

Answer Scheme**Multiple Choice [40 marks]**

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

[Turn over

Answer Scheme for Sec 4E Biology Preliminary Examination 2020**Section A: Structured Questions [50 marks]**

Question 1			Expected answers	Marks	Additional Guidance
	(a)	(i)	more transpiration / water lost from lower surface or v.v.;	1	R skin A only if stomata ref. has been made)
		(ii)	waterproof AW ;	1	
			cuticle / (waxy) layer AW (must be ref. upper);	1	
			correct ref. stomata / pores on upper or lower surface ; release of water (vapour);	1	
	(b)		paper / slide / leaf surface not properly dry, touched with (wet) fingers, damaged vein / xylem in leaf, slow to set up expt. after drying, any reasonable qualified student error	1 1 2 max.	
	(c)		run the experiment more times / repeat ; take an average ; perform expt. on another similar leaf	1 1 1 1 max.	R leaf of different species
	(d)		cobalt chloride paper on bench AW ; timed ;	1 1	A takes less time to change
			Total: [10]		

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Question 2			Expected answers	Marks	Additional Guidance								
	(a)	(i)	male 20–34 ;	1									
		(ii)	16 (%) ;	1									
	(b)		<table><tr><td>component in cigarette smoke</td><td>effect on the body</td></tr><tr><td>carbon monoxide</td><td>reduces oxygen carrying capacity of blood / AW ;</td></tr><tr><td>tar</td><td>(named) cancer / irritates airways / damages cilia / COPD / emphysema / (stimulates) increased mucus production ;</td></tr><tr><td>nicotine</td><td>addictive / stimulant / increases blood pressure ;</td></tr></table>	component in cigarette smoke	effect on the body	carbon monoxide	reduces oxygen carrying capacity of blood / AW ;	tar	(named) cancer / irritates airways / damages cilia / COPD / emphysema / (stimulates) increased mucus production ;	nicotine	addictive / stimulant / increases blood pressure ;	1 1 1	
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nicotine	addictive / stimulant / increases blood pressure ;												
	(c)	(i)	coronary arteries become, narrowed / blocked ;	1									
			cause of blockage described ;	1									
			coronary arteries supply the heart muscle with blood ;	1									
			(blockage) reduces / stops, blood flow to (heart) muscle ;	1									
			(muscle tissue / cells die) because, cannot respire / lack of oxygen / lack of (named) nutrient / lack of energy ;	1									
			AVP ;	1									
			<u>3 max.</u>										
			(ii)	stress ;		1							
		eating diet high in fats /		1									
		cholesterols											
		genetic predisposition / genes ;		1									
		being older ;		1									
		gender ;		1									
		lack of exercise ;		1									
		AVP ;;;		1									
		<u>2 max.</u>											
[Total: 10]													

Question 3			Expected answers	Marks	Additional Guidance
	(a)	(i)	125 x 60 x 24 + 180 000 ;	1	
		(ii)		1	

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			180 000 – 1500 ÷ 180 000 x 100 + 99 – 99.2 ;		
	(b)	(i)	too large / greater relative molecular mass than 68 000 - 70 000 / unable to pass through basement membrane ;	1	ignore: reference to speed of response
		(ii)	water is reabsorbed (from filtrate) ; (approximately half) urea remains in urine; ref. to reabsorption of other substances ;	1 1 1 <u>2 max.</u>	
	(c)	(i)	low temperature detected + by receptors / sensors on skin ; brain ; any corrective mechanisms from shivering / hairs raised / sweating reduced/stopped / vasoconstriction of blood vessels;; temperature rises again ;	1 1 1 <u>2 max.</u>	A hypothalamus R of capillaries
		(ii)	(colon) water absorbed into blood ; rise / excess (in water content of blood) detected ; excess water excreted / removed / more urine produced AW ; by kidney ; correct ref. ureter / bladder / urethra in correct context ;	1 1 1 1 1 <u>3 max.</u>	A ref. hypothalamus A correct ref. to ADH A nephron
		[Total: 10]			

Question 4			Expected answers	Marks	Additional Guidance
	(a)	(i)	D;	1	
		(ii)	a pair of muscles;	1	

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			pulling/effect of muscles acting/working in opposite directions/OWTTE;	1	A – one contracts while the other relaxes
	(b)		automatic / no thought required / not a conscious action; allow: no (higher centres in) brain involved stimulus always leads to the same response; allow: fixed response	1 1 1 1 2 max.	ignore: reference to speed of response
	(c)	(i)	a rapid/fast/immediate/instantaneous; automatic/involuntary response (to a stimulus);	1 1	A no conscious effort
		(ii)	(controlled/coordinated by) spinal cord;	1	
	(d)		rapid response ; protective / AW ; mechanical damage / injury ; e.g. ; already present immediately after birth ;	1 1 1 1 2 max.	<i>i.e.</i> before learning can take place
[Total: 10]					

Question 5			Expected answers	Marks	Additional Guidance
	(a)		self (–pollination) ;	1	
	(b)	(i)	(carried by) wind ; pollen to stigma ; of another (wheat) plant / flower ; correct ref. to cross-pollination (now being possible) ;	1 1 1 1 2 max.	I ref. to animals R if ref. to seed / fruit
		(ii)	wind can't carry / can't be carried far / reduced dispersal ; too much dependence on self-pollination / lack of (genetic) variation AW ;	1 1	

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		wind may not be blowing (over short time period) ; reduces chances of pollination / fertilisation ;	1 1 <u>2 max.</u>	
		[Total: 5]		

Question 6			Expected answers	Marks	Additional Guidance
	(a)		spongy wall / spongy or uterus lining / endometrium	1	R uterus / uterus wall
	(b)	(i)	14 – 20 days;	1	ranges can be smaller than those given, max 1 if they give 19 = 20 days for both
		(ii)	19 – 25 days;	1	
	(c)		necessary substances can diffuse across placenta; bloods might be of different groups; mother's blood pressure too great; ref. possible exclusion of potentially harmful substances e.g. pathogens;	1 1 1 1 <u>2 max.</u>	R diseases
		[Total: 5]			

Section B: [20 marks]

Question 7			Expected answers	Marks	Additional Guidance
	(a)		axes fully labelled with units; suitable scale; plots; best-fit line (smooth or straight);	2 1 1 1 <u>4 max.</u>	at least half of graph paper used
	(b)		time for clotting decreases as temperature rises from 10 °C to 35 °C/ AW; time for clotting increases as temperature increases from 35 °C to 45 °C/ AW; greatest changes at lowest and highest temperatures;	1 1 1	

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		optimum time for clotting at 35 °C/ clots fastest at 35 °C; least change over range 25 °C to 45 °C;	1 1 <u>3 max.</u>	
	(c)	causing clotting; fibrinogen to fibrin; mesh/fibres traps cells; scab formed; prevents entry of bacteria/virus/disease organisms;	1 1 1 1 1 <u>3 max.</u>	
[Total: 10]				

Question 8			Expected answers	Marks	Additional Guidance
	(a)	(i)	(Down's syndrome) inherited / genetic ; mutation + chromosome / reference to chromosome 21 / one extra or 3 instead of 2 or 47 not 46 or 24 not 23 in + gamete/egg/sperm ;	1 1	
		(ii)	(sickle cell anaemia) mutation + gene ; homozygous recessive / two recessive alleles ;	1 1 <u>1 max.</u>	
	(b)	(i)	Hb ^A Hb ^S + Hb ^A Hb ^S ; Hb ^A /Hb ^S /Hb ^A /Hb ^S or gametes correct for stated parent genotypes ; Hb ^A Hb ^A + 2Hb ^A Hb ^S + Hb ^S Hb ^S ; or possible genotypes of child correct for stated gametes ; 3 Normal + 1 sickle cell anemia or possible phenotypes of child correct for stated genotypes ;	1 1 1 <u>3 max.</u>	
		(ii)	(carriers of sickle cell anemia) 50% / half / 0.5 / 1 in 2 ;	1	
		(iii)	An explanation linking three of		

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		the following: in areas where Malaria is prevalent people may die before reproducing ; people with sickle cell (alleles) live long enough to reproduce ; sickle cell (alleles) are passed onto future generations, more sickle cell (alleles) in the population ; as a result of natural selection / survival of the fittest ;	1 1 1 1 <u>3 max.</u>	
			[Total: 10]	

Question 9		Expected answers	Marks	Additional Guidance																
	(a)	(mitosis) chromosome number maintained / diploid AW + (meiosis) chromosome number halved / haploid AW; (mitosis) identical offspring / clones + (meiosis) to produce non-identical gametes / sex cells / any gamete correctly named; (mitosis) e.g. of where it occurs – plant or animal / in bacteria; growth / repair + (meiosis) in gonads / testes / ovaries / anthers; (mitosis) asexual reproduction + (meiosis) sexual reproduction; (mitosis) 2 new cells produced + (meiosis) 4 new cells produced; one parent (mitosis) + two parents (meiosis); 1 nuclear division (mitosis) + 2 nuclear divisions (meiosis);	1 1 1 1 1 <u>5 max.</u>	<table><tr><th>Mitosis</th><th>Meiosis</th></tr><tr><td>2 daughter cells</td><td>4 daughter cells</td></tr><tr><td>haploid</td><td>diploid</td></tr><tr><td>chromosome number maintained</td><td>chromosome number halved</td></tr><tr><td>occurs in all organs/body cells</td><td>occurs in gamete producing organs/named</td></tr><tr><td>produces body cells/used in growth</td><td>produces gametes/named</td></tr><tr><td>ref. asexual reproduction</td><td>ref. sexual reproduction</td></tr><tr><td>no genetic variation in offspring AW</td><td>genetic variation in offspring AW</td></tr></table>	Mitosis	Meiosis	2 daughter cells	4 daughter cells	haploid	diploid	chromosome number maintained	chromosome number halved	occurs in all organs/body cells	occurs in gamete producing organs/named	produces body cells/used in growth	produces gametes/named	ref. asexual reproduction	ref. sexual reproduction	no genetic variation in offspring AW	genetic variation in offspring AW
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no genetic variation in offspring AW	genetic variation in offspring AW																			
	(b)	named antibiotic (e.g. ampicillin / kanamycin / penicillin e.g.);	1 1																	

[Turn over

		gene of interest / bacterial host cut with same restriction enzyme;	1	R cleaned
		ligase to join;	1	
		recombinant DNA;	1	
		fungus / bacterium (need not be linked to name);	1	
		fermenter (or described);	1	
		sterilised + to prevent contamination AW;	1	
		substrate / nutrient medium / culture medium (or constituents named) + containing carbohydrate (or named) + respiration / ref energy or protein / amino acids + for growth ;	1	
		paddles for stirring or reason for stirring to supply of oxygen / air ;	1	
		sparger / bubbles / large surface area (of O ₂) ;	1	
		temperature control ± removal of CO ₂ / pH control ;	1	
		maximum / increased rate of growth ;		A 25 – 45 °C if given A pH 5 – 8
		extraction / filtration / purification / crystalization ;	5 max.	
		[Total: 10]		

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