Mark Scheme

Q1.

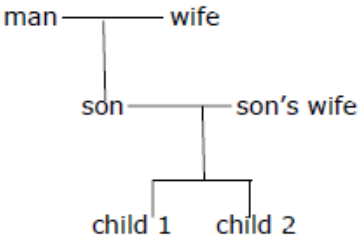
Question number	Answer	Notes	Marks
(a)	C hypothalamus; A does not control sweating B does not control sweating D does not control sweating		1
(b)	B motor; A transmits impulse from sensory to motor C alternative name for A with same function D transmits impulse to brain		1
(c)	• (sweat) evaporates from (the surface of) the skin; • using heat from body/blood; • cools body/reduces body temperature;		3
(d)	• runs in families; • must be faulty/mutated gene/chromosome/allele; • which transfers/passes on information to offspring;		3
(e)	obesity / high sugar intake / high BMI;		1
(f)	• exercise/activity of individual varies; • greater rate of aerobic respiration; • heat given off as by-product/increased body temperature; • external temperature varies; • hotter more sweating/cooler less sweating; • mass of individual varies; • volume of water in the body/fluid intake varies;	Allow reverse argument for mps 2 and 3	5 Total 14

Q2.

Question number	Answer	Notes	Marks
(a) (i)	absorbs uv light; reduces/prevents risk of skin cancer;		2
(ii)	eye/ retina/ choroid/ red blood cell/ haemoglobin ;		1
(b) (i)	mother x father Hh hh; gametes H h h; fertilisation Hh hh; phenotype white forelock normal;		4
(ii)	chance of producing a boy is 0.5/½; chance of producing offspring with condition 0.5/½; chance of producing boy with condition is ½ × ½ = ¼;		3
(c)	Any 4 from different (genetic) code produced; different order of amino acids; codes for different proteins/enzymes; enzyme substrate complex not formed; causes change in pigment;		4
			Total 14 marks

Q3.

Question number	Answer	Mark
(a)	A response that makes reference to the following points: • form of gene (1) • characteristic (gene) that is expressed (1)	2

Question number	Answer	Mark
(b)(i)	man Dd (1) wife Dd/dd (1) son dd and son's wife Dd (1) child 1 (boy) dd and child 2 (girl) Dd (1)  2 marks for setting out as a family tree (minus 1 for each mistake)	6

Question number	Answer	Additional guidance	Mark
(b)(ii)	Process: probability of boy = 1 : 1/1 in 2/0.5/50% (1) probability of polydactyly = 1 : 1/1 in 2/0.5/50% (1) probability of boy with polydactyly is 0.5 × 0.5 = 1 : 3/1 in 4/0.25/25% (1)	allow 3 marks for correct final answer	3

Q4.

Question number		Answer	Notes	Marks
(a)	(i)	chromosomes (1)		1
	(ii)	 (1)  (1)		2
(b)	(i)	complementary bases pair up 3 DNA double helix unwinds 1 strands separate 2 two DNA strands form 4		1
(c)	(i)	thymine/T (1)	R thiamine/thyamine	1
	(ii)	guanine/G/cytosine/C (1)		1
(c)		any four from • allows formation of gametes (1) • haploid (1) • allows variation to occur (1) • which allows species to evolve (1) • allows diploid number to be maintained (1) • at fertilisation (1)		4

Q5.

Question number	Answer	Mark
(a)	A	1

Question number	Answer	Mark
(b)(i)	45 000	1

Question number	Answer	Mark
(b)(ii)	A description that makes reference to any two of the following points: • large (1) • increase (1) • more than doubled (1)	2

Question number	Answer	Mark
(c)(i)	One mark for each of the following: • abstain from/reduce sexual partners (1) • use condom (1)	2

Question number	Answer	Mark
(c)(ii)	Antibiotics/named antibiotic	1

Question number	Answer	Mark
(d)	An explanations that makes reference to any two of the following points: • lack of barrier (1) • allows fluids to mix (1) • fluids contain bacteria/viruses/fungi (1)	2

Q6.

Question number		Answer	Notes	Marks
(a)	(i)	A (the inheritance of two different alleles, both of which are expressed) B is incorrect as one allele is not expressed in codominant inheritance C is incorrect as the ABO inheritance does not involve the inheritance of multiple alleles D is incorrect as ABO inheritances does not involve the inheritance of multiple alleles		1
	(ii)	I^AI^A and I^Ai^o		1
(b)	(i)	• blood group O contains no antigens; • antigens removed/digested (by enzyme); • carbohydrase digest carbohydrates; • protease digest proteins;		Max 3
	(ii)	reduces need to find donor/cheaper/blood readily available/less chance of transfusing incorrect blood group/less risk of disease/infection;		1
(c)	(i)	parent genotypes X^hX^H and X^HY;	One mark for parent genotypes and one mark for gametes **and** linkage	1
		gametes and linkage X^h X^H X^H Y X^h X^H X^H Y X^hX^H X^hY X^HX^H X^HY ;		1
	(ii)	1 in 4/25%/quarter/1/4 /1:3/0.25;		1
			Total question = 9 mark	

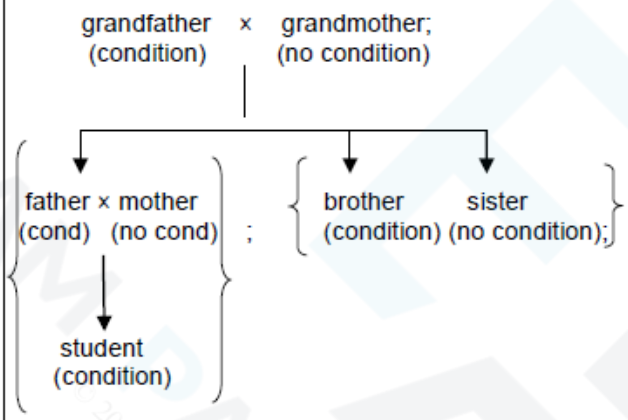
Q7.

Question number	Answer	Notes	Marks
(a)	any three from • change in base sequence/named mutation (1) • of DNA (1) • causing change in genotype/gene (1) • incorrect protein produced (1) • change in phenotype/characteristics (1)	Allow change in DNA for mps 1 and 2 (1)	3
(b) (i)	father X^HY mother X^HX^h (1) gametes X^H Y X^H X^h (1) F1 X^HX^H normal female; X^HX^h carrier female; X^HY normal male; X^hY haemophiliac male (1)		4
(ii)	(chance of first and second child is) ¼/0.25/25% (1) for both is ¼ x ¼/0.25 x 0.25 (1) = 1/16/0.0625/6.25% (1)		3
(c)	any five from • males only have one X chromosome (1) • two X chromosomes/H and h needed to be a carrier (1) • recessive allele/h (1) • carried on X chromosome (1) • either present or not (1) • no chance for dominant allele to be present (1) • to mask recessive (1)		5

Q8.

Question number	Answer	Notes	Marks
(a) (i)	ovulation;		1
(ii)	fertilisation		1
(iii)	Any two from: • zygote/embryo/cells divides/splits; • each half develops into one offspring;		1 1
(b) (i)	**A** FSH and LH;		1
(ii)	Any four from: • removal of egg from female ovary; • collect sperm from male; • egg fertilised; • embryos formed; • embryo inserted into uterus/female;	Allow egg and sperm fuse Allow zygote formed	Max 4
		Total question = 9 marks	

Q9.

Question number	Answer	Notes	Marks
(a) (i)	B; (an alternative form of gene) A it is not an allele C it is not an allele D it is not an allele		1
(ii)	only expressed in the homozygous state/not expressed in the heterozygous state;	Allow valid descriptions/examples of homozygous/heterozygous states	1
(b) (i)			3
(ii)	• occurs only in males/not females/more common in males/females are carriers; • recessive; • probably sex-linked/carried on X chromosome;		3 Total 8

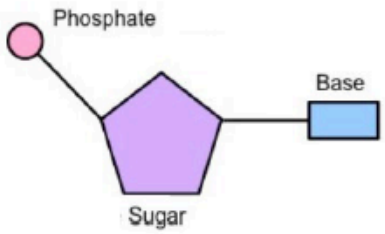
Q10.

Question number	Answer	Notes	Marks
(a) (i)	• correct labelling of axes (1) • suitable scale (1) • X and Y axis correct way round (1) • plotting (2)	minus 1 for each incorrect plot	5
(ii)	Any two from • few at lower end/150-151/top end/160 (1) • majority in middle/154-157 (1) • increases to 154-155 then decreases (1)		2
(b)	Any three from • nutrition (1) • sex (1) • age (1) • genes/genetically based (1)		3

Q11.

Question number	Answer	Notes	Marks
(a) (i)	any three from • prevents excessive loss of blood (1) • forms scab over wound (1) • prevents entry of bacteria /pathogens/microorganisms(1) • so prevents infection (1) • allows wound to heal (1)		3
(ii)	• (allele) on X/sex chromosome (1) • passed on to offspring/inherited by children (1)		2
(b) (i)	D; (X^hY) A the genotype is not X^hX^h B the genotype is not X^HX^h C the genotype is not X^HY		1
(ii)	B; (X^HX^h) A the genotype is not $X^h X^h$ C the genotype is not X^HY D the genotype is not X^hY		1
(iii)	• offspring genotypes X^HX^h and X^hY (1) • 1 carrier female to 1 haemophiliac male = 50%/0.5/½ (1)	full marks for correct figures only.	2
(iv)	• unusual for female to be haemophiliac (1) • both alleles have to be affected (1) • must have a haemophiliac father and mother with haemophilia/carrier (1)	any correct reference to excessive blood loss	3
	Total for question = 12 marks		

Q12.

Question number	Answer	Notes	Marks
(a) (i)	Any two from: • (movement of substances/named solute or gas) against a concentration gradient(1) • using energy/ATP(1)		2
(ii)	Any two from: • parent homozygous recessive/heterozygous / carriers (1) • one (recessive) allele inherited from each parent (1) • reference to homozygous recessive disorder/caused by recessive alleles (1)		2
(iii)	• protein/CFTR is not modified/folded/protein has an incorrect shape(1) • protein/CFTR not transported (to its destination)(1)		2
(iv)	1408 x 3 (1) 4224	Full marks for correct final answer. Max 2 marks ecf for final answer if it is correct from calculation	2
(v)	• (deoxyribose) sugar(1) • joined to a (nitrogenous) base/named base(1) • phosphate group attached to sugar (1)  	Allow one mark only if all 3 components just listed Fully labelled diagram for full marks	3
(b)	any three from • deletion(1) • of one codon/TTT (1) • phenylalanine missing from protein (1) • shape of final protein changed/different protein formed (1)	allow description of deletion	3
		Total for Question = 14 Marks	