Answers to end-of-chapter questions Chapter 18: Inheritance

- a a large letter for the smooth fur allele and a matching small letter for the rough fur allele, using letters that look different from each other, e.g. A and a (not S and s)
 - b AA, Aa and aa
 - c AA smooth fur, Aa smooth fur, aa rough fur
- 2 a a large letter for the red colour allele and a matching small letter for the white colour allele, using letters that look different from each other, e.g. R for the red colour allele and r for the white colour allele
 - **b** R is dominant, because this is the allele that has an effect in a heterozygous plant.
 - c RR, red; Rr, red; rr, white
- **3** a A gene is a length of DNA that codes for a particular protein; an allele is one of two or more forms of a gene.
 - b A dominant allele shows its effect in a heterozygous organism; a recessive allele only has an effect when no dominant allele is present.
 - c A homozygous organism has two identical alleles of a gene, e.g. **AA**; a heterozygous organism has two different alleles of a gene, e.g. **Aa**.
 - **d** The genotype shows the alleles of a gene that an organism possesses; the phenotype describes the characteristics of the organism.
 - e Mitosis is a type of nuclear division in which genetically identical daughter cells are produced; meiosis is a type of nuclear division that produces daughter cells with only half the full number of chromosomes, and that are genetically different from one another. Mitosis is used in growth, repair and asexual reproduction; meiosis is used to produce gametes.
 - f A haploid cell has one full set of chromosomes; a diploid cell has two full sets.

- g The base sequence is the sequence of bases A, C, G and T found in a DNA molecule; amino acid sequence is the sequence of amino acids found in a protein. The base sequence on a DNA molecule determines the sequence in which amino acids are linked together to build a protein.
- h DNA is found in the nucleus; it molecules are made up of two strands of bases, linked together by pairing between A and T, C and G, and wound into a double helix. mRNA is made in the nucleus and travels out into the cytoplasm; it is made of one strand of bases and is not wound into a helix.
- 4 a symbols should be the same letter, large and small, and easily distinguishable, e.g.
 EE for indented edges;
 ee for smooth edges;
 [2]

indented

smooth

b parents' phenotypes

- parents' genotypes EE ee (E) (e) gametes all Ee offspring genotypes indented and phenotypes parents' genotypes correct; gametes correct and placed inside circles; offspring genotype and phenotype correct; entire genetic diagram laid out correctly with all headings. [4]
- c parents' phenotypes indented indented parents' genotypes Ee Ee gametes E and e E and e

offspring genotypes and phenotypes

	E	<u>e</u>
E	EE indented	Ee indented
e	Ee indented	ee smooth

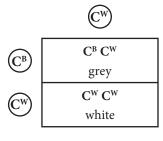
parents' genotypes correct; all gametes correct and shown inside circles; genotypes of offspring correct; phenotypes of offspring correctly associated with genotypes; 99:302 is approx, 3:1 and genetic diagram shows 3 indented: 1 smooth;

[5]

[2]

- 5 breed the black rabbit with a white rabbit; if there are any white offspring the black rabbit *must be* heterozygous; if there are no white offspring the black rabbit *is probably* homozygous; properly constructed genetic diagram (see answer to question 4b) showing cross between BB and bb giving all Bb offspring; which will all be black; properly constructed genetic diagram showing cross between Bb and bb giving 1 Bb: 1 bb offspring; so 50 % black and 50 % white offspring / ratio of 1:1 black: white. [max 5]
- 6 a C^B C^B black feathers;
 C^B C^W grey feathers;
 C^W C^W white feathers;
 two correct for one mark;
 all correct for two marks;
 [2]
 - b they are codominant; capital letter would be used to stand for a dominant allele and small letter for a recessive allele;
 - c parents' phenotypes grey white parents' genotypes $C^B C^W C^W$ gametes C^B and C^W

offspring genotypes and phenotypes



- parents' genotypes correct; all gametes correct and shown inside circles; genotypes of offspring correct; phenotypes of offspring correctly associated with genotypes; would expect, 1:1 grey: white / 50 % grey and 50 % white offspring; [5]
- 7 a there are four colour-blind males but only one colour-blind female;
 males who marry out of the family do not have colour-blind sons;
 [2]
 - b person 2 X^BX^b;

 person 3 X^bY;

 person 11 X^BX^B or X^BX^b;

 person 13 X^bY;

 person 19 X^BY;

 [5]

offspring genotypes and phenotypes

(VR)

	$\mathbf{X}^{\mathbf{y}}$	X
	X ^B X ^b	X ^b X ^b
(X_p)	carrier female	colour-blind
		female
	X ^B Y	X ^b Y
(Y)	male with normal	colour-blind
	vision	male

(vb)

parents' genotypes correct;
all gametes correct and shown inside circles;
genotypes of offspring correct;
phenotypes of offspring correctly associated
with genotypes;
50:50 / 1 in 2, chance that any son will be
colour-blind; [5]

d the allele for colour-blindness is on the X
chromosome;
man passes on a Y chromosome to his sons; [2]

- 8 first woman's genotype could be I^A I^A or I^AI^O; her husband's genotype must be I^OI^O; second woman's genotype must be I^A I^B; her husband's genotype could be I^A I^A or I^AI^O; baby with blood group O must be I^OI^O; so must have inherited an I^O allele from both its mother and its father; so its parents must be the first couple; baby with blood group B could be I^BI^O or I^BI^B;
- and must have inherited an **I**^B allele from at least one its parents; so its parents must be the second couple; so the women have been given the correct babies; use of correctly set out genetic diagram; [max 8]