

6.1 Reproduction, DNA and genomes

Name: _____ Class: _____ Date: _____

Total: 21 marks**KEY WORDS** meiosis • genome • nucleotide

Objective

Compare sexual and asexual reproduction, explain meiosis and fertilisation, and describe DNA, genes and the genome. Original questions for spec statements 4.6.1.1–4.6.1.5.

1 Key knowledge and worked examples

Sexual reproduction – two gametes fuse (sperm + egg; pollen + egg): meiosis makes gametes, genetic information mixes, offspring show **variation**. **Asexual reproduction** – one parent, mitosis only, no fusion: offspring are genetically identical clones.

Meiosis (in reproductive organs): copies of the genetic information are made → the cell divides **twice** → **four gametes**, each with a **single set** of chromosomes, all genetically different. **Fertilisation** joins gametes and restores the normal number; the zygote divides by **mitosis**; cells differentiate as the embryo develops.

(Bio) Both methods in one organism: malarial parasite – asexual in the human, sexual in the mosquito; fungi – asexual spores + sexual; strawberry – sexual seeds + asexual **runners**; daffodil – **bulb division**.

DNA: a **polymer** of two strands in a **double helix**; found in the nucleus as **chromosomes**. A **gene** is a small section of DNA coding for a sequence of amino acids → one specific protein. The **genome** is the entire genetic material of an organism.

Human genome importance: finding genes linked to diseases; understanding and treating inherited disorders; tracing human migration patterns.

(Bio) DNA structure: repeating **nucleotides** – sugar + phosphate + one of four bases (**A, C, G, T**); alternating sugar–phosphate backbone; **three bases code for one amino acid**.

(HT Bio) Protein synthesis: on **ribosomes**, from a template; **carrier molecules** bring the amino acids in order; the chain **folds** to a unique shape – enzyme, hormone or structural protein. **C pairs with G; T with A**. Most mutations do nothing; some alter a protein slightly; a few change its shape so an enzyme no longer fits its substrate. **Non-coding DNA** switches genes on and off, so variants there change

how genes are expressed.

Worked example (3 marks). Explain how meiosis and fertilisation together keep the chromosome number constant.

Meiosis halves the chromosome number, making gametes with a single set; two gametes fuse at fertilisation; restoring the full number in the zygote, so every generation has the same number.

2 Practice

2.1 Give two differences between sexual and asexual reproduction. [2]

2.2 How many gametes does one meiosis produce, and how do they compare genetically? [2]

2.3 Give three reasons why studying the human genome matters for medicine. [3]

3 Exam-style questions

3.1 A strawberry plant reproduces sexually through seeds and asexually through runners. Compare the offspring of the two methods and suggest when each is an advantage. [5]

3.2 (*Bio*) Describe the structure of DNA, including nucleotides and how the base sequence relates to protein structure. [5]

3.3 (*HT*) Explain how a mutation in a gene can change the protein made and the organism's phenotype. [4]
