Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

Each answer shows the steps, then the **result**.

2.1

- body cell: 46
- egg cell: 23

2.2

Any two (1 mark each):

- mitosis gives two cells; meiosis gives four
- mitosis cells are diploid; meiosis cells are haploid
- mitosis cells are identical; meiosis cells are genetically different
- mitosis is for growth and repair; meiosis makes gametes

2.3

- the mother's eggs all carry an X; half the father's sperm carry X and half carry Y
- so half the zygotes are XY (boy) and half XX (girl)

2.4

- a rare, random change in the DNA (genetic material)
- ionising radiation (or certain chemicals, e.g. in tobacco smoke)

3.1

- a random mutation gives some bacteria resistance
- the antibiotic kills the bacteria that are not resistant; the resistant ones survive
- the resistant bacteria reproduce and pass on the allele, so resistance becomes common

3.2

- two strands twisted into a double helix
- the strands are joined by pairs of bases
- A pairs with T and C pairs with G

3.3

(a) both Ff; child 4 has CF, so is ff and got one f from each parent; the parents do not have CF, so each also has an F

(b) gametes F, f from each parent; offspring FF, Ff, Ff, ff; ff is 1 in 4; probability **0.25** or 25%

(c) $\frac{1}{25}$ of the town; $50\,000 \div 25 = \mathbf{2000}$

(d) points to include:

- each parent has two alleles of every gene, one on each chromosome of a pair (K)
- in meiosis the chromosome pairs separate, so each gamete gets only one of each pair (K)
- the chromosomes are shared out randomly, so each gamete has a different mix of alleles (An)
- fertilisation is random: any sperm can fuse with any egg (K)
- so each zygote gets a new combination of alleles from the two parents (An)
- this explains why child 4 has CF (ff) while 3 and 5 do not (App)

Levels: **5–6** a full, logical answer with correct biology and correct terms; **3–4** several correct points, partly linked; **1–2** one or two relevant points.