2021 Prelim Bio P2 MS

1a	P: ovary; Q: cervix; R: vagina 3 correct – [2]; 2 correct – [1]; 1 correct – [0]	
1b	The oviduct is blocked/ occluded/ sealed/ closed off [1] Fertilisation cannot occur as ovum cannot be moved to meet/ fuse with the sperm due to the blocked oviduct. [1]	
1c	**X** is in uterine lining [1]	
1d	Between day 21-24; [1] Progesterone functions to maintain the thickness of the uterine lining; [1] During this period, progesterone level is increasing towards peak, indicating uterine lining is most likely the thickest. [1]	
2a	**ANY one of below** Epithelium of the villus have numerous microvilli; [1] to increase surface area to volume ratio for faster absorption of digested food [1]. OR Epithelium/ wall of villus is one cell thick [1] to reduce diffusion distance for faster absorption of digested food [1]. OR Contains a lacteal which continually transports fats away from ileum [1] to maintain a steep concentration gradient for faster absorption of fats [1]. OR Well-supplied with blood capillaries which continually transports digested food away from duodenum [1] to maintain a steep concentration gradient for faster absorption of digested food [1].	
2b	The villi in person with coeliac disease is shorter/ has smaller surface area to volume ratio [1]. Less glucose absorbed into bloodstream, resulting in less aerobic respiration, releasing less energy, hence causing fatigue [1]	
3a	correct arrangement of at least 4 vascular bundles [1] correct labelling of xylem and phloem [1]	

3b	When the rate of respiration slows down, less energy is released resulting in less active transport [1]. Less active transport results in less translocation of sucrose and amino acids from leaves to the rest of the plant for growth [1]. Less respiration results in less energy for cell activities such as photosynthesis to produce glucose, reducing plant growth [1]. Less mineral ions absorbed/ ions absorbed more slowly at the roots by active transport [1]. Less nitrate ions causes less amino acids / protein results in less protoplasm/ growth; [1]	•
3ci	Loss of water vapor through stomata of leaves [1]	
3cii	The wind blows away the water vapour that accumulates outside the leaf. [1] This causes a steeper water vapour concentration gradient between the inside of the leaf and the atmosphere. [1] This allows water vapour to diffuse out of the leaf faster [1], increasing rate of transpiration.	
3ciii	The leaf folds up, reducing exposed surface area to reduce rate of transpiration OR stomata closes, reducing rate of transpiration. [1]	
4a	8 [1]	
4b	Only visible features were accepted as this question ask for 'this flower'. Any [2] Has a large and conspicuous petal; [1] Non-pendulous anther and compact stamen; [1] Non-feathery and compact stigma; [1]	
4ci	self-pollination [1]	
4cii	Any [2] · Plants bear either male or female flowers. · Anthers and stigmas in the same plant mature at different times. · Stigmas are situated far away from the anthers in the same plant. · Pollen grains of a flower have no fertilizing effect on the stigmas of the same plant.	

5a	Protein molecules are too large [1] to pass through the partially permeable basement membrane. [1]	
5b	All glucose molecules [1] are reabsorbed into blood/ bloodstream/ blood capillaries at the proximal convoluted tubules. [1]	
5c	X 80.0 [1]	
5d	High protein diet/ protein-rich diet/ meals [1] Higher amount of/ More excess amino acids are deaminated to produce more urea [1]	
6a	trypsin [1], amylase [1]	
6b	There is no lipase produced / found [1] in stomach / mouth / before small intestine [1] OR Lipase only produced / found [1] in the by epithelial cells / intestinal juice in the small intestine [1]	
6c	enzymes only work in solution / when dissolved [1] OR enzyme / lipase / is dry [1]	
6di	Diabetes [1]	
6dii	insulin injections/ insulin inhaler/ insulin pills/ diet low in carbohydrates/ starch/ sugars [1]	

7a	The blood clot travels from the legs into the right atrium of the heart via the vena cava. [1] When the muscles in the atria of the heart contract, tricuspid valve is forced open and the blood clot moves into the right ventricle. [1] When the muscles in the ventricles of the heart contract, pulmonary valve/ sumi-lunar valve is forced open and the blood clot moves from the right ventricle into the pulmonary artery. [1] The tricuspid valve closes to prevent backflow of blood from right ventricle to right atrium. [1] The blood clot then travels through the pulmonary valve into the pulmonary artery and into the lungs. [1]	
7b	Less/ No oxygen will be transported to these cells and cells will undergo less/ no aerobic respiration [1] Less/ No energy is released for cellular activities [1]	
7c	They move less and stay in bed/ bedridden. OR COVID-19 might cause damage in blood vessels' walls. [1]	
8a	Axes drawn and labelled with units [1] Smooth line/ curve [1] Plots are correct [1] Scale is appropriate [1]	
8b	As time increases from 0h to 7h [1] , radioactivity increases from 0.0Bq to 90.0Bq. [1] Reject: incorrect units (e.g. /Bq)	

8c	Radioactive water (R: solution) enters root hair cell by osmosis and transported upwards in xylem; [1] Moves out of xylem to mesophyll cells; [1] [Photosynthesis] Radioactive water used for photosynthesis (R: water is photolysed) ; [1] Radioactive oxygen gas produced and diffuses out of leaves; [1] **OR** [Transpiration] Thin film of moisture around spongy mesophyll evaporates; [1] Radioactive water vapour diffuses out of leaves [1]	
9a	label the cornea - (i) [1] label the ciliary muscles - (ii) [1]	
9b	An increase in light intensity stimulates photoreceptors to produce nerve impulses; [1] The sensory neurone in the optic nerve transmits nerve impulses to the brain; [1] The motor neurone transmits nerve impulses to the effectors, muscles in the iris; [1] Circular muscles contract; Radial muscles relax to decrease size of pupil [1]	
9ci	correct labelling of C [1]	
9cii	ciliary muscles contract; [1] suspensory ligament slackened; [1] lens become more convex [1]	
10Ea	meiosis [1] metaphase II [1]	

10Eb

Similarities (at least [1])

- Both involve nuclear division
- Both form / produce new daughter cells
- Both involve prophase, metaphase, anaphase and telophase

R: both involve metaphase/ only one parent cell/ centrioles/ doubling of chromosome number

Differences (Any [2])

Mitosis	Meiosis
Involves one nuclear division	Involves two nuclear divisions
Produces two diploid daughter cells	Produces four haploid daughter cells
Daughter cells are genetically identical	Daughter cells are genetically dissimilar
No crossing over (of alleles)	Crossing over (of alleles) may occur
Occurs in somatic cells for growth	Occurs in reproductive organs for gamete formation/ reproduction
No pairing of homologous chromosomes	Homologous chromosomes pair up at prophase I
No independent assortment	Independent assortment will occur

10Ec	In prophase I, crossing over [1] between non sister chromatids of homologous chromosomes occur, resulting in different combinations of alleles. [1] In metaphase I, independent assortment [1] of chromosomes occur, resulting in gametes having different combinations of chromosomes/ different pairing of chromosomes/ random arrangement of chromosomes.[1]	
10Oa	Osmosis refers to movement of water molecules only while active transport and diffusion refers to movement of all molecules or ions/ substances. [1] Osmosis and diffusion are passive processes while active transport requires energy. [1] Osmosis is the movement of water molecules down a water potential gradient; diffusion is the movement of molecules or ions down a concentration gradient while active transport is the movement of molecules or ions against the concentration gradient. [1] Osmosis and active transport require a partially permeable membrane while diffusion does not require a partially permeable membrane. [1]	
10Ob	DNA is the chemical that makes up the genetic material in living organisms. DNA is organised into highly coiled (condensed) structures called chromosomes [1] in the nucleus of cells. A gene is a sequence of nucleotides and it is made up of a small segment of DNA [1] in a chromosome. [1]	
10Oci	identical alleles versus different alleles [1]	
10Ocii	expressed outward appearance (OR expressed and can be seen) of a trait versus genetic combination (OR combination of alleles) in an individual [1] R: genetic makeup	
10Ociii	unit of inheritance versus alternative form of a gene [1]	