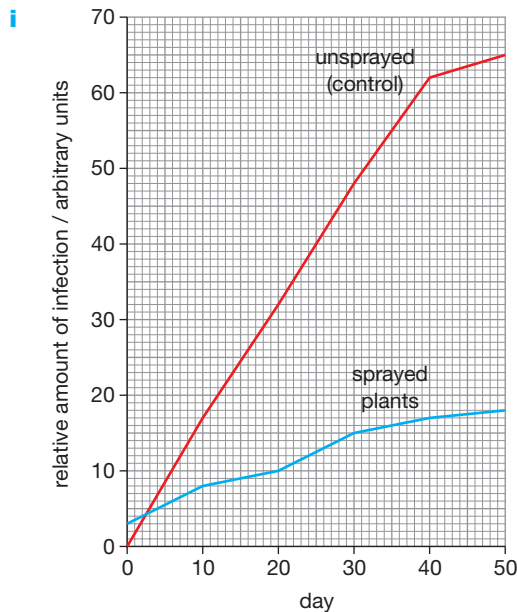


- 7 ► a Reduced growth / photosynthesis (1), affecting the appearance of the crop so not harvested / unfit for sale (1)



Axes correct way round, labelled (1), all points correctly plotted on both curves (2), key to each curve (1), points joined by straight lines (1)

- ii Sprayed: 12 (1), unsprayed 40 (1).
- iii The Control shows whether there is any infection without the fungicide (1). It is needed to be able to see how much effect the fungicide is having on the infection, i.e. as a comparison (1).
- iv By day 30, the infection in the unsprayed (Control) plants was approximately the same as in Year 1 (1). However the infection in the sprayed plants had increased (1). This was probably because the plants had developed resistance to the fungicide (1).

## UNIT 5 ANSWERS

### CHAPTER 16

- 1 ► C    2 ► A    3 ► B    4 ► D
- 5 ► a A = base / thymine; B = base / cytosine; C = deoxyribose / sugar; D = phosphate; E = nucleotide.
- b Franklin used X-ray diffraction on DNA to find out about its structure. Watson & Crick used Franklin's data and other information to build a model of the structure of DNA.
- c A always pairs with T, and C always pairs with G.
- 6 ► a i A gene is a length of DNA that codes for a protein.  
ii Alleles are different forms of a gene.
- b A chromosome is a structure in the nucleus of a cell composed of DNA (and proteins).
- c i Both have 23 pairs of chromosomes in each cell.  
ii Woman's skin cells contain XX sex chromosomes, man's contain XY.

- 7 ► a Flow diagram should have boxes showing the stages in order: (1) the two strands of the DNA separate; (2) each strand acts as a template for the formation of a new strand; (3) DNA polymerase assembles nucleotides alongside the two strands; (4) Two DNA molecules formed.
- b i Caused by an addition, duplication or deletion of a base, resulting in all triplets of bases after the mutation being different and so different amino acids are coded for.  
ii Caused by a change in one base in a triplet, by substitution or inversion, so that it codes for a different amino acid. Triplets after the mutation are not altered; so subsequent amino acids will not be affected.
- 8 ► a Five.  
b AUG GAG CCA GUA GGG  
c ATG GAG CCA GTA GGG  
d The mRNA base sequence is converted into the amino acid sequence of a protein during a process called translation. The mRNA sequence consists of a triplet code. Each triplet of bases is called a codon. Reading of the mRNA base sequence begins at a start codon and ends at a stop codon. Molecules of tRNA carrying an amino acid bind to the mRNA at an organelle called the ribosome.

### CHAPTER 17

- 1 ► D    2 ► D    3 ► C    4 ► B
- 5 ► a Both types of division start with each chromosome copying itself / DNA replicating / DNA copying itself / chromatids forming.  
Plus any two of:
- Mitosis produces two daughter cells, meiosis produces four daughter cells.
  - Daughter cells from mitosis are genetically identical to each other and the parent cell; daughter cells from meiosis are genetically different from each other and the parent cell.
  - Mitosis produces daughter cells with the same number of chromosomes as the parent cell / diploid to diploid; meiosis halves the chromosome number / diploid to haploid.
- b Mitosis, they are formed by division of body cells to produce more body cells.
- c Because the number of chromosomes per cell is reduced by half.
- 6 ► a They have been formed by mitosis, so are genetically identical.  
b Meiosis is used to form pollen and egg cells, so fertilisation results in seeds that are genetically different from each other.
- 7 ► a Control.  
b Plants from cuttings would be genetically identical, which is better in order to compare the effects of the treatment with nitrogen-fixing bacteria. Seeds would be genetically different, so their growth might depend on their genes, rather than the treatment.

- c** The nitrogen-fixing bacteria provide nitrates needed for growth. This is an environmental effect on growth, rather than a genetic one. Therefore the environment plays a big part in the growth of these plants.
- 8 ▶ a** Meiosis, because sperm are gametes that are haploid / contain half the number of chromosomes of body cells.
- b** Mitosis, because body cells are dividing to produce more body cells with the normal chromosome number.
- c** Mitosis, because body cells are dividing to produce more body cells with the normal chromosome number.
- d** Meiosis, because pollen grains are gametes that are haploid / contain half the number of chromosomes of the plant's body cells.
- e** Mitosis, because the zygote must divide to produce more body cells with the normal chromosome number.
- 9 ▶ a** Genetic – eye colour is inherited and not affected by the environment.
- b** Genetic – it depends on inheriting XX or XY chromosomes.
- c** Environmental – the pH of soil is a feature of the plant's environment.
- d** Both – genes determine whether a plant falls into the tall or dwarf categories, but environmental factors affect how well each plant grows.
- e** Both – genes affect the risk level, but environmental factors such as diet, smoking, etc. also have an effect.
- 10 ▶ a** Chromosomes align themselves along the equator of the cell, attached to the spindle fibres.
- b** Spindle fibres shorten and pull chromatids towards opposite poles of the cell.
- c** Chromosomes reach the opposite poles of the cell. Nucleus starts to re-form.

## CHAPTER 18

**1 ▶ D**      **2 ▶ A**      **3 ▶ D**      **4 ▶ C**

- 5 ▶ a** All tall.  
**b** All tall.  
**c** All tall.  
**d** 3 tall : 1 short.  
**e** 1 tall : 1 short (or 2 : 2).  
**f** All short.

- 6 ▶ a i** Homozygous.  
**ii** Dominant gene hides the expression of the recessive gene when heterozygous; recessive gene expressed only in homozygous form.

**b i** B and b; **ii** all Bb.

**c i** Heterozygous.

**ii**

	B	b
B	BB	Bb
b	Bb	bb

Phenotypes = 3 black : 1 red.

- 7 ▶ a** Gametes of parents = R and r  
 Genotypes of F1 = Rr  
 Genotypes of F1 parents = Rr and Rr  
 Gametes of F1 parents R, R and r, r  
 Genotypes of F2 =

	R	r
R	RR	Rr
r	Rr	rr

**b** A, B and C are red, D is yellow.

- 8 ▶ a** Individual 8 has cystic fibrosis, but neither of his parents does, so they must be heterozygous and the allele must be recessive. If the allele was dominant, he would have to have inherited at least one dominant allele from one parent, so that parent would have cystic fibrosis too.
- b** 3 and 4 must be heterozygous for the gene, as they do not have the disease, but their son does. 11 must be homozygous for the gene, since she has the disease.

**c i** Probability that the next child is male is 1 in 2, or 0.5:

	X	Y
X	XX	XY
X	XX	XY

**ii** Let A = the normal allele of the gene and a = cystic fibrosis gene.

Individual 11's genotype = aa. Individual 10's genotype could be AA or Aa.

So there are two possible outcomes:

AA × aa

	A	A
a	Aa	Aa
a	Aa	Aa

Aa × aa

	A	a
a	Aa	aa
a	Aa	aa

Depending on whether 10 is AA or Aa, there could be no chance, or a 1 in 2 chance (0.5 probability) of their next child having cystic fibrosis. It could also be argued that if the genotype of 10 is unknown, the probability of the child having cystic fibrosis is 1 in 4, or 0.25.

- 9 ▶ a** They must both be heterozygous. Let S = allele for short hair and s = allele for long hair.

	S	s
S	SS	Ss
s	Ss	ss

There is a 1 in 4 chance of producing a longhaired guinea pig (ss).