3.2 Inheritance and evolution

Name: _____ Class: _____ Date: _____ **Total: 30 marks**

Objective

Build the skills to answer exam questions on **inheritance, variation and evolution** 、 : DNA, genes and alleles, genetic crosses and family pedigrees, sex determination, mitosis and meiosis, mutation, and natural selection.

You must be able to:

- use the terms gene, allele, dominant, recessive, homozygous and heterozygous
- complete a genetic cross and give probabilities and ratios
- interpret a family pedigree
- explain natural selection and antibiotic resistance

1 Key knowledge and worked examples

Genes and inheritance

idea	rule
gene	a section of DNA that codes for a protein
allele	one form of a gene, e.g. F or f
dominant / recessive	a dominant allele shows when one copy is present; a recessive allele shows only with two copies
homozygous / heterozygous	two identical alleles (FF or ff) / two different alleles (Ff)
genotype / phenotype	the alleles present / the feature that shows
natural selection	variation; competition; the best adapted survive and reproduce; they pass on their alleles

Worked example 1: a cross. Two heterozygous pea plants, $Tt \times Tt$ (T = tall). Find the ratio of tall to short.

1. Known: each parent gives T or t.
2. Rule: list all offspring: TT, Tt, Tt, tt.
3. Numbers: 3 tall, 1 short.
4. Result: 3 : 1 (a probability of 0.25 for short).

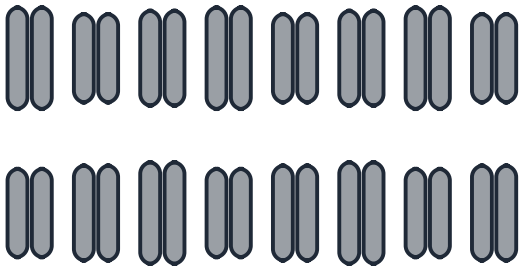
Worked example 2: expected numbers. A cross gives a 3 : 1 ratio and 240 seeds. How many are expected to show the recessive feature?

1. Known: 1 in every 4.
2. Rule: total × fraction.
3. Numbers: $240 \times \frac{1}{4}$.
4. Result: 60 **seeds**.

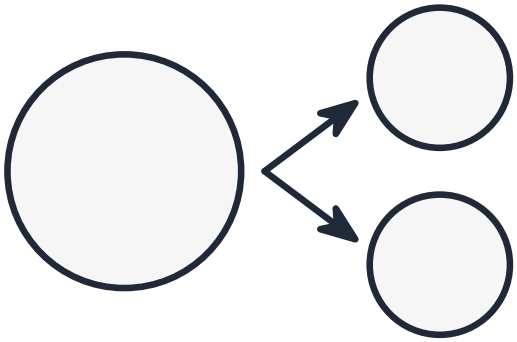
Answer shapes: show the parents' gametes and a Punnett square before you give a ratio.

2 Practice

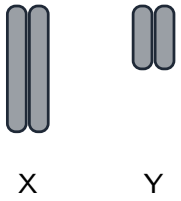
2.1 State the number of chromosomes in a human body cell and in a human egg cell. [2]



2.2 Give **two** differences between mitosis and meiosis. [2]



2.3 Explain why there is a 50% chance that a baby will be a boy. [2]

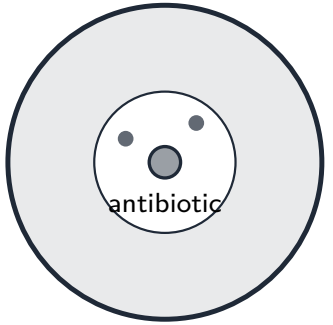


2.4 Define the term mutation, and give **one** factor that makes mutations more likely. [2]

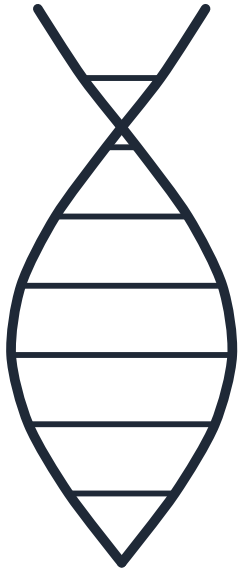


3 Exam-style questions

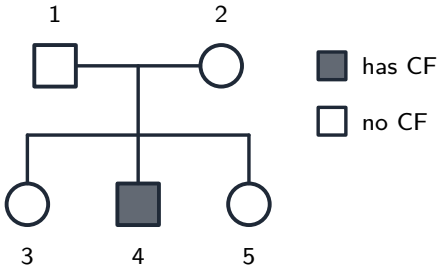
3.1 Explain how a population of bacteria becomes resistant to an antibiotic. [3]



3.2 Describe the structure of DNA. [3]



3.3 Cystic fibrosis (CF) is caused by a recessive allele, f. The dominant allele is F. The family pedigree is shown.



(a) Give the genotypes of parents 1 and 2, and explain how you know. [3]

(b) Draw a Punnett square for parents 1 and 2, and give the probability that their next child will have CF. [4]

(c) In one country, 1 person in 25 carries the CF allele. Calculate the number of carriers expected in a town of 50 000 people. [3]

(d) Children 3, 4 and 5 have the same parents but are all different. Explain how meiosis and fertilisation produce this variation. [6]