MULTIPLE-CHOICE QUESTIONS

1. Which is TRUE about a testcross?

   (A) It is a mating between two hybrid individuals.
   (B) It is a mating between a hybrid individual and a homozygous recessive individual.
   (C) It is a mating between an individual of unknown genotype and a homozygous recessive individual.
   (D) It is a mating to determine which individual is homozygous recessive.

2. All are true of cross-over EXCEPT

   (A) it normally occurs between sister chromatids
   (B) it is the site of a chiasma
   (C) it is responsible for linked genes being inherited separately
   (D) it cannot occur between sex chromosomes in human males

3. A round watermelon is crossed with a long watermelon and all the offspring are oval. If two oval watermelons are crossed, what is the percent of watermelons that will be round?

   (A) 0
   (B) 25%
   (C) 50%
   (D) 75%

4. In peas, the trait for tall plants is dominant (*T*) and the trait for short plants is recessive (*t*). The trait for yellow seeds is dominant (*Y*) and the trait for green seeds is recessive (*y*). A cross between two plants results in 292 tall yellow plants and 103 short green plants. Which of the following are most likely to be the genotypes of the parents?

   (A) *TtYY* × *Ttyy*
   (B) *TTYy* × *TTYy*
   (C) *TTyy* × *TTYy*
   (D) *TtYy* × *TtYy*

5. A child is born with blood type O. All of the following could be the blood type of the parents EXCEPT

   (A) A and B
   (B) A and A
   (C) O and O
   (D) AB and O

6. *ABCDEF* → *ABEDCF*

   A rearrangement in the linear sequence of genes as shown in the diagram above is known as a/an

   (A) translocation
   (B) deletion
   (C) addition
   (D) inversion

7. A diploid organism has 36 chromosomes per cell. How many linkage groups does it have?

   (A) 9
   (B) 18
   (C) 36
   (D) 72

8. The expression of both alleles for a trait in a hybrid individual is

   (A) pleiotropy
   (B) epistasis
   (C) codominance
   (D) incomplete dominance

9. How many autosomes does the human male normally have?

   (A) 2
   (B) 22
   (C) 23
   (D) 44

10. A couple has 6 children, all girls. If the mother gives birth to a seventh child, what is the probability that the seventh child will be a girl?

    (A) $^{6}/_{7}$
    (B) $^{1}/_{128}$
    (C) $^{1}/_{2}$
    (D) 1

11. Assume that two genes, *A* and *B*, are not linked. If the probability of allele A being in a gamete is $^{1}/_{2}$ and the probability of allele *B* being in a gamete is $^{1}/_{2}$, then the probability of BOTH *A* and *B* being in the same gamete is

    (A) $^{1}/_{2}$
    (B) $^{1}/_{4}$
    (C) 1
    (D) $^{1}/_{8}$

12. Gene *R* controls the formation of feathers on a bird. In addition, it seems to be responsible for traits in several other body systems. What is the best explanation for this type of inheritance?

    (A) blending inheritance
    (B) codominance
    (C) pleiotropy
    (D) epistasis

13. In one strain of mice, fur color ranges from white to darkest brown with every shade of brown in between. This pattern of inheritance for fur color is most likely controlled by

(A) multiple genes
(B) a single gene with many alleles
(C) pleiotropy
(D) incomplete dominance

14. How is Huntington's disease inherited?

(A) It is sex-linked recessive.
(B) It is autosomal recessive.
(C) It is sex-linked dominant.
(D) It is autosomal dominant.

15. Two traits, *A* and *B*, are linked, but they are usually not inherited together. The most likely reason is

(A) they are not on the same chromosome
(B) they are not sex-linked
(C) they are on the same chromosome but are far apart
(D) they are close together on the same chromosome

16. A cross was made between two fruit flies, a white-eyed female and a wild male (red eyed). One hundred F_1 offspring were produced. All the males were white eyed and all the females were wild. When these F_1 flies were allowed to mate, the F_2 flies were observed and the following data was collected.

	Females		**Males**
P:	White eyed	×	Wild (red eyed)
F_1:	59 wild		51 white eyed
F_2:	24 wild 26 white eyed		23 wild 27 white eyed

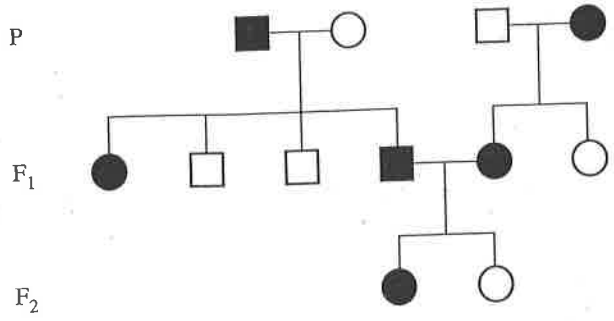
What is the most likely pattern of inheritance for the white-eyed trait?

(A) autosomal dominant
(B) autosomal recessive
(C) sex-linked dominant
(D) sex-linked recessive

17. A man who has a sex-linked allele will pass it on to

(A) all his daughters
(B) all his sons
(C) $^1/_2$ of his daughters
(D) $^1/_2$ of his sons

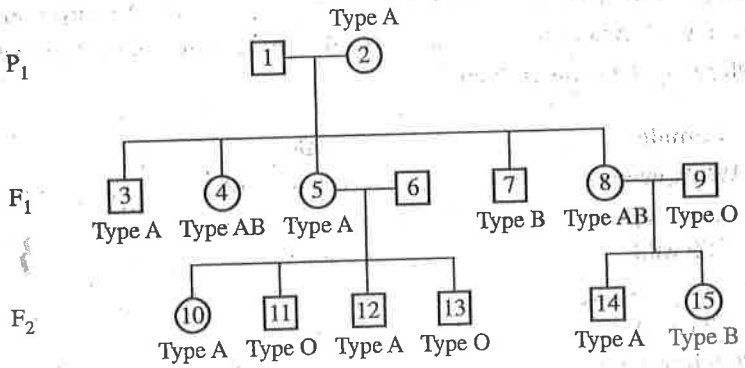
18. The figure below shows a pedigree for a family that carries the gene for Huntington's disease. Individuals who express a particular trait are shown shaded in.



What is the genotype of the daughter in the F_2 generation who does not have the disease?

(A) *H/H*
(B) *H/h*
(C) *h/h*
(D) *X–X*

19. This figure shows a pedigree of the blood types for a family. What is the genotype for person number 14?



(A) *A/A*
(B) *A/i*
(C) *i/i*
(D) *A/B*

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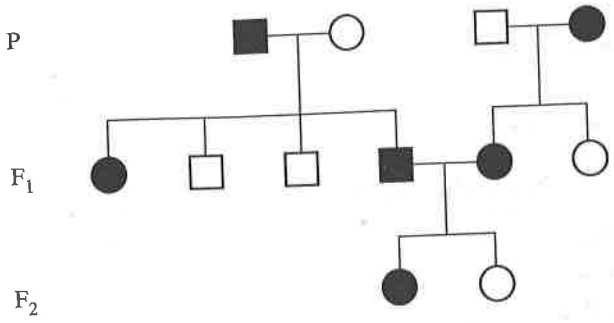

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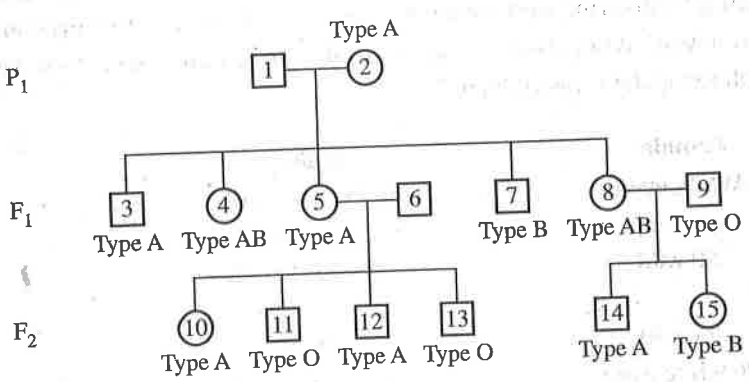

(A) *A/A*
(B) *A/i*
(C) *i/i*
(D) *A/B*

Answers to Multiple-Choice Questions

1. **(C)** A testcross is an actual mating between a pure recessive animal and an animal that shows the dominant phenotype but whose genotype is unknown.

2. **(A)** Cross-over occurs between homologous chromosomes, not sister chromatids. Sister chromatids are genetically identical. If cross-over did occur between sister chromosomes, it would be undetectable.

3. **(B)** Here is the cross.

	R	*L*
R	*RR*	*RL*
L	*RL*	*LL*

RR is round, *RL* is oval, and *LL* is long.
The inheritance is an example of incomplete dominance.

4. **(D)** Since there are four genes (*T, t, Y,* and *y*) but only two phenotypes in the offspring, the traits for height and seed color must be linked, that is, on the same chromosome. So solve the problem this way. Consider the traits separately at first. The phenotype ratio in the offspring for height is 3:1, tall to short. Therefore, the parents must be *Tt* and *Tt*. The phenotype ratio in the offspring for seed color is 3:1, yellow to green. Therefore, the parents must be *Yy* and *Yy*. Now, put both genotypes together. The parents must be *TtYy* and *TtYy*.

5. **(D)** Blood type O is homozygous recessive, *ii* or I^oI^o. The child must receive an *O* allele from each parent. Blood type AB has no *O* allele. Therefore, choice D is excluded as a parent.

6. **(D)** The section of the strand shows genes *CDE* inverted.

7. **(C)** Linked genes are located on one chromosome. Since there are 36 chromosomes, there are 36 linkage groups.

8. **(C)** In codominance, both traits show. An example is blood type in humans, where a person who has a gene for blood antigen A and another for blood antigen B has the AB blood type.

9. **(D)** Autosomes are the chromosomes other than sex chromosomes (X and Y).

10. **(C)** No matter how many children a couple has, the chance that the child will be a boy *or* a girl is always $^1/_2$. Although it is true that whether the sperm carries an X or a Y sex chromosome determines the sex of the child, that it is irrelevant to the question here.

11. **(B)** Since *A* and *B* are not linked, they assort independently. To find the probability of two independent events happening, multiply the chance of one happening by the chance of the other happening.

12. **(C)** When one gene seems to control the expression of several traits, the pattern of inheritance is pleiotropy. A classic example of pleiotropy in humans is cystic fibrosis.

13. **(A)** Examples of polygenic inheritance in humans are genes for skin color and height.

14. **(D)** Although the trait is autosomal dominant, symptoms do not usually appear until later in life, long after the person with the condition has passed the trait on to children and, perhaps, grandchildren.

15. **(C)** If genes are on the same chromosome but far apart, they will often be inherited separately because they will often be separated by cross-over.

16. **(D)** Here is the first cross.

	X	Y
X–	X–X	X–Y
X–	X–X	X–Y

All the female offspring are carriers (X–X), and all the male offspring have white eyes (X–Y).

Here is the second cross.

	X–	Y
X–	X–X–	X–Y
X	X–X	XY

There is a 50 percent chance that a male will be white eyed and a 50 percent chance he will be red eyed. There is a 50 percent chance a female will be white eyed and a 50 percent chance she will be red eyed (a carrier).

17. **(A)** A man gives his sons the Y chromosome and passes sex-linked traits to all his daughters.

18. **(C)** Females are represented as circles; males as squares unless otherwise stated. You should know that Huntington's disease is inherited as autosomal dominant. The F_2 daughter who does not have the condition must have inherited one healthy gene from each parent. She must be *h/h*, normal.

19. **(B)** Person 14 has blood type A. It can be *A/A* or *A/i*. Since his father has type O blood, person 14 must have inherited the A from his mother and the O from his father. His genotype therefore is *A/i*.