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Level: SL IB in Biology
Subject: Biology
Topic: IB SL Biology
Type: Topic Question

All International Baccalaureate IB Topic Questions SL Biology

BIOLOGY

SL - IB

Key skills

Mark Scheme

Answer 1

The correct answer is D

- Option A is incorrect as although there can be differences in mutation rates between twins, it is dependent on many factors and is not the most likely explanation. Interestingly, recent research on early developmental mutations in twins is impacting the classical interpretation about epigenetics!
- Option B is incorrect as although epigenetic changes can influence the expression of a gene encoding for a protein, they can't alter the structure of the protein
- Option C is incorrect as both twins would be expected to inherit any epigenetic modifications from the parents but these are lost very early on in embryonic development

Answer 2

The correct answer is A; a particular gene occupies a specific position, or locus, on a chromosome, and this position will be the same across all individuals in a species.

Answer 3

The correct answer is C.

- Mutations in an existing allele can give rise to a new allele.
- Eukaryotic chromosomes exist in homologous pairs, with each member of the pair carrying one allele of a gene; this means that every eukaryotic cell has two alleles of every gene.

Some genes may have two different versions, or alleles, but it is also possible to have more than two, or multiple alleles of a gene. A single eukaryotic cell, however, will only have a maximum of two alleles for any one gene.

Answer 4

The correct answer is C. Female gametes all contain X chromosomes, whereas male gametes contain half X and half Y chromosomes. It is therefore the male gamete that determines the sex of the offspring and not the female.

Both sperm cells and egg cells contain sex chromosomes, meaning that A and D are incorrect statements.

Fathers have both an X and a Y chromosome, so can pass on either to their offspring.

Answer 5

The correct answer is C.

- Answer A is incorrect as it is derived from subtracting the remaining allele frequency (0.28) from 0.72 instead of 1
- Answer B is incorrect as it refers to the frequency of both I^A and I^B alleles
- Answer D is incorrect as it was calculated by dividing the allele frequency of I^B by 2

Remember that the allele frequency in a population must add up to 1.

① Allele frequency for the I^o allele is 0.72
The allele frequency for the remaining two alleles can be calculated as follows:

$$1 - 0.72 = 0.28$$

Since they have an equal abundance in this population, it means that the frequency for the I^B allele will be:

② $0.28 \div 2 = 0.14$ [1 mark]

Answer 6

The correct answer is D. Continuously variable traits are usually polygenic and follow a normal distribution (bell-shaped curve).

Statement II is incorrect because that is a classic feature of discontinuous variation.

Statement IV is incorrect because continuously variable traits can be influenced by environmental factors eg. protein content of the diet on human height.

Answer 7

The correct answer is A.

The key to this question is the recognition that the two alleles are codominant ie. both have an effect on the phenotype. This is evident in the family-tree diagram, where parental phenotypes appear in the offspring of both crosses. If both alleles are present, their effects 'merge' and create a moderately long-haired phenotype. Once codominance is apparent, you can conclude that H^LH^L homozygous is long hair and H^LH^S heterozygous is moderately-long-haired.

Answer 8

The correct answer is D as it shows a ratio of 3.02:1

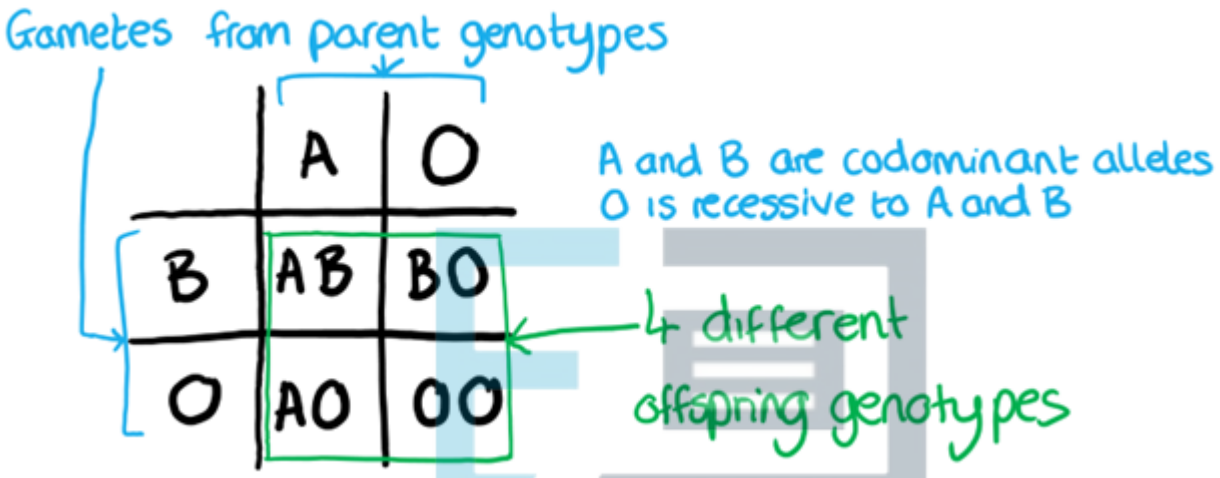
Option C is also a very close ratio with 3.2:1 but it is not the closest to the expected outcome of 3:1

A and B are a long way off the expected outcome with B having the ratios the opposite way round to what is expected

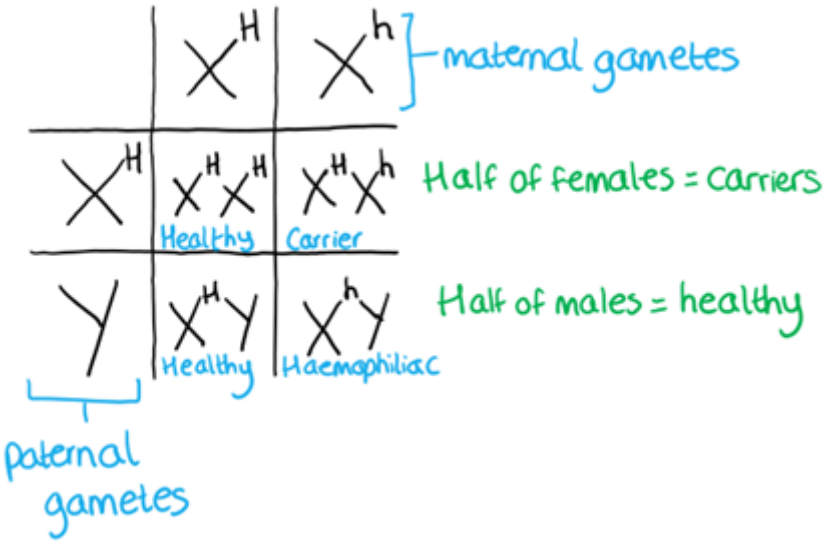
Answer 9

The correct answer is B.

Options A, C and D are incorrect as they wouldn't give the correct phenotypes in the correct ratios.



Answer 10



The correct answer is D.

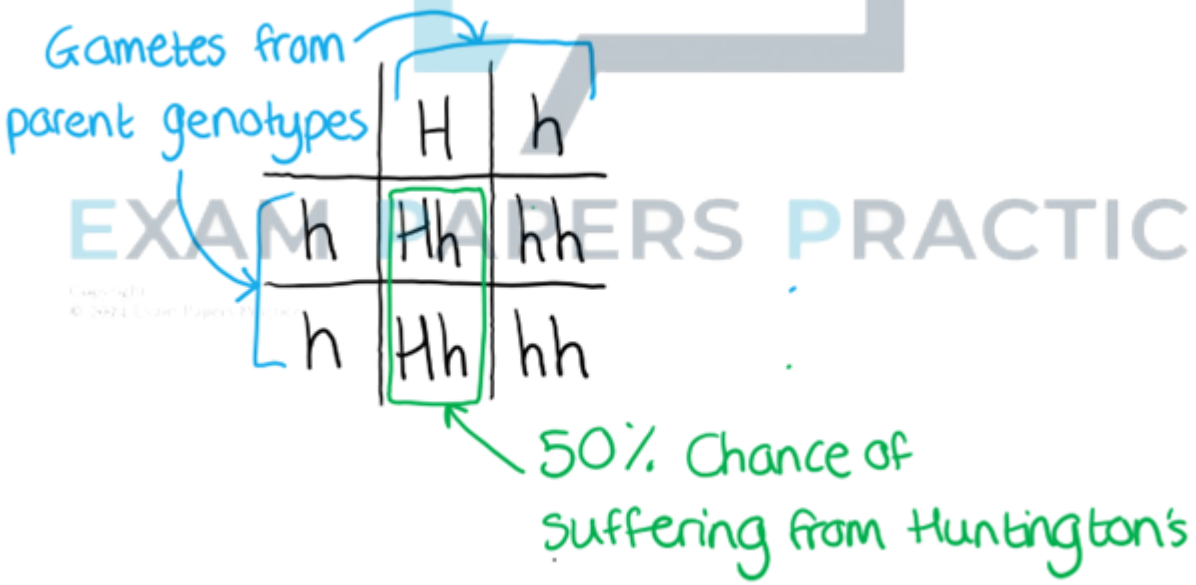
Answer 11

The correct answer is C because cystic fibrosis is a disease caused by a recessive allele, therefore any sufferer must be homozygous recessive. The sufferer must have inherited one faulty recessive allele from each parent, so the two healthy parents are heterozygous.

Based on the explanation above, all other answers contain one implausible genotype. Though it is not possible to determine whether a healthy individual is homozygous dominant or heterozygous if they have no offspring, in this case both individuals 2 and 3 have children with cystic fibrosis, so we know that they are heterozygous.

Answer 12

The correct answer is A; Huntington's disease is caused by a dominant allele so parent genotypes must be Hh (heterozygous) and hh.



Answer 13

The correct answer is C because person Y is a healthy female who would have inherited one healthy allele from her mother and one faulty haemophilia allele from her father. As haemophilia is located on the X chromosome, her father only has one copy to give, and as he is a sufferer, we know that this copy will be the faulty allele.

A and B are not plausible genotypes; A would be a sufferer rather than healthy, and B could not occur as individual Y's father could not pass on a healthy version of the gene.

D is a male genotype, and the key tells us that individual Y is a female.