

**Question 27** (Answer: **C**)

- A female has two X chromosomes, so every egg carries an X – statement 2, not statement 1.
- A male has one X and one Y, so a sperm carries either – statement 3.
- It is the sperm, therefore, that determines the sex of the child.

**Question 29** (Answer: **D**)

- Colour blindness is X-linked recessive, so the mother is  $X^cX^c$ .
- A son gets his single X from his mother and his Y from his father.
- So he must receive  $X^c$  – every son of an affected mother is colour blind, a chance of 100%.

**Question 32** (Answer: **C**)

- White  $\times$  black giving speckled offspring means both alleles show in the same bird.
- That is codominance – neither allele is dominant over the other.
- It is not incomplete dominance, because the feathers stay white \*and\* black rather than blending to grey.

**Question 30** (Answer: **B**)

- A gene occupies a fixed position on a chromosome.
- Alleles are the different versions of that same gene.
- So an organism with two chromosomes of a pair carries two alleles of every gene.

**Question 31** (Answer: **B**)

- Both parents are heterozygous, so the cross is  $Pp \times Pp$ .
- The four equally likely offspring are PP, Pp, Pp and pp.
- Three of the four carry a dominant allele and so have extra toes; only pp (1 in 4) does not.

**Question 32** (Answer: **D**)

- Red-green colour blindness is caused by a recessive allele on the X chromosome.
- A male has only one X, so one copy of the allele affects him.
- A female needs two copies, which is why it is far more common in males – but it does occur in females.

**Question 30** (Answer: **B**)

- White  $\times$  red giving \*all\* roan offspring shows both alleles are expressed together – codominance.
- Crossing two roan parents then gives red, roan and white in a 1 : 2 : 1 ratio.
- So a quarter of the offspring are red and a quarter white, with a half roan.

**Question 31** (Answer: **B**)

- Look for a child with the condition whose parents do not have it – that shows the allele is recessive.
- If both sexes are affected roughly equally, the gene is not sex-linked.
- Unaffected parents of an affected child must both be carriers.

**Question 32** (Answer: **C**)

- A sex-linked recessive allele is carried on the X chromosome.
- A male has only one X, so a single copy makes him affected.
- A female needs two copies to be affected, so an unaffected female with an affected son must be a carrier.

**Question 32** (Answer: **B**)

- Each parent can pass on  $I^o$ , so cross  $I^A I^o$  with  $I^B I^o$ .
- The four equally likely offspring are  $I^A I^B$ ,  $I^A I^o$ ,  $I^B I^o$  and  $I^o I^o$ .
- Only  $I^o I^o$  is group O, so the probability is 1 in 4 = 0.25.