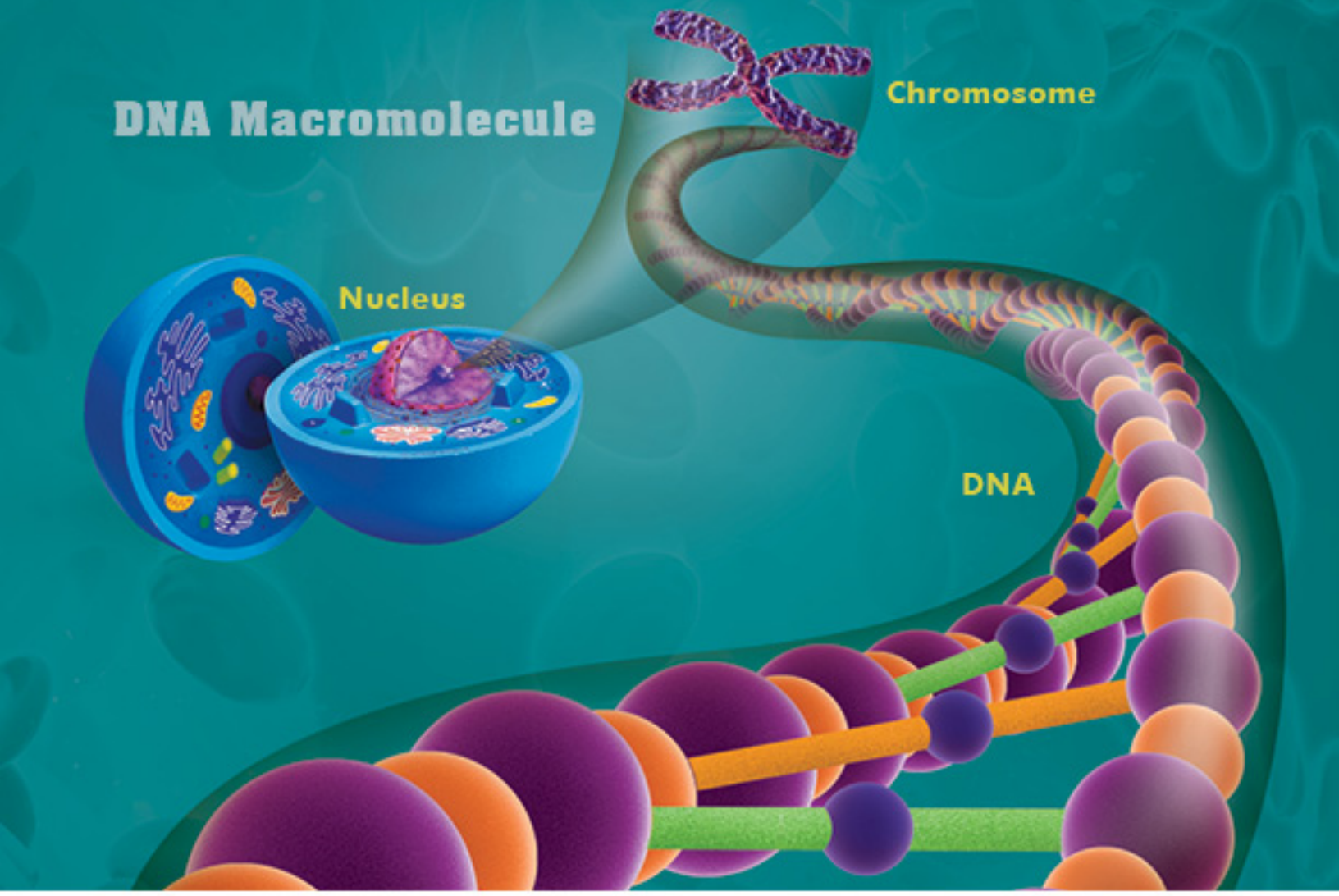
SAMPLE CONTENT

PERFECT

BIOLOGY - I

Std. XII Sci.



Target Publications Pvt. Ltd.

Written as per the revised syllabus prescribed by the Maharashtra State Board of Secondary and Higher Secondary Education, Pune.

Perfect
Biology – I
STD. XII Sci.

Salient Features

- Exhaustive coverage of syllabus in Question Answer Format.
- Covers answers to all Textual Questions.
- Covers answers to all Board Questions till date.
- Includes solved Board Questions from 2013 to 2018.
- Covers relevant NCERT Questions.
- Includes Board Question Papers of 2017 and 2018.
- Quick Review, Exercise, Multiple Choice Questions and Topic test at the end of each chapter for effective preparation.
- Important inclusions: NCERT Corner, Apply Your Knowledge.

Printed at: **Repro India Ltd.,** Mumbai

P.O. No. 141406

TEID: 12961_JUP

Preface

In the case of good books, the point is not how many of them you can get through, but rather how many can get through to you.

"Std. XII Sci. : PERFECT BIOLOGY - I" is a treasure house of knowledge that'd not only prepare you to face the conspicuous Std. XII final exam but also equip you up on parallel ground to face the prospective NEET exam.

This book is specifically aimed at Maharashtra Board students. The content of the book is framed in accordance with Maharashtra State board syllabus splattered with additional snippets of information from the NCERT syllabus. This lethal combination of apt material from both the syllabus makes it the ultimate reference material for Std. XII.

This book has been developed on certain key features as detailed below:

- Sub-topic wise classified **Question and Answer** format of the book provides students with appropriate answers for all textual questions. We've also included additional questions to ensure complete coverage of every concept.
- **Solutions to Board Questions** along with marking scheme (wherever relevant) have been included.
- **NCERT Corner** and **Notes** cover additional bits of relevant information on each topic.
- **Apply Your Knowledge** covers brain-storming questions to stengthen the students' conceptual understanding.
- **Quick Review** section facilitates instant revision at a glance.
- **Exercise** helps the students to gain insight on the various levels of theory questions.
- **Multiple Choice Questions** and **Topic Test** assess the students on their range of preparation and the amount of knowledge of each topic.

The journey to create a complete book is strewn with triumphs, failures and near misses. If you think we've nearly missed something or want to applaud us for our triumphs, we'd love to hear from you.

Please write to us at : mail@targetpublications.org

A book affects eternity; one can never tell where its influence stops.

Best of luck to all the aspirants!

Yours faithfully,

Publisher

Edition: Second

PAPER PATTERN

- There will be one single paper of 70 Marks in Biology.
- Duration of the paper will be 3 hours.

Section A: **(8 Marks)**

This section will contain Multiple Choice Questions and Very Short Answer(VSA) type of questions.

There will be 4 MCQs and 4 VSA type of questions, each carrying one mark.

Students will have to attempt all these questions.

Section B: **(20 Marks)**

This section will contain 10 Short Answer (SA-I) type of questions, each carrying 2 marks.

Internal choice is provided for only one question.

Section C: **(27 Marks)**

This section will contain 9 Short Answer (SA-II) type of questions, each carrying 3 marks.

Internal choice is provided for only one question.

Section D: **(15 Marks)**

This section will contain 3 Long Answer (LA) type of questions, each carrying 5 marks.

Internal choice is provided for each question.

Distribution of Marks According to the Type of Questions

Type of Questions		
MCQ	1 Mark each	4 Marks
VSA	1 Mark each	4 Marks
SA - I	2 Marks each	20 Marks
SA - II	3 Marks each	27 Marks
LA	5 Marks each	15 Marks

Contents

Sr. No.	Chapter	Marks	Page No.
1	Genetic Basis of Inheritance	05	1
2	Gene: Its Nature, Expression and Regulation	04	32
3	Biotechnology: Process and Application	03	67
4	Enhancement in Food Production	03	89
5	Microbes in Human Welfare	03	105
6	Photosynthesis	05	124
7	Respiration	05	156
8	Reproduction in Plants	04	181
9	Organisms and Environment - I	03	218
	Board Question Paper - March 2017		241
	Board Question Paper - July 2017		243
	Board Question Paper - March 2018		245
	Board Question Paper - July 2018		247

Note: All Textual questions are represented by * mark.
NCERT Questions are represented by # mark.

04 Enhancement in Food Production

Syllabus

4.0	Introduction	4.2	Tissue Culture
4.1	Plant Breeding	4.3	Single Cell Protein

4.0 Introduction

Note

i. Plant breeding technology has helped in bringing about green revolution in India to fulfill the national requirement of food production.

ii. Plant breeding methods involve use of genetics, molecular biology and tissue culture techniques for developing plants with desired traits.

4.1 Plant Breeding

***Q.1. What is plant breeding? Describe various steps involved in classical breeding of plants.**

Ans: Plant breeding: Plant breeding is an applied branch of Botany which involves collective use of art and science for changing and improving the heredity of plants in order to create desired types.

The main steps in breeding a new genetic variety of a crop are:

i. Collection of variability.
ii. Evaluation and selection of parents.
iii. Cross hybridisation among the selected parents.
iv. Selection and selfing of superior recombinants.
v. Testing, release and commercialization of new cultivars.

i. Collection of variability:

Variations are the differences seen among individuals of a species or population, for a particular character. They are inheritable and useful in selection.

Collection and preservation of all the different wild varieties, species and relatives of cultivated species is done for the exploitation of natural genes available in the population. All such collected genes are effectively exploited for the plant breeding programmes.

The germplasm collection is the entire collection of plants and seeds having all the diverse alleles for all genes in a particular crop.

ii. Evaluation and selection of parents:

The germplasm is evaluated for identifying plants with desirable combination of characters.

Such identified plants are selected and then used in the process of hybridization.

Purelines are created whenever desirable and possible.

iii. Cross hybridization among the selected parents:

Hybridization is the crossing of two plants differing from each other genotypically in one or more characters or traits.

Useful characters are usually scattered in different races, varieties, etc. It is possible to combine all the characters in a single variety, through hybridization.

Its main objectives are:

a. To produce a single variety having a combination of good characters.
b. To exploit and utilize the hybrid vigour.
c. To increase and generate genetic variations through recombination.

iv. Selection and selfing of superior recombinants:

This step involves selection of only those plants from the progeny of hybrids, that have the desired combinations of characters.

The plants which are superior to both the parents and exhibit hybrid vigour are collected.

These plants are self-pollinated for a number of generations till they become homozygous for the trait.

Due to this, plants attain a state of uniformity and characters do not segregate in the progeny. Such plants are called pure lines.

v. Testing, release and commercialization of new cultivars:

The newly developed variety undergoes critical evaluation for yield, quality, resistance to diseases and insect pests, etc. before it is released for cultivation.

In India, such evaluations are carried out by the Indian Council of Agricultural Research (ICAR), New Delhi.

The varieties developed by different breeders are evaluated together at several locations in different agroclimatic zones of the country.

The performance of the new varieties is compared with that of the existing varieties and also with one another.

The variety that is superior is chosen for release under a new name with the permission of the Government.

***Q.2. Give the objectives of plant breeding.**

Ans: Objectives/Need of plant breeding:

i. To develop desired plants that are better suited for cultivation, give better yield and are disease resistant.
ii. To develop plants with improved quality.
iii. To produce plants that have increased tolerance limits to environmental stresses like drought, salinity and extreme temperatures
iv. To develop plants which are resistant to pathogens and pests.

Q.3. What is domestication?

Ans: Domestication is the process of bringing a species under human management. All our major food crops represent domesticated varieties.

Q.4. Explain the steps involved in hybridization.

Ans: Hybridization involves the following steps:

i. Selection and isolation of parents:

Here, two healthy plants with desirable characters are selected.

The parent plants are grown separately on isolated plots to avoid cross pollination. Self pollination is carried out in both the parents to produce purelines.

Self pollination is done for 6-8 generations till the majority of plants become homozygous and true breeding.

The last generation of both the parents are used for further steps of hybridization.

ii. Emasculation: It is the removal of stamens from one of the parents (if bisexual) before they release their pollen grains. It is done by the following methods:

a. Forceps method b. Hot water or alcohol method

Importance of emasculation: It prevents self-pollination.

iii. Bagging: Soon after emasculation, the flowers are covered by butter paper or polythene bags to prevent cross-pollination by undesired pollen grains. The bags are tied at the base of the flower or inflorescence.

iv. **Collection of pollen grains:** At maturity, pollens from other non-emasculated selected parent plants are collected in dry bags.

v. **Crossing:** Fresh pollens are used for crossing. In wheat and oats, the pollen viability is only of few minutes. When the stigma of emasculated flower matures, the polythene bag is removed and stigma is dusted with pollen grains. It is advisable to perform crossing early in the morning as in most of the crops, stigma becomes receptive at different times in the morning.

vi. **Tagging:** A tag with relevant information is attached to the plants. The tag carries information like:

a. date of emasculation
b. field record number
c. date of pollination and crossing
d. details of male and female parents

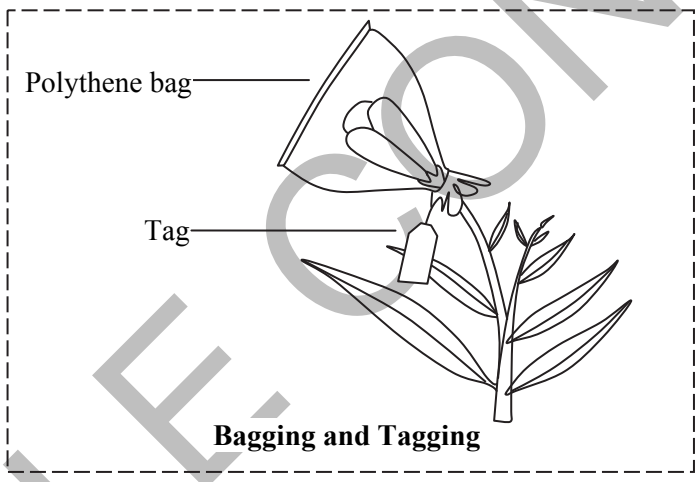
Q.5. With the help of suitable diagram, define 'bagging' and 'tagging' of flower. [Oct 13]

Ans: i. Bagging:

During hybridization, emasculated flowers are covered with butter paper or polythene bag of suitable size to prevent pollination by pollen grains of unwanted source. This is known as bagging. *[½ **mark**]*

ii. Tagging:

After dusting the pollen grains on the stigma of the emasculated flower, it is rebagged and a tag with relevant information such as date of emasculation, date of pollination, details of male and female parents, etc. is attached with plants. This is known as tagging. *[½ **mark**]*

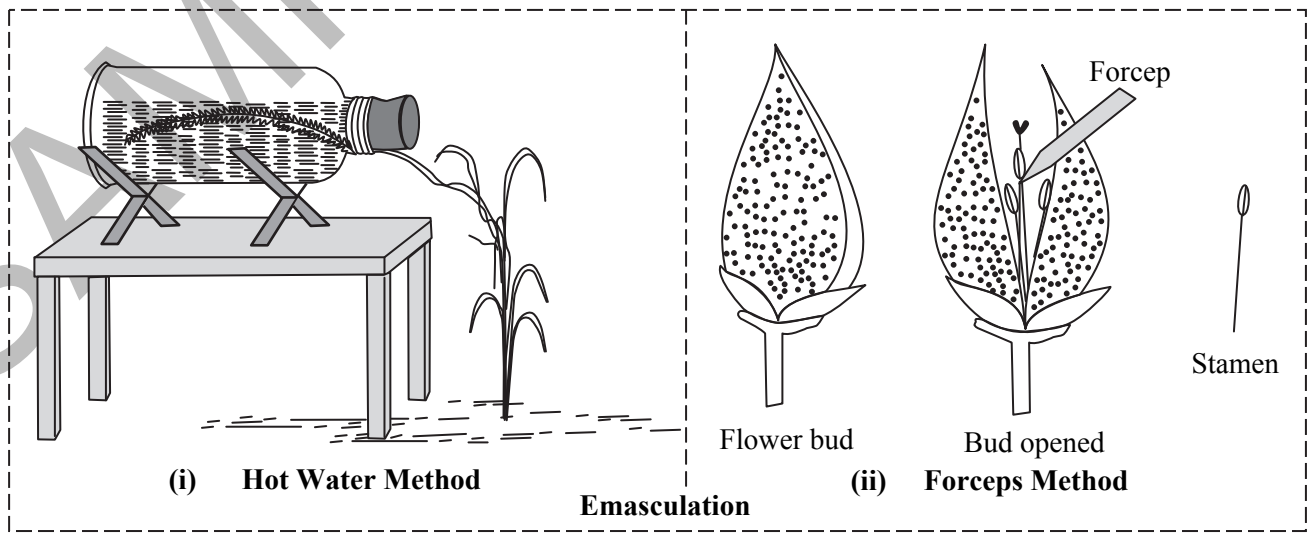


Bagging and Tagging

*[Correct diagram and labels (Tag, polythene bag) – **1 mark**]*

Q.6. Draw neat labelled diagrams of emasculation of flowers by: (i) Hot water method (ii) Forceps method.

Ans:



(i) Hot Water Method **(ii) Forceps Method**

Emasculation

Q.7. What is hybrid vigour?

Ans: Hybrid vigour (heterosis) is the superiority of the hybrid over either parent in one or more characters.

***Q.8. Write a note on Green Revolution.**

Ans: i. In the post-independence era, the crisis and challenge of supplying enough food to the increasing population with a limited suitable agricultural land was a difficult task.

ii. The development of many improved high yielding varieties of rice and wheat during 1960 to 1970 through the techniques of plant breeding helped the farming community to attain record agriculture production in our country.

iii. This achievement was popularly known as "Green Revolution". The Green Revolution ensured unprecedented surge in the Indian economy and has provided numerous employment opportunities which have help to improve the quality of life.

iv. The use of genetically improved varieties for cultivation, expansion of usable farmland, cultivation of double crops in the same farmland, optimum use of fertilizers, etc. are the basic elements considered in green revolution.

Q.9. Write examples of high yielding varieties of rice and wheat.

Ans: High yielding varieties of wheat:

i. Sonalika and Kalyansona (High yielding and disease resistant 'semi dwarf' varieties)
ii. Sharbati-Sonora
iii. Sonora-64
iv. Lerma Rojo 64-A
v. Safed Lerma

High yielding varieties of rice:

i. IR-8 (Semi dwarf rice variety formed at International Rice Research Institute (IRRI), Philippines)
ii. Jaya and Ratna: Developed in India
iii. Vijaya
iv. Kanti
v. Jayanti
vi. Padma

#Q.10. Name any five hybrid varieties of crop plants, which have been developed in India.

Ans: Some hybrid varieties of crop plants developed in India are:

No.	Crop	Hybrid variety	Resistant to disease/insect pests
i.	Wheat	Himgiri	Hill bunt, Leaf and stripe rust (fungi)
ii.	Cauliflower	Pusa shubhra and Pusa snowball K-1	Black rot (bacteria)
iii.	Cowpea	Pusa komal	Bacterial blight
iv.	Chilli	Pusa sadabahar	Leaf curl and chilli mosaic virus
v.	Okra	Pusa sawani, Pusa A-4	Shoot and fruit borer (insect)

Q.11. Explain, how plant breeding helped farmers to develop a sugarcane crop with high sugar content?

Ans: i. *Saccharum barberi* was commonly cultivated in North India but had poor yield and sugar content.

ii. *Saccharum officinarum*, a tropical species grown in South India had high sugar content and better yield, but it did not grow successfully in North India because of its susceptible nature to all serious crop diseases.

iii. These two species were crossed to obtain hybrid varieties which have the desirable combination of characters like high yield, greater sugar content and resistance to most of the crop diseases.

iv. These hybrid varieties are successfully growing in North India.

***Q.12.What is plant breeding? Describe the breeding of crop plant for disease resistance and high yielding.**

Ans: *Refer Q.1 for definition of plant breeding*

i. A number of pathogens like fungi, bacteria and viruses cause different diseases to the crop plants which results in significant decrease in crop yield.

ii. Conventional breeding techniques like hybridisation and selection or by mutation breeding are used for plant breeding.

iii. Hybridisation involves the following steps:

a. Screening germplasm for resistant sources

b. Hybridisation of selected parents

c. Selection and evaluation of hybrids

d. Testing and release of new varieties

iv. Hybrid varieties of crops resistant to diseases (fungal, bacterial and viral) and high yielding varieties of crops bred by hybridisation.

Q.13. What is mutation?

Ans: A sudden and heritable variation which appears in an organism due to permanent change in their genotype is known as Mutation.

It is a phenomenon in which alteration of base sequences in DNA is caused, which results in changes in the genotype and phenotype of an organism.

Q.14. Write a short note on 'Mutational breeding'. [Mar 16]

Ans: i. The process of induction and utilization of mutation for development of new crop varieties having desirable traits is known as mutational breeding.

ii. Mutational breeding helps in developing desirable traits in an organism, like producing disease resistant varieties of crops.

iii. Chemicals or physical factors called mutagens are used for inducing mutations artificially.

iv. Varieties of moong beans resistant to yellow mosaic virus and powdery mildew have been developed by the technique of mutational breeding.

[Explanation including examples – any four points – ½ ***mark each****]*

Q.15. How do some plants possess the quality of insect resistance, naturally?

Ans: i. In some crop plants, insect resistance may be found due to morphological, biochemical or physiological character.

ii. Hairy leaves in some plants are associated with resistance to insect pests. e.g. resistance to jassids in cotton.

iii. Smooth leaved and nectar-less cotton varieties are not attacked by the bollworms.

iv. Maize variety with high aspartic acid, low nitrogen and sugar content, is not affected by maize stem borers.

***Q.16. Give the names of two insect resistant varieties of crop.**

Ans:

No.	Crop	Hybrid variety	Resistant to
i.	Brassica (Rapeseed mustard)	Pusa Gaurav	Aphids
ii.	Okra (Bhindi)	Pusa Sawni; Pusa A-4	Shoot and fruit borer

***Q.17. Explain the term 'biofortification' with one example.**

Ans: i. Biofortification is the method of breeding of crops to produce varieties which have increased nutritional value.

ii. This can be done either through conventional selective breeding or through genetic engineering.

iii. It is the most practical means to improve public health.

iv. The objectives of biofortification are improving;

a. protein content and quality. b. vitamin content.

c. oil content and quality (unsaturated fats) d. micronutrients and mineral content.

v. Golden rice is a genetically modified crop developed for its nutritional value. Golden rice contains genes from the soil bacterium *Erwinia* and either maize or daffodil plants. It contains increased levels of beta-carotene (provitamin A) which can be converted by the body into vitamin A. This can help overcome disorders due to vitamin A deficiency.

Q.18. Explain selective breeding with example.

Ans: i. In selective breeding, plant breeders search seed or germplasm banks for existing varieties of crops which are naturally high in nutrients.

ii. These high-nutrient varieties are crossbred with high-yielding varieties of crops, to provide a seeds with high yields and increased nutritional value.

iii. Crops with sufficient amounts of nutrients must be bred to have a measurable positive impact on human health.

iv. Such crops must be developed with the involvement of nutritionists and should have extra nutrients, as storage, processing and cooking of the food affects their available nutrient levels.

Examples:

a. Hybrid maize with almost double the quantity of amino acids like lysine and tryptophan.

b. Wheat variety, Atlas-66 with high protein content.

c. Rice variety with five times more iron.

d. Vitamin A enriched carrots, spinach, pumpkin.

e. Vitamin C enriched bittergourd, bathua, mustard, tomato.

f. Iron and calcium enriched spinach.

g. Protein enriched beans and garden peas.

4.2 Tissue Culture

Concept of Cellular Totipotency

***Q.19. Explain the term 'Totipotency'.**

Ans: The ability of a single cell to divide and differentiate into a mature plant if placed in the appropriate environment is called cellular totipotency.

In 1902, Haberlandt was the first to demonstrate totipotency and introduce plant tissue culture.

Q.20. Define plant tissue culture technique.

Ans: The culturing or growing isolated protoplasts or cells or tissue or organ on nutrient medium under controlled aseptic conditions to produce a complete plant or plant parts is called tissue culture technique.

Q.21. Define the following terms:

i. Morphogenesis **ii. Clones**

Ans: i. Morphogenesis:

The process of development of different organs such as root, stem, leaves, etc. from the callus is called morphogenesis or organogenesis.

ii. Clones:

The genetically identical organisms produced from the original parent organism are described as clones of each other.

Q.22. List out the things required for plant tissue culture technique.

Ans: The basic and essential requirements for tissue culture technique are as follows:

i. Plant material from which explant is taken.
ii. Specialized nutrient or culture medium as per the requirement.
iii. Aseptic laboratory conditions.
iv. Facility to control different factors such as temperature, light, humidity, etc.
v. Different growth factors such as auxins, cytokinins, etc.

Q.23. What are the requirements of the nutrient medium used for plant tissue culture?

Ans: i. Semi-solid or liquid medium: Agar-agar obtained from red algae is used as a solidifying agent.
ii. Specific concentrations of organic and inorganic nutrients, vitamins, sucrose and plant growth hormones (auxin, cytokinin, etc.)
iii. pH of medium adjusted to 5-5.8.

Q.24. Which medium is commonly used for plant tissue culture technique?

Ans: MS medium (Murashige and Skoog) is commonly used for plant tissue culture technique.

Q.25. Write a note on methods for sterilization of tools and culture media.

Ans: Sterilization Methods:

i. Sterilization of plant materials (explants): The plant materials and explants are sterilized by disinfectants like 1% sodium hypochlorite or 10% hydrogen peroxide or 70% ethanol or 0.1% $HgCl_2$.

ii. Sterilization of nutrient media: Culture medium is taken in a conical flask and plugged with cotton. It is sterilized by autoclaving at 15 lbs psi for 30 min. at 121°C.

iii. Sterilization of glassware and instruments: Glasswares like petriplates, flasks, pipettes, etc. and metallic instruments are sterilized in a hot air oven at 160°–180° C for 2 – 4 hours.

iv. Sterilization of inoculation chamber: Inoculation chamber is sterilized by U.V. light.

***Q.26. Describe different steps involved in tissue culture technique.** **[Mar 18]**

Ans: The different steps involved in tissue culture technique are:

i. Explant culture:

Tissue or plant part that is excised from the original plant and is used for initiation of a culture is known as explant. e.g. root apex, shoot apex, pollen grains, etc. The explants are sterilized properly and placed on solid nutrient medium. The cells from explants absorb nutrients and start multiplying.

ii. Callus formation and its culture:

Callus is an unorganized mass of loosely arranged parenchyma cells which develop from explant tissue due to proliferation of cells.

All the cells of callus are identical because they are produced by mitosis only.

iii. Organogenesis:

Growth hormones like auxins and cytokinins in proper proportion are provided to the callus to induce formation of organs.

If auxins are more, roots are formed (rhizogenesis) and if the cytokinins are in more quantity, then the shoot system begins to develop (caulogenesis).

iv. Formation of cell or suspension culture:

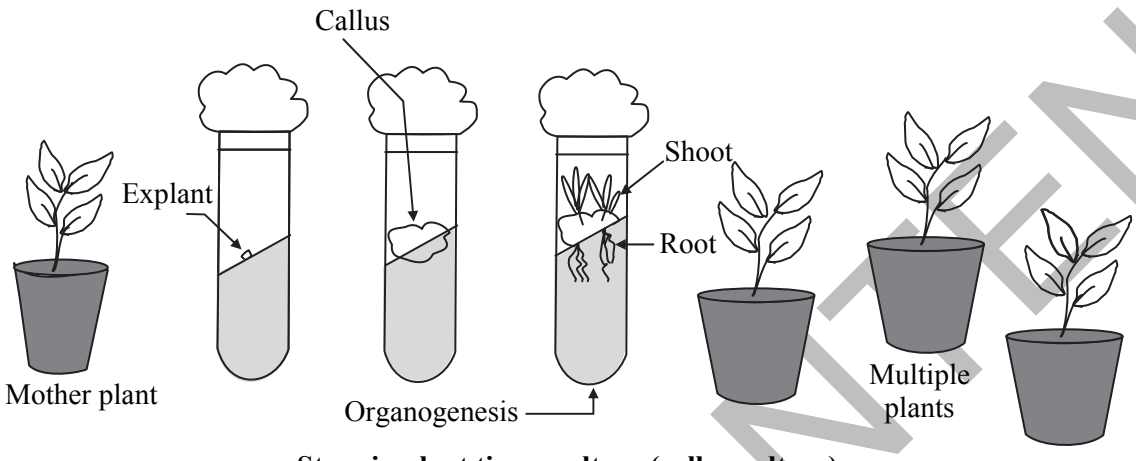
Callus is transferred to liquid nutrient medium and then it is agitated constantly at 100-250 rpm. Due to agitation, cells from callus get separated.

Agitation prevents the aggregation of cells, also serves the purpose of aeration and mixing of medium.

Suspension culture grows much faster than callus culture. They need to be sub-cultured every week.

v. Transplanting:

The healthy plantlets are transferred to soil in pots. They are kept in growth chambers and then in glass houses. Gradual exposure of plantlets to the environment is called hardening. The hardened plants are then transferred to the field.



Steps in plant tissue culture (callus culture)

***Q.27. Describe suspension culture.**

Ans: Suspension culture:

i. A fragment of callus is transferred to a liquid culture medium.
ii. It is agitated constantly at 100-250 rpm aseptically for aeration, mixing of medium and to prevent aggregation of cells.
iii. The callus breaks into isolated single cells as well as small groups of cells.
iv. This cell suspension culture contains a few single cells, cell clumps and dead cells.
v. Cell suspension cultures are homogenous in size and can grow on a large scale like cultures of micro-organisms.
vi. Isolated cells can be used for protoplast culture and somatic hybridisation.

Q.28. Describe the various applications of plant tissue culture in detail.

Ans: Tissue culture technique has wide applications:

i. Micropropagation:

a. It is a type of tissue culture technique which is used to produce large number of genetically identical plants within a short time period.
b. Due to this technique, multiplication of plants becomes season independent and also rare plants can be conserved.
c. Micropropagules require little space, thus storage becomes easy
d. Commercial production of potato, banana, orchids, etc. is possible.

ii. Production of disease free plants:

a. Tissue culture technique is useful for the recovery of healthy plants from diseased plants.
b. Generally, apical meristems are used as explants as they are free from infection.
c. Good variety of banana, potato and sugarcane is successfully recovered by culturing apical meristem.

iii. Production of secondary metabolites:

a. Cell or suspension culture enables the production of many useful secondary metabolites.
b. Secondary metabolites produced include alkaloids, allergens, anti-tumor agents, enzymes, hormones, etc.

iv. Somatic hybridization:

a. Tissue culture is used to produce a new plant variety from the hybrid protoplast of two plants.
b. The hybrid protoplast is obtained by the fusion of protoplasts from two different plants using fusogenic agent like polyethylene glycol.
c. E.g.: Potato + Tomato = Pomato
Raphanus + *Brassica* = *Raphanobrassica*

NCERT Corner

- **Applications of tissue culture**

i. Propagation of large number of plants through the process of microporpagation results in production of **'somaclones'** (plants that are genetically identical to the original plant from which they were grown).
ii. Hybrid protoplasts produced by the fusion of individual protoplasts from two different plants (somatic hybridization), are called **'somatic hybrids.'**

Q.29. Explain micropropagation technique.

Ans: Micropropagation:

It is a type of tissue culture technique which is used to produce large number of plants propagules.
In this technique, shoot apical meristem is used as explants. Using the proper proportion of growth hormones, many shoot apices can be produced.
These shoot apices are called micropropagules. These are genetically identical and from them, individual plants can be obtained.

#Q.30. Which part of the plant is best suited for making virus free plants and why?

Ans: Healthy plants can be recovered from diseased plant by using tissue culture technique.
In this, apical meristems are used as explant, which produce disease-free plants. This is because, in plants, the apical meristem is generally free from infection, i.e. without pathogens like viruses.

***Q.31. Give the name of a secondary metabolite with its plant source.**

Ans:

Plant source	Secondary metabolite
Catharanthus roseus	Vincristin, Vinblastin
Daucus carota	Anthocyanin
Datura stramonium	Tropane
Mentha piperata	Menthol
Nicotiana tabacum	Nicotine

4.3 Single Cell Protein

Q.32. What is SCP? What are the advantages SCP?

Ans: i. Single cell protein (SCP):

Single cell protein (SCP) refers to any microbial biomass produced by uni and multicellular micro-organisms and can be used as food or feed additives.
ii. Microbes like *Chlorella* (green algae), *Spirulina* (BGA), *Methylophilus methylotrophus* (bacteria) are grown on large scale as source of good protein.

iii. Advantages:

a. *Spirulina* serves as a good source of proteins, minerals, vitamins, fats and carbohydrates.
b. It can be produced throughout the year.
c. Large quantities of SCP from very small land area can be obtained due to rapid growth of microbes.
d. Cheap substrates or even wastes can be used for production.

e. Some SCPs are good sources of vitamin B-complex.
f. SCP is expected to solve the problem of protein deficiency in the children of developing countries.
g. It can be used as a food for human beings or as feed for animals like chickens and calves.
h. It can be an ideal supplement to conventional food.

Apply your knowledge

Q.33. Match the columns:

	Column I		Column II
i.	Sugarcane	a.	PEG
ii.	Golden rice	b.	*Spirulina*
iii.	Wheat variety	c.	Co. 205
iv.	SCP	d.	Atlas – 66
v.	Fusogenic agent	e.	Provitamin A
		f.	Tropane

Ans: (i – c); (ii – e); (iii – d); (iv – b); (v – a)

Q.34. Identify the techniques/methods that would be used in order to achieve the following objectives:

	Objective	Technique/Method
i.	A genetic engineer wants to prevent pollination by unwanted pollen grains during hybridization.	_____
ii.	A biotechnologist wants to obtain single isolated cells from the callus in order to carry out protoplast culture.	_____
iii.	A plant geneticist wants to cross breed a high-nutrient variety with a high yield variety of crop, obtained from the germplasm bank.	_____
iv.	A plant breeder wants to use a bisexual flower as a female parent during hybridization.	_____

Ans: i – Bagging
ii – Suspension culture
iii – Selective breeding
iv – Emasculation

Q.35. A person who is allergic to pulses is advised to take a *Spirulina* capsule daily. Give reason.

Ans: i. Pulses serve as a rich source of proteins in our diet.
ii. *Spirulina* serves as an ideal supplement for protein rich pulses.
iii. It is a rich source of Vitamin – B complex, minerals and other essential amino acids.
Hence, the person who is allergic to pulses was advised to take a *Spirulina* capsule daily as a substitute for the source of proteins in his diet.

Quick Review

Five Steps in Plant Breeding

- Collection of variability
- Evaluation and selection of parents
- Cross hybridization among selected parents
- Selection and selfing of superior recombinants
- Testing, release and commercialization of new cultivars

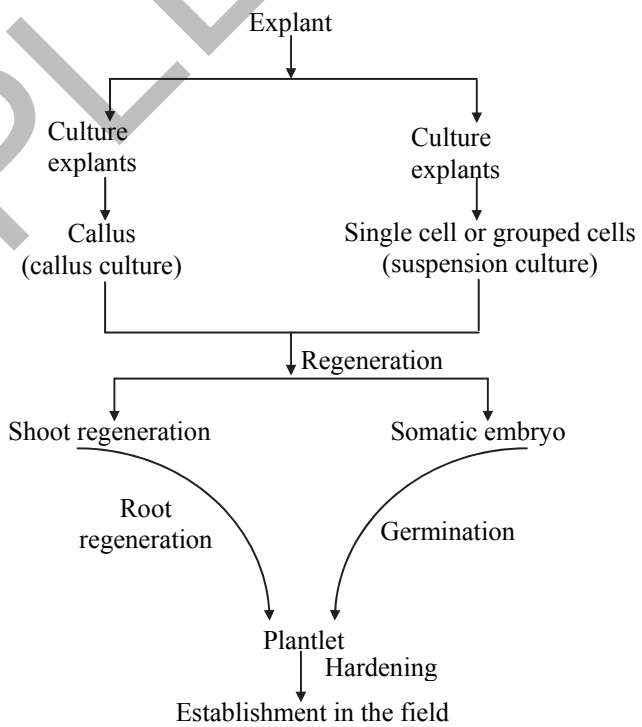
High yielding hybrid crop varieties

- Rice
  - e.g. Jaya
  - Ratna
  - Vijaya
  - Padma
  - Kanti
  - Jayanti
- Wheat
  - e.g. Sonalika
  - Kalyansona
  - Sonora -64
  - Lerma Rojo 64-A
  - Safed Lerma
  - Sharbati-Sonora
- Sugarcane
  - e.g. Co. 421
  - Co. 419
  - Co. 205
  - Co. 453
  - Co. 740

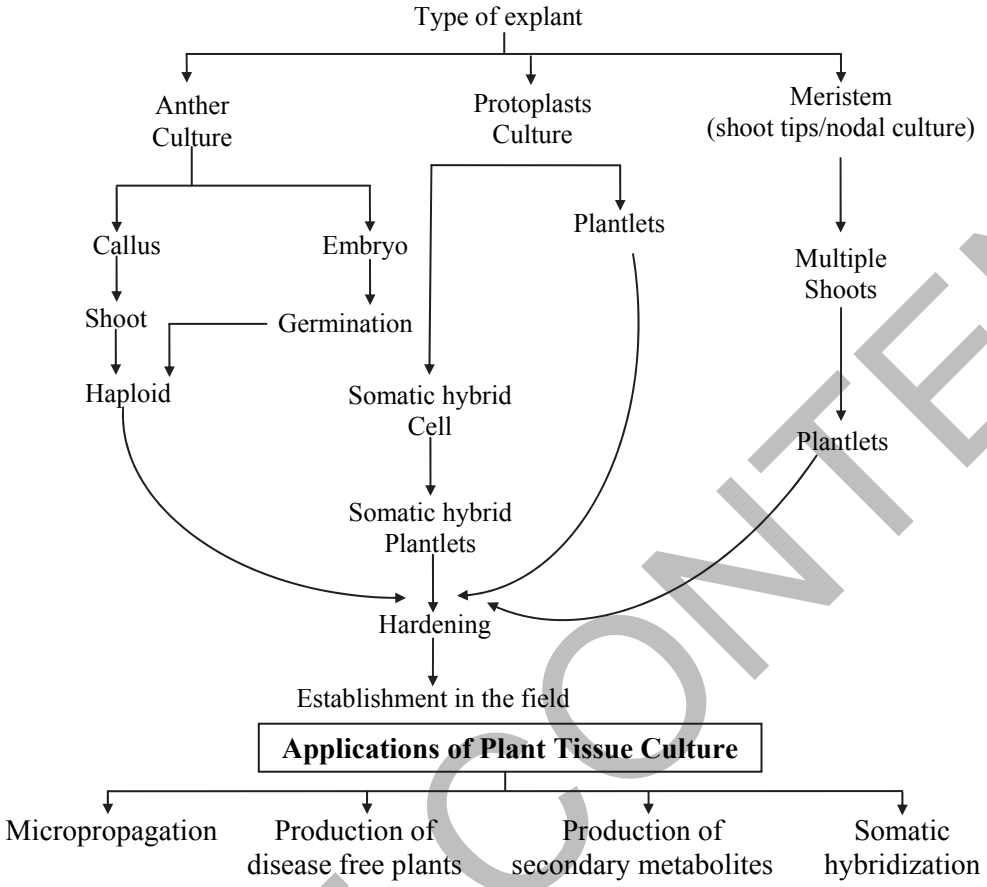
Methodology of Tissue Culture

- Explant culture
- Callus formation and its culture
- Organogenesis
- Formation of cell or suspension culture

- **Schematic representation indicating the callus culture and suspension culture.**



- **Schematic representation indicating the anther, protoplast, embryo and shoot tip culture.**



- **Scientists and their contribution:**

No.	Scientists	Contribution	Year
i.	Dr. Norman E.Borlaug	Father of green revolution. Developed semi dwarf varieties of wheat.	–
ii.	Haberlandt	Demonstrated totipotency in plants for the first time.	1902

Exercise

One Mark Questions

*1. Define mutation breeding. **[July 18]**
Ans: *Refer Q.14(i)*

2. What is cellular totipotency?
Ans: *Refer Q.19*

3. Give an example of a genetically modified crop, stating its improved quality.
Ans: *Refer Q.17(v)*

*4. Define SCP.
Ans: *Refer Q.32(i)*

5. Give application of mutation breeding. **[Mar 16]**
Ans: *Refer Q.14(ii)*

6. What is the importance of culturing apical meristems in plant tissue culture?
Ans: *Refer Q.30*

7. What is emasculation? **[July 16]**
Ans: *Refer Q.4(ii)*

8. Name the secondary metabolites in *Catharanthus roseus*. **[Mar 17]**
Ans: *Refer Q.31*

9. What is a mutagen?
Ans: *Refer Q.14(iii)*

*10. Give the scientific name of the bacterium cultivated as a source of SCP.
Ans: *Refer Q.32(ii)*

11. Name the high yielding semi-dwarf varieties of wheat selected and introduced in India in 1963. **[Mar 15]**
Ans: *Refer Q.9(i)*

12. What is 'heterosis'?
Ans: *Refer Q.7*

13. Name two microbes that can be used for the production of SCP on a large scale.
Ans: *Refer Q.32(ii)*

14. What is organogenesis?
Ans: *Refer Q.21(i)*

15. Give two examples of hybrid varieties of crops showing resistance to disease caused by bacterial pathogens.
Ans: *Refer Q.10(ii and iii)*

*16. Explain how healthy plants are recovered from diseased plant.
Ans: *Refer Q.30*

17. Give reason : Emasculation is done in a flower which is selected as female parent. **[Oct 15]**
Ans: *Refer Q.4(ii)*

18. Which growth hormones control the induction of root and shoot formation in plant tissue culture?
Ans: *Refer Q.26(iii)*

19. Name any one crop and its hybrid insect resistant variety.
Ans: *Refer Q.16*

Two Marks Questions

1. How can inducing genetic mutations artificially help to develop desirable traits in crop plants?
Ans: *Refer Q.14*

*2. Define the following terms:
a. Explant b. Callus
Ans: a. *Refer Q.26(i)* b. *Refer Q.26(ii)*

3. State the natural mechanisms of insect resistance adopted by various crop plants.
Ans: *Refer Q.15*

4. Explain how suspension culture is prepared from callus. **[Mar 13]**
Ans: *Refer Q.27*
*[Any two points – **1 mark each**]*

#5. Explain what is meant by Biofortification.
Ans: *Refer Q.17*

6. Give the names of 'two' insect-resistant crop varieties. **[July 17]**
Ans: *Refer Q.16*

7. What are the advantages of micropropagation?
Ans: *Refer Q.28(i)*

8. a. Which are the secondary metabolites produced by tissue culture technique?
b. Give any two examples of secondary metabolites with their respective plant sources.
Ans: a. *Refer Q.28(iii)*
b. *Refer Q.31 (any two examples)*

9. Enlist any four basic and essential requirements for plant tissue culture experiments.
Ans: *Refer Q.22*

10. State the objectives of plant breeding in agriculture.
Ans: *Refer Q.2*

11. With the help of diagrams, describe emasculation and bagging. **[Mar 14]**
Ans: *Refer Q.4(ii), 5(i) and 6*
*[Definition of emasculation and bagging – ½ **mark each**, Diagram (any one method of emasculation – ½ **mark**]*
*[Diagram (Bagging) – ½ **mark**]*

12. Give two examples each:
a. High yielding varieties of rice
b. Semi-dwarf varieties of wheat
Ans: *Refer Q.9*

*13. Enlist the applications of tissue culture. **[July 18]**
Ans: *Refer Q.28 (only points i, ii, iii, iv)*

14. Give advantages of single cell protein (SCP). **[Oct 13]**
Ans: *Refer Q.32 (iii)*
*[Any four advantages – ½ **mark each**]*

15. What is golden rice?
Ans: *Refer Q.17(v)*

16. Define:
a. Domestication b. Mutation
Ans: a. *Refer Q.3* b. *Refer Q.13*

Three Marks Questions

1. Name the disease resistant varieties of crop plants for the different pathogens like fungus, bacteria and virus.
Ans: *Refer Q.10(i, ii, iii and iv)*

2. What is 'tissue culture'? Describe the methodology of tissue culture. **[Mar 15]**
Ans: *Refer Q.20 and 26*
*[Definition – ½ **mark**, Diagram – **1 mark**, three steps with explanation – **1½ marks**]*

3. Explain callus formation and its culture with the help of a neat labelled diagram.
Ans: *Refer Q.26(ii) and diagram*

4. Explain any two applications of tissue culture. **[Old course Mar 13]**
OR
Describe any 'two' applications of tissue culture technique. **[Mar 14]**
Ans: *Refer Q.28* *[1½ **mark** each application]*

5. What is 'biofortification'? Which steps would you follow to develop a new variety of crop plant by selective breeding? **[Oct 15]**

Ans: *Refer Q.17(i) and 18*

*[Definition of Biofortification – **1 mark**, Any two steps of selective breeding – **2 marks**]*

6. Explain the following processes carried out during hybridization with the help of diagrams.
   a. Bagging b. Tagging
   c. Emasculation

Ans: *a. and b. Refer Q.5*
c. *Refer Q.4(ii) and Q.6 (for diagram)*

7. What are the ingredients of nutrient media used for plant tissue culture?

Ans: *Refer Q.23*

8. Explain micropropagation and somatic hybridization. **[July 16]**

OR

*Explain the importance of micropropagation and somatic hybridization.

Ans: *Refer Q.28 (i, iv)*

*[Explanation of micropropagation (any three points) – **1½ marks**, Explanation of somatic hybridization (any three points) – **1½ marks**]*

9. a. Name the medium used for plant tissue culture.
   b. Enlist any four major components for *in vitro* propagation of explants in tissue culture.

Ans: *a. Refer Q.24 b. Refer Q.23*

10. Explain selective breeding. Give any 'two' examples and their nutrients obtained by selective breeding. **[Oct 14]**

Ans: *Refer Q.18*

*[Explanation of two points – **1 mark**, Any two examples – **½ mark each**, Nutrient content – **½ mark each**]*

Five Marks Questions

1. Explain the impact of Green Revolution on the Indian economy and enlist any six varieties of rice / wheat developed between 1960 to 2000.

Ans: *Refer Q.8 and 9*

#2. Briefly describe various steps involved in plant breeding.

Ans: *Refer Q.1*

3. Which microbial cultures are generally grown as a good source of SCP? Enlist the advantages of large scale production of microbial biomass over traditional methods of producing proteins for food or feed.

Ans: *Refer Q.32*

Multiple Choice Questions

1. Crop improvement is also termed as
   (A) evolution (B) mutation breeding
   (C) plant breeding (D) crop rotation

*2. Process of bringing wild species of plant under human management is called
   (A) Selection (B) Introduction
   (C) Domestication (D) Hybridization

*3. The classical method of plant breeding is
   (A) hybridization
   (B) mutation breeding
   (C) genetic engineering
   (D) tissue culture

*4. Germplasm includes
   (A) only improved varieties of crop.
   (B) all cultivated varieties and wild relatives of a particular crop.
   (C) all hybridized varieties only.
   (D) only mutant varieties of a crop.

5. Emasculation is required for
   (A) selective hybridization
   (B) pure lines
   (C) self pollination
   (D) natural hybridization

6. The technique of removal of stamens from the flowers of female parent is
   (A) selection (B) harvesting
   (C) bagging (D) emasculation

7. Apart from high yield, the other main objective of plant breeding is
   (A) improvement of quality
   (B) development of resistance to pathogen
   (C) reduction in dormancy period
   (D) all the above

8. In hybridization, tagging is done on
   (A) male parent (B) female parent
   (C) both (A) and (B) (D) hybrids

9. Hybrid vigour is due to
   (A) Homozygosity (B) Linkage
   (C) Emasculation (D) Heterozygosity

10. In *Brassica* (rapeseed, mustard) _____ variety is resistant to Aphids. **[Mar 17]**
   (A) *Pusa A-4* (B) *Pusa Gaurav*
   (C) *Pusa Sawni* (D) *Pusa Shubra*

*11. An improved insect resistant variety *"Pusa Gaurav"* is variety of
   (A) Brassica (B) Flat bean
   (C) Cowpea (D) Bhindi

*12. The better yielding semi-dwarf rice varieties developed in India are
(A) Jaya and Ratna
(B) Kalyan sona and Sonalika
(C) Sharbati sonora and Sonalika
(D) Pusa and Lerma

13. Vijaya, Padma, Kanti and Jayanti are high yielding varieties of _____ **[July 17]**
(A) wheat (B) jowar
(C) sugarcane (D) rice

14. A wheat variety resistant to hill bunt disease is _____. **[Mar 13]**
(A) *Pusa Shubhra* (B) *Himgiri*
(C) *Pusa Gaurav* (D) *Pusa Sawani*

15. Brown rust of wheat is caused by _____. **[Mar 18]**
(A) viruses (B) bacteria
(C) fungi (D) aphids

16. Wheat variety 'Atlas 66' is improved for _____. **[Oct 14]**
(A) high proteins (B) high carbohydrates
(C) high fats (D) high vitamins

17. "Golden rice" or Miracle rice is transgenic rice, rich in
(A) Vitamin B and iron
(B) Vitamin A and iron
(C) Vitamin A and vitamin B
(D) Iron

18. _____ is an example of GM crop developed for its nutritional value by using soil bacterium *Erwinia.* **[July 2018]**
(A) IR8
(B) Taichung Native - I
(C) Vijaya
(D) Golden rice

19. Cellular totipotency is demonstrated by
(A) only gymnosperm cells
(B) all plant cells
(C) all eukaryotic cells
(D) only bacterial cells

*20. The ability of a plant cell by virtue of which it can generate whole plant under suitable conditions is called
(A) micropropagation
(B) totipotency
(C) somatic hybridization
(D) organogenesis

21. Murashige and Skoog's medium is used for
(A) bacterial cultures.
(B) raising plants through micropropagation.
(C) culture of *Spirulina*.
(D) isolation of fungal strains.

*22. In most of the plants, a part which is free from infections/diseases is
(A) apical bud (B) flower
(C) root (D) stem

23. For the production of disease free plant, the explant is taken from _____ meristem. **[Mar 13]**
(A) lateral (B) apical
(C) intercalary (D) secondary

24. Unorganized mass of cells developed from parenchyma cells is called
(A) callus (B) explant
(C) clone (D) tissue

*25. In tissue culture, which one of the following pairs of substances are used to induce shoot and root formation respectively in the callus?
(A) Cytokinin and auxin
(B) auxin and cytokinin
(C) PEG and IAA
(D) ethylene and ABA

*26. Fusogenic agent used for somatic hybridization is
(A) PEG (B) Auxin
(C) Cytokinin (D) Agar

27. Somatic hybridisation is carried out by
(A) pollen culture (B) cell culture
(C) protoplast fusion (D) haploid culture

*28. "Vincristin", a secondary metabolite is obtained from the plant
(A) *Catharanthus roseus*
(B) *Asparagus racemosus*
(C) *Daucus carota*
(D) *Datura stramoneum*

29. 'Tropane' is obtained from _____. **[July 16]**
(A) *Daucus carota*
(B) *Catharanthus roseus*
(C) *Datura stramoneum*
(D) *Mentha piperata*

30. Single cell protein can be obtained from
(A) yeast culture (B) *Asparagus*
(C) *Spirulina* (D) fungi

Answers to Multiple Choice Questions

1.	(C)	2.	(C)	3.	(A)	4.	(B)
5.	(A)	6.	(D)	7.	(D)	8.	(B)
9.	(D)	10.	(B)	11.	(A)	12.	(A)
13.	(D)	14.	(B)	15.	(C)	16.	(A)
17.	(B)	18.	(D)	19.	(B)	20.	(B)
21.	(B)	22.	(A)	23.	(B)	24.	(A)
25.	(A)	26.	(A)	27.	(C)	28.	(A)
29.	(C)	30.	(C)				

TOPIC TEST

Total : 25 Marks

Section A (1 × 5 = 5 Marks)

1. Explants can be sterilized using
   (A) 1% sodium hypochloride (B) 10% hydrogen peroxide
   (C) 70% ethyl alcohol (D) all of the above
2. IR-8 variety of rice is developed for
   (A) increased yield (B) disease resistance
   (C) biofortification (D) resistance to insect pests
3. Which two hybrid varieties of Okra were bred to develop resistance to insect pests?
4. Who is considered as the 'Father of green revolution'?
5. Name the agency responsible for carrying out testing, prior to release and commercialization of new cultivars in India.

Section B (2 × 3 = 6 Marks)

6. State the reasons why SCP is termed as an ideal dietary supplement.
7. What are the desired traits that can be incorporated into crops by plant breeding?

   OR

   Describe any four steps of tissue culture technique.
8. Describe the process of development of new crop varieties by the use of mutagens.

Section C (3 × 3 = 9 Marks)

9. Describe the formation of hybrid varieties of sugarcane in India. Give two examples of improved breeds of sugarcane.
10. Define the following terms:
    a. Clones
    b. Single cell protein
    c. Plant breeding
11. Describe the process of obtaining single isolated cells from a callus.

    OR

    Sketch and label the process of regeneration of new plantlets by callus culture.

Section D (5 × 1 = 5 Marks)

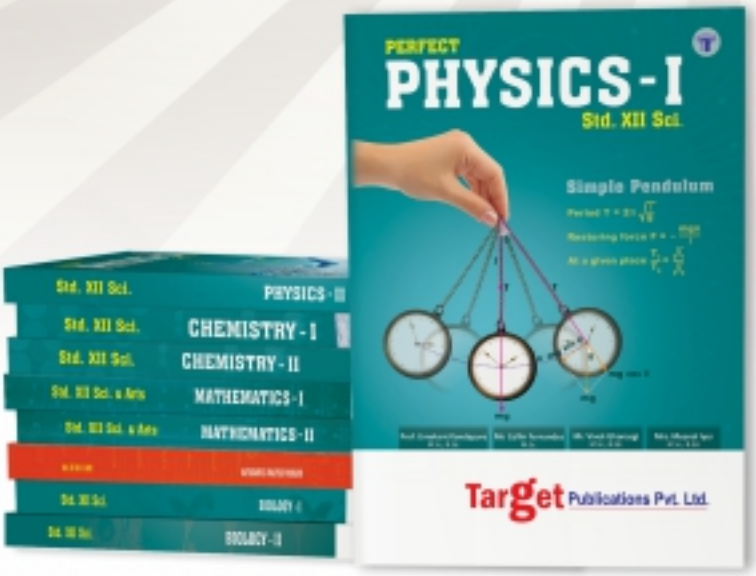
12. What is biofortification? State its objectives and briefly explain the methods for the development of biofortified crops with the help of one example each.

    OR

    Define 'plant tissue culture'. Briefly describe micropropagation and production of disease free plants using tissue culture.

Std. XII

Perfect Science



AVAILABLE SUBJECTS:

- Perfect Physics - I
- Perfect Physics - II
- Perfect Chemistry - I
- Perfect Chemistry - II
- Perfect Mathematics - I
- Perfect Mathematics - II
- Mathematics Practice Problems
- Perfect Biology - I
- Perfect Biology - II

BUY NOW

SALIENT FEATURES:

- Exhaustive coverage of syllabus based on the Paper Pattern
- Inclusion of previously asked Board Questions with Marking Scheme
- Coverage of relevant questions beyond the realms of the textbook
- Assessments at the end of every chapter for self-evaluation
- Two Model Question Papers to assess the level of preparation of students

Target Publications Pvt. Ltd.

88799 39712 / 13 / 14 / 15

mail@targetpublications.org

www.targetpublications.org