HL Paper 1

Which is a source of chromosomes for pre-natal diagnosis of abnormalities by karyotyping?

A. Sperm
B. Ovaries
C. Erythrocytes
D. Chorionic villi

Markscheme

D

Examiners report

This was one of the best discriminators on the paper. 72% chose chorionic villi as the source of chromosomes for pre-natal diagnosis of abnormalities. The most popular wrong answer was erythrocytes, which was perhaps surprising as many of these candidates will have known that erythrocytes lack a nucleus.

The presence of freckles is a characteristic controlled by a dominant gene. Two parents who are heterozygous for the characteristic have three children, all of whom have freckles. Which statement is true if they have a fourth child?

A. There is a 100 % chance that their next child will have freckles.

B. There is a 75 % chance that their next child will have freckles.

C. There is a 50 % chance that their next child will have freckles.

D. The next child will have no freckles as the ratio is 3 with freckles to 1 without freckles.

Markscheme

B

Examiners report

[N/A]

What is a plasmid?

A. Chloroplast DNA
B. Mitochondrial DNA
C. Small circle of DNA that can transfer genes to or from a prokaryote
D. The bacterial chromosome

Markscheme

C

Examiners report

N/A

The feather colour of a certain breed of chicken is controlled by codominant alleles. A cross between a homozygous black-feathered chicken and a homozygous white-feathered chicken produces all speckled chickens. What phenotypic ratios would be expected from a cross between two speckled chickens?

A. All speckled

B. 1 black feathers : 1 white feathers

C. Speckled, black feathers and white feathers in equal numbers

D. 1 black feathers : 2 speckled feathers : 1 white feathers

Markscheme

D

Examiners report

[N/A]

What is the major health issue resulting from the Chernobyl nuclear accident in 1986?

A. Coronary thrombosis
B. Cholera
C. Sex-linked diseases
D. Thyroid cancer

Markscheme

D

Examiners report

[N/A]

How are enzymes used during gene transfer involving plasmids?

	To cut plasmids	To extract gene from DNA	To rejoin DNA
A.	✓	✓	✓
B.	—	✓	—
C.	✓	✓	—
D.	✓	—	✓

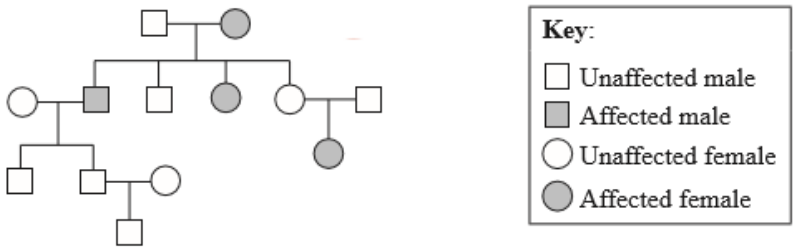
Markscheme

A

Examiners report

Two answers have been accepted in this question. As stated in a G2, since no example is specified for gene transfer in the guide, candidates could have studied examples that start with mRNA or from a gene in DNA. Since the former would not use enzymes to cut DNA, candidates would choose D, whereas those who had studied a DNA example would choose A, so both answers A and D have been considered as correct.

Alkaptonuria is an inherited condition in humans that affects phenylalanine and tyrosine metabolism, resulting in the production of black-coloured urine. What deduction can be made about the allele for this condition from the pedigree chart?



A. It is autosomal dominant.
B. It is autosomal recessive.
C. It is X-linked recessive.
D. It is Y-linked recessive.

Markscheme

B

Examiners report

N/A

What is a gene mutation?

A. Failure of chromosome pairs to separate properly during cell division
B. Changes to genes caused by natural selection
C. Changes to the nucleotide sequence of the genetic material
D. Changes in karyotypes

Markscheme

C

Examiners report

N/A

What does therapeutic cloning involve?

A. Developing genetically identical cultures of human cells for use in drug testing
B. Helping infertile couples to conceive by injecting the father’s sperm into the mother’s egg
C. Producing embryonic stem cells for medical use
D. Replacing a mutant allele in an embryo to prevent genetic disease

Markscheme

C

Examiners report

[N/A]

A new allele that provides herbicide resistance is identified in soybean plants. The allele is dominant. Which of the following would be carried out in a herbicide-resistant plant to find out if it is homozygous or heterozygous for the gene?

A. Gel electrophoresis
B. Karyotyping
C. Test cross
D. DNA profiling

Markscheme

C

Examiners report

This question proved very easy for the candidates. There were some questions from teachers on G2s as to whether gel electrophoresis and DNA profiling would also be correct molecular techniques to distinguish plants homozygous or heterozygous for the trait in question.

A certain breed of mouse can have fur that is either black or brown. A mouse breeder performs a test cross using a brown mouse to determine the unknown genotype of a black mouse. There are four offspring produced by the cross. What conclusions can be drawn?

A. If the black mouse is homozygous, one of the four offspring must be brown.
B. If the black mouse is heterozygous, three of the four offspring must be black.
C. The black mouse must be homozygous if all four offspring are black.
D. The black mouse must be heterozygous if any of the offspring are brown.

Markscheme

D

Examiners report

Question 13 was the least effective on the paper in terms of discriminating between the candidates, which is unusual for a genetics question. Teachers raised a variety of objections to it. The statistics suggest the problem was that some good candidates chose C rather than D. To answer the question correctly it was first necessary to read the second sentence carefully and deduce from it that brown mice are homozygous recessive because they were used in the test cross. Answers A and B could then easily be eliminated. Answers C and D needed to be carefully considered. C should have been rejected because four offspring are too few to be sure that the black mouse was homozygous. There is a one in sixteen chance of getting four black offspring from a cross between a heterozygous black mouse and a homozygous brown recessive. On the other hand, answer D is undoubtedly correct. To cope with this type of question, candidates need to understand the difference between the possible outcomes of a cross as shown in a Punnett square and actual outcomes, which cannot be expected to correspond exactly with Mendelian ratios.

In a human with type A blood, what determines the blood group?

A. Sex chromosomes

B. One or two alleles

C. Multiple alleles

D. Codominant alleles

Markscheme

B

Examiners report

Many candidates failed to read that the question was referring only to type A blood. In the guide, in section 4.3.3 it says: State that some genes have more than two alleles (multiple alleles). We can say that multiple alleles refers to more than 2 alleles, therefore answer C is incorrect.

What is the chromosome number in a human gamete with non-disjunction?

A. 46

B. 45

C. 24

D. 23

Markscheme

C

Examiners report

Although most good candidates answered this question well, some candidates had different number of chromosomes in a disjunction. Unlike what happens in plants, the probability of having more than one chromosome suffering non-disjunction in humans in very low, let alone the whole set of chromosomes.

What is a characteristic of the human Y chromosome?

A. It is made of DNA and histones covered by phospholipids.
B. It contains some genes that are not present on the X chromosome.
C. It is the largest chromosome in the human karyotype.
D. It has a condensed length of approximately 100 μm.

Markscheme

B

Examiners report

Although the fact that Y-chromosomes contain genes not present in the X chromosome is not part of the guide, in 4.3.5 and 4.3.6 candidates are expected to explain how the sex chromosomes determine sex, therefore they should be able to answer the question correctly. All the other answers are obviously wrong, so could easily be discarded.

What is the difference between the alleles of a gene?

A. Their position on the chromosome
B. Their amino acid sequence
C. Their pentose sugars
D. Their base sequence

Markscheme

D

Examiners report

N/A

What is meiosis?

A. Division of a diploid nucleus to form diploid nuclei
B. Reduction division of a haploid nucleus to form diploid nuclei
C. Reduction division of a diploid nucleus to form haploid nuclei
D. Division of a haploid nucleus to form haploid nuclei

Markscheme

C

Examiners report

N/A

Which is a characteristic of the haploid number of eukaryotic chromosomes?

A. It doubles in mitosis.

B. It is fixed for each species.

C. It is an even number for all species.

D. It is positively correlated with an animal's mass.

Markscheme

B

Examiners report

[N/A]

Which statement about the polymerase chain reaction (PCR) is correct?

A. PCR allows DNA to be cloned in a test tube and millions of copies can be made in hours.
B. PCR allows the synthesis of RNA from DNA molecules.
C. PCR is a natural process carried out by some viruses to amplify DNA molecules.
D. PCR is a man-made technique used to identify the nucleotide sequence of DNA.

Markscheme

A

Examiners report

There was a G2 question about whether D could also be correct in light of modern fluorescent DNA sequencing which involves PCR. In questions such as this, candidates need to choose the most correct answer. This discriminated well and did not confuse candidates.

What causes genetic variety in the formation of gametes during meiosis?

A. Crossing over in prophase I and random orientation of homologous chromosomes in metaphase I
B. Crossing over in metaphase I and random orientation of homologous chromosomes in metaphase II
C. Linkage of genes in prophase I and crossing over in metaphase I

D. Linkage of genes in metaphase I and random orientation of homologous chromosomes in metaphase II

Markscheme

A

Examiners report

N/A

What was an aim of genetic modification of organisms?

A. To provide stem cells from embryos for medical use
B. To make crop plants resistant to herbicides
C. To provide sperm cells for *in vitro* fertilization (IVF)
D. To produce genetically identical sheep

Markscheme

B

Examiners report

Although the resistance to pests is often referred to as an example of the use of genetic modification in plants, this was a very easy question and most candidates chose plant resistance to herbicides.

In humans the ABO blood groups are an example of inheritance involving multiple alleles. In a family the parents have blood group A and blood group B respectively. Their first child has blood group O. What is the probability that their next child will have blood group B?

A. 100 %
B. 75 %
C. 50 %
D. 25 %

Markscheme

D

Examiners report

N/A

What makes gene transfer between species possible?

A. All species use the same genetic code.
B. All species have the same genetic material.
C. All species produce the same polypeptides.
D. All species transcribe genes using plasmids.

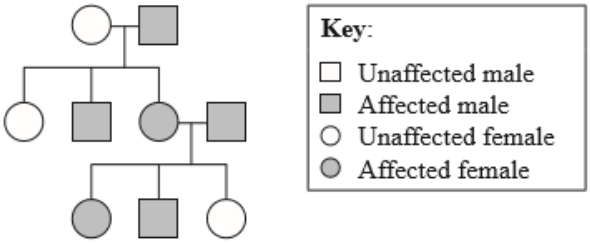
Markscheme

A

Examiners report

In question 12, answer B was chosen by an unexpectedly large number of candidates. Perhaps these candidates rejected answer A because they misunderstood the term genetic code. This term is sometimes used to mean the base sequence of genes in a genome, whereas the correct meaning is the correspondence between each of the 64 codons and the amino acids into which they are translated.

The diagram shows a pedigree.



According to the pedigree shown, which pattern of inheritance is indicated?

A. Sex-linked recessive trait
B. Autosomal recessive trait
C. Autosomal dominant trait
D. Codominant alleles

Markscheme

C

Examiners report

Three teachers expressed concern over this question suggesting that it is not possible to rule out codominance. Codominance would be indicated as a third colour in the pedigree and all offspring of the first generation parents would need to be represented by the intermediate phenotype.

One type of gene mutation involves a base substitution.

Original DNA sequence:	GAC TGA GGA **CTT** CTC TTC AGA
mutated sequence 1:	GAC TGA GGA **CAT** CTC TTC AGA
mutated sequence 2:	GAC TGA GGA **CTC** CTC TTC AGA

mRNA codons for valine	GUU GUC GUA GUG
mRNA codons for glutamic acid	GAA GAG

What are the consequences of the base substitutions in the two new sequences of DNA?

A. Both are mutations that would result in different polypeptides.
B. Sequence 2 would result in a changed polypeptide but sequence 1 would not.
C. All three DNA sequences would translate into the same polypeptide.
D. Only the original DNA and sequence 2 would translate into the same polypeptide.

Markscheme

D

Examiners report

This question caused concern from three teachers due to the ambiguity of the term "different" polypeptides, as in different with respect to one another or different with respect to the original DNA sequence. In such cases of ambiguous interpretation, students should be advised to read all possible answers. Choice D could then be recognized as unequivocally correct.

What is characteristic of homologous chromosomes?

A. They have an identical DNA sequence.
B. They are of the same length in karyograms.
C. They form pairs in prokaryotes.
D. They carry the same alleles.

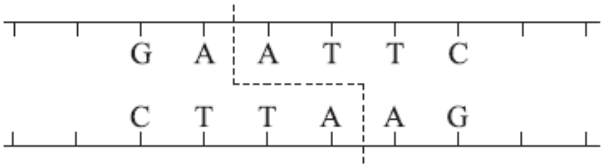
Markscheme

B

Examiners report

These were all very good discriminators.

What type of enzyme could be used to cut a DNA molecule as indicated by the dotted line on the diagram below?



A. DNA ligase
B. DNA polymerase
C. Helicase
D. Restriction enzyme

Markscheme

D

Examiners report

[N/A]

What could be achieved by DNA profiling using gel electrophoresis?

A. The chromosome number of an organism could be counted.
B. It could be proven that human tissue found at the site of a crime did not come from a person suspected of having committed the crime.
C. A karyotype could be produced.
D. Extinct species of living organisms could be brought back to life.

Markscheme

B

Examiners report

N/A

Which process can be used to amplify small fragments of DNA?

A. Gel electrophoresis

B. Polymerase chain reaction

C. DNA profiling

D. Electron microscopy

Markscheme

B

Examiners report

[N/A]

In a cross between red haired cattle and white haired cattle the offspring produced are always a colour called roan (light red). If the roan cattle are interbred they produce white, roan and red offspring.

How many alleles are controlling this character?

A. 1
B. 2
C. 3
D. 4

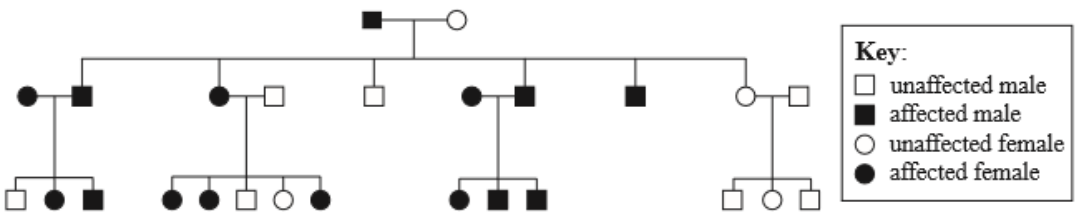
Markscheme

B

Examiners report

N/A

What evidence is given in the pedigree chart below to prove that the condition is caused by a dominant allele?



A. Two unaffected parents have unaffected children.
B. Two affected parents have affected children.
C. An affected parent and an unaffected parent have affected children.
D. Two affected parents have an unaffected child.

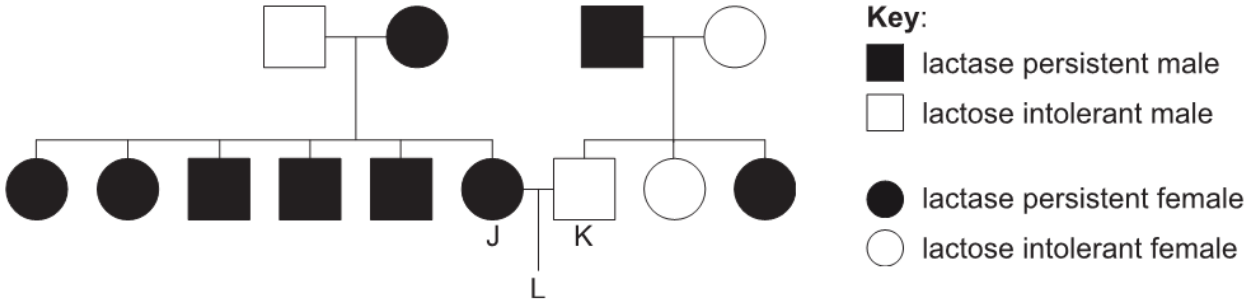
Markscheme

D

Examiners report

Most candidates answered this question incorrectly. Although it was a good question, it was perhaps a little bit too complicated for candidates to analyze a pedigree in such a short time. It was agreed at grade award that it would have made a better Paper 2 question.

A dominant autosomal allele for lactase persistence allows humans to digest milk as adults. People who lack this allele are lactose intolerant in adulthood.



If J and K have a child L, what is the probability that L will be lactase persistent?

A. 25 %

B. 50 %

C. 75 %

D. 100 %

Markscheme

B

Examiners report

[N/A]

When genes are transferred between species, the amino acid sequence of the polypeptide translated from them is unchanged. Why is this so?

A. All organisms use ribosomes for protein synthesis.
B. DNA replication is semi-conservative.
C. The enzymes used are substrate specific.
D. The genetic code is universal.

Markscheme

D

Examiners report

N/A

What is a definition of a clone?

A. A group of cells derived from a single parent cell
B. Differentiated cells that retain the capacity to divide
C. A fetus developed specifically for medical use
D. A group of cells that have lost the ability to differentiate

Markscheme

A

Examiners report

This was an easy question for most candidates.

Which of the following statements about homologous chromosomes is correct?

A. Each gene is at the same locus on both chromosomes.
B. They are two identical copies of a parent chromosome which are attached to one another at the centromere.
C. They always produce identical phenotypes.
D. They are chromosomes that have identical genes and alleles.

Markscheme

A

Examiners report

This question discriminated very well. However, many choose either B or D, both of which were incorrect showing a lack of understanding of what homologous chromosomes are.

What event occurs only in meiosis?

A. Fusion of gametes to promote genetic variation
B. Random separation of chromatids
C. Random separation of homologous chromosomes
D. Replication of chromosomes

Markscheme

C

Examiners report

These were all very good discriminators.

What description is matched with the correct phase in meiosis I?

A.	Prophase I	recombination occurs only between sister chromatids
B.	Metaphase I	homologous chromosomes join together at each end of the cell
C.	Anaphase I	homologous chromosomes are pulled apart
D.	Telophase I	two diploid nuclei are produced

Markscheme

C

Examiners report

[N/A]

What does the universal nature of the genetic code allow?

A. Change of genetic code in the same species
B. Transfer of genes between species
C. Formation of clones
D. Infection by bacteria

Markscheme

B

Examiners report

N/A

If a father with A-type blood and a mother with B-type blood have a child, what is the probability that the child will have O-type blood?

A. 50 % chance if both parents have the recessive allele.
B. 25 % chance if both parents have the recessive allele.
C. 0 % chance because neither parent has the allele.
D. 50 % chance if either parent has the recessive allele.

Markscheme

B

Examiners report

Two teachers expressed concern over this question arguing that both B and C could be correct. It is agreed that ruling out answer C is based on the subtleties of language as the data does not support the statement that definitively neither parent has the allele. C would only be correct if the statement said "if neither parent has the allele".

What is the effect of dominant alleles?

I. They mask the effect of recessive alleles.
II. They become more frequent than recessive alleles in a population.
III. They have a joint effect with recessive alleles when characteristics are co-dominant.

A. I only
B. I and II only
C. I and III only
D. I, II and III

Markscheme

A

Examiners report

Although some teachers criticized this question, it is perfectly fair. Many candidates believed that dominant alleles have a joint effect with recessive alleles in co-dominance.

The sequence of the first six amino acids of the normal β hemoglobin (Hb^A) chain are listed.

valine – histidine – leucine – threonine – proline – glutamic acid

Which sequence of amino acids could there be in the first six amino acids of the sickle-cell β hemoglobin (Hb^S) chain?

A. glutamic acid – histidine – leucine – threonine – proline – valine
B. valine – valine – histidine – leucine – threonine – proline
C. glutamic acid – histidine – leucine – threonine – proline – glutamic acid
D. valine – histidine – leucine – threonine – proline – valine

Markscheme

D

Examiners report

Question 11 was not popular with some teachers. Like question 7, it was felt to depend solely on a memorised fact, in this case the specific mutation that causes sickle cell anemia. This knowledge is specified by the programme, so could have been expected, but ideally answer C should have been slightly different so that it could have been eliminated using understanding.

Which genetic condition can be diagnosed by karyotyping?

A. Trisomy 21
B. Sickle-cell anemia
C. Hemophilia
D. Colour blindness

Markscheme

A

Examiners report

N/A

What term describes the failure of sister chromatids to separate during anaphase II?

A. Sex linkage
B. Karyotyping
C. Non-disjunction
D. Semi-conservative replication

Markscheme

C

Examiners report

Questions 7, 8, 10, 11 and 12 also had relatively low discrimination indices because a high proportion of candidates answered them correctly, indicating either good knowledge or that these questions proved to be rather too easy.

Which sequence of DNA would be suitable in DNA profiling?

A. ---ATTCGTGAATCAGCC--
B. ---ATTCGTGAATTTGCC--
C. ---ATTCGTGATTGCAGC--
D. ---ATTCGTGATTCGTGA--

Markscheme

D

Examiners report

This question had the greatest number of G2 comments. Although teachers believed this was an unfair question, some candidates were able to see the tandem repeats only present in answer D. This was the only answer with 7 base pair repeats (there can be between 2 and 60 base pair in a tandem repeat). It is agreed that it is possibly too short a sequence to easily see the repeats and that this could have put off some good candidates.

In humans a V-shaped hair line is dominant to a straight hair line. A woman with a V-shaped hair line and a man with a straight hair line have children. The woman has a mother with a straight hair line. What is the proportion of children who are likely to have a V-shaped hair line?

A. Half of the children
B. A quarter of the children
C. All of the children

D. None of the children

Markscheme

A

Examiners report

N/A

Which of the following is an inherited disease that is due to a base substitution mutation in a gene?

A. Trisomy 21
B. Sickle cell anemia
C. AIDS
D. Type II diabetes

Markscheme

B

Examiners report

N/A

What commonly causes Down syndrome in humans?

A. Non-disjunction
B. Base substitution
C. Amniocentesis
D. Gene mutation

Markscheme

A

Examiners report

N/A

In a person who is heterozygous for sickle-cell anemia, where is the mutation found?

A. In every gamete produced

B. Only in gametes carrying an X chromosome

C. In all brain cells

D. In blood plasma

Markscheme

C

Examiners report

This question proved to be too hard for all candidates. Most candidates answered that the mutation for sickle-cell anemia is found in blood plasma. This is probably because they know anemia is related to blood, but failed to realize that plasma has no cells, therefore no DNA (6.2.6 in guide). Many candidates also went for gametes with X chromosome; probably wrongly believing this is a sex-linked disease. Others believed every gamete has the mutation, forgetting that gametes only have half the genetic information, so in a heterozygous individual, not all gametes receive the mutation. All nucleated cells in the body (except half of the gametes) have the mutation; therefore the only possible answer was brain cells.

Red-green colour blindness is a sex-linked condition. Which of the following always shows normal vision?

A. A homozygous male
B. A homozygous female
C. A heterozygous male
D. A heterozygous female

Markscheme

D

Examiners report

Although some teachers complained about the wording of this question, it turned out to be a very good discriminator. Some candidates thought a homozygous female always showed normal vision, but a female homozygous for the colour blindness allele would not have normal vision.

Which technique causes fragments of DNA to move in an electric field?

A. Polymerase chain reaction (PCR)
B. Genetic modification
C. Therapeutic cloning
D. Gel electrophoresis

Markscheme

D

Examiners report

N/A

Which of the following genotypes is possible in the offspring of a homozygous male with blood group A and a female with blood group B?

A. I^AI^A
B. I^Ai
C. ii
D. I^Bi

Markscheme

B

Examiners report

N/A

What do **all** human males inherit from their mother?

I. An X chromosome
II. A Y chromosome
III. Mitochondrial DNA

A. I only
B. I and II only
C. I and III only
D. I, II and III

Markscheme

C

Examiners report

Answers A and C were accepted as correct. As the origin of mitochondrial DNA is not in the syllabus, candidates could not be expected to know that mitochondrial DNA is only inherited from the mother.

Which is a possible risk associated with a genetic modification of crops?

A. Crop plants will become weaker with time.

B. It can increase mutations in the organisms that consume them.

C. Starch obtained from genetically modified plants will be more difficult to digest.

D. Resistance to herbicide genes can be transferred to weeds.

Markscheme

D

Examiners report

[N/A]

What maximum number of different genotypes and phenotypes are possible among the children of a mother with blood group A and a father with blood group B?

	Genotypes	Phenotypes
A.	2	2
B.	2	4
C.	4	4
D.	4	2

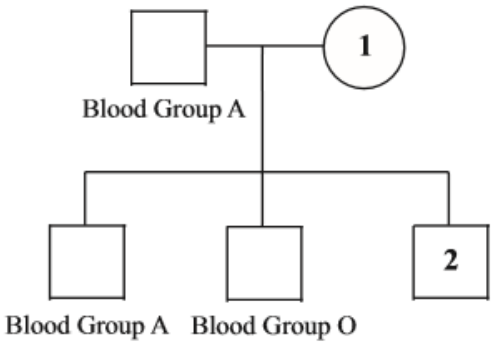
Markscheme

C

Examiners report

[N/A]

The pedigree chart below shows the blood types of three members of a family.



Which could be the blood types of individuals 1 and 2?

	Individual 1	Individual 2
A.	A	AB
B.	AB	B
C.	O	B
D.	B	A

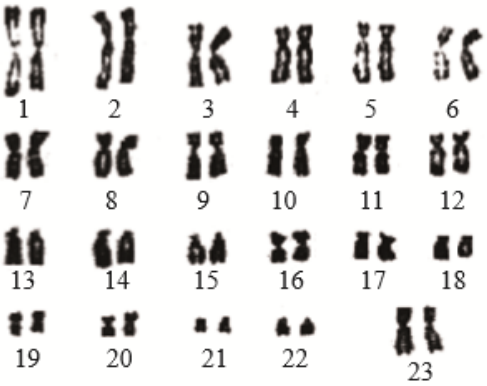
Markscheme

D

Examiners report

N/A

Questions 38 and 39 refer to the following karyotype.



[Source: www.ds-health.com/trisomy.htm]

What procedure(s) could have been involved in the creation of the karyotype?

I. Chorionic villus sampling
II. DNA profiling
III. Amniocentesis

A. I only
B. II only
C. I and III only
D. I, II and III

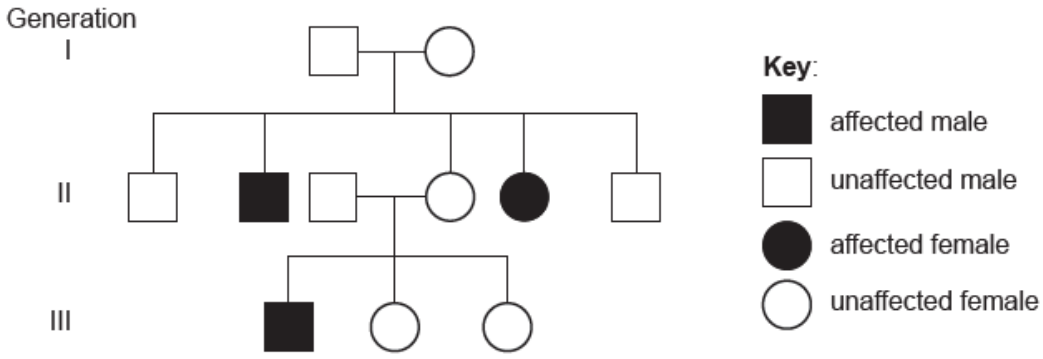
Markscheme

C

Examiners report

One teacher comment suggested that the term trisomy in the source could have confused the candidates but this did not seem the case, as the questions were answered correctly by most candidates.

What proves that the inheritance of the condition shown in this pedigree chart is autosomal recessive and not autosomal dominant?



A. There is no affected person in generation I.

B. Both males and females are affected.

C. Two unaffected parents have a child that is affected.

D. Not everybody in generation III is affected.

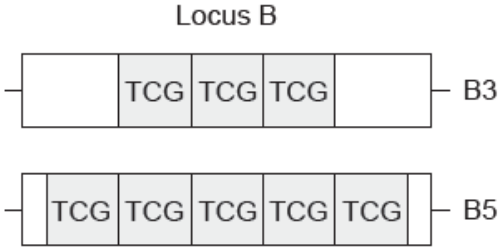
Markscheme

C

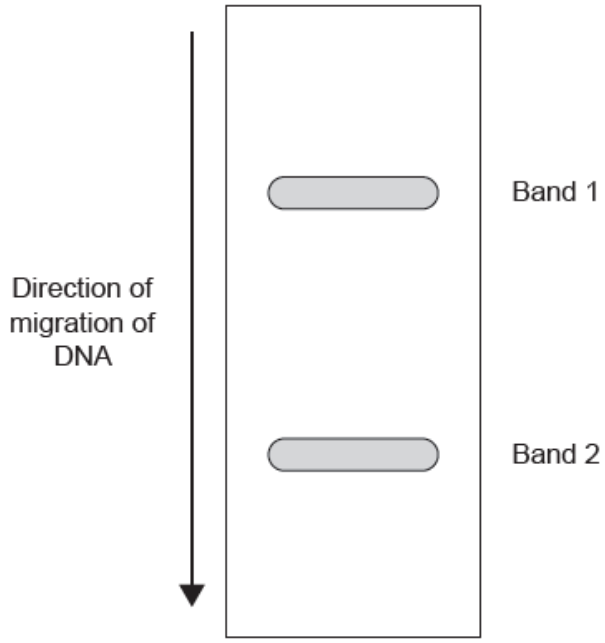
Examiners report

[N/A]

A DNA profile was made of one individual in a paternity suit. Locus B was used to distinguish between this individual and other individuals. The individual had two alleles of the gene at locus B which are shown below:



Gel electrophoresis was used to separate and visualize the alleles B3 and B5. The gel, with two bands of DNA, is shown below.



What DNA is in bands 1 and 2?

	Band 1	Band 2
A.	mix of B3+B5	B3 only
B.	mix of B3+B5	B5 only
C.	B5 only	B3 only
D.	B3 only	B5 only

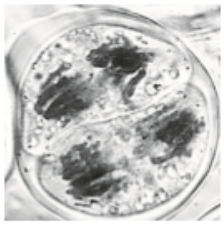
Markscheme

C

Examiners report

[N/A]

What stage of meiosis is shown in the micrograph?



[Source: www.vcbio.science.ru.nl/en/virtuallessons
Used with permission.]

A. Prophase I
B. Metaphase II
C. Anaphase II
D. Telophase I

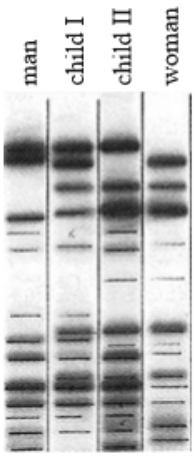
Markscheme

C

Examiners report

More candidates than expected thought that the stage of meiosis shown was Telophase I. It could be identified as the second division of meiosis because two dividing cells within one circular wall were visible. Several of the chromosomes were not yet at the poles so this was late Anaphase II.

What conclusion can be made from the following evidence from an analysis of DNA fragments?



A. Both children are related to both parents.
B. Child I is related to the man but child II is not.
C. Both children are unrelated to either of the parents.
D. Child II is related to the man but child I is not.

Markscheme

A

Examiners report

The quality of the diagram here was not as high as it could have been but it was still a discriminating and effective question.

What information can be concluded from the karyotype?

[Source: http://en.wikipedia.org/wiki/File:NHGRI_human_male_karyotype.png]

A. The person is a normal male.
B. The person is a normal female.
C. The person is a male with Down syndrome.
D. The person is a female with Down syndrome.

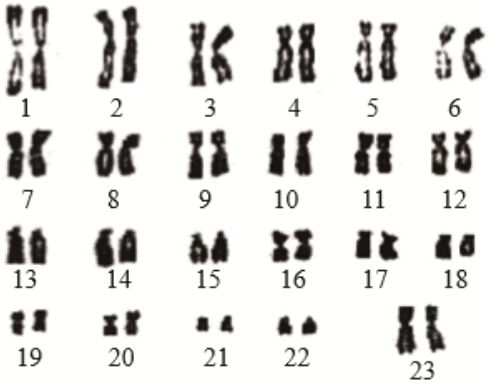
Markscheme

C

Examiners report

Questions 7, 8, 10, 11 and 12 also had relatively low discrimination indices because a high proportion of candidates answered them correctly, indicating either good knowledge or that these questions proved to be rather too easy.

Questions 38 and 39 refer to the following karyotype.



[Source: www.ds-health.com/trisomy.htm]

What can be concluded from the karyotype provided?

A. There was non-disjunction during meiosis in the mother.
B. There was non-disjunction during meiosis in the father.
C. The fetus is male.
D. The fetus is female.

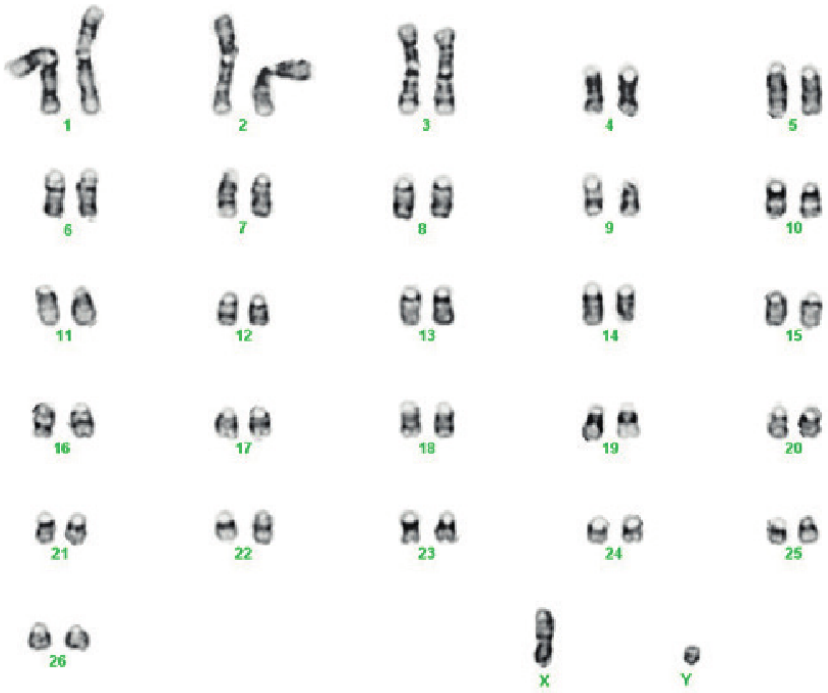
Markscheme

D

Examiners report

One teacher comment suggested that the term trisomy in the source could have confused the candidates but this did not seem the case, as the questions were answered correctly by most candidates.

The image shows a karyogram.



[Source: https://commons.wikimedia.org/wiki/File:Karyotype_of_sheep_(Ovis_aries).png, (https://commons.wikimedia.org/wiki/File:Karyotype_of_sheep_(Ovis_aries).png,) by M. Singh, X. Ma, E. Amoah and G. Kannan]

What information can be determined from this karyogram?

A. The sex is female.

B. The haploid number is 54.

C. Disjunction occurred during meiosis.

D. The species is not human.

Markscheme

D

Examiners report

[N/A]