

BIOTECHNOLOGY SCHEME OF EVALUATION  
Cell Biology and Genetics

Time 2 30 Hours

Max Marks: 60

**I. Answer any eight of the following.**

**2 x8 = 16**

1. What is synaptonemal complex?

The synaptonemal complex (SC) is a protein structure that forms between homologous chromosomes (two pairs of sister chromatids) during meiosis and is thought to mediate synapsis and recombination during meiosis I in eukaryotes. The synaptonemal complex is a tripartite structure consisting of two parallel lateral regions and a central element. Previous to the pachytene stage, during leptotema, the lateral elements begin to form and they initiate and complete their pairing during the zygotene stage. After pachynema ends, the SC usually becomes disassembled and can no longer be identified.

**Definition -2 Marks**

2. Define Test cross.

Test cross is a cross of an individual organism of dominant and an organism with a homozygous recessive genotype (and phenotype)

**Definition -2 Marks**

3. Define coupling and repulsion.

Coupling: when genes come from the same parent they enter the same gamete & are inherited together.

Repulsion: genes are inherited separately when genes come from different parents & they enter different gametes.

**Definition -2 Marks**

4. What are microfilaments ?

Microfilaments are double-stranded molecules of polymerized fibrous (F) actin; the monomeric form of the protein is globular (G) actin; and these two forms exist in equilibrium in the cell. The microfilaments are present in bundles and form a three-dimensional (3D) intracellular meshwork.

**Definition -2 Marks**

5. Define an allele

Alleles may appear in pairs or in multiple forms of alleles, which affect a specific trait of the offspring. Locus is the location where a gene is found on a chromosome. A pair of alleles determine the same trait.

**Definition -2 Marks**

6. What are mutagens? Give two examples.

Mutagens are chemical compounds or physical agents forms of radiation (such as ultraviolet (UV) light or X-rays) that cause irreversible and heritable changes (mutations) in the cellular genetic material, deoxyribonucleic acid (DNA).

Examples: chemical mutagens - alkylating agents , azides and Ethyl methane sulphonate

Physical agents - ultraviolet (UV) and gamma radiation

**Definition -1 Mark**

**Examples-1 Mark**

7. Write any two functions of lysosome

Intracellular digestion

Removal of dead cells

Role in metamorphosis

Help in protein synthesis

Help in fertilization

Role in osteogenesis

**Any two functions-2 Marks**

8. What is meant by linkage map?

A map of the genes on a chromosome based on linkage analysis. A linkage map does not show the physical distances between genes but rather their relative positions, as determined by how often two gene loci are inherited together.

**Definition -2 Marks**

9. What are nucleolus?

An area inside the nucleus of a cell that is made up of RNA and proteins and is where ribosomes are made. Ribosomes help link amino acids together to form proteins. The nucleolus is a cell organelle.

**Definition -2 Marks**

10. Define cell theory.

Cell theory states that living things are composed of one or more cells, that the cell is the basic unit of life, and that cells arise from existing cells.

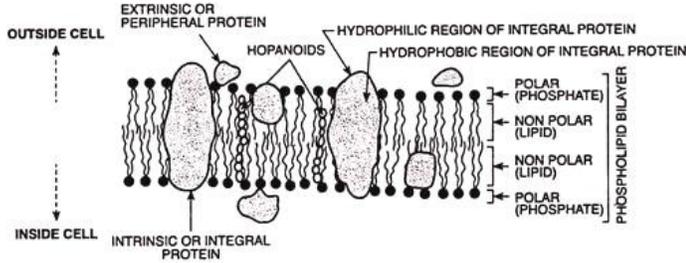
**Definition -2 Marks**

**II. Answer any six of the following.**

**4 x 6 = 24**

11. Describe the structure of plasma membrane.

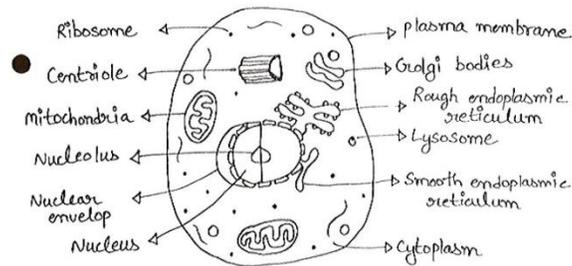
Plasma membrane is found in all cells and separates the interior of the cell from the outside environment. The cell membrane consists of a lipid bilayer that is semipermeable. The cell membrane regulates the transport of materials entering and exiting the cell.



**Diagram -2 Marks**

**Explanation-2 Marks**

12. Write the ultra-structure of animal cell.

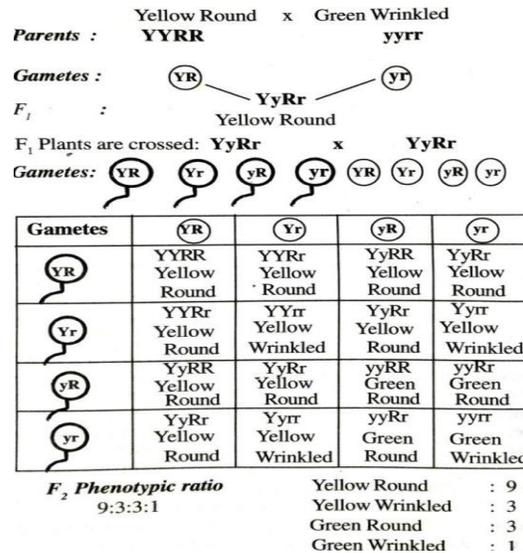


**Diagram -2 Marks**

**Explanation-2 Marks**

13. Explain and illustrate the law of Independent Assortment.

This law is based on dihybrid experiment. According to this law, the genes for each pair of characters separate independently from those of other characters during gamete formation.



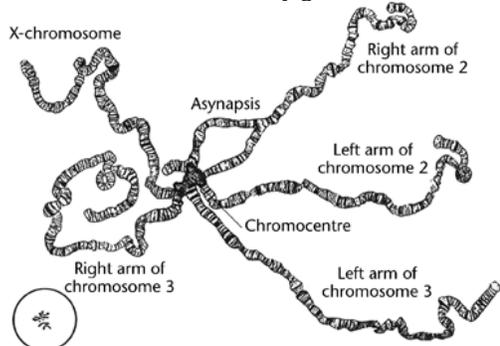
**Punnett square -2 Marks**

**Explanation-2 Marks**

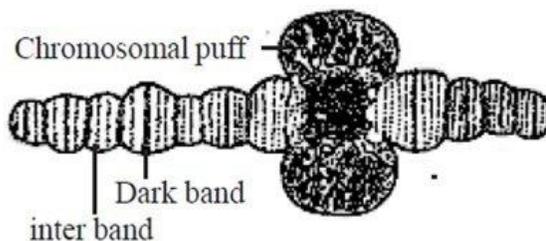
14. Explain the mechanism of crossing over.

**Explanation-4 Marks**

15. Write a note on Salivary gland chromosome



**Diagram -2 Marks**



**Explanation-2 Marks**

16. Illustrate plumage colour in poultry (13:3).

**Punnett square -2 Marks**

**Explanation-2 Marks**

**c**

|               |              |
|---------------|--------------|
| CCII - White  | ccII - White |
| CCli - White  | ccLi - White |
| CCii - Colour | cCli - White |
| Ccii - Colour | CCli - White |
| ccii - White  | CcLi - White |

White leghorns x Plymouth rock (white)  
(Genetically coloured)

CCII
ccii  
\
/  
Ccli  
White

*F<sub>1</sub> individuals are inbred*

*Gametes:* C<sup>I</sup> C<sup>i</sup> c<sup>I</sup> c<sup>i</sup>      C<sup>I</sup> C<sup>i</sup> c<sup>I</sup> c<sup>i</sup>

| Gametes        | C <sup>I</sup> | C <sup>i</sup> | c <sup>I</sup> | c <sup>i</sup> |
|----------------|----------------|----------------|----------------|----------------|
| C <sup>I</sup> | CCII<br>White  | CCli<br>White  | CcII<br>White  | Ccli<br>White  |
| C <sup>i</sup> | CCii<br>White  | CCii<br>Colour | Ccli<br>White  | Ccii<br>Colour |
| c <sup>I</sup> | CcII<br>White  | Ccli<br>White  | ccII<br>White  | ccLi<br>White  |
| c <sup>i</sup> | Ccli<br>White  | Ccii<br>Colour | ccLi<br>White  | ccii<br>White  |

*F<sub>2</sub> generation:* 13 white; 3 colour

17. Write the significance of cell cycle.  
Significance of cell cycle.

- Renewing of damaged cells.
- Production of new cells from older ones.
- Maintains the total number of chromosomes.
- Provides more cells for growth and development.
- Repairs and controls damages caused to the cells.
- Also helps in survival and growth of living organisms.

**Any 4 points-4 Marks**

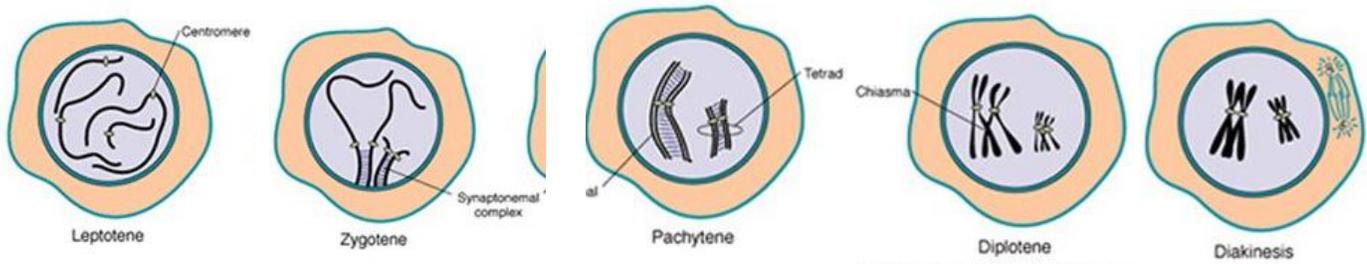
18. Explain the chromosome evolution in cotton.

**Explanation-4 Marks**

III. Answer any two of the following.

10 x 2 = 20

19. Explain prophase 1 in detail and write a note on the significance of meiosis.



**Diagram -2.5 Marks**

**Explanation-7.5 Marks**

20. Write single stranded and multi stranded hypothesis.

Single-stranded DNA is **the single DNA strand that is created during the replication process of DNA**. The replication of single-stranded DNA forms two separate single-stranded chromosomes that join together to form double-stranded DNA (dsDNA). In the multiple strand models **the chromosome is supposed to consist of several DNA-protein strands**. Simple multi-stranded model. According to this model the chromosome consists of 64 double helices of DNA arranged in a parallel manner, and twisted together like the strands of a rope.

**Explanation-7.5 Marks**

21. Write the application of mutation in plants, animals and microbes.

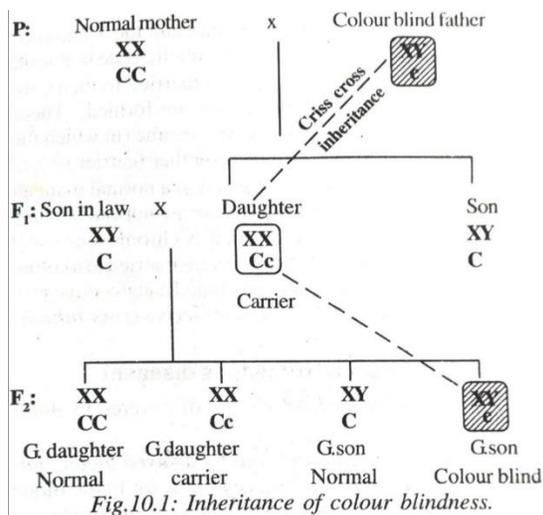
- the production of transgenic animals resistant to disease
- increasing the productivity of animals
- in the treatment of genetic disorders
- Production of vaccines.

**Application of mutation in microbes**

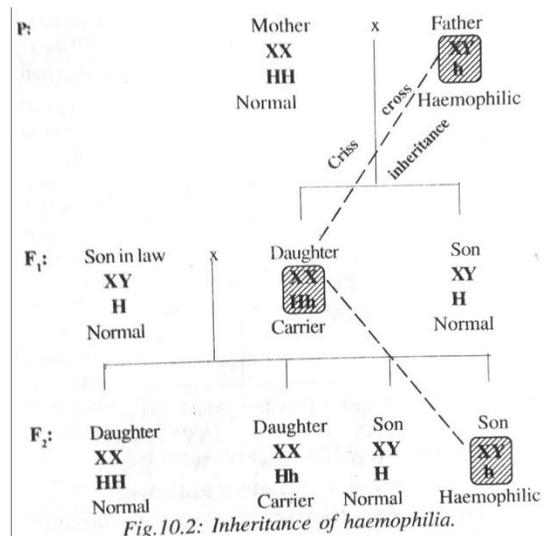
- Determination of Function
- Demonstration of Metabolic Pathways in Microorganisms
- For Understanding The Metabolic Regulation
- For Matching a Biochemical Entity with a Biological Function
- For Locating the Site of Action of External Agents
- For the Production of Useful Products

**Any 10 points-10 Marks**

22. What is sex-linked inheritance explain the same in colour blindness and hemophilia.



**Punnett square -2 x2=4 Marks**



**Explanation-3x2=6 Marks**