Secondary 4 Biology

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

2024 Preliminary Examination Suggested Answer

1(a)(i)	root hair cell + long and narrow protrusion	1
1(a)(ii)	 soil water has a higher water potential than the cell sap of root hair cell / cell A hence, water molecules moved from soil water to the cell sap of root hair cell / cell A via osmosis through a partially permeable membrane cell sap of root hair cell now has a higher water potential than cell sap of cortical cells leading to water molecules moving into the cell sap of cortical cells this process continues until water molecules reaches the xylem vessel 	3
1(b)(i)	still air: graph C moving air: graph B	1
1(b)(ii)	 In the presence of moving air, there is a greater mass of water lost from 0 to 30 minutes, where the greatest mass of water lost is (6.1 – 2.1 =) 4.0 g at 30 min Moving air removes the layer of water vapour immediately outside the leaves, reducing / lowering the concentration gradient of water vapour between the intercellular air spaces and the atmospheric air compared to the plant in still air Hence, there is a higher net rate of water vapour diffusing out of the intercellular air spaces (through the stomata) to the atmospheric air in the plant exposed to moving air 	3
1(c)(i)	252	1
1(c)(ii)	 any three from: 1 (carbon dioxide / ¹⁴C) enters (leaf), through stoma(ta) / by diffusion and diffuses into the chloroplast 2 photosynthesis occurs and radioactive carbon dioxide is converted to glucose in the presence of light energy and chlorophyll 3 excess glucose is then converted to sucrose for transportation 	3
	[Tota	l: 12]
2(a)	D	1
2(b)(i)	 test-tube 3 contained bile but test-tube 2 did not. Bile emulsifies large fat droplets into smaller fat droplets increases surface area to volume ratio of fats for a faster rate of digestion by lipase into fatty acids and glycerol in test-tube 3 than 2 since fatty acids are acidic, hence, pH in test-tube 3 decreases faster / at an earlier time than test-tube 2 	3
2(b)(ii)	 any one from: shows that bile, does not (chemically) digest fats / does not make solution acidic ; shows that, lipase / enzyme, is required (for breakdown of fats into fatty acids and glycerol) 	1

2(c)(i)		2						
	all enzymes dentaured							
	line drawn showing that decrease after optimum is steeper than increase ;							
	1 line does not have to start at the origin or end at the x-axis							
	label line to point where line meets the x-axis and label indicating that all the lipase is denatured / AW ;							
	2 line must meet the x-axis							
	[Tot	al: 7]						
3(a)	1 light is refracted / bent by cornea	3						
	 3 lens becomes more convex + light rays refracted / bent (more) by lens formed on retina 							
3(b)	lens bends / refracts light rays <u>too much</u> so they meet before retina / drawn on diagram ;	1						
	[Tot	al: 4]						
4(a)(i)	1 Amino groups of excess amino acids are deaminated and converted to urea	1						
		-						
4(a)(ii)	1 The molecule of urea is transported by the <u>hepatic vein</u> from the liver / organ D to the right atrium of the <u>heart</u> via the <u>vena cava</u>	3						
	2 From right atrium, the molecule of urea then enters right ventricle and exit to the lungs via the <u>pulmonary artery</u> and returns to the left atrium of the heart via							
	<u>pulmonary vein</u> 3 From left atrium, the molecule of urea then enters the left ventricle and exit the							
	heart via the <u>aorta</u> to the kidney via the <u>renal artery</u>							
4(b)(i)	1 ultrafiltration happens at the glomerulus / K where the high hydrostatic pressure of blood forces small molecules such as water / glucose / urea / ions into proximal	2						
	 2 selective reabsorption occurs at proximal convoluted tubule / L, where all glucose and amino acids are reabsorbed while urea and some water are not reabsorbed 							
	if no description of ultrafiltration and selective reabsorption is mentioned = 1m							

4(b)(ii)	1 An increased concentration of ADH stimulates the increased permeability of the	2
	collecting duct to water molecules	
	to a lower volume of water in the collecting duct	
	[Tot	al: 8]
5(a)	Any one from:	1
~ /		
	1 Inhibits the synthesis of bacterial cell walls	
	3 Inhibits protein synthesis in ribosome	
	4 Inhibits enzyme action in cytoplasm	
5(b)(i)	$[(100 - 180) / 180] \times 100\%$	1
5(0)(1)	= -44%	1
5(b)(ii)	Any three from:	3
	1 daily doses / use (of erythromycin) peak 1989 / at 2.8 doses per 1000 people	
	2 (bacterial) infections (resistant to erythromycin) peak, in 1993 / at 180 bacterial	
	infections per 1000 people	
	3 no record of <u>resistant</u> infections, until 1991 / from 1983 to 1989 / first 6 years	
	4 delay (of 4 years) between peak of doses and peak of (resistant) infections	
5(b)(iii)	any two from:	2
5(b)(iii)	any two from: 1 fewer doses of ervthromvcin used	2
5(b)(iii)	 any two from: 1 fewer doses of erythromycin used 2 development of new, antibiotics / treatments / vaccines 	2
5(b)(iii)	 any two from: 1 fewer doses of erythromycin used 2 development of new, antibiotics / treatments / vaccines (or any example that would cause a reduced usage of antibiotics) 	2
5(b)(iii)	 any two from: 1 fewer doses of erythromycin used 2 development of new, antibiotics / treatments / vaccines (or any example that would cause a reduced usage of antibiotics) 3 more, awareness / education about, overuse of antibiotics / antibiotic resistance 4 improved detection / screening (of nathogens to avoid spread) 	2
5(b)(iii)	 any two from: 1 fewer doses of erythromycin used 2 development of new, antibiotics / treatments / vaccines (or any example that would cause a reduced usage of antibiotics) 3 more, awareness / education about, overuse of antibiotics / antibiotic resistance 4 improved, detection / screening (of pathogens to avoid spread) (reference to improved, cleanliness / hygiene or more people vaccinated / 	2
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7(a)(ii)	0 to 2 minutes:	5						
	 During vigorous exercise, muscle tissues contract more vigorously and the demand of energy of muscle cells increases. However, the <u>supply of oxygen</u> to the muscles cells is <u>unable to meet</u> the <u>increased demand of oxygen</u> of the muscle cells. Hence, muscle cells undergo <u>anaerobic respiration</u> and produces <u>lactic acid</u> which <u>lowers the pH</u> from <u>7.07 to 6.55</u>. 							
	2 to 30 minutes:							
	 any two from: After exercise, the pH increases gradually from 6.55 to 7.06 because lactic acid is transported away from the muscle cells to the liver. Lactic acid is oxidised to harmless substances in the liver. During this time, breathing rate and heart rate remained high to take in more oxygen for oxidation of lactic acid and to transport lactic acid at a faster rate to the liver. 							
	[Tot	al: 8]						
8(a)	any three from:	3						
	 the high concentration of nitrates / phosphates in untreated sewage encouraged the rapid growth of producers / plants / algae on the surface of the river this blocked the sunlight entering the river, resulting in the death of fully submerged producers / plants / algae the dead producers / plants / algae then decomposed / fed on by bacteria leading to reduced oxygen / not enough oxygen (in water / environment) that resulted in the death of marine animals 							
8(b)	275	1						
8(c)(i)	any three from:	3						
	1 from 1957 to 2005, percentage of fish with low plates decreases from 91 % to 16 %							
	2 from 1957 to 2005, percentage of fish with many plates increases from 0 % to 49 %							
	3 from 1957 to 1975, percentage of fish with medium plates increases from 9 % to 35 % and remained constant at 35 % from 1975 to 2005							
	4 percentage of fish with low plates from highest to lowest % of stickleback population ;							
	5 percentage of fish with many plates from lowest / 0 to highest % of stickleback population ;							

8(c)(ii)	 Random the (Thre 2 From 198 m, which increases Fish with to fish with to fish with Hence, <u>m</u> on their a Over time population 	mutation / geneti e Spined Stickleb 57 to 2005, there allowed the fish to s the <u>selection pro-</u> many plates wer th median numbe <u>nore</u> fish with mar <u>alleles</u> to their offs e, the <u>frequency con</u> in increases.	c change resulted back) fish. was an increased to be more visible <u>essure.</u> e <u>better</u> / best pro- er of plates followe ny plates <u>survived</u> pring of alleles that cod	d in the variation of armour plates on d water transparency from 0.8 m to 7 e to predators, which acted as / otected against predation compared ed by low number of armour plates. d to reproductive age which passed e for many armour plates in the	5
				[Tota	l: 12]
9(a)(i)	any anther to	o stigma between	two flowers		1
9(a)(ii)	 sugary fluid stimulates growth of pollen tube down the style by producing enzymes to digest the tissues of the stigma, style and ovary pollen tube reaches the opening to the ovule, the micropyle, in the ovary, absorbs sap and burst to release male gametes nucleus of male gamete then fuses with nucleus of female gamete to form a zygote 				
9(b)	any one of the following:11The larger the petals, the easier for the insects to land on (and move into the flower's nectary) / pollinators require a larger landing platform2The larger the petals, the more attractive to the pollinators				
9(c)	 any one of the following: above 20 mm, the size of petal is large enough and does not affect how well the pollinators land on above 20 mm, the level of attractiveness to the pollinators are the same 				
9(d)(i)					2
		parent plant 1	parent plant 2		
	phenotype	purple	purple		
	genotype	heterozygous	heterozygous		
	1 mark per o				
	i main pei C				

9(d)(ii)	 The ratio of the offspring shown in Fig. 9.3 is 3 purple to 1 white flower This indicates that allele for white flower is recessive and allele for purple flower is dominant 						
	3 In order to achieve a 3 purple : 1 white ratio, the parent plants must both be heterozygous so that there will be a possibility (or 50% chance) for both parents to pass down the allele for white flower / recessive allele to its offspring						
	[Total:	10]					
10(a)	Fusion of nucleus of the male gamete with the nucleus of the female gamete to form a diploid zygote	1					
10(b)	1 After fertilisation, zygote / fertilised ovum undergoes mitosis to form an embryo,						
	 a ball of cells embryo will be transported through the oviduct towards the uterus, by the sweeping action of cilia in the oviduct, where it implants itself into the uterine lining 						
10(c)	 any three of the following: 1 The percentage of successful fertilisation is zero 10 days before ovulation as menstruation has just ended / is still ongoing, hence, there is no egg cell present for fertilisation 2 The percentage of successful fertilisation increases as the number of days draw 						
	 nearer / is closer to ovulation because when an egg cell is released, it has a higher chance of being fertilised by the sperm cell as sperm cells can survive 3 to 5 days in the female reproductive system 3 After ovulation, the percentage of successful fertilisation decreases sharply as the egg cell can only survive for 1 to 2 days in the female reproductive system 4 10 days after ovulation, the percentage of successful fertilisation is almost zero as the egg cell would not be viable 						
10(d)	parental : Rh negative mother x heterozygous Rh positive father '	4					
	parental genotype : dd x Dd						
	gametes : (d) (d) x (D) (d)						
	F_1 genotype : Dd Dd Dd dd						
	F ₁ phenotype : Rh positive Rh positive Rh positive Rh negative						
	F ₁ phenotype ratio : 3 Rh positive : 1 Rh negative						
	Probability of Rh positive child: 0.75						
	1m: parental genotype & gametes 1m: F1 genotype & F1 phenotype 1m: ratio 1m: probability						