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Answers Key:

V. Case Study Questions

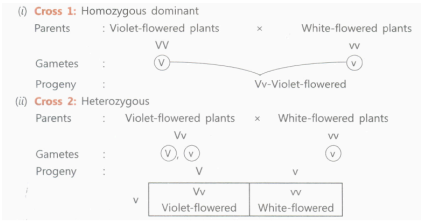
1. (a) G - Ampicillin-resistance gene
   H- Tetracycline-resistance gene
   (b) A - BamHl, B - Sal I
   (c) F is EcoRI
   (d) Ori.
2. (a) 27 varieties.
   (b) The 'new' variety of Basmati has been developed by crossing the Indian Basmati variety with the semi-dwarf varieties of the U.S.
   (c) Neem and turmeric.

Assertion and reason

3. (c): Selectable markers are the substances which helps in identifying recombinants and eliminating non recombinants. Generally the genes encoding the resistance to antibiotics such as tetracycline, ampicillin, kanamycin or chloramphenicol, etc. are useful selectable markers for E.coli.
4. (b) If both A and R are true, but R is not the correct explanation of A
5. (c) If A is true, but R is false
6. a)Both (A) and (R) are true and (R) is the correct explanation of (A)

IV. Answer the following.

7. (a) Round and yellow seeds
   (b) Rr Yy
   (c) RY, Ry, rY, ry
   (d) 9 round, yellow seeded: 3 Round, green-seeded: 3 wrinkled, yellow seeded: 1 green, wrinkled - seeded
   (e) Yellow-seeds: green seeds = 3 : 1 Round seeds: Wrinkled seeds = 3 : 1
8. (a) It must be homozygous dominant, since it produces only violet flowers.
   (b) The plant must be crossed with a plant bearing white (recessive) flowers.
   If the progeny consists of plants, all producing violet flowers, the plant is homozygous dominant. (Cross 1)
   If the progeny contains violet-flowered plants as well as white-flowered plants, the given plant is heterozygous. (Cross2)



9. **Bacillus thuringiens· :**
   (a) This bacterium produces a protein, which is toxic to he larvae of insects like bollworm, budworm, flies, bettles,etc.
   Bt-toxin gene has been cloned from the bacteria and been expressed in plants to provide resistance to insects without the need for chemical insecticides.
   (b) The gene (cry) coding for the protein has been isolated using restriction enzymes.
   They are cloned in the vectors and then introduced into a number of crop plants like cotton, tomato, corn, rice, etc.
   There are a number of different forms of the gene, that code for insect-specific Cry proteins, e.g., crylAc and cryllAb control cotton bollworm.
   crylAb controls corn borer.
   The transgenic plants (called as Bt corn, Bt rice, Bt cotton, etc.) produce the protein in their cells and express the insect/pest resistance.
10. Small volume cultures cannot yield appreciable quantities of products. To produce these products in large quantities the development of 'bioreactors' was required where large volumes (100-1000 litres) of culture can be processed. Thus bioreactors can be thought of as vessels in which raw materials are biologically converted into specific products, using microbial, plant, animal or human cells or individual enzymes.
    Role. A bioreactor provides the optimal conditions for achieving the desired product by providing optimum growth conditions (temperature, pH, substrate, salts, vitamins, oxygen). One of the most commonly used bioreactor is of stirring type. A stirred tank reactor is usually cylindrical or with a curved base to facilitate the mixing of the reactor contents. The stirrer facilitates even mixing and oxygen availability throughout the bioreactor. Alternatively air can be bubbled 1lhroughthe reactor. If you look at the figure closely you will see that the bioreactor has an agitator system; an oxygen delivery system, a foam control system, a temperature control system, pH control system, sampling ports so that small volumes of the culture can be withdrawn periodically.
11. (a) Refer Quick Review (Same value points to be awarded in an explanation)
    (b) Purpose : Used to ligate with a vector for further cloning. Detection of bacteria or virus by amplification of their DNNdetection of HIV in AIDS patient. Detection of mutation in genes in suspected cancer patients.
12. (a) Plasmids are extra-chromosomal, self-replicating, usually circular double-stranded DNA molecules found in bacteria and in some yeast.
    (b) ADA is adenosine deaminase deficiency, this enzyme is crucial for the immune system to function. The patient lacks functional T-Iymphocytes and

fails to fight the infecting pathogens. Children with ADA deficiency are cured by bone marrow transplantation or enzyme replacement therapy, where ADA is given by injection. Byusing gene therapy techniques, lymphocytes are taken from the patient's bone marrow and the normal gene for ADA is introduced into the lymphocytes using retrovirus. These cells are re-introduced in the patient's immune system. As these cells are not immortal, the patient requires periodic infusion of such genetically engineered lymphocytes. Hence, it is not a permanent cure. If the functional gene is introduced into the bone marrow cells at early embryonic stage, it would be a permanent cure.

III.Answer the following. (Any Seven)

13. **Phenylketonuria:**
It is caused by a recessive mutant allele on chromosome 12.
The affected individuals lack an enzyme that catalyses the conversion of the amino acid phenylalanine into tyrosine.
As a result, phenylalanine is metabolised into phenyl pyruvate, phenyl acetate, etc.
Accumulation of these chemicals in the brain results in mental retardation.
These are also excreted in the urine, as they are not absorbed by the kidney tubules.

14. 1. The DNA fragments are separated by electrophoresis using agarose as the matrix.
2. Since, DNA fragments are negatively charged; they move towards the anode under the electric fields through the medium and separate/resolve according to their size due to the sieving effect of agarose gel.
3. The separated fragments can be viewed by staining the DNA with ethidium bromide followed by exposure to UV radiation.
Elution is the process in which the separated bands of DNA are cut out from the gel and extracted.

15. (a) Restriction endonucleases are called so, because they restrict the growth of bacteriophage by cutting their DNA at specific sequences.
(b) A palindrome in DNA is the sequence of base pairs that reads the same on the two strands of DNA, when the orientation of reading is kept the same.
Restriction enzymes cut the strand of DNA a little away from the centre of the palindrome site, but between the same two bases in both the strands.
This creates single-stranded stretches overhanging at the ends of the palindrome; they are called sticky ends.

16. (i) In the above bacterial cell, i.e. A is plasmid B is chromosomal DNA.
(ii) If the enzyme Eco RI acts on both linear DNA and plasmid DNA, each having three recognition sites, the restriction enzyme will generate 3 fragments from plasmid DNA (as it is circular) and 4 fragments from linear DNA.

17. Lactic acid bacteria; curd
Saccharomyces cerevisiae ; bread
Propionibacterium sharmanii; swiss cheese

18. Two chains of DNA sequence corresponding to A and B chains of human insulin prepared, introduced them into plasmids of E. coli to produce separate A and B chains, A and B chains extracted combined by creating disulphide bonds.

19. Enzyme-linked immunosorbent assay:
1. Using conventional methods, early diagnosis is not possible.
2. By the time, the symptoms of the disease appear, the concentration of the pathogen is very high.
3. But by ELISA, the presence of the pathogen can be detected, when its concentration is low and the symptoms have not appeared; hence, early treatment and cure is possible.

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20. (a) Transgenic animals are those animals, which have their DNA manipulated to possess and express one/ more foreign gene(s).
(b) Mica.
(c) They are produced for the following purposes:
(i) Transgenic animals are designed to allow the study of how genes are regulated and how they affect the normal functions of the body and its development, e.g. information has been obtained as to how insulin has a role as growth factor.
(ii) Transgenic animals that produce useful biological compounds are created by introducing a portion of the DNA that codes for the product, e.g. a-I-antitrypsin is produced for treating emphysema.
(iii) Transgenic animals are being developed to test the safety of vaccines, e.g. polio vaccine has been tested on transgenic mice.
(iv) Transgenic animals with more sensitivity to toxic substances are being developed to test the toxicity of drugs.

II.Answer the following. (Any Five)

21. Since dwarfness (recessive trait) has appeared in the progeny, the tall pea plant must be heterozygous for tallness, i.e. its genotype is Tt

Selfing :	Tall Tt	×	Tall Tt
Gametes :	(T), (t)		(T), (t)
Progeny :	T		t

	T	t
T	TT Tall	Tt Tall
t	Tt Tall	tt Dwarf

The phenotypic ratio is 3 Tall : 1 dwarf.
Since tallness is dominant over dwarfness, the homozygotes (TT) as well as the heterozygotes (Tt) are tall.
The recessive trait is expressed only under homozygous condition (tt) and hence appears only in one-fourth of the progeny.

22. Pedigree analysis is the study of transmission of particular traits over the generations for finding out the possibility of their occurrence in the future generations.
Importance of pedigree analysis is as follows
(i) It is used to know the possibility of expressive or recessive allele, which may cause genetic disorders.
(ii) It shows the origin of a trait and inheritance pattern of that trait in a family.

23. 1.The gene for haemophilia is present in the X-chromosome.
2.The son receives the X-chromosome from his mother; so a carrier-mother passeson the disease to 50% of her sons.
3. When the mother is normal, the sons .have no chance of getting the disease, even if the father is haemophilic, because father passes on the Y-chromosome to his sons.

24.

The specific DNA sequence where the replication of DNA is initiated is called origin of replication(Ori)
For the multiplication of the alien DNA in the host it has to be integrated to the origin of replication(Ori)

25. In case of ZO-ZZ type of sex determination the female produces two types of eggs.The one-half of eggs is with **Z-chromosome** and the other half without **Z-chromosome.**The male homomorphic sex chromosomes and is homogametic.It forms only one kind of sperms each with **Z-chromosome.** On fertilization by a sperm with **Z-chromosome,** the **Z-containing** egg gives rise to male offspring **ZZ** and **Z-lacking** egg produces female offspring **ZO.** Such type of sex determination is found in case of butterflies and moths.
26. i) Agarose gel electrophoresis
    ii) Agarose
    iii) Ethidium bromide
    iv) Elution

I. Multiple Choice Question

27. (a) Klinefelter's syndrome
28. (d) Is used for in vitro replication of specific DNA sequence using thermostable DNA polymerase
29. (c) Escherichia
30. (b) Reduce herbicide accumulation in food articles for health safety
31. (b) 1980
32. (d) adenosine deaminase deficiency
33. (a) A - 3, B - 4, C - 1, D - 5
34. (a) human α-lactalbumin
35. (d) Autosomal recessive
36. (d) G and A from 5′ to 3′
37. (c) Cry I Ab
38. (b) Bioreactors

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