SL Paper 2

a. Draw a labelled diagram of the human adult male reproductive system. [5]

b. Describe the application of DNA profiling to determine paternity. [5]

c. Explain the inheritance of colour blindness. [8]

Markscheme

a. a. scrotum – *shown around testes*;

b. testis/testis/testicle – *shown inside scrotum*;

c. epididymis – *shown adjacent to testis and connected to sperm duct*;

d. sperm duct/vas deferens – *double line connecting testis/epididymis to urethra*;

e. seminal vesicles – *sac shown branched off sperm duct (not off the urethra);*

f. prostate gland – *shown positioned where sperm duct connects with urethra*;

g. urethra – *shown as double line linking bladder to end of penis*;

h. penis – *with urethra passing through it*;

*Award **[1]** for each structure clearly drawn and labelled that conforms to the italicized guidelines given*.

b. a. DNA from child, mother and possible father(s) used to establish paternity;

b. (DNA profiling is done) for legal reasons / divorce / inheritance;

c. (DNA profiling is done) for personal reasons / self-esteem issues for children/fathers/parents;

d. DNA copied/amplified using PCR;

e. DNA cut using restriction enzymes;

f. (gel) electrophoresis used to separate DNA fragments;

g. pattern of bands is produced (in gel);

h. analysed for matches between child with mother and possible father;

i. (about) half the child's bands will match the father (while the other half will match the mother);

c. a. colour blindness caused by recessive allele / colour blindness is recessive;

b. gene located on X chromosome/sex-linked;

c. X^b is allele for colour blindness and X^B is allele for normal colour vision/dominant allele;

d. male has one X and one Y chromosome;

e. male has only one copy of gene(s) located on X chromosome;

f. X chromosome (in males) comes from female parent;

g. any male receiving allele from mother will express the trait;

h. X^bY is genotype for colour blind male;

i. many more males have colour blindness than females;

j. female will express colour blindness only if is homozygous recessive/$X^b X^b$;

k. heterozygous/$X^B X^b$ female is a carrier;

l. colour blind female could be born to colour blind father and carrier mother;

*Marks may be earned for use of **annotated** diagram/Punnett square to show points given above.*

*Accept use of letters other than B and b as long as capital letter is used for dominant and lower case letter for recessive alleles. For using other improper notation (not showing X or Y), award **[0]** for the first misuse and then apply ECF to additional notation as long as usage is consistent.*

*(Plus up to **[2]** for quality)*

Examiners report

a. There were many good drawings. However, there were too many sloppy ones. Often the sperm duct and urethra were shown without double lines. The physical proximity and connections of sperm duct, prostate gland, and urethra were usually drawn incorrectly. In a few cases the female reproductive system was drawn.

b. DNA profiling for paternity cases was answered well by many candidates. However, many had the procedures quite poorly sequenced. Little attention was given to selectively breaking up the DNA, or use of restriction enzymes. Weaker answers would have benefitted from more precise terminology such as DNA fragments or DNA bands rather than just DNA. There was fair understanding of gel electrophoresis. Many candidates missed out as they failed to mention DNA from the mother must be used as well as DNA from father and child. Almost no responses included why one might do this process.

c. Inheritance of colour blindness seemed to be pretty well answered by many. There was better attention to correct notation than in the past. There was good use of annotated Punnett grids to clarify answers. However, the candidate needed to label or explain the Punnett grid in order to earn marks. It was surprising that many did not include the genotypes in their explanations. Marks were lost by incorrect use of the term gene when allele should have been used.