Zhonghua Secondary School
Preliminary Examination 2023
Secondary 4E Biology

Paper 2 – Section A: Structured Questions (50 marks)

No	Marking Points	Marks	Remarks
1(a)	Salt / Sodium chloride / any solute that can be found in sea water (eg. sucrose, glucose, amino acids)	1	
1(b)	As the % seawater increases, the rate of contractile vacuole output decreases As the % seawater increases, the difference of water potential between seawater and cytoplasm decreases Contractile vacuoles expel less water to maintain osmotic pressure / water potential in the organism to prevent dehydration	1 1 1 1	ORA not accepted due to nature of question
1(c)	The higher the seawater %, the smaller the body volume	1	ORA not accepted due to nature of question
1(d)	The cell burst / undergo lysis Any one The contractile vacuole is ineffective in expelling water (at % lower than 20% seawater The cell takes in too much water via osmosis (leading to lower rate of contractile output)	1 1 1	
2(a)i	Anywhere in shaded area between 2 and 9 min	1	
2(a)ii	The lungs and heart **cannot meet the oxygen demand**	1	
2(b)	Oxygen uptake cannot meet demand + during the 4 min Anaerobic respiration occurs; Glucose oxidised to lactic acid + energy release to supplement demand;	1 1 1	
2(c)i	Decreases from high at time 0 + Levels at about 12 mins and remains	1	
2(c)ii	Glycogen is broken down into glucose (thus increasing blood glucose concentration); for increased respiration rate + to meet increased energy demand	1 1	
2(d)	lactic acid curve rises sooner / higher / takes longer to return to normal	1	

No	Marking Points	Marks	Remarks
3(a)	Aerobic respiration / oxidation of glucose takes place to release energy for active transport (during selective reabsorption)	1 1	
3(b)	Provide a large surface area to volume ratio; rapid diffusion/reabsorption of nutrients like glucose and amino acids	1 1	
3(c)	**Difference** Proximal tubular cells are replaced by thin dialysis membrane surrounded by dialysis fluid; no active transport in dialysis machine but diffusion occurs; **Similarities** with same concentration of glucose and minerals; Microvilli are similar to long narrow tubing + to provide large surface area to volume ratio both processes aid in removal of urea	 1 1 1 1 1	
4(a)i	C – sweat gland D – adipose/fatty tissue/layer	1	Reject: fat (it is not a structure)
4(a)ii	any two from: less food eaten / less fat in diet / exercise; so fat used by body + for respiration / release energy ; body using more energy than it is taking in ;	 1 1 1	
4(b)	A is a receptor / nerve ending; touch / pressure / pain / temperature ; examples of uneven distribution e.g. high density in fingers / lips ; exposed areas + need higher sensitivity AW ;	1 1 1	
4(c)	less blood flows + in blood vessel / close to skin surface decrease in radiation / heat loss / AW; vasoconstriction OR blood vessels / arterioles / arteries / part B + narrow / constrict ;	1 1 1	Reject neurone

No	Marking Points	Marks	Remarks
5(a)i	a gene is a section of DNA / unit of inheritance / codes for poypeptide an allele is a different / an alternative version of the same gene	1 1	
5(a)ii	genotypes of parents: Tt · Tt ; gametes: T, t, T, t ; offspring genotypes: TT, Tt, Tt, tt ; offspring phenotypes: straight, straight, straight, curly ;	1 1 1 1	
5(b)	**max two similarities** from: placenta/umbilical cord + provides nutrition / oxygen / food; amniotic sac / amniotic fluid + receives mechanical protection / offspring / fetus cushioned **max two differences** from: shape of uterus / womb ; duration of pregnancy / gestation ; (human longer than pigs) numbers of offspring higher in guinea pig ;	 1 1 1 1 1	 Reject two uterus in guinea pigs
6(a)	G – F – A – C – E – B – D	1	
6(b)i	Meiosis	1	
6(b)ii	Any 2 One parent cell in G divides to for… …in D. Each daughter cell in D h… …romosomes as the parent cell There o… …in C and then in B. … …homologous pairings in A	1 1 1 1	Stages must be mentioned to support your answers.
6(c)	… …: diploid	1	
6(d)	D… …replication OR Chromosomes duplicated (to produce a replica of itself)	1	

Paper 2 – Section B: Longer Structured Questions (30 marks)

No	Marking Points	Marks	Remarks
7(a)	Start, max, end correctly plotted for X, Y, Z (Graphs can be straight lines/curves) Graphs labelled/legend provided	1	1 mark for each labelled graph
7(b)	When blood glucose concentration rises above normal insulin is released by the islets of Langerhans (in the pancreas); Insulin stimulates conversion of excess glucose to glycogen in the liver/muscles OR causes the liver/muscles to take up more glucose from the blood; blood glucose concentration to decrease to normal levels.	1 1 1	
7(c)	Advantage: Drug Y takes a longer time to wear off, so the person doesn't need to consume the drug too many times a day Disadvantage (any 1) Drug Y takes 3h to reach max effectiveness/takes 1.5h to start working, and will not be effective at treating an immediate spike in blood glucose concentration Drug Y's effectiveness s only 60 AU, so a larger dose may be required each time (Link drug property to real life effects/compare it to other drugs)	1 1 1	
7(d)	12-3 pm. Digestion takes some time, consuming the drug after the meal will allow the drug to be effective when blood glucose concentration is increasing.	1 1	*Accept any reasonable timeframe that matches the spike in blood glucose level after digestion and absorption.*
8(a)	Increases by 0.75 g per dm3 / from 0 to 0.75 g per dm3 in first hour ; due to absorption of alcohol into the blood in stomach / small intestine / duodenum / ileum ; decrease in alcohol by 0.75 g per dm3 / from 0.75 to 0 g per dm3 from 1 to 6 hour ; alcohol transported to liver via hepatic portal vein ; alcohol break down using enzymes in the liver ;	1 1 1 1 1	
8(b)	different rate of absorption/metabolism due to differences in • weight / mass / size ; • gender ; • age ; • health of liver ; • kidney efficiency	Any 2 1 1 1 1 1	
8(c)	Alcohol is broken down by alcohol dehydrogenase	1	

No	Marking Points	Marks	Remarks
	into acetylaldehye which is later converted to carbon dioxide and water	1 1	
E9(a)	Water and mineral salts are being transported by xylem vessels from the roots up the stem mainly by transpiration pull These materials are transported (from roots) upwards to the leaves sucrose and amino acids are translocated by phloem tissues from leaves to other parts of plant sucrose are loaded into sieve tube cells for translocation energy is provided by companion cells	1 1 1 1 1 1 1	
E9(b)(i)	Low water potential in guard cell's cell sap due to movement of water out of cells they become flaccid resulting in decrease in stomatal pore (due to uneven wall thickness)	1 1	
E9(b)ii	Advantage: closure of stomata reduces transpiration/loss of water vapour from the leaves water is conserved in the plant/prevents dehydration in plant Disadvantage: less amount of carbon dioxide may be absorbed rate of photosynthesis is reduce	 1 1 1 1	
O9(a)	(4000 / 100) x 3 = 133 333 (accept 133000)		penalise if no working shown
O9(b)	[Bioaccumulation] Pain killer / chemicals accumulate in the tissues because it is non-biodegradable or it is absorbed into the body of the organism such as into the fatty tissues, so may not be excreted. When vultures feeds on the carcasses, the level of insecticide just builds up (accumulates); [Bioamplification] Idea of NBC increasing along trophic levels Vultures need to feed on a relatively large amount of carcasses to obtain sufficient energy, resulting in increased quantity of insecticides in their bodies;	 1 1 1 1 1 1	
O9(c)	Painkillers are still being used in farm animals Fed uncontaminated food / kept away from painkiller Health of individuals are monitored / treated for illnesses Eggs (artificially) incubated; reduced mortality in young Provision of male / female to manipulate breeding Protection from hunting / predators	1 1 1 1 1 1	

No	Marking Points	Marks	Remarks
	Reduced competition	1	
O9(d)	Maintain / increase genetic variation / gene pool Reducing the risk of inbreeding Less likely all contaminated with painkiller Less risk to losing individuals due to disease, natural disaster etc Balance in ecosystem For education, research purposes	1 1 1 1 1 1	All points must be linked to vultures