Genetics, Inheritance & Selection

Question Paper

Level	O Level
Subject	Biology
Exam Board	Cambridge International Examinations
Topic	Inheritance
Sub Topic	Genetics, Inheritance & Selection
Booklet	Question Paper 2

Time Allowed: **57 minutes**

Score: **/47**

Percentage: **/100**

1 Flower colour is controlled by a single pair of alleles. The allele for red flowers is dominant to the allele for white flowers.

A plant homozygous for red flowers is crossed with a plant homozygous for white flowers. All the resulting plants have red flowers (F_1 generation).

When the F_1 generation are crossed with each other, 18 plants are obtained. 12 plants have red flowers and 6 have white flowers (F_2 generation).

What ratio is expected in the F_2 generation and what ratio has been obtained?

	expected ratio red to white	obtained ratio red to white
A	1:1	2:1
B	1:1	3:1
C	3:1	2:1
D	3:1	3:1

2 In the commercial manufacture of insulin, a human gene is inserted into which of these?

A a chromosome of a human cell

B a protein molecule in a yeast cell

C the DNA of a bacterium

D the nucleic acid in a virus

3 A recessive homozygote is crossed with a heterozygote of the same gene.

What will be the phenotypes of the F_1 generation?

A all dominant

B 75 % dominant 25 % recessive

C 50 % dominant 50 % recessive

D 25 % dominant 50 % heterozygous 25 % recessive

4 A child has blood group O.

Which couple could be the parents of this child?

	blood group of father	blood group of mother
A	A	B
B	AB	B
C	O	AB
D	AB	A

5 Which process is used to produce insulin commercially?

A extracting glycogen from the liver to stimulate production of insulin

B extracting insulin from the pancreas of human volunteers

C inserting a bacterial gene into a person's pancreas cells

D inserting the human insulin gene into a bacterium

6 Two heterozygotes are crossed. Some of the offspring show the recessive characteristic.

What is the probability that one of these offspring that shows the recessive characteristic is homozygous?

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

7 Which statement about human blood groups is correct?

A A person with the blood group A cannot have an I^O allele.

B A person with the blood group B may have either the genotype I^BI^B or I^BI^O.

C In a person with blood group AB, the I^B allele is recessive to the allele I^A.

D The alleles I^O and I^B are co-dominant and have equal effect on a phenotype.

8 Bacteria can be genetically modified to produce human insulin.

What is a possible danger of this procedure?

A Bacterial insulin is less effective in treating diabetes than animal insulin.

B The genetically modified bacteria may become insulin resistant.

C The genetically modified bacteria may produce too much insulin.

D The presence of a new gene in the bacteria may alter the way that existing genes work.

9 Which statement about chromosomes is correct?

A Chromosomes are long DNA molecules called genes which are divided into sections.

B Chromosomes include a long molecule of DNA divided into sections called genes.

C Chromosomes include genes which are divided into sections called DNA molecules.

D Genes include long DNA molecules called chromosomes.

10 In maize, one allele of a particular gene allows chlorophyll production while the other allele prevents this, giving plants with cream coloured leaves.

Half the seeds from a cross between two green-leaved plants were sown in trays kept in the dark. The other half were sown in similar conditions except that they received light.

The table gives the results obtained.

numbers of seedlings			
kept in the dark		kept in the light	
green leaves	cream leaves	green leaves	cream leaves
?	405	320	110

What was the number of green-leaved plants formed from seeds germinating in the dark?

A 0 **B** 110 **C** 320 **D** 405

11 The body cells of a mammal contain two copies of 24 000 genes, making 48 000 genes in total.

Of these 48 000 genes in the body cells of a mammal, how many would have been inherited from its mother?

A 6 000

B 12 000

C 24 000

D 48 000

12 The inheritance of the ABO blood groups in humans is controlled by three alleles (I^A, I^B and I^O), only two of which can be present in one individual.

What are the possible blood groups of children born to a homozygous group A woman and a heterozygous group B man?

A A and B only

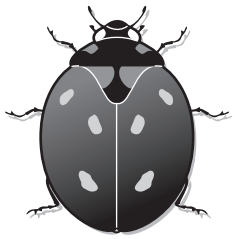
B A and AB only

C A, B and AB only

D A, B, AB and O

13 The diagram shows two distinct forms of beetle. The difference between them is controlled by a single gene. The allele for the black form is dominant to the allele for red.

red form
with black spots



black form
with red spots

What kind of variation is shown by the beetle and why?

A continuous variation because it is controlled by genes

B continuous variation because there are two forms

C discontinuous variation because it is controlled by genes

D discontinuous variation because the two forms are distinct

14 A pregnant woman is told by a genetic counsellor that her baby has equal chances of being blood group A or blood group AB.

What are possible genotypes of the woman and her husband?

A AA and BO

B AB and BO

C AO and BB

D AB and AO

15 Which statement about the genotypes of organisms is correct?

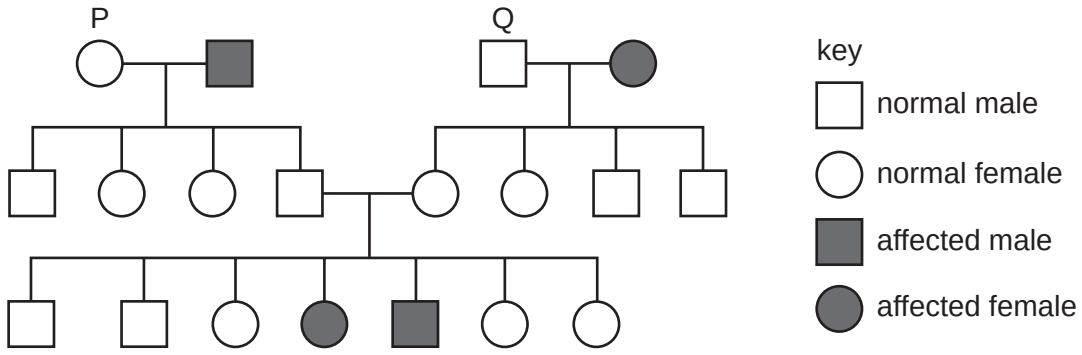
A Dominant alleles are only found in homozygotes.

B One recessive allele always causes a recessive phenotype.

C Recessive phenotypes must be homozygous.

D The dominant phenotype must be heterozygous.

16 The diagram shows the inheritance of a recessive characteristic that is controlled by a single pair of alleles, T and t.



T represents the dominant allele and t represents the recessive allele.

What are the most likely genotypes of individuals P and Q?

	P	Q
A	Tt	Tt
B	Tt	TT
C	TT	Tt
D	TT	TT

17 What causes sickle cell anaemia?

A a change in the structure of a gene

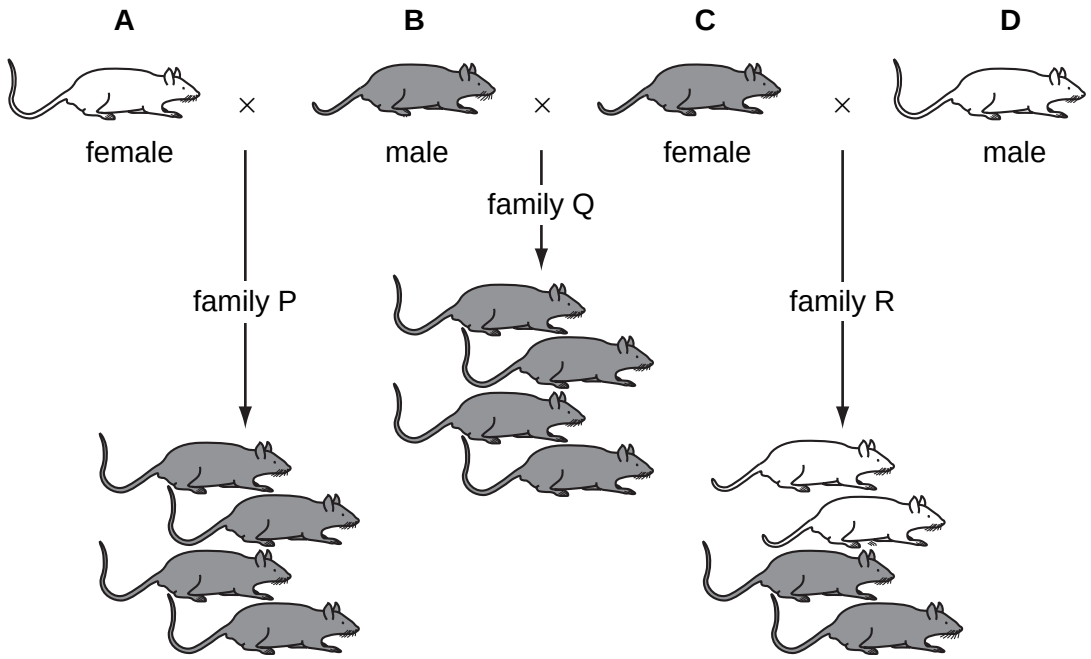
B an iron-deficient diet

C infection following a bite from a mosquito

D loss of blood following an accident

18 The diagram shows the inheritance of coat colour in mice.

Which mouse is heterozygous for coat colour?



19 When a breed of cattle with red coats is crossed with the same breed with white coats, the offspring all have coats with a mixture of red and white hairs, a condition called roan.

If roan cows were crossed with a red-coated bull, the theoretical ratio of the offspring would be

A all red.

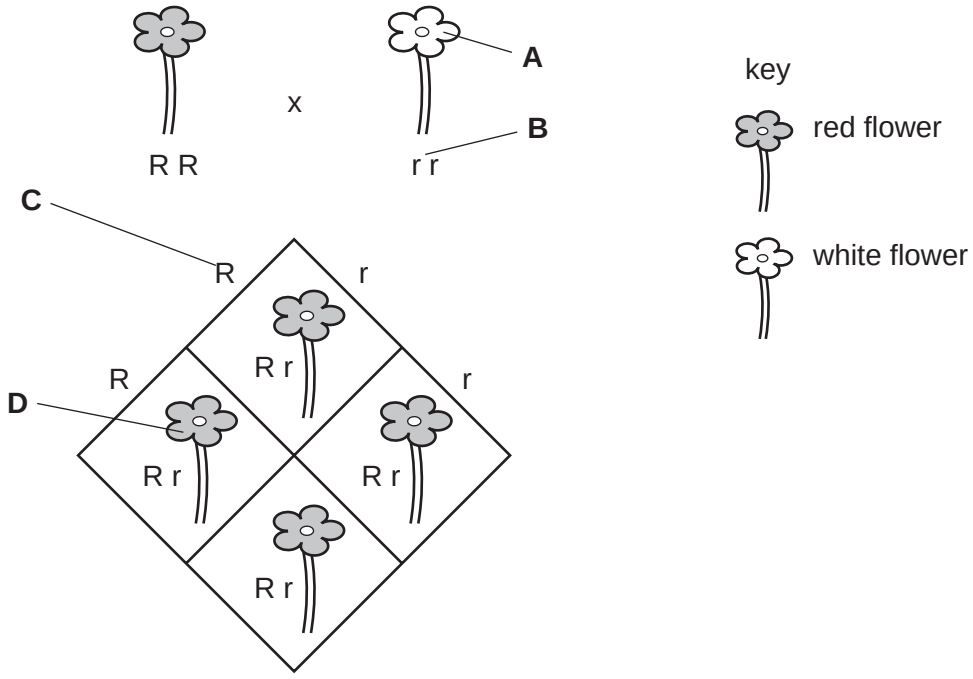
B all roan.

C 1 red : 1 roan.

D 3 red : 1 roan.

20 The diagram shows a simple genetic cross between a red flower and a white flower.

Which represents the dominant phenotype?



21 Six processes in genetic engineering are listed.

1 The bacterium is cloned.

2 The gene is copied.

3 The gene is switched on.

4 The gene is transferred into a bacterium.

5 The human gene is isolated.

6 The protein, insulin, is synthesised.

Which four processes, in the correct order, show the production of human insulin by bacteria?

A $2 \rightarrow 3 \rightarrow 5 \rightarrow 6$

B $3 \rightarrow 1 \rightarrow 4 \rightarrow 6$

C $5 \rightarrow 3 \rightarrow 2 \rightarrow 6$

D $5 \rightarrow 4 \rightarrow 1 \rightarrow 6$

22 Which blood group genotype is homozygous dominant?

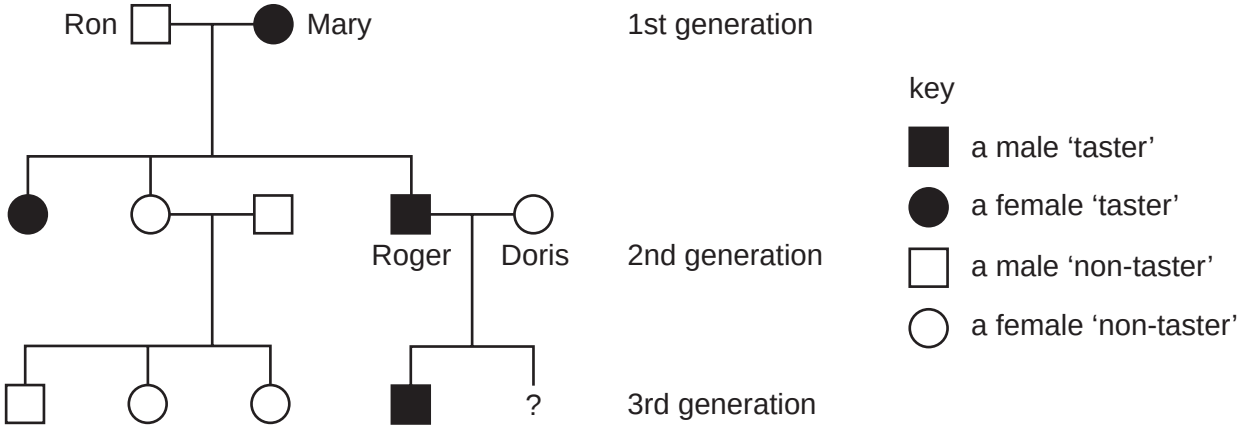
A I^A I^O

B I^A I^B

C I^B I^B

D I^O I^O

23 Below is a family tree showing the inheritance of the ability to taste a certain substance. The allele for the ability to taste this substance is dominant to the allele for the inability to taste it.



What is the probability of the second child of Roger and Doris being a 'non-taster'?

A 0.25 **B** 0.34 **C** 0.5 **D** 1.00

24 In rabbits the allele for black hair is dominant. A heterozygous black-haired rabbit is crossed with a heterozygous black-haired rabbit.

Which phenotypic ratio would result?

A 1 : 1 **B** 1 : 2 : 1 **C** 3 : 1 **D** all similar

25 A farmer saves the seeds from his best maize crop plants to sow for next year's crop.

This is an example of

A artificial selection.

B genetic engineering.

C natural selection.

D variation.

26 The inheritance of the ABO blood groups depends on three alleles I^A, I^B and I^o.

I^A and I^B are codominant, I^o is recessive.

What are the possible genotypes for a man of blood group A?

A I^AI^A only

B I^AI^A, and I^AI^B only

C I^AI^A, and I^AI^o only

D I^AI^A, I^AI^o and I^AI^B

27 Which statement is true of a dominant allele?

A It cannot undergo mutation.

B It gives a greater chance of survival than a recessive allele.

C It gives the same phenotype in heterozygotes and homozygotes.

D It is only responsible for male characteristics.

28 What determines the sex of a child?

A chromosome content of the ovum

B chromosome content of the sperm

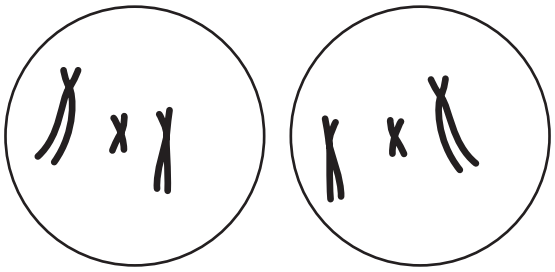
C number of days between ovulation and fertilisation

D number of days between fertilisation and implantation

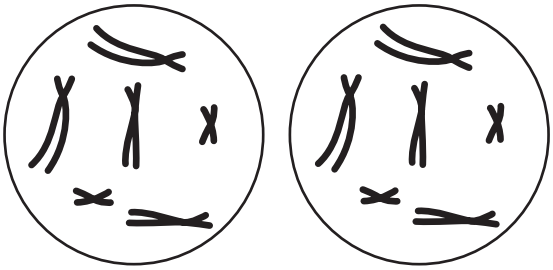
29 The diagram shows the chromosomes in a cell.

Which diagram shows the product of **one** division of the cell by mitosis?

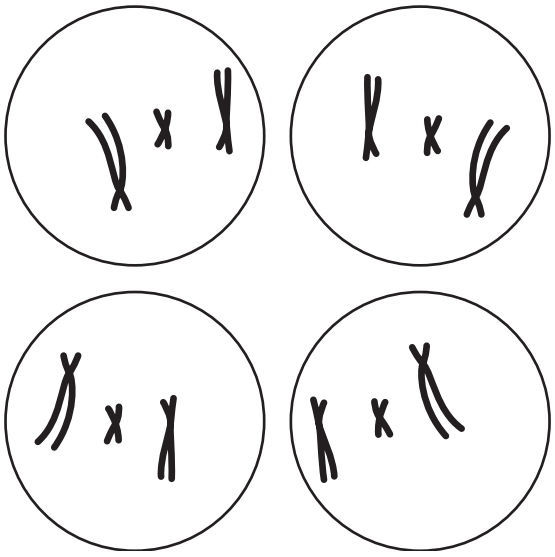
A



B



C



D

30 Cells contain long thread-like structures that carry genetic information.

What are these structures called?

A alleles

B chromosomes

C genes

D nuclei

31 Farmers crossed two breeds of cattle, the Jersey from Europe and the Sahiwal from Africa. For many generations, the farmers picked out the offspring with the highest milk yields to breed the next generation.

Which phrase best describes this process?

A artificial selection

B discontinuous variation

C evolution

D natural selection

32 A textbook states that because human insulin is a single …X…, its production is controlled by a single …Y… .

What are X and Y?

	X	Y
A	carbohydrate	DNA molecule
B	carbohydrate	gene
C	protein	DNA molecule
D	protein	gene

33 A plant has 20 chromosomes in its leaf cells. The plant reproduces both sexually and asexually.

What is the correct number of chromosomes in the gametes and in cells used for asexual reproduction?

	number of chromosomes	
	gametes	cells used for asexual reproduction
A	10	10
B	10	20
C	20	10
D	20	20

34 Dillip and Shabnam made four statements about themselves.

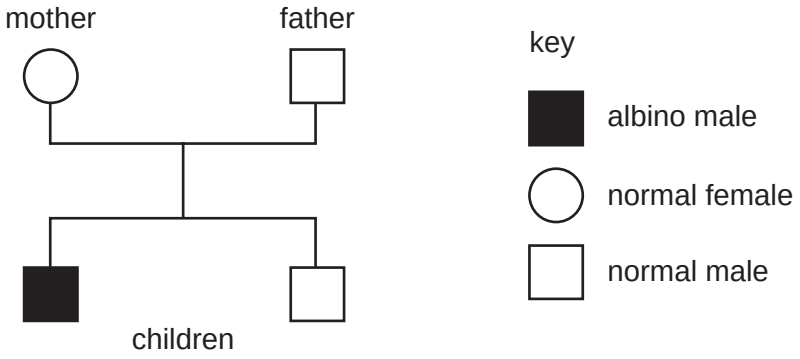
	Dillip	Shabnam
1	I am a boy.	I am a girl.
2	I am 150 cm tall.	I am 153 cm tall.
3	I am not very good at games.	I am good at games.
4	My blood group is A.	My blood group is AB.

Which statements describe characteristics that show discontinuous variation?

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

35 In humans the allele for albinism is recessive.

The diagram shows the inheritance of albinism in a family.



What are the genotypes of the parents?

	mother	father
A	heterozygous	heterozygous
B	heterozygous	homozygous dominant
C	homozygous recessive	homozygous dominant
D	homozygous recessive	homozygous recessive

36 Huntington's disease is an inherited condition caused by a dominant allele.

A person heterozygous for the disease and a person without the disease have a child.

What is the probability that their child will inherit the dominant allele for Huntington's disease?

A 0 **B** 0.25 **C** 0.5 **D** 0.75

37 The skin cells of an animal contain 8 chromosomes.

How many chromosomes will be present in each of the gametes produced by this animal?

A 16 **B** 8 **C** 4 **D** 2

38 In pigs, the allele for black hair is dominant to the allele for red hair.

Two black-haired pigs mated and produced twelve offspring. Of the first eleven, eight had black hair and three had red hair.

What is the probability of the twelfth offspring having red hair?

A 0.75 **B** 0.50 **C** 0.33 **D** 0.25

39 A woman has blood group O. Her child also has blood group O.

Which blood group can her husband **not** have?

A A **B** B **C** AB **D** O

40 Sex in humans is determined by **X** and **Y** chromosomes inherited from parents.

Which shows the chromosome inherited from the father and from the mother?

	sex of child	chromosome from father	chromosome from mother
A	male	**X**	**Y**
B	male	**Y**	**X**
C	female	**X**	**Y**
D	female	**Y**	**X**

41 Which two characteristics both show continuous variation?

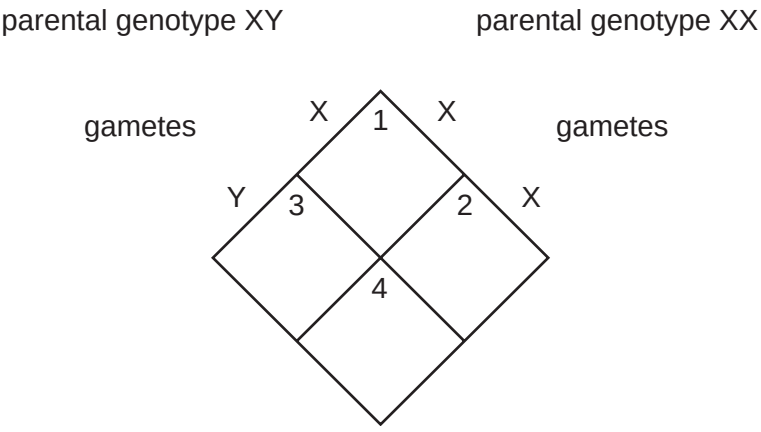
A eye colour and height

B gender and eye colour

C height and weight

D weight and blood group

42 The diagram shows the inheritance of sex in humans.



Which sex are the offspring in boxes 1, 2, 3 and 4?

	1	2	3	4
A	boy	girl	boy	girl
B	boy	girl	girl	boy
C	girl	boy	girl	boy
D	girl	girl	boy	boy

43 Chimpanzees have 48 chromosomes in each normal body cell.

How many chromosomes does a chimpanzee gamete contain?

A 23 **B** 24 **C** 46 **D** 48

44 Pure breeding pea plants with green pods are crossed with pure breeding pea plants with yellow pods.

All the F1 generation have green pods. Plants from the F1 generation are allowed to be interbred.

What colour are pods of the F2 generation?

A all green

B all yellow

C 1 green : 1 yellow

D 3 green : 1 yellow

45 How many chromosomes are there in a zygote which develops into a Down's syndrome baby?

A 23

B 24

C 46

D 47

46 A study was made of children whose mothers were blood group O (genotype I^OI^O) and whose fathers were blood group AB (genotype I^AI^B).

Which statement about their children is correct?

A All will have the same blood group.

B 50% will have the same blood group as their mother.

C 50% will have the same blood group as their father.

D None will have the same blood group as either parent.

47 Two heterozygous plants are crossed.

What is the ratio of homozygous genotypes to heterozygous genotypes amongst the offspring?

	homozygous genotypes		heterozygous genotypes
A	1	:	1
B	1	:	2
C	1	:	3
D	3	:	1