Past-paper walk-through

Monohybrid inheritance ▪ 17.4

eXercise

Questions in this set

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Question 27

0610/21 N25 ▪ Q27 ▪ 1 mark

27 Which statements describe the sex chromosomes in human gametes?

1 Egg cells contain either an X or a Y chromosome.

2 Egg cells contain only X chromosomes.

3 Sperm cells contain either an X or a Y chromosome.

4 Sperm cells contain only Y chromosomes.

A 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

Solution 27

Answer: **C**

Why

- 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

0610/21 N25 ▪ Q29 ▪ 1 mark

29 A female with red-green colour blindness has a child with a male who does **not** have red-green colour blindness. The child is male.

What is the chance of this child having red-green colour blindness?

A 0% **B** 25% **C** 50% **D** 100%

Solution 29

Answer: **D**

Why

- 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

0610/22 N25 ▪ Q32 ▪ 1 mark

32 The photograph shows a speckled chicken.

Speckled chickens have white feathers and black feathers.

Question 32

When a chicken with only white feathers and a chicken with only black feathers are crossed, all of the offspring are speckled.

What would be the expected phenotypic ratio if a speckled chicken was crossed with a chicken with only white feathers?

Question 32

A all offspring have only white feathers

B all offspring are speckled

C 1 white feathers only : 1 speckled

D 3 white feathers only : 1 speckled

Solution 32

Answer: **C**

Why

- White × 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

0610/23 N25 ▪ Q30 ▪ 1 mark

30 What are alleles?

A a pair of chromosomes

B different versions of the same gene

C the total number of genes on one chromosome

D two genes side by side on the same chromosome

Solution 30

Answer: **B**

Why

- 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

0610/23 N25 ▪ Q31 ▪ 1 mark

31 Polydactyly in cats is a dominant condition that causes affected cats to be born with extra toes.

What is the probability of two cats that are heterozygous for polydactyly having an offspring with **no** extra toes?

A 0.125 **B** 0.25 **C** 0.50 **D** 0.75

Solution 31

Answer: **B**

Why

- 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

0610/23 N25 ▪ Q32 ▪ 1 mark

32 Which statement describes red-green colour blindness?

A It is an example of codominance.

B It is more common in females than in males.

C It only occurs in males.

D The recessive allele is located on an X chromosome.

Solution 32

Answer: **D**

Why

- 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

0610/21 J25 ▪ Q30 ▪ 1 mark

30 A farmer bred together male cattle with white hair and female cattle with red hair. All the offspring produced had roan hair (a mixture of red and white).

He then repeatedly bred together two roan cattle, and the offspring were in the ratio of 1 red : 2 roan : 1 white.

What explains why the farmer obtained this ratio?

A The red phenotype is dominant to the white phenotype.

B The roan phenotype is an example of codominance.

C The roan phenotype is dominant to the red phenotype and the white phenotype.

D The white phenotype is dominant to the red phenotype.

Solution 30

Answer: **B**

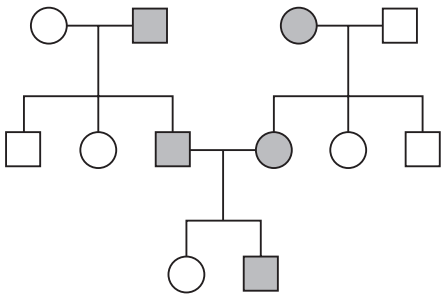
Why

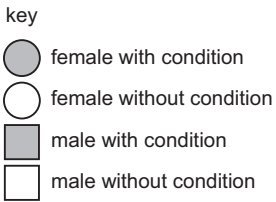
- White $\times$ red giving *all* roan offspring shows both alleles are expressed together – codominance.
- Crossing two roan parents then gives red, roan and white in a $1:2:1$ ratio.
- So a quarter of the offspring are red and a quarter white, with a half roan.

Question 31

0610/22 J25 ▪ Q31 ▪ 1 mark

31 The diagram shows the inheritance of a genetic condition in one family.





What can be concluded about this genetic condition?

Question 31

A The alleles for the condition must be codominant.

B It is caused by a dominant allele.

C It is caused by recessive alleles.

D The alleles for the condition must be sex-linked.

Solution 31

Answer: **B**

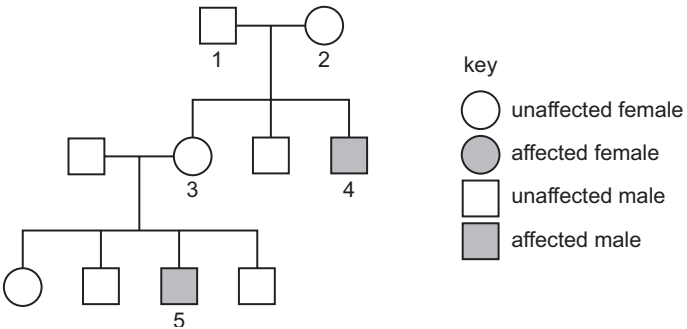
Why

- 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

0610/23 J25 ▪ Q32 ▪ 1 mark

32 The diagram shows the inheritance, in one family, of a sex-linked recessive disease.



Question 32

Which individuals in the diagram are heterozygous for this disease?

A 1 and 2 **B** 1 only **C** 2 and 3 **D** 4 and 5

Solution 32

Answer: **C**

Why

- 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

0610/22 M25 ▪ Q32 ▪ 1 mark

32 A man with blood group A and genotype I^AI^o has a child with a woman who has blood group B and genotype I^BI^o.

What is the probability of the child having blood group O?

A 0.00 **B** 0.25 **C** 0.50 **D** 1.00

Solution 32

Answer: **B**

Why

- 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 $4 = 0.25$.