

2021 O Level Mark Scheme – CT and Markers' Report

Paper 2

S/N	Answer	Comments and explanation
1a	P: vena cava Q: right atrium	-
b	- Transport <u>blood rich in oxygen</u> and nutrients from <u>aorta</u> - To <u>cardiac/heart muscles</u>	-
c	- Oxygen <u>dissolves in the moisture lining the alveolar walls</u> and then - <u>Diffuses</u> into the <u>blood capillaries</u> - Oxygen combines with the haemoglobin in red blood cells to form <u>oxyhaemoglobin</u> at the lungs, where <u>oxygen concentration is high</u> - Oxygen is carried in the form of oxyhaemoglobin from the lungs to the <u>left atrium of the heart via pulmonary vein</u> - Blood rich in oxygen is pumped into the <u>left ventricle</u> and out of the heart via the <u>aorta</u> - Aorta transports blood to the kidney via the <u>renal artery</u> - At the kidney, where <u>oxygen concentration is low</u>, <u>oxyhaemoglobin releases oxygen</u>, which then <u>diffuses through the walls of the blood capillaries</u> into the cells of the tissues.	No need for excessive details about the oxygenation of blood in the lungs. Route to the kidneys is important. Crucial to refer to the renal artery and the correct side of the heart.
d	- <u>damaged tissues and platelets produce thrombokinase</u> - <u>thrombokinase converts inactive prothrombin into active thrombin</u> in the presence of <u>calcium ions</u> - thrombin catalyses the conversion of the soluble protein fibrinogen into <u>insoluble fibrin threads</u> to <u>form a mesh to trap blood cells</u>.	
2a	i) $6 \times 2.5 = 15 \text{ au/year}$ ii) Heat iii) $20 \times 2.5 = 50 \text{ au/year}$	
b	Percentage transferred = $15 / 90 \times 100 = 16.7\%$	
C	- For animals to move, they must release more energy via aerobic respiration for muscle contraction. - By reducing movement of animals, less energy is lost as heat to the surroundings, - this allows more energy to be used for growth	
3a	B, salivary amylase C: pancreatic/intestinal lipase A: pepsin	-
b	- Enzymes involved in digestion catalyse catabolic reactions - By lowering the activation energy of the digestion reaction	Common mistakes: to list a range of digestive enzymes and their associated substrates and products, referencing to

	- Substrate, e.g. starch - with a 3-D shape complementary to the active site of the enzyme, e.g. amylase, - will fit into amylase to form an enzyme-substrate complex - chemical reaction occurs, substrate is broken down by enzyme into products e.g. maltose - products leave the active site of enzyme and enzyme remains chemically unchanged	optimal pH values and possible denaturation
4a	- Nn x Nn - N, n, N, n - NN, Nn, Nn, nn - Normal, normal, normal, PKU	“carrier” is not acceptable for phenotype. Similarly, “affected” is less ideal compared to “PKU”.
b	- 25% or 1 in 4 or 1/4	
c	- Mother’s bloodstream would possess the enzyme - Amino acid phenylalanine from fetal blood diffuses into maternal bloodstream - via the placenta - Enzyme would then be available in mother’s body to break down phenylalanine	Note: Enzymes are too large to diffuse into fetal bloodstream. It is the amino acids that diffuse from fetus to mother.
d	- Down syndrome	-
5a	- The process by which (harmful) <u>metabolic waste products and toxic substances</u>, - such as <u>urea</u>, are <u>removed</u> from the body of an organism.	-
bi	<i>arrow starting at glomerulus and arrowhead pointing to the Bowman’s capsule.</i>	Some candidates only indicated the position of the process and did not indicate the direction of ultrafiltration.
bii	<i>arrow starting at kidney tubules and arrowhead pointing at the capillaries.</i>	Although many candidates drew the origin of their arrow showing reabsorption within the nephron, these sometimes did not reach the capillaries. Others only drew arrows along the nephron or within the tubule showing the direction of flow.
c	- increases the permeability of the cells of the walls of structure V, the collecting duct, to water molecules. - Thereby increasing the <u>reabsorption</u> of water back into the blood capillaries	Key word: <i>reabsorption</i> of water or <i>increased absorption of water back into the blood</i> .
di	Similarity: Both dialysis fluid and blood plasma contain essential substances such as glucose, amino acids and mineral salts. Differences: Dialysis fluid does not contain any urea or metabolic waste products while blood plasma contains urea and metabolic waste products.	“waste substances” is too vague – “urea/metabolic or nitrogenous waste” needs to be highlighted.

	Dialysis fluid lacks red blood cells, white blood cells and platelets while blood plasma contains them. The direction of flow of the dialysis fluid is opposite to that of the blood plasma [any 3, at least 1 of each category]	
dii	- Contains no metabolic waste or urea, hence creates a <u>steep concentration gradient between the blood plasma and the dialysis fluid, enabling unwanted urea to diffuse out of the blood into the dialysis fluid</u> - <u>maintaining the correct solute composition and water potential of the blood</u>	Need to specify the name of the nutrient, and link to the idea of restoring a normal level in the plasma.
6	- Isolate the insulin gene by cutting it using restriction enzymes - Cut bacterial plasmid using the same restriction enzyme - to form complementary sticky ends. - Mix the plasmid with the DNA fragment containing the human insulin gene. - Add DNA ligase to seal the human insulin gene to the plasmid - to form a recombinant plasmid - Use temporary heat shock / electric shock to re-inserted the plasmid back into bacteria - The bacteria that contains the recombinant plasmid is known as transgenic bacteria and can be grown in a fermenter for mass production of insulin.	Perceived misconceptions by examiner due to poor phrasing of answers: - Removing insulin rather than the insulin <i>gene</i> - Using 'restrictive' enzymes rather than <i>restriction enzymes</i> - Restriction enzymes cutting 'out' the plasmid or removing a section of it
7ai	- All points plotted correctly - Axes labelled - Scale is sufficiently large - Best fit line is drawn correctly [extrapolation -1]	Most common error: Poor line of best fit, most responses contain lines with unequal numbers of points above and below their line.
aii	<i>According to graph</i>	
aiii	<i>According to graph</i>	
7b	- When the potato strip is placed in 0.0 to 0.4 mol dm⁻³ of sucrose solution, the water potential of the sucrose solution is higher than the water potential of the cell sap of the potato cells. Water molecules enters the potato cell via osmosis through a partially permeable membrane, causing the potato cell to become turgid and expand in length. - When the potato strip is placed in 0.6 to 1.0 mol dm⁻³ of sucrose solution, the water potential of the sucrose solution is lower than the water potential of the cell sap of the potato cells. Water molecules leaves the potato cell via osmosis through a partially permeable membrane,	

	causing the potato cell to become flaccid and contract in length.	
7c	<i>Drawing question</i>	
8a	1 – hair → hair stands to trap a layer of air on the skin surface, reducing heat loss to surroundings 2 – thermoreceptor / nerve ending → detect decrease in temperature and sends nerve impulse to the hypothalamus via sensory neurone 3 – sensory neurone → sends nerve impulse from the thermoreceptor to the hypothalamus 4 – adipose tissue / subcutaneous fat → acts as an insulating layer to reduce heat loss to the surroundings 5 – blood capillary → decrease blood flow in the blood capillaries in the skin reduces heat loss	Misconceptions: Capillaries cannot constrict, only arterioles can. Structure 3 commonly misidentified as relay neurone or nerve.
b	- The maintenance of a constant internal environment whereby - A receptor detects a stimulus and sends signals to the control center to - Initiate a corrective mechanism, - which brings about the reverse effect of the stimulus - and a negative feedback is sent to the receptor when the set-point is reached to cause the corrective mechanism to stop	
c	- A drop in temperature of the blood is detected by the hypothalamus. - Thermoreceptors detect the temperature change and sends nerve impulses to the brain - Hypothalamus of the brain is stimulated and sends nerve impulses to various body parts via the motor neurons to the effectors, (namely arterioles in skin, sweat glands, hair erector muscles, and skeletal muscles)	Several candidates recognised that receptors detect the temperature change but did not develop their answer further to include nerve impulses. Only candidates that performed well overall, noted the role of the hypothalamus in detection of blood temperature. Some candidates recognised the role of the hypothalamus in transmitting nerve impulses, although the role of the motor neurone was not often described.
9E a	<i>Arrow placed at the intersection between two graphs.</i>	-
B	- From 0-6h, rate of photosynthesis was 0 - No sunlight, plant cannot photosynthesize - From 6-12h, rate of photosynthesis increased from 0 to 60 au. - This is because the sun is rising, and this increases the light intensity available for photosynthesis to take place. - At 12h, rate of photosynthesis is the peak - At midday, light intensity is the highest - From 12-18h, rate of photosynthesis decreases from 60 to 0 au.	Need to describe changes in light intensity rather than 'sun rising and setting' or there being 'more or less sunlight'.

	- Because the sun is setting and hence light intensity or light energy available decreases - From 18-24h, 0au rate - No sunlight, plants cannot photosynthesise.	
c	- According to the graph, the area under the curve is largely similar - This means that overall rate of photosynthesis is largely equal to the overall rate of respiration - Glucose produced from photosynthesis is largely used up for respiration - No excess glucose being converted to starch and stored in the plant	
90 a	- The two ovaries produces eggs and releases them when the eggs become mature - Each ovary also produces hormones such as oestrogen for growth and repair of the uterine lining; - and progesterone to maintain and thicken the uterine lining for implantation of embryo	
b	- The progesterone levels in the pregnant woman from month 0-3 is low, maintaining at below 50au each month, this would be similar to the maximum progesterone levels of the woman who is not pregnant. - Progesterone levels of the pregnant woman increased significantly from months 3-9, with levels increasing to 250au in months 8-9, in order to maintain the thick uterine lining. This would be unlike the progesterone levels in a healthy young woman who is not pregnant, whose progesterone levels will decrease just before menstruation.	
c	- The pollen grain lands on the stigma of the female plant. - The sticky and sugary fluid secreted by the mature stigma stimulates the pollen grain to germinate - A pollen tube grows out from each pollen grain and the male gamete enters the pollen tube - As the pollen tube grows, it secretes enzymes to digest its way through the tissues of the stigma and style. - The pollen tube grows down the style and enters the ovule in the ovary through the micropyle - Two male gametes are then released whereby one of them fuses with the nucleus of the ovule to form a zygote, and fertilisation takes place.	