Solutions

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

2.1

- haploid has one set of chromosomes (n); diploid has two sets (2n)

2.2

- crossing over; independent assortment (random orientation)

3.1 B

- Halving the number means fertilisation restores the diploid number, keeping it constant

3.2 A

- Homologous chromosomes are separated in meiosis I

3.3

- crossing over: homologous chromosomes swap matching segments at chiasmata, making new combinations of alleles; independent assortment: the homologous pairs line up in a random order at the equator, so gametes receive different mixes of maternal and paternal chromosomes

3.4

(a)

- $2^4 = 16$

(b)

- crossing over also creates new allele combinations, adding to the variety

3.5

(a)

- **Crossing over** in prophase I — non-sister chromatids of a bivalent exchange lengths of DNA at a chiasma, producing new combinations of alleles on one chromosome. **Independent assortment** in metaphase I — each bivalent lines up on the equator independently of the others, so either homologue may go to either pole. **Random assortment of chromatids** in metaphase II — the sister chromatids, no longer identical after crossing over, separate independently

(b)

- 2^n where n is the haploid number, here 3; $2^3 = 8$ different gametes

(c)

- Crossing over creates chromatids that are not simply one homologue or the other, so the real number of gamete types is far greater than 8; and fertilisation is random —

any one of the male gametes may fuse with any one of the female gametes, multiplying the possibilities

(d)

- Meiosis gives four haploid cells, mitosis two diploid cells; meiotic products are all genetically different from each other and from the parent, mitotic products are genetically identical to it