

6.2 Genetic inheritance and sex determination

Name: _____ Class: _____ Date: _____

Total: 19 marks**KEY WORDS** allele • homozygous • Punnett square

Objective

Use genetics vocabulary, complete Punnett squares and family trees, explain inherited disorders and embryo screening, and determine sex. Original questions for spec statements 4.6.1.6–4.6.1.8.

1 Key knowledge and worked examples

Definitions to recite cold: **gamete** – sex cell; **chromosome** – DNA structure in the nucleus; **gene** – DNA section coding a protein; **allele** – a version of a gene; **dominant** – expressed with one copy; **recessive** – expressed only with two copies; **homozygous** – two identical alleles; **heterozygous** – two different alleles; **genotype** – the alleles present; **phenotype** – the expressed characteristics.

Single-gene examples: mouse fur colour; red-green colour blindness. Most characteristics come from **multiple genes interacting**.

Worked example (4 marks). CF is caused by a recessive allele (f). Both parents are carriers. Construct a Punnett square and give the probability of an affected child.

Parents $Ff \times Ff \rightarrow$ gametes $F, f \times F, f$. Square: FF, Ff, Ff, ff . Only ff expresses cystic fibrosis – probability 1 in 4 or 25 %; carriers Ff are 2 in 4, phenotypically normal.

Polydactyly – extra fingers/toes – **dominant** allele; one affected (heterozygous) parent $Dd \times dd$ gives 50 % affected. **Cystic fibrosis** – disorder of cell membranes – **recessive**.

Embryo screening: judging economic (cost), social (family choices) and ethical (right to life of embryos, information) issues with given information – informed judgement, no single required answer.

Sex determination: 23 pairs of chromosomes; 22 pairs + one sex pair. **Female XX, male XY**; $X \times Y$ cross gives **1:1** – 50 % each.

2 Practice

2.1 Define allele and genotype. [2]

2.2 A heterozygous brown-eyed parent (Bb) crosses with a blue-eyed parent (bb). Give the expected phenotype ratio. [2]

2.3 Name one dominant and one recessive inherited disorder of humans. [2]

3 Exam-style questions

3.1 Explain the difference between genotype and phenotype, using a plant stem-height gene with alleles T (tall, dominant) and t (dwarf) as your example. [4]

3.2 (*HT*) Two parents are both heterozygous for polydactyly (Dd). Construct a genetic cross and predict the probability that a child has polydactyly. [4]

3.3 A couple are both carriers of cystic fibrosis. Explain why they might choose embryo screening, and give one economic and one ethical issue it raises. [5]
