival in the event of changes in environment/ better adapted in changing environment;	[2] 0.5m each	

Qn	Answer	Marks	Markers' Report
7(bi)	Selective breeding/pollinate/cross breed/hybridise; Select teosinte plants <u>with softer and more kernels/larger fruits</u>; Select plants with more and softer kernels and larger fruits; **<u>Repeat breeding and selection process many times</u>** to cross pollinate to produce maize;	[2] 0.5m each	Many candidates still unsure how to carry out selective breeding; teosinte is the ANCESTOR of maize, it is impossible to cross-breed maize with teosinte. Also there is no genetic engineering involved.
7(bii)	difference in sequence of 5th codon (AAG → AAC); different mRNA sequence produced/state mRNA sequence; which will code for a different polypeptide/ different amino acid added; and hence different function of protein	[2] 0.5m each	Many candidates still make the mistake of saying that amino acids are made in the cell instead of being added to the growing polypeptide. Also they failed to link the structure of protein produced to their function.
8(a)	Having 2 sets of chromosomes; each set inherited from one parent;	[1] 0.5m each	
8(b)	- 4 chromosomes - colour one set of chromosomes to denote paternal/maternal - chromosome made up of 2 sister chromatids - spindle fibre attached to centromere - daughter chromosomes moving to opposite poles (anaphase) - show at least one event of crossing over	[2]	any mistakes -0.5m

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<tr><td>8(c)</td><td><table><tr><th>Stage</th><th>DNA content of cell/arbitrary units</th></tr><tr><td>G1</td><td></td></tr><tr><td>S</td><td>4x</td></tr><tr><td>G2</td><td>4x</td></tr><tr><td>M</td><td>4x</td></tr><tr><td>C</td><td>2x</td></tr></table></td><td>[2]
0.5m each</td><td></td></tr>
<tr><td>8(di)</td><td>Fertilised eggs (diploid) will develop into females, unfertilised eggs (haploid) into males;</td><td>[1]
0.5m each</td><td>Many candidates did not read the question and context. The male ants will not be genetically identical to the Queen ant because it is haploid.</td></tr>
<tr><td>8(dii)</td><td><u>reduction</u> division/halving number of chromosomes prior to fertilisation;
ensure that zygote formed is diploid;
prevent doubling of number of chromosomes with each successive generation;
genetic variation</td><td>[2]
0.5m each</td><td></td></tr>
</table>

Section B (30 marks)

Qn	Answer	Marks	Markers' Report
9(a)	Time for which ^{32}P is supplied; Total time of experiment; Duration of sampling intervals; Type / species / similar plant; Concentration of ^{32}P; All organisms sampled at the same time / same mass; Position/size of stem wells; Volume/concentration of solution; Location / temperature / light / CO2 / other viable answers	[1] 0.5m each	Mass of soil given to plant – 0m as plants were already growing in forest
9(b)	organisms that feed on other organisms to obtain energy	[1]	Feed on producers/plants – 0m
9(c)	Plants Radioactivity in treated plants increased in week 1 then decreases gradually; plants make use of ^{32}P to make amino acids/proteins, causing the increase; after week 1, new proteins made by plants no longer contain ^{32}P, which causes the decrease; Species X level of radioactivity increased during week 1, then steeply decreases until 0 at week 4; As Species X mainly feeds on the species of plant in the experiment; hence ^{32}P bioaccumulates within Species X to cause the increase; Species X may be eaten by secondary consumers, while new offspring of Species X do not contain ^{32}P, causing the	[6] 0.5m each	All 4 populations of organisms should be mentioned in answer: 2m – description of graph for each organism 4m – explanation of what causes the changes

Qn	Answer	Marks	Markers' Report
	decrease; Other primary consumers ^{32}P in other primary consumers increases more slowly/gradually than Species X; Because they have food sources other than the plant species in the experiment; Secondary consumers Shows a gradual increase in ^{32}P as compared to the primary consumers; Due to bioamplification; as they feed on the primary consumers, their level of ^{32}P increases;		
9(d)	During photosynthesis; The leaf uses the carbon atoms from carbon dioxide; To produce glucose; Which is then used in respiration; Which releases carbon dioxide into the atmosphere; Glucose is also passed on to consumers which feed on the plant; Carbon in the plant is also turned into fossil fuels (coal); during the process of fossilisation;	[Max 3] 0.5m each	Processes should be named, i.e. photosynthesis, respiration, feeding/consumption, fossilisation.
10(a)	When body needs the functional TK; Phosphate binds to a site away from the active site; Changes the shape of active site; Causes the non-functional TK to become functional/activated; Causes the active site to be complementary to the substrate; Substrate can bind to active site/enzyme-substrate complex formed.	[3] 0.5m each	

Qn	Answer	Marks	Markers' Report
10(b)	Faulty TK's active has the same shape as the functional form of TK; It is **always/constantly** active [1] ; Cell division occurs uncontrollably. *(leading to leukemia, which is a type of cancer)*	[2]	
10(c)	Graph should be slower and max lower than without imatinib [1] Imatinib binds to a site away from the active site; Changes the shape of active site; Active site no longer complementary to substrate; Substrate cannot bind to active site; Less TK/active site available/enzyme-substrate complexes formed decreases; Less products formed/rate of reaction decreases.	[4] 0.5m each	Imatinib inhibits faulty TK [0.5]
E11(a)	insert a leafy shoot through the hole in the cork of the potometer; petroleum jelly around the region of shoot that passes through the cork makes the apparatus airtight and waterproof; have two setups, one with fan (air movement), one without fan (no air movement); record the distance that the air bubble has moved using the <u>scale</u>; (record distance – 0.5m) As the shoot transpires, it absorbs water from the potometer to replace what was lost during transpiration, bubble moves to the left; Water reservoir provides supply of water to ensure that air bubble does not reach too close to the plant;	[5] 1m each	Many candidates did not read the questions carefully and focused their answer on explaining how air movement affects rate of transpiration.

Qn	Answer	Marks	Markers' Report
	The further the air bubble moved, the faster the rate of transpiration; Purpose of the tap is to reset the apparatus;		
E11(b)	presence of chloroplast; in the mesophyll (spongy and palisade) cells; to trap light energy and convert light into chemical energy stored in glucose; xylem vessels within vascular bundle; helps to transport water for photosynthesis; intercellular air spaces; facilitate diffusion of gases; Guard cells become turgid/flaccid; to close/open stomata; allow carbon dioxide to diffuse into the leaf and used for photosynthesis;	[5] 0.5m each	Max 5m
O11(a)	Decrease in skin temperature (stimulus) is detected by thermoreceptors in skin; Send nerve impulses to hypothalamus (regulatory center); Corrective mechanism: 1. sweat glands less active; less sweat produced, less water in sweat evaporate, less heat is lost. 2. vasodilation of arterioles; less blood sent to surface of skin, less heat loss 3. metabolic rate increases; less heat generated 4. Contraction of skeletal muscles/shivering; generate more heat. (2 complete explanations) Body temperature increases and goes back to norm;	[4] 0.5m each	Hair stands to trap layer of air for insulation is not a significant corrective mechanism for humans because our hair is not long enough to trap such a thick layer of air.

Qn	Answer	Marks	Markers' Report
O11(b)	Feedback sent to hypothalamus to stop corrective mechanism; Diverging light rays are reflected off bear; Ciliary muscles contract and suspensory ligaments slacken; Suspensory ligaments relax pull on lens; Lens becomes thicker and more convex ; Light rays sharply focused on retina; Photoreceptors stimulated; Nerve impulses produced transmitted to brain; Via sensory neurone; in optic nerve; Brain interprets impulses and bear/image is seen; Nerve impulses transmitted down the relay neurone in the spinal cord; Across a synapse; from motor neurone; to the adrenal glands above the kidneys; Adrenaline is secreted such that his heart beat increased;	[6] 0.5m each	Max 6m Bear standing 5m from David is considered a near object.