BYJU'S EXAM PREP

Important Questions on Inheritance Biology

1. A recessive X-linked gene causes one type of white eye in Drosophila. By mating four F2 females of a wild-type Drosophila with a white-eyed male , What are the chances of finding out that all five females are heterozygous for the white-eye trait?
   A. 2/15 B. 1/16
   C. 4/5 D. 3/16

2. The recombination frequency between different loci is given below:

Loci	Recombination frequency
a and b	14%
a and c	50%
c and d	9%
d and b	50%

   Which of the following represents the same linkage group?
   A. a and c B. c and d
   C. a and b D. Both B and C

3. If a, y and z forms a linkage group and x, b and c forms another linkage group; find out the true statement from the following?
   A. a and y have a recombination frequency of 50%.
   B. x and z have a recombination frequency lesser than 50%.
   C. a and b have a recombination frequency of 50%.
   D. y and z have a recombination frequency higher than 50%.

4. If the AaBbCCDd genotype is test crossed, how many different phenotypes can be seen in the progeny?
   A. 4 B. 8
   C. 16 D. 20

5. If reciprocal crosses do not produce identical outcomes, What does that indicate?
   A. Incomplete dominance exists.
   B. Sex has no effect on traits.
   C. There is no trait segregation.
   D. The characteristics are sex-linked

6. The prune (pn) and garnet (g) X-linked recessive mutations recombine with a frequency of 0.4 in Drosophila. Both of these mutations result in brown eyes rather than dark red eyes. Females homozygous for the pn mutation were bred with males hemizygous for the g mutation, and the F1 daughters were crossed with their brown-eyed brothers. Predict the number of sons with dark red eyes who will come from this last cross.
   A. 35%
   B. 20%
   C. 40%
   D. 50%

7 Given below are genotypes of some gametes. A and B are two genes showing linkage between them.

P. $\frac{A \quad B}{a \quad B}$

Q. $\frac{\quad\quad}{a \quad b}$

R. $\frac{\quad\quad}{A \quad b}$

S.

If P and R are the non- recombinant gametes of a double heterozygous parent, which of the following statement is correct?
   A. The parents had coupling configuration.
   B. The parents had repulsive configuration.
   C. P and S are recombinant gametes of parents having coupling configuration.
   D. R and S are recombinant gametes of parents having repulsive configuration.

8. Which of the following statement can be related to site-specific recombination?
   A. The process needs two homologous chromosomes.
   B. The recombination occurs between homologous regions.
   C. It is only seen in humans.
   D. Both B and C

9. Charcot-marie-tooth diseases is caused by which of the following chromosomal aberration?
   A. Deletion
   B. Inversion
   C. Translocation
   D. Duplication

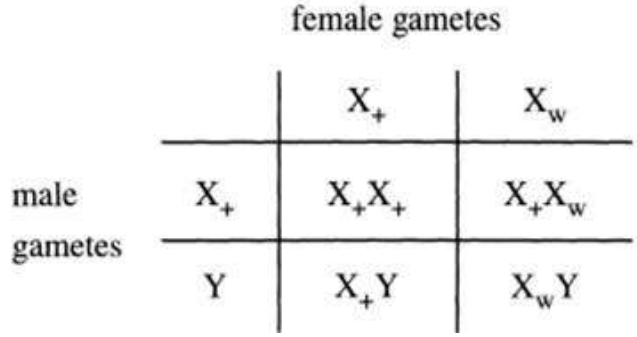
10. What is the total number of transitions and transversions that can take place in the genome?
   A. 4 and 4
   B. 2 and 6
   C. 4 and 8
   D. 6 and 8

Answers

1. B	2. D	3. C	4. B	5. B	6. B
7. A	8. B	9. D	10. C		

Solutions

Solution 1.
Parents: X+X+ (X) XwY



F1 progeny: X+Xw and X+ Y
F2 cross: X+Xw (X) X+ Y
1/2 of the females can be expected to be heterozygous (X+Xw).
(1/2) 4 = 1/16 = 0.062 is the probability that all four of the F2 females will be heterozygous for the w allele**.**

Solution 2.
The genes in one chromosome form a linkage group. 1% recombination frequency is equal to 1 map unit therefore loci a and b are 14 map unit apart and belongs to the same linkage group. Likewise, c and d is 9 map units apart and are in the same linkage group. The locus c is in 50 map unit distance from a; d is 50 map unit away from b. Recombination frequency 50 means that the loci are independently assorting and are located in different chromosomes. Therefore, the correct answer is D.

Solution 3.
A linkage group includes all genes in a chromosome. If the recombination frequencies between two genes are 50% it is considered to assort independently and hence is located in different chromosomes. According to the given data, here a, y and z are located in one chromosome and x, b and c are in another chromosome. Considering all these facts together, the only correct statement is C.

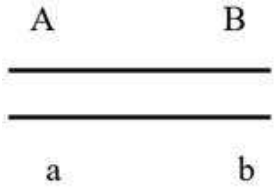
Solution 4.
● The test cross is made up of an individual with an unknown dominant phenotype and an individual (parent) who is homozygous recessive for that trait.
● Here the test cross of AaBbCCDd can be represented as
AaBbCCDd X aabbccdd

● For any test cross, the number of phenotypes is 2^n where n=number of heterozygous loci.
● In this case, the number of heterozygous is 3. Therefore, $2^3 = 8$.

Solution 5.
● Reciprocal crosses in which the phenotypes of each sex are reversed in comparison to the initial cross, in order to examine the influence of parental sex on inheritance patterns.
● Reciprocal crosses are used to determine if alleles are found on sex chromosomes or autosomes, as well as to eliminate the influence of cytoplasmic characteristics.
● Mendel discovered that reciprocal crossings produced the same outcomes. As a result, he came to the conclusion that sex had no effect on the dominance of a trait.

Solution 6.
The genotype of the F1 females is pn +/+ g. For the two X-linked genes, 40% of their sons will be recombinant, and half of the recombinants will contain the wild-type alleles for these genes. As a result, the probability of sons with dark red eyes will be 1/2 x 40% = 20%.

Solution 7.
It is given that P and R are non- recombinant gametes, therefore Q and S are recombinant gametes and the alleles in the parent were arranged as follows:



Therefore the parent had coupling configuration and thus the correct option is A.
Further, P and S cannot be a combination. If P is recombinant S should be non-recombinant and vice versa. Same is applicable in the case of R and S.

Solution 8.
Site-specific recombination is the recombination between non-homologous molecules. The process is initiated between two DNA molecules that have very short sequence in common. The integration of bacteriophage DNA into *E. coli* genome is an example for site-specific recombination. In this case, the recombination takes place between the core sequence common in phage and bacterial DNA. Cre- lox P system and FLP-FRT system are also examples for site specific recombination. This means that the only correct statement regarding site-specific recombination is B.

Solution 9.
Type I Charcot-Marie-Tooth illness causes muscle weakness by duplicating a portion of chromosome 17.

Solution 10.
● Transition is the replacement of a purine by another purine or a pyrimidine by another pyrimidine.
● Transversion is the replacement of a purine by a pyrimidine, or a pyrimidine by a purine.
● So, there are 4 possible transitions A—G and C— T, and 8 possible transversions A—C, A—T, G—C, G—T.

BYJU'S EXAM PREP

CSIR NET Life Science 2022

A Foundation Course

Complete Prep of Life Science for June 2022 Aspirants

Why take this course?

- 400+ Hrs Live Classes & Doubt Sessions for complete conceptual clarity
- 3000+ Practice Questions covering all levels of difficulty
- 20+ Unit Wise Study Modules & Mind Maps
- 50+ Full Mock Tests, Chapter Wise Mock Tests, PYQs Mock Tests