Answers to Workbook exercises Chapter 18

Exercise 18.1 Fruit fly inheritance

a Body divided into head, thorax and abdomen; six jointed legs; one pair of antennae; wings attached to thorax.

b *Drosophila*

c

Genotype	Phenotype
NN	normal wings
Nn	normal wings
nn	vestigial wings

d **phenotypes of parents** normal wings vestigial wings

genotypes of parents **Nn** **nn**

gametes (N) and (n) all (n)

	gametes from vestigial winged fly	
		(n)
gametes from normal winged fly	(N)	**Nn** normal wings
	(n)	**nn** vestigial wings

e About half would have each phenotype, so about 41 with normal wings and 41 with vestigial wings.

Exercise 18.2 Black and chestnut horses

a i E

ii Ee

iii chestnut

b i **Ee** The foal must have had two **e** alleles, one from each of its parents. The mare was **ee**. The stallion was black, so he must have had one black allele and one chestnut allele.

ii **phenotypes of parents** black chestnut

genotypes of parents **Ee** **ee**

gametes (E) and (e) all (e)

	gametes from chestnut mare	
		(e)
gametes from black stallion	(E)	**Ee** black
	(e)	**ee** chestnut

So there was about a 1 in 2 chance that the foal would be chestnut.

iii Exactly the same: 1 in 2. Each time they have a foal, half of the stallion's sperm will be carrying an **E** allele and half carrying an **e** allele, so the chance of a sperm carrying an **e** allele fertilising the egg is 1 in 2.

Exercise 18.3 Pedigree

a Neither of the parents of the two people with PKU have PKU. If the allele was dominant, then at least one of the parents would have it and would therefore show the condition. This situation can only be explained if both parents are heterozygous, with one copy of the normal allele and one of the recessive PKU allele. Two of their children must have received the recessive allele from both parents.

b Both of person 4's copies of this gene are the recessive allele. It is virtually impossible for the same mutation to have occurred in both of them, as mutation is a random event.

c Person 1 could be either **QQ** or **Qq**.
Person 2 could also be either **QQ** or **Qq**.
Person 3 must be **Qq**, as they don't show the condition but do pass on a **q** allele to a child.
Person 4 is **qq**.
Person 5 could be **QQ** or **Qq**, as both of her parents have the genotypes **Qq**.

d The only way person 5 could have a child with PKU is if she has the genotype **Qq**, and her partner has this genotype as well. There is a good chance that she does not have the **q** allele (in other words that she is **QQ**) and it is likely that her partner will also be **QQ**. However, if she does have the genotype **Qq**, and if she marries someone from a family in which some members have PKU, then there is a risk that he could also be **Qq**, in which case there is a one in four risk of them having a child with PKU.

Exercise 18.4 Sex linkage in fruit flies

S

a For example, X^R and X^r.

b

phenotypes of parents	white-eyed male	red-eyed female
genotypes of parents	X^rY	$X^R X^r$
gametes	(X^r) and (Y)	(X^R) and (X^r)

	gametes from red-eyed female		
		(X^R)	(X^r)
gametes from white-eyed male	(X^r)	$X^r X^R$ red-eyed female	$X^r X^r$ white-eyed female
	(Y)	X^RY red-eyed male	X^rY white-eyed male

The predicted ratio is therefore 1 red-eyed female : 1 white-eyed female : 1 red-eyed male : 1 white-eyed male.