

ISC Solved Paper 2019

Biology

Class-XII

(Maximum Marks : 70)

(Time allowed : Three hours)

This paper comprises **TWO PARTS** – Part I and Part II.

Answer **all** questions.

Part I contains **one** question of 20 marks having four subparts.

Part II consists of Sections A, B and C.

Section A contains **seven** questions of **two** marks each

Section B contains **seven** questions of **three** marks each, and

Section C contains **three** questions of **five** marks each.

Internal choices have been provided in two questions in Section A, two questions in Section B and in all three questions of Section C.

PART- I

[20 Marks]

Answer **all** questions.

1. (a) Answer the following questions briefly and to the point: [8×1]

- (i) Name the antibody which is most effective in allergies.
- (ii) What is the function of GEAC ?
- * (iii) What is a *clone*?
- (iv) What do detritus food chains begin with?
- (v) Give the full form of EFB.
- * (vi) How many chromosomes are present in meiocytes of a fruit fly?
- (vii) Name the common ancestor of apes and man.
- (viii) Give the scientific term used for the preservation of germplasm at a very low temperature.

- Ans.(a) (i) IgE
- (ii) GEAC (Genetic Engineering Approval Committee) makes decisions about the validity of GM research and the safety of GM-organisms for public services.
- (iv) Detritus food chain begins with dead organic matter.
- (v) EFB stands for European Federation of Biotechnology.
- (vii) *Dryopithecus/Ramapithecus*.
- (viii) Cryopreservation.

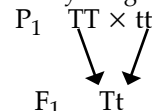
(b) Each of the following sub-parts, (i) to (iv) has four choices. Choose the best option in each case:

(i) Eyelids in human foetus separate in:

[4 × 1]

- (1) 14 weeks
- (2) 16 weeks
- (3) 24 weeks
- (4) 40 weeks

(ii) Study the given monohybrid cross:



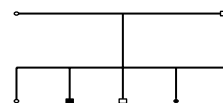
A test cross for this F_1 will be:

- (1) $Tt \times TT$
- (2) $Tt \times tt$
- (3) $Tt \times Tt$
- (4) $TT \times tt$

* (iii) Montreal Protocol aims at:

- (1) Reduction of ozone depleting substances.
- (2) Biodiversity conservation.
- (3) Control of water pollution.
- (4) Control of CO_2 emission.

(iv) In the given pedigree chart, the trait shown is :



- (1) Autosomal dominant
- (2) Autosomal recessive
- (3) X-linked
- (4) Y-linked

- Ans.(b) (i) (3) 24 weeks
 (ii) (2) $Tt \times tt$
 (iv) (2) Autosomal recessive
- (c) Give *one* significant contribution of each of the following scientists: [4×1]
- (i) Wallace
 (ii) R. Mishra
 (iii) G. Gamow
 (iv) Sanger
- Ans. (c) (i) Wallace : Played role in developing theory of natural selection.
 (ii) R. Mishra : Father of Indian Ecology.
 (iii) G. G. amow: Suggested that the genetic code should be made of a combination of three nucleotides.

- (iv) Sanger: Used the dideoxy method to sequence human mitochondrial DNA.
- (d) Define the following: [2 × 1]
- (i) Carrying capacity
 (ii) Homologous chromosomes
- Ans. (i) Carrying capacity: It is the maximum population that an area will support without undergoing deterioration.
- (ii) Homologous chromosomes: Chromosomes having the same genes at the same loci but possibly different alleles.
- * (e) Give a reason for each of the following : [2 × 1]
- (i) Bagging is essential in artificial hybridisation.
 (ii) Climax stage is achieved quickly in secondary succession as compared to primary succession.

PART- II

[50 Marks]

SECTION - A [14 Marks]

Answer all questions

- *2. Enumerate any four essential features of good and effective poultry farm management practices. [2]
- *3. What is a single cell protein? How is it significant for human welfare? [2]
4. (a) List four reasons for drug addiction. [2]

OR

- (b) List four effects of alcoholism on human health.

Ans.Reasons for drug addiction are:

- (a) Curiosity and experimentation.
 (b) Need for adventure and excitement.
 (c) To escape facing problems.
 (d) Stress from pressure to excel in academics or examination.
 (e) Television, movies, news papers, internet, etc.
 (f) Unstable or unsupportive family structures and peer pressure. (Any four)

OR

Effects of alcoholism on human health are:

- (a) Reckless behaviour, vandalism and violence.
 (b) Drop in academic performance and absence from school.
 (c) Lack of interest in personal hygiene.
 (d) Withdrawal and isolation.
 (e) Depression, fatigue, aggressive and rebellious behaviour, deteriorating relationship between family and friends.
 (f) Loss of interest in hobbies.
 (g) Fluctuations in sleeping, eating habits, weight, appetite etc.
 (h) Social problems like stealing and spread of infectious diseases (e.g. AIDS, hepatitis B).
 (i) Damage of nervous system and cirrhosis. (Any four)

5. State four features of flowers pollinated by insects. [2]

Ans.Features of flower pollinated by insects are:

- (a) The flowers are brightly coloured, showy, large and if small they becomes conspicuous by grouping as in capitulum and umbel, etc.
 (b) The flowers are sweetly scented so as to attract the insects for pollination.
 (c) The flowers have nectar secreting glands which secrete abundant nectar which attract the pollinating insects.
 (d) Flowers may have edible pollen e.g., *rosa* and *clematis*.
 (e) The flowers have stamens and stigma inserted.
 (f) Flowers possesses pollen kit as an yellowish sticky substance. (Any four)

6. What is reproductive fitness? Explain it with the help of an example. [2]

Ans. According to Darwin, fitness refers to reproductive fitness. The individuals those who are best fit in an environment, leaves more progeny than others. These, therefore, will survive more and hence are selected by nature. He called it natural selection and implied it as a mechanism of evolution.

For example, industrial melanism: It is a case of natural selection. In England, it was observed before industrialisation that white-winged moth were more than dark-winged moth. But the situation became reversed after industrialisation. It was found that predators spotted and picked the moth against a contrasting background. During pre-industrialisation, the tree trunks were covered by white lichens and on white-background dark coloured moth can be picked up. During post industrialisation, the tree trunks were covered by dark, dust, coal particles and became dark, on which white moth can easily be picked up. Thus, it was

found that industrial melanism supports evolution by natural selection.

7. Give one significant difference between primary lymphoid organs and secondary lymphoid organs. Give one example of each. [2]

Ans. Difference between primary lymphoid organ and secondary lymphoid organs:

| Primary lymphoid organs | Secondary lymphoid organs |
|---|---|
| Organs where immature lymphocytes differentiate into antigen-sensitive lymphocytes are primary lymphoid organs. | Organs where matured lymphocytes migrate, interact with antigens and then proliferate to become effector cells are secondary lymphoid organs. |
| E.g. Bone marrow and thymus. | E.g. Spleen, lymph nodes |

- *8. (a) Explain the term *biofortification*. How is this technique useful for the production of golden rice? [2]

OR

(b) Write a short note on *Electrophoresis*.

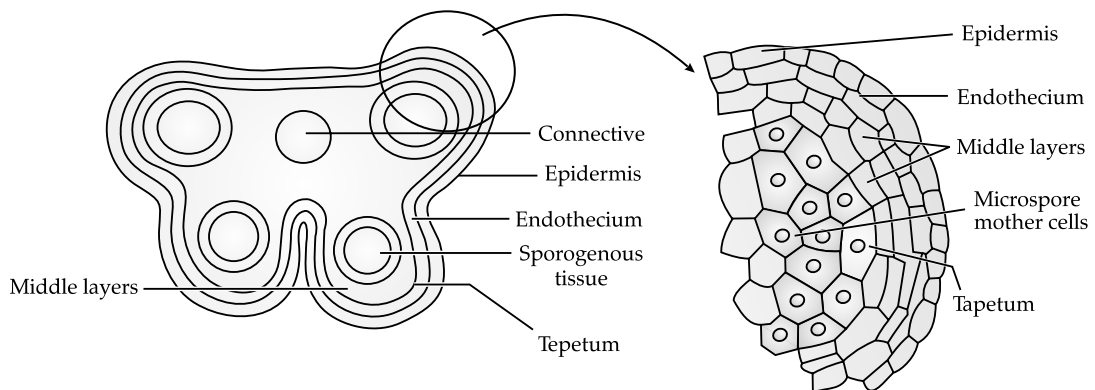
Ans. (b) Gel-electrophoresis is a technique of separation of DNA molecules under the influence of an electric field. DNA fragments get separated according to their sizes through the pores of agarose gel. In this technique, DNA samples are loaded into wells (indentations) at one end of the gel, and an electric current is applied to pull them through the gel. DNA fragments are negatively charged, so they

10. (a) Draw a labelled diagram of the T.S. of a mature anther. [3]

OR

(b) Draw a labelled diagram of the internal structure of human ovary

Ans. T.S of a mature anther:



move towards the positive electrode.

Because all DNA fragments have the same amount of charge per mass, small fragments move through the gel faster than larger ones. When a gel is stained with a DNA-binding dye, the DNA fragments can be seen as bands, each representing a group of same-sized DNA fragments.

SECTION - B [21 Marks]

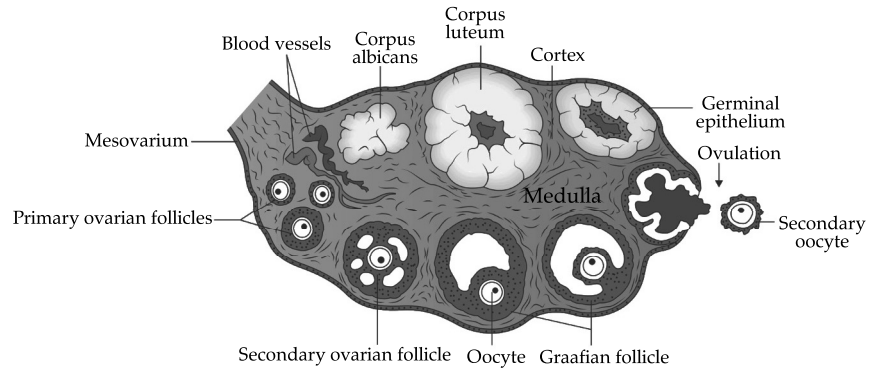
Answer all questions

9. Explain the evolution of long neck of giraffe according to Charles Darwin. [3]

Ans. According to Darwin, nature selects only those individuals which are with more favourable variations and are best adapted to the environment. The less fit and unfit organisms are left out by selection. This sorting out of individuals with useful variations is called natural selection by Darwin and survival of fittest by Wallace.

Darwin explained evolution of long neck of modern giraffe by stating the existence of long necked and short necked giraffe in the ancestral population. After the change in the climate, resulting in presence of trees and no grasslands, the longer necked giraffe with longer forelegs were more successful in reaching the soft leaves of trees for feeding. Therefore, natural selection favoured longer necked progeny generation after generation. Selection of longer neck through a long series of generations resulted in the evolution of such long-necked modern giraffe.

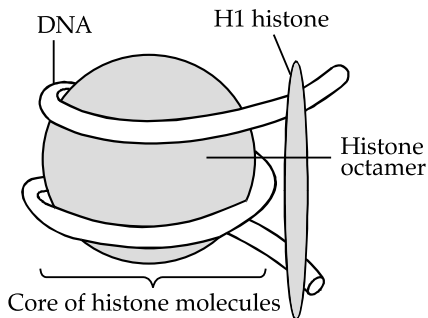
Internal structure of Ovary:



11. Describe the structure of a nucleosome with the help of a well-labelled diagram. [3]

Ans. Structure of a nucleosome:

- (i) The negatively charged DNA is wrapped around the positively charged histone octamer to form a structure called nucleosome.
- (ii) A nucleosome contains 200 bp of DNA helix.
- (iii) Nucleosomes constitute the repeating unit of a structure in nucleus called chromatin, thread-like stained (coloured) bodies seen in nucleus.
- (iv) The nucleosomes in chromatin are seen as 'beads-on-string' structure to form chromatin fibers that further coils and condense at metaphase stage of cell division to form chromosomes.



12. (a) Explain the Rivet Popper hypothesis. [3]

OR

(b) Define:

- (1) Standing crop
- * (2) Stenothermal organisms
- * (3) Niche

Ans. (a) Rivet Popper hypothesis: It was given by Stanford ecologist Paul Ehrlich. In an airplane (ecosystem) all parts are joined together using thousands of rivets (species). If every passenger travelling in it starts popping a rivet to take home (causing a species to become extinct), it may not affect flight safety (proper functioning of the ecosystem) initially, but as more and more rivets are removed, the plane becomes dangerously weak over a period of time. Furthermore, which rivet is removed

may also be critical, serious threat to flight safety than loss of a few rivets on the seats or windows inside the plane.

OR

(1) Standing crop: A standing crop is the total dried biomass of the living organisms present in a given environment.

13. Give the biological names of the following: [3]

- (i) The mould from which penicillin is obtained.
- (ii) Baker's yeast.
- (iii) The microbe used to control insect larvae growing on cotton.
- (iv) The microbe used to produce Swiss cheese.
- (v) The fungus that is being developed as a bio-control agent.
- (vi) A symbiotic nitrogen fixing bacterium found in root nodules.

Ans. (i) *Penicillium notatum*

(ii) *Saccharomyces cerevisiae*

(iii) *Bacillus thuringiensis*

(iv) *Propionibacterium shermanii*.

(v) *Trichoderma sp*

(vi) *Rhizobium*

14. Explain the different types of endosperms in angiosperms. [3]

Ans. Endosperm is the nutritive tissue formed as a result of triple fusion in the angiosperms. It is generally triploid. Endosperm development starts prior to embryo development.

It is of three types:

- (i) **Nuclear type:** Primary endosperm nucleus divides repeatedly to form a large number of free nuclei. PEN undergoes series of mitotic division without cytokinesis.
- (ii) **Cellular endosperm:** Cell wall formation occurs immediately after PEN division resulting in the formation of cellular endosperm. e.g., Balsam, *Petunia*.
- (iii) **Helobial endosperm:** It is a combination of nuclear and cellular endosperm.

15. A homozygous pea plant with round seed coat and yellow cotyledons is crossed with another homozygous pea plant having wrinkled seed coat and green cotyledons. [3]

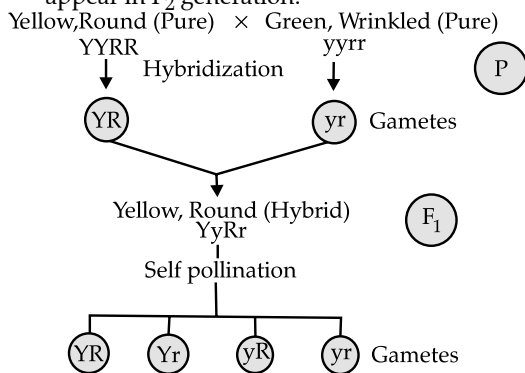
- (i) Give the types of gametes produced by plants of F₁ -generation.
- (ii) Give the dihybrid phenotypic ratio with the corresponding phenotypes.
- (iii) State the Mendel's principle involved in this cross.

Ans. (i) F₁ plant (YyRr) will produce only parental gametes (YR, yr).

(ii)

| Phenotype | Phenotypic ratio |
|------------------|------------------|
| Yellow, Round | 9 |
| Yellow, Wrinkled | 3 |
| Green, Round | 3 |
| Green, Wrinkled | 1 |

(iii) Mendel's Principle involved is Law of Independent Assortment: It states that when more than one pair of characters are involved in a cross, the segregation of one pair of contrasting characters is independent of the segregation of other pair of contrasting characters and also that new recombination of characters along with the parental type also appear in F₂ generation.



| | | | | | |
|-------|------|------|------|------|----------------|
| ♀ \ ♂ | YR | Yr | yR | yr | |
| YR | YYRR | YYRr | YyRR | YyRr | F ₂ |
| Yr | YYRr | YYrr | YyRr | Yyrr | |
| yR | YyRR | YyRr | yyRR | yyRr | |
| yr | YyRr | Yyrr | yyRr | yyrr | |

| Phenotype | Genotype | Genotypic ratio | Phenotypic ratio |
|------------------|----------|-----------------|------------------|
| Yellow Round | YYRR | 1 | 9 |
| | YYRr | 2 | |
| | YyRR | 2 | |
| | YyRr | 4 | |
| Yellow, Wrinkled | YYrr | 1 | 3 |
| | Yyrr | 2 | |
| Green, Round | yyRR | 1 | 3 |
| | yyRr | 2 | |
| Green, Wrinkled | yyrr | 1 | 1 |

SECTION - C [15 Marks]

16. (a) Describe the physico-chemical events that take place during fertilization in humans. [5]

OR

- (b) (i) Define and give the role of amniocentesis.
- (ii) Name the causative agent and give any one symptom of Gonorrhoea.
- (iii) What is the significance of dispersal of seeds? Give any two points.
- *(iv) What are seasonal breeders? Give an example.
- (v) How is the chromosome number maintained in sexually reproducing organisms? [5]

Ans. (a) Physico-chemical events that take place during fertilisation in humans:

- (i) During copulation (coitus), semen is released by the penis into the vagina (insemination).
- (ii) The motile sperms swim rapidly, pass through the cervix, enter into the uterus and finally reach the junction of the isthmus and ampulla (ampullary-isthmic junction) of the fallopian tube.
- (iii) The ovum released by the ovary is also transported to the ampullary-isthmic junction where fertilisation takes place.
- (iv) Fertilisation can only occur if the ovum and sperms are transported simultaneously to the ampullary-isthmic junction. Hence, not all copulations lead to fertilisation and pregnancy.
- (v) The process of fusion of a sperm with an ovum is called fertilisation.
- (vi) During fertilisation, a sperm comes in contact with the zona pellucida layer of the ovum and induces changes in the membrane that block the entry of additional sperms to ensure that only one sperm can fertilise an ovum.
- (vii) The secretions of the acrosome help the sperm enter into the cytoplasm of the ovum through the zona pellucida and the plasma membrane.
- (viii) This includes the completion of the meiotic division of the secondary oocyte.
- (ix) The second meiotic division is also unequal and results in the formation of a second polar body and a haploid ovum (ootid).
- (x) Soon, the haploid nucleus of the sperm and that of the ovum fuse together to form a diploid zygote.

OR

(b) (i) **Amniocentesis:** It is a technique of foetal sex determination based on the pattern of chromosome, in the amniotic fluid surrounding the developing embryo.

Role: It helps to detect any genetically controlled congenital disease or any metabolic disorders in foetus.

(ii) **Causative agent:** *Neisseria gonorrhoeae*

Symptom: Painful or frequent urination.

(iii) **Advantages of seed dispersal are:**

- (a) Protection from predation
- (b) Better survival areas
- (c) Less competition **(Any two)**

(v) In sexually reproducing organisms, the gametes undergo meiosis and hence, each gamete contains only half set of chromosomes.

17. (a) (i) **What are restriction endonucleases? Give the rules of their nomenclature.** [5]

(ii) **Explain the mechanism of action of restriction endonucleases that makes them suitable for genetic engineering.**

OR

(b) (i) **Explain what are the desirable characteristics of an ideal cloning vector used in rDNA technology.**

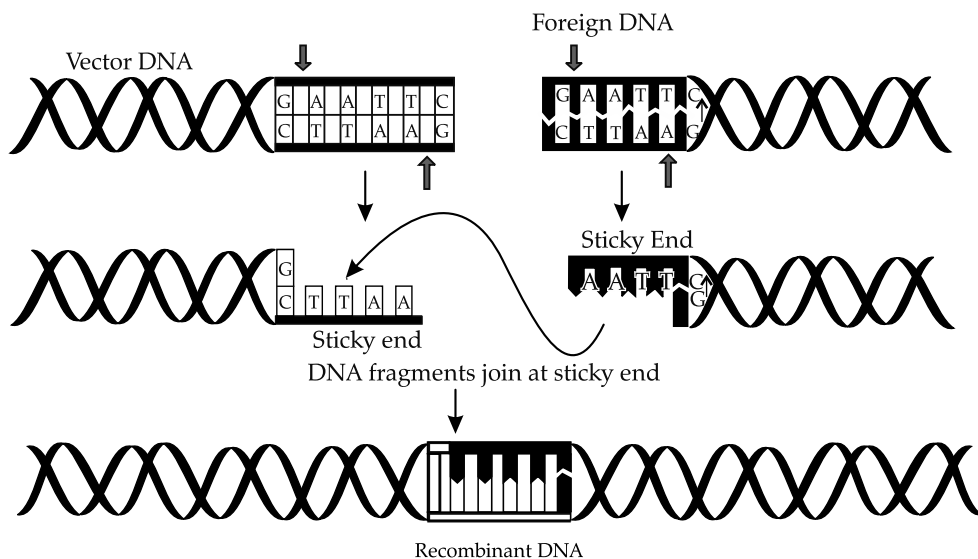
(ii) **Describe two vectorless methods of gene transfer used in rDNA technology.** [5]

Ans. (i) *Restriction endonuclease* is an enzyme from bacteria that can recognize specific base sequences in DNA and cut the DNA at that site (the restriction site).

Rules for naming the restriction enzymes are:

The enzyme cuts both DNA strands at the same site

EcoRI cuts the DNA between bases G and A only when the sequence GAATTC is present in the DNA



First letter indicates genus and the second two letters indicate species of the prokaryotic cell from which they were isolated.

- E.g. *EcoRI*: The first letter of the name comes from the genus and the next two from the name of the species of the bacterium *i.e.* prokaryotic cell. Thus *Eco* stands for the genus and species of the prokaryotic cell from which the enzyme was isolated *i.e.* *E. coli*.
- R stands for strain. 'I' follows order in which the enzyme was isolated.

(ii) **Mechanism of action of endonucleases is as follows:**

- Each restriction endonuclease can bind to specific recognition sequence of the DNA and cut each of the two strands at specific points in their sugar-phosphate backbones.
- Each restriction endonuclease recognizes a specific palindromic nucleotide sequences in the DNA.
- Restriction enzymes cut the strand a little away from the centre of the palindrome sites, but between the same two bases on the opposite strands.
- This leaves single stranded over hanging stretches at the end called sticky ends.
- They form H-bonds with their complementary cut counter parts with the help of the enzyme DNA ligase.
- When cut by the same restriction enzyme, the resultant DNA fragments have the same kind of sticky-ends and these are joined together by DNA ligases.

OR

(b) (I) Features of cloning vector are:

- (i) **Origin of replication (ori):** This is a sequence from where replication starts and any piece of DNA when linked to this sequence can be made to replicate within the host cells. This sequence is also responsible for controlling the copy number of the linked DNA.
- (ii) **Selectable marker:** The vector requires a selectable marker, which helps in identifying and eliminating non transformants and selectively permitting the growth of the transformants. **Transformation** is a procedure through which a piece of DNA is introduced in a host bacterium. Normally, the genes encoding resistance to antibiotics such as ampicillin, chloramphenicol, tetracycline or kanamycin, etc, are considered useful selectable markers for *E. coli*.
- (iii) **Cloning sites:** In order to link the alien DNA, the vector needs to have very few

recognition sites for the commonly used restriction enzymes. Presence of more than one recognition sites within the vector will generate several fragments, which will complicate the gene cloning.

(II) Methods of vectorless gene transfer are:

- (i) **Micro-injection :** In this, recombinant DNA is directly injected into the nucleus of an animal cell by using microneedle or micro-pipette.
- (ii) **Biolistics (gene gun) method :** In this, cells are bombarded with high velocity micro-particles of gold or tungsten coated with DNA. This method is suitable for plants.
- (iii) **'Disarmed pathogen' vectors :** These vectors, when infect the cell, transfer the recombinant DNA into the host. **(Any two)**
- *18. (a) Give a graphic representation of carbon cycle in nature. [5]

OR

- (b) Give a graphic representation of phosphorus cycle in nature.

