9. STRATEGIES FOR ENHANCEMENT IN

Biology Smart Booklet

Theory + NCERT MCQs + NEET PYQs

STRATEGIES FOR ENHANCEMENT IN FOOD PRODUCTION

TISSUE CULTURE

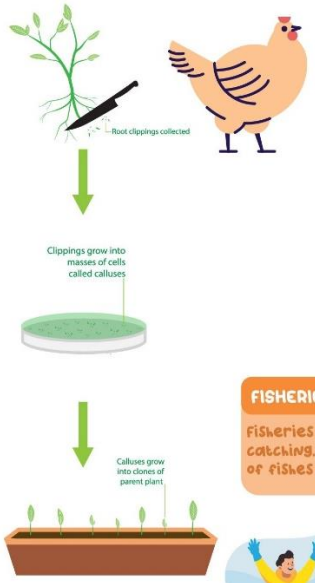
Meristem Culture
Meristem (apical or axillary) is used to grow into a new plant. Banana, Potato.

Somatic hybridization
Fusion of protoplasts to produce new somatic hybrids.

Totipotency
Capacity of cell/ tissue to generate a whole new plant.

Explant
any plant part that can be used for tissue culture

Method of growing plants tissue or any part of plant in an artificial medium of nutrients under sterile conditions
It produces new plants from cultured tissue.
Helps in producing disease free plant
It produces genetically identical plants.



SINGLE-CELL PROTEIN (SCP)

- Single – cell protein is the solution to hunger & malnutrition.
- Spirulina rich in fats, carbohydrates, & vitamins.
- Can be derived from biomass of unicellular or multicellular or microbes.
- SCPO is good alternate source of protein for animal & human nutrition.
- It can also help to combat vitamin B 12 deficiency.

MANAGEMENT OF FARM AND FARM ANIMALS

DAIRY FARM MANAGEMENT
Management of animals for milk & its products for human consumption

POULTRY FARM MANAGEMENT
Domestication of fowls (birds) for meat & eggs

ANIMAL HUSBANDRY
Agricultural practice of breeding & raising livestock (buffaloes, goats, horses etc.) that are useful to humans

FISHERIES
Fisheries industry deals with catching, processing selling of fishes

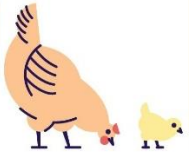
ANIMAL BREEDING

IN – BREEDING
Breeding between animals of same breed or closely – related breeds. In breeding increases homozygosity Long – term continuous inbreeding decreases fertility, causing inbreeding depression.

OUT – BREEDING
Breeding of unrelated (distant) related animals.
Out – Crossing – Mating of same breed animals but no common ancestor since 4 – 6 generations.
Cross – breeding – Superior males of one breed crossed with superior females of other breed
Interspecific hybridistion – Animals of two different related species are mated.

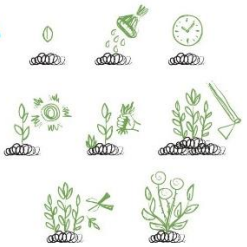
CONTROLLED – BREEDING
Artificial insemination
Semen from male parent is injected into reproductive tract of female parent by the breeder.
MOET
Multiple Ovulation Embry transfer Technology used for herd improvement.

BEE – KEEPING
Apiculture
Practice of Bee – keeping for honey & beeswax



PLANT BREEDING
Manipulating traditional plant varieties to new ones to increase yield & develop resistance

STEPS
Collection of wild varieties
Evaluation of wild plants & selection of parents
Cross – hybridisation
Selection of superior recombinants and testing.
Testing, release and commercialization



FOR IMPROVING FOOD QUALITY
- Biofortification – aims to increase healthy content of food, like increasing vitamin, mineral, fats & protein content of the food.
- Wheat variety – Atlas 66 with high protein content
- Iron – Fortified rice
- Vitamin A – Enriched carrots
- Vitamin C – Enriched bitter ground

FOR INSECT RESISTANCES
Insect and pest infestation destroy large – number of crops
Resistance to jassids in cotton & cereal leaf beetle in wheat.

Crop	Variety	Insect Pests
Brassica (rapeseed mustard)	Pusa Gaurav	Aphids
Flat bean	Pusa Sem 2, Pusa Sem 3	Jassids, aphids & fruit borer
Okra (Bhindi)	Pusa Sawani Pusa A-4	Shoot and Fruit borer

FOR DISEASE RESISTANCE
Ability to prevent the pathogen from causing diseases

Crop	Variety	Resistance to diseases
Wheat	Himgiri	Leaf and Stripe rust
Brassica	Pusa Swarnim (Karan rai)	White rust
Cauliflower	Pusa Shubhra, Pusa Snowball K-1	Black rot and Curl blight black rot
Cowpea	Pusa Komal	Bacterial blight
Chilli	Pusa Sadabahar	Chilly mosaic virus, Tobacco mosaic virus and Leaf curl

STRATEGIES FOR ENHANCEMENT IN FOOD PRODUCTION

Animal husbandry:

Animal husbandry is the agricultural practice of breeding and raising livestock. Animal husbandry deals with the care and breeding of livestock like buffaloes, cows, pigs, horses, cattle, sheep, camel goat etc. It includes poultry farming and fisheries. Fisheries include rearing, catching, selling, etc., of fish, molluscs (shell-fish) and crustaceans (prawns, crabs, etc.) More than 70% of livestock population of the livestock live in India and China.

Management of Farm and Farm Animals:

A professional approach of farm management have increased the food production many folds. Some of the management procedures applied in various livestock are as follows:

Dairy farm management:

Dairying is the management of animals for its milk and its product for human consumption. In dairy farm management, we deal with processes and systems that increase yield and improve quality of milk.

Selection of good breeds having high yielding potential, combined with resistance to diseases is very important.

Cattle have to be housed well, should have proper water and be maintained disease free.

The feeding of cattle should be carried out in a scientific manner (quality and quantity of fodder).

Strict cleanliness and hygiene are importance while milking, storage and transport of the milk and its products.

Poultry Farm Management:

Poultry is the class of domesticated birds used for food or for their eggs. It mainly includes chicken and ducks and with turkey and geese.

Important components of poultry farm management includes:

- Selection of disease free and suitable breeds.
- Proper and safe farm condition.
- Proper feed and water.
- Hygiene and health care.

Animal Breeding:

It aims at increasing yields of animals and improving the desirable qualities of the product. A breed is a group of animals related by descent and similar in most of characters like general appearance, features, size, configuration etc. There are two

kinds of breeding.

Inbreeding: A process that occurs between the members of closely related individuals within the same breed for about 4 to 6 generations is known as inbreeding. Here, first of all, males and females with superior traits are identified and then mated in pairs. Generally, it is the cow that carried the superior desired trait-like increased milk production and the superior male is the bull that can give superior progeny. Inbreeding results in increased homozygosity. This is harmful as it can lead to the expression of harmful recessive alleles. Superior traits can be eliminated. Continued inbreeding leads to inbreeding depression. Inbreeding depression is the loss of desired traits due to successive inbreeding. This affects both productivity and fertility.

Outbreeding: Outbreeding is the breeding among unrelated animals. For outbreeding such animals are chosen who do not have common ancestors for 5 to 6 generations.

Cross-breeding: Cross-breeding involves breeding between a superior male of one breed and a superior female of another breed. The desired trait can be obtained through cross-breeding. The animals or the offspring obtained is known as a hybrid. From both the parents, the animal produce has both the desired trait.

Interspecific hybridisation: Interspecific hybridisation male and female animals of two different species are mated. The progeny may combine desirable features of both and parents. Ex- mule.

Artificial Insemination: Controlled breeding experiments are carried out using artificial insemination. The semen is collected from the male that is chosen as a parent and injected into the reproductive tract of the selected female by the breeder.

Multiple Ovulation Embryo Transfer Technology (MOET):

Multiple Ovulation Embryo Transfer Technology (MOET) is used to increase the success rate of artificial insemination. In this method, a cow is administrated hormones (FSH) to induce follicular maturation and super ovulation, instead of one egg; they produce 6-8 eggs. The fertilised eggs 8-32 cells stages, are recovered non-surgically and transferred to surrogate mothers. The genetic mother is available for another round of super ovulation.

Bee-keeping:

Bee-keeping or apiculture is the maintenance of hives of honeybees for the production of honey. Honey is a food of high nutritive value and also finds use in the indigenous systems of medicine. It also produces beeswax.

The most common species of honey bee is Apis indica.

The following points are important for successful bee-keeping:

- Knowledge of the nature and habits of bees.
- Selection of suitable location for keeping the beehives.
- Catching and hiving of swarms.

- Management of beehives during different seasons.
- Handling and collection of honey and of beeswax.
- Keeping beehives in crop fields during flowering period increases pollination efficiency and improves the yield.

Fisheries:

Fishery is an industry devoted to catching, processing or selling of fish, shellfish or other aquatic animals.

Fresh water fishes which are very common include catla, rohu and common carp. Common marine fishes are Hilsa, sardines, mackerel and pomfrets.

Different techniques have been applied to increase production like aquaculture and pisciculture. Blue Revolution is implemented to increase fish production.

Pisciculture: It is a process of growing fish and selling it or using its products for domestic or commercial use. Fish can be grown both in salt water and fresh water.

Aquaculture: It is a process of growing any aquatic animals and selling them for commercial purposes. It involves feeding, harvesting and many other processes. The most popular one's grown under controlled environments are shrimps, crab, fish, lobster, and few others.

Plant Breeding:

Plant Breeding is the purposeful manipulation of plant species in order to create desired plant species in order to create desired plant types that are better suited for cultivation, give better yields and are disease resistant.

Classical plant breeding involves crossing or hybridization of pure lines, followed by artificial selection to produce plants with desirable traits of higher yield, nutrition and resistance to disease.

The main steps in plant breeding are:

- Collection of variability is the collection and preservation of all the different wild verities, species and relatives of the cultivated species. The entire collection having all the diverse alleles for all genes in a given crop is called germplasm collection.
- Evaluation and selection of parents is the identification of plants with desirable combination of characters. The selected plants are multiplied and used in the process of hybridization.
- Cross hybridization among the selected parents to obtained desired crop characters for example high protein quality of one parent may need to be combined with disease resistance from another parent. This is possible by cross hybridizing the two parents to produce hybrids that genetically combine the desired characters in one plant.
- Selection and testing of superior recombinants -The selection process is crucial to the success of the breeding objective and requires careful scientific evaluation of the progeny. This step yields plants that are superior to both of the parents.

- Testing, releasing and commercialization of new cultivars -The newly selected lines are evaluated for their yield and other agronomic traits of quality, disease resistance, etc.

Wheat and Rice:

- Production of wheat and rice increased tremendously between 1960-2000 due to introduction of semi-dwarf varieties of rice and wheat.
- In 1963, several varieties such as Sonalika and Kalyan Sona, which were high yielding and disease resistant were introduced all over the wheat growing field of India.
- Semi-dwarf rice varieties were derived from IR-8, and Taichung Native-1 were introduced in 1966. Later better-yielding semi-dwarf varieties Jaya and Ratna were developed in India.

Sugar cane:

- Saccharum barberi and Saccharum officinarum were crossed to get the desirable qualities of high yield, thick stems, high sugar and ability to grow in the sugar cane areas of north India.
- **Millets:** Hybrid maize, jowar and bajraare developed in India. These varieties are high yielding and resistant to water stress.

Plant Breeding for Disease Resistance:

Several fungal, bacterial and viral pathogens affect the yield and quality of plant products. To minimise this loss disease resistant varieties were developed. Breeding is carried out by conventional method or by mutation breeding.

Steps for breeding disease resistant plants:

- Selection of genome with disease resistant traits.
- Mating of the selected parents.
- Selection of superior hybrids.
- Testing of the hybrid for superior variety.
- Release of the new variety.

Crop	Variety	Resistance to diseases
Wheat	*Himgiri*	*Leaf and stripe rust, hill bunt*
Brassica	*Pusa swarnim (Karan rai)*	*White rust*
Cauliflower	*Pusa Shubhra, Pusa Snowball K-1*	*Black rot and Curl blight black rot*
Cowpea	*Pusa Komal*	*Bacterial blight*
Chilli	*Pusa Sadabahar*	*Chilly mosaic virus, Tobacco mosaic virus and Leaf curl*

Mutation:

Mutation is the process by which genetic variations are created through changes in the base sequence within genes resulting in the creation of a new character or trait not found in the parental types. It is done by using mutants like chemicals or radiations. This process is called mutation breeding. e.g. Mung bean resistance to yellow mosaic virus and powdery mildew were induced by mutation.

Resistance to yellow mosaic virus in bhindi (Abelmoschus esculentus) was transferred from a wild species and resulted in a new variety of A. esculentus called Parbhani kranti.

Plant breeding for Developing Resistance to Insect Pests:

Crop plant and crop products are destructed by insects and pests on large scale. To prevent this loss new varieties resistance to them are developed.

Crop	Variety	Insect Pests
Brassica (rapeseed mustard)	*Pusa Gaurav*	*Aphids*
Flat bean	*Pusa Sem 2, Pusa Sem 3*	*Jassids, aphids and fruit borer*
Okra (Bhindi)	*Pusa Sawani Pusa A-4*	*Shoot and Fruit borer*

Bio-fortification:

Breeding crops with higher levels of vitamins and minerals, or higher protein and healthier fats. Breeding for improved nutritional qualities have following objectives of improving.

- Protein content and quality.
- Oil content and quality.
- Vitamin content.
- Micronutrient and mineral content.

Atlas 66, having a high protein content, has been used as a donor for improving cultivated wheat.

IARI, New Delhi have released many verities of vegetables crops rich in vitamins and minerals like vitamin A enriched carrot, spinach and pumpkin and vitamin C enriched bitter guard, bathua, mustard ,iron and calcium enriched spinach and bathua; and protein enriched beans – broad, lablab, French and garden peas.

Single Cell Protein (SCP):

Alternate source of protein for animal and human nutrition. Microbes are grown on industrial scale as a source of good protein.

Microbes like spirulina can be grown easily on materials like wastewater from potato processing plants having starch, molasses, animal manure and even sewage to produce large quantities and can serve as food rich in protein, minerals, fats, carbohydrates and vitamins.

Methylophilus methylotrophus has high rate of biomass production and growth, it can be expected to produce 25 tonnes of protein by 250 g of microorganism.

Tissue Culture:

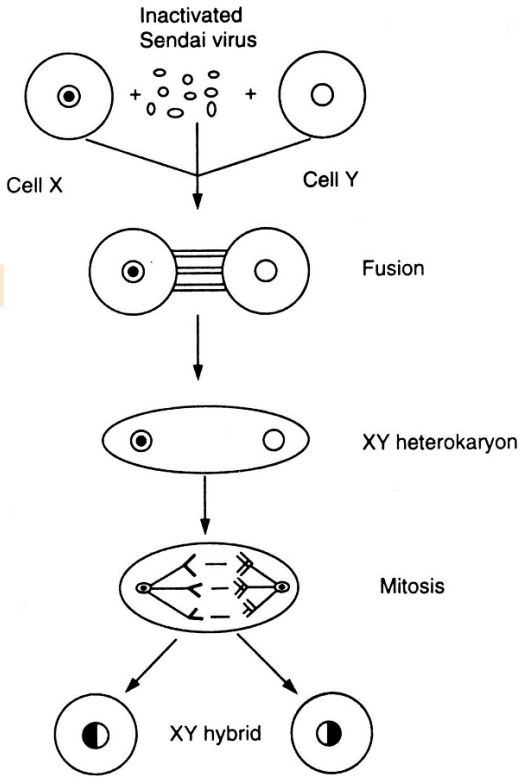
The capacity to generate whole plants form any cell/explant is called totipotency. Thousands of plants can be produced from explants in short interval of time using suitable nutrient medium, aseptic condition and use of phytohormones. This method of producing thousands of plant is called micropropagation. Each of these plants will be genetically identical to the original plant from which they were grown, i.e., they are soma clones. Many important food plants like tomato, banana, apple.

Meristem Culture:

The recovery of healthy plants from diseased plants can be done by meristem culture. Although the plant is infected with a virus, the meristem (apical and axillary) is free of virus. Hence, one can remove the meristem and grow it in vitro to obtain virus-free plants.

Somatic Hybridisation:

Isolation of single cells from their plants and after digesting their cell wall fusing the cytoplasm's of two different varieties is called somatic hybridisation and these hybrids are called somatic hybrids.



NCERT LINE BY LINE QUESTIONS

1. Practical applications of biological and biotechnological principles include **[Pg-165,E]**
   (A) animal husbandry and plant breeding to increase the production of food products
   (B) plant breeding to increase dairy production
   (C) tissue culture techniques (D) Both (a) and (c) are correct
2. Selective breeding of livestock is known as **[Pg-165,E]**
   (A) animal husbandry (B) plant breeding (C) poultry farming (D) fisheries
3. Consider the following statements: **[Pg-165,E]**
   (a) The practices of animal husbandry include raising and breeding the livestock, fisheries and poultry farming.
   (b) More than 70% of the world's livestock population is in India and China.
   Select the correct option.
   (A) Both (a) and (b) are true. (B) (a) is true but (b) is false.
   (C) Both (a) and (b) are false. (D) (a) is false but (b) is true.
4. Which of the following sets of organisms does not represent livestock? **[Pg-165,E]**
   (A) Cows, pigs, horses, and fishes (B) Sheep, pigs, camels, and fishes
   (C) Cows, pigs, camel, and goats (D) Poultry, fishes, and elephants
5. Fisheries include rearing, catching and selling of **[Pg-165,E]**
   (A) fishes, mollusks, and crustaceans (B) fishes only
   (C) fishes and shell-fish only (D) fishes and crustaceans only
6. Raising and breeding of animals for milk and milk products are known as **[Pg-166,E]**
   (A) fisheries (B) dairying(C) poultry farming (D) plant breeding
7. Which of the following set of animals is not expected to be found in dairy farms? **[Pg-166,E]**
   (A) Cattle, buffalo, goat, and sheep (B) Camel, buffalo, goat, and sheep
   (C) Cattle, buffalo, goat, and cattle (D) Poultry, cattle, goat, buffalo
8. Which of the following set of products is not obtained from a dairy farm? **[Pg-166,E]**
   (A) Milk, butter, cheese, yogurt (B) Milk, condensed milk, cheese, yogurt
   (C) Butter, egg, cheese, yogurt (D) Ice cream, yogurt, milk, cheese
9. Milk production at dairy farms is dependent on the quality of breeds. Which of the following is not a criterion for the selection of dairying breeds? **[Pg-166,M]**
   (A) High yielding potential under the local climatic conditions
   (B) Disease resistance
   (C) Color of purebred for registering purpose and dairy type
   (D) Expression of foreign genes
10. Which of the following measures are taken to realize the yield potential of cattle breeds at dairy farms? **[Pg-166,M]**
    (A) Proper housing, adequate water supply
    (B) Cleanliness and hygiene of both cattle and handler
    (C) Feeding cattle in a scientific manner (D) All of these
11. Consider the following statements:
    (a) Animal husbandry refers to the domesticated birds used for food and/or eggs.
    (b) Chicken, ducks, turkey, geese are some examples of poultry.
    Select the correct option. **[Pg-165,166,E]**
    (A) Both (a) and (b) are true. (B) (a) is true but (b) is false.
    (C) Both (a) and (b) are false. (D) (a) is false but (b) is true.
12. Match the Column-I with Column-II.**[Pg-165,166,E]**

Column-I	**Column-II**
(I) Raised for egg production	(1) Turkey, geese and ducks
(II) Raised for meat	(2) Ayrshire,Guernsey,Holstein-Friesian and Jersey
(III) Cattle breed with high milk production	(3) Important factors for success with poultry
(IV) Proper feeding good management and sanitation	(4) Hens

Select the correct option

	(i)	(ii)	(iii)	(iv)
(a)	1	4	2	3
(b)	4	1	2	3
(c)	4	2	1	3
(d)	3	1	4	2

13. The causative agent of Avian Influenza is **[Pg-167,E]**
(A) H5N1 virus (B) HIV (C) *E. coli* (D) Clostridium

14. Which of the following measures is/are required to prevent the spread of H5N1 virus from birds to a human? **[Pg-167,E]**
(A) Consumption of poultry and eggs above the temperature of 100°C
(B) Influenza vaccination
(C) Maintain personal hygiene (D) All of these

15. Leghorn, Minorca and Andalusia are the small-sized breeds of chickens. The most population breed for egg production is **[Pg-167,E]**
(A) Leghorn (B) Minorca (C) Andalusia (D) None

16. Consider the following statements:
(a) A breed is a group of related animals that are true to the genetic traits characteristic of the breed.
(b) Animals of the same breed do not share a common ancestor.
Select the correct option. **[Pg-167,M]**
(A) Both (a) and (b) are true. (B) (a) is true but (b) is false.
(C) Both (a) and (b) are false. (D) (a) is false but (b) is true.

17. Use of selective mating for the production of breeds of domesticated animals with desired traits is known as **[Pg-167,E]**
(A) plant breeding (B) animal breeding
(C) poultry (D) farming

18. Consider the following statements about animal breeding. Which of the given statements is Incorrect? **[Pg-167,M]**
(A) Animal breeding aims to improve the growth rate and production of useful products from the animals.
(B) It includes the production of improved breeds of domesticated animals to obtain milk and meat of superior quality.
(C) It does not aim to improve disease resistance in animals.
(D)Methods of animal breeding are based on selective breeding.

19. Match the terms in Column-I with a suitable description in Column-II.

Column-I	**Column-II**
(I) Inbreeding	(1) Overcomes inbreeding depression
(II) Outbreeding	(2) Increased homozygosity
(III) Inbreeding depression	(3) Crossing the different breeds.
(IV) Outcrossing	(4) Reduced productivity due to inbreeding

Select the correct option

	(i)	(ii)	(iii)	(iv)
(a)	4	1	2	3
(b)	2	3	4	1
(c)	1	2	4	3
(d)	2	3	4	1

20. The straight-breeding technique of crossing the related animals to increase the genetic purity and homozygosity of progeny is [NCERT Exemplar] **[Pg-167,E]**
(A) outbreeding (B) inbreeding (C) outcrossing (D) crossbreeding

21. Select the incorrect statement. [NEET-2019] **[Pg-167,M]**
(A) Inbreeding is essential to evolve pure line in any animal.
(B) Inbreeding selects harmful recessive genes that reduce fertility and productivity.
(C) Inbreeding helps in accumulation of superior genes and elimination of undesirable genes.
(D) Inbreeding increases homozygosity.

22. Homozygous pure lines in cattle can be obtained by [NEET-2017] **[Pg-167,M]**
(A) Mating of related individuals of the same breed.
(B) Mating of unrelated individuals of the same breed.
(C) Mating of individuals of different breed.
(D)Mating of individuals of different species.

23. The results of inbreeding are not always desirable because **[Pg-167,E]**
(A) the selected superior bull produces progeny with improved traits
(B) crossing the related animals of the same breed produces pure lines
(C) the progeny exhibits increased the frequency of both undesirable and desirable genes
(D) it increases milk production in cows

24. Match the Column-I with Column-II.**[Pg-167,168,M]**

Column-I	**Column-II**
(A) Outbreeding	(1) Mating of animals of the same breed but no common ancestors for 4–6 generations.
(B) Outcrossing	(2) Mating of animals of different species
(C) Crossbreeding	(3) Includes outcrossing and cross-breeding.
(D) Interspecific hybridization	(4) Mating of superior males and females of different breeds.

Select the correct option

	(I)	**(II)**	**(III)**	**(IV)**		**(I)**	**(II)**	**(III)**	**(IV)**
(a)	1	4	2	3	(b)	4	1	2	3
(c)	4	2	1	3	(d)	3	1	4	2

25. Most of the mating done by animal breeders are outcrossing because **[Pg-168,M]**
(a) it reduces the expression of harmful genes by masking them in heterozygous genotype
(b) it helps in bringing the desirable traits into the progeny
(c) it increases homozygosity (d) it produces pure lines
Select the correct option.
(A) a, b, c, d are true (B) a and b are true
(C) a and d are true (D) c and d are true

26. The offspring of crossbreeding is **[Pg-168,E]**
(A) pure line (B) hybrid (C) homozygous genotype (D) inbred lines

27. Hisardale is the breed of sheep developed by crossing **[Pg-168,E]**
(A) Cochin ram and Ghagus ewe (B) Bikaneri ewes and Marino rams
(C) Bikaneri rams and Marino ewes (D) Cochin ewe and Marino ram

28. Mule is the hybrid produced by crossing **[Pg-168,E]**
(A) male donkey and a female horse (B) female donkey and a male horse
(C) male hinny and a female horse (D) stallion and mare

29. Interspecific hybridization is the mating of [NEET-2016] **[Pg-168,M]**
(A) superior males and females of different breeds
(B) more closely related individuals within the same breed for 4–6 generations
(C) animals within the same breed without having common ancestors
(D) two different related species

30. Interspecific hybridization between stallion and female donkey produces the hybrids called [NCERT Exemplar] **[Pg-168,E]**
(A) mule (B) hinny (C) jack (D) jennet

31. The process of placing the sperms in the female reproductive tract by artificial means is known as **[Pg-168,E]**
(A) artificial insemination (B) interspecific hybridization
(C) asexual reproduction (D) parthenogenesis

32. The process of artificial insemination is advantageous over normal mating.
Select the incorrect statement about the process. **[Pg-168,M]**
(A) It permits the fertilization of a large number of female animals from the semen collected in one ejaculation of a superior bull.
(B) Collected semen is cooled slowly and stored at −195.5 degrees Celsius for a longer period.
(C) It permits the easier use of exotic breed bulls as superior males.

(D) The collected semen should not be frozen as it kills sperms.

33. The technique of controlled breeding experiments that includes superovulation in cows to make them produce 6–8 eggs per ovarian cycle is known as **[Pg-168,E]**
(A) artificial insemination (B) hormonal induction
(C) multiple ovulation embryo transfer technology (D) embryo transfer technology

34. MOET (Multiple Ovulation Embryo Transfer technology) includes the use of _____ to stimulate superovulation in cows. **[Pg-168,E]**
(A) LH (B) FSH and prostaglandins (C) GnRH (D) gonadotropins

35. Consider the following event: **[Pg-168,169,M]**
(I) Superovulation in cows (II) Fertilization of eggs
(III) Mating with elite bull (IV) Transfer of eggs to surrogate mothers
V) The second round of superovulation in genetic mother
Arrange the events of MOET in the correct order and select the correct option.
(A) I, II, IV, III, V (B) I, III, II, IV, V
(C) I, III, IV, II, V (D) II, III, I, IV, V

36. The scientific name of the Indian honey bee is **[Pg-169,E]**
(A) *Apis indica* (B) *Apis Indica* (C) *Apis Indiana* (D) *Apis Indica*

37. Maintenance of hives of honeybees for honey production is called **[Pg-169,E]**
(A) bee-keeping (B) apiculture (C) bee-breeding (D) both (a) and (b)

38. Which of the following does not represent the importance of apiculture? **[Pg-169,E]**
(A) Obtain nutritious hone (B) Provides bee wax
(C) Honey bees are pollinating agents (D) All are the importance of apiculture

39. Which of the following sets of industries use the products obtained from apiculture? [NCERT Exemplar] **[Pg-169,E]**
(A) Indigenous system of medicines, cosmetics and polishes
(B) Allopathic medicines, cosmetics
(C) Medicines, leather production
(D) The food industry, dairy products

40. Honey bees are pollinator of **[Pg-169,E]**
(A) corn, sunflower, apple and oats (B) barley, corn, apple and sunflower
(C) sunflower, Brassica, apple and pear (D) wheat, rye, apple and pear

41. Which of the following species are most commonly domesticated to obtain honey?
(A) *Apis dorsata* and *Apis indica* (B) *Apis dorsata* and *Apis mellifera*
(C) *Apis florea* and *Apis indica* (D) *Apis indica* and *Apis mellifera*

42. Match Column-I with Column-II [NCERT Exemplar] **[Pg-169,170,M]**

Column-I	**Column-II**
(a) Edible freshwater fishes	(1) Prawn, lobster, oyster
(b) Edible marine fishes	(2) Catla, Rohu and common carp
(c) Seafood	(3) Improved production of useful products from aquaculture
(d) Blue revolution	(4) Hilsa, Sardines,Mackerel and Pomfrets

Select the correct option.

	a	**b**	**c**	**d**
(a)	2	4	1	3
(b)	1	3	4	2
(c)	4	2	1	3
(d)	3	1	4	2

43. Among the following edible fishes, which one is a marine fish having a rich source of omega-3 fatty acids? [NEET-2016] **[Pg-169,M]**
(A) Mrigala (B) Mackerel (C) Mystus (D) Mangur

44. Fisheries have an important place in Indian economy because **[Pg-170,E]**
(A) it provides food to the population
(B) it serves as the only source of livelihood in many coastal regions
(C) it obtains fish oil, pearls, fish protein, etc.

(D) all the given options are correct.

45. Select the incorrect match from the following **[Pg-169,170,M]**
(A) Pisciculture: fish farming
(B) Aquaculture: raising aquatic animals to obtain useful products
(C) Fishes: a rich source of vitamin D, riboflavin, omega-3 fatty acid and minerals
(D) Honey: a rich source of sugars, fats,and fibers

46. Father of Blue revolution in India is **[Pg-169,E]**
(A) Dr. Arun Krishnan (B) Nirpakh Tutej (C) Vishal Shekhar (D) Durgesh Patel

47. **Assertion:** Bird flu is a viral disease and is caused by the H5N1 virus.
Reason: Bird flu is transmitted from affected birds to humans through direct contact or consumption of their eggs. **[Pg-167,H]**
(A) Both assertion and reason are true but reason is the correct explanation of assertion.
(B) Both assertion and reason are true but reason is not the correct explanation of assertion.
(C) Assertion is true but reason is false. (D) Both assertion and reason are false.

48. **Assertion:** Inbreeding is required to obtain pure line in any animal.
Reason: Mendel obtained pure line of pea plants by cross-pollination. **[Pg-167,H]**
(A) Both assertion and reason are true but reason is the correct explanation of assertion.
(B) Both assertion and reason are true but reason is not the correct explanation of assertion.
(C) Assertion is true but reason is false. (D) Both assertion and reason are false.

49. **Assertion:** Controlled breeding experiments are done using interspecific hybridization.
Reason: Outcrossing increases homozygosity in the progeny. **[Pg-167,168,H]**
(A) Both assertion and reason are true but reason is the correct explanation of assertion.
(B) Both assertion and reason are true but reason is not the correct explanation of assertion.
(C) Assertion is true but reason is false. (D) Both assertion and reason are false.

50. **Assertion:** A group of bees is called swarm.
Reason: Honey bees are pollinators of many crop plants. **[Pg-169,H]**
(A) Both assertion and reason are true but reason is the correct explanation of assertion.
(B) Both assertion and reason are true but reason is not the correct explanation of assertion.
(C) Assertion is true but reason is false. (D) Both assertion and reason are false.

51. A tremendous increase in crop and food production as an outcome of the application of plant breeding and production technology is known as **[Pg-170,E]**
(A) Green revolution (B) White revolution (C) Blue revolution (D) Grey revolution

52. Father of the green revolution in India is [NCERT Exemplar] **[Pg-170,E]**
(A) Verghese Kurien (B) Vikram Sarabhai (C) MS Swaminathan (D) Homi J Bhabha

53. Consider the following statements about plant breeding. **[Pg-170,M]**
(a) It is the deliberate manipulation of plant genome to create or impart the desired traits in the plants.
(b) It aims to obtain plant types with better productivity and disease resistance.
Select the correct option.
(A) Both (A) and (B) are true. (B) (A) is true but (B) is false.
(C) Both (A) and (B) are false. (D) (A) is false but (B) is true.

54. A true breeding plant is [NEET-2016] **[Pg-171,M]**
(A) near homozygous and produces offspring of its own kind
(B) always homozygous recessive in its genetic constitution
(C) one that is able to breed on its own
(D) produced due to cross-pollination among unrelated plants

55. Classical breeding approach uses the proven tools of **[Pg-171,E]**
(A) hybridization of pure lines and artificial selection of desired genotypes.
(B) hybridization of pure lines and genome manipulation of selected progeny.
(C) incorporation of desired genes and artificial selection of progeny.
(D) genome manipulation only.

56. Which of the following is not an objective of plant breeding? **[Pg-170,E]**
(A) To improve crop productivity and quality.
(B) To impart stress and pathogen resistance in crop plants.
(C) To increase tolerance of crop plants for insect pests.

(D) All are the objectives of plant breeding.

57. Which of the following set of factor cause environmental stress in plants? **[Pg-170,E]**
(A) Pathogens, drought and flood
(B) Salinity, extreme temperatures anddrought
(C) Parasites, extreme temperatures anddrought (D) Parasites, pathogens and flood

58. Consider the following steps in plant breeding: **[Pg-171,M]**
(I) Testing, release and commercialization of new cultivars
(II) Collection of variability
(III) Selection and testing of superior recombinants
(IV) Cross hybridization among the selected parents
(V) Evaluation and selection of parents
Arrange the steps in correct order and selection the correct option.
(A) I, V, IV, II, III (B) II, V, III, IV, I
(C) II, V, IV, III, I (D) II, IV, V, III, I

59. In the plant breeding programs, the entire collection (plants/seeds) having all the diverse alleles for all genes of a given crop is called [NEET-2013, 2011]**[Pg-171,M]**
(A) Germplasm collection
(B) Selection of superior recombinants
(C) Cross-hybridization among the selected parents
(D) Evaluation and selection of parents

60. Sum total of all the hereditary material belonging to single species is known as [NCERT Exemplar] **[Pg-171,E]**
(A) genotype (B) germplasm (C) hybrid (D) cultivar

61. Consider the following statements about germplasm collection: **[Pg-171,M]**
(a) The gene of interest should be present in the base population to initiate a breeding program.
(b) Genetic variability is a prerequisite to develop a new cultivar by breeding programs. Select the correct option.
(A) Both (a) and (b) are true. (B) (a) is true but (b) is false.
(C) Both (a) and (b) are false. (D) (a) is false but (b) is true.

62. The selected superior recombinants in plant breeding program are self pollinated for several generations so as to **[Pg-171,M]**
(A) increase the homozygosity to prevent segregation of the desired trait in the progeny.
(B) increase the heterozygosity to prevent segregation of the desired trait in the progeny.
(C) increase the homozygosity to allow segregation of the desired trait in the progeny.
(D) increase the heterozygosity to allow segregation of the desired trait in the progeny.

63. The new cultivars produced by plant breeding programs are evaluated for **[Pg-171,E]**
(A) yield (B) morphological and quality traits
(C) resistance to diseases and stress (D) all the given choices are correct

64. Around _____ of the Indian population is employed in agricultural activities which in turn accounts for _____ of the country's GDP. **[Pg-171,E]**
(A) 62%, 33% (B) 33%, 62% (C) 32%, 63% (D) 30%, 62%

65. Which of the following factors were responsible for limited agricultural production after the independence of India? **[Pg-172,E]**
(A) Limited land for agriculture and scarce resources
(B) Seasonal rainfall in deserts
(C) Lower temperature conditions in Northern plains
(D) A small fraction of the population involved in agricultural activities

66. The key strategies targeted by Dr. Norman E. Borlaug that resulted in the Green Revolution in the world were [NCERT Exemplar] **[Pg-172,M]**
(A) development of sugarcane cultivars with insect pest resistance
(B) development of high yielding wheat cultivars with desired agronomic traits to realize the maximum productivity
(C) development of maize cultivars with disease resistance
(D) all the given options are correct

67. Which of the following set of the traits correctly represent the features of semidwarf varieties developed by Dr. Norman E. Borlaug? [NCERT Exemplar] **[Pg-173,E]**
(A) Better crop production and lodging resistance
(B) Adapted to local climatic conditions and lodging resistance
(C) High yielding, adapted to local climatic conditions, lodging resistance
(D) Lodging resistance and better crop yield

68. Nobel laureate Norman E. Borlaug was the director of Wheat Program at_____and developed semidwarf varieties of wheat. **[Pg-173,E]**
(A) Center for Plant Breeding and Genetics
(B) Indian Society of Genetics and Plant Breeding
(C) Centro Internationale de Mejoramiento de Maiz y Trigo
(D) International Centre for Plant Breeding Education and Research

69. Match Column-I with Column-II. **[Pg-173,M]**

Column-I	**Column-II**
(a) Kalyan Sona,Sonalika	(1) Pearl millet
(b) Jamnagar Giant and Improved Ghana	(2) Wheat
(c) Pusa Lal and Pusa Sunhari	(3) Tomato
(d) Pusa Ruby	(4) Sweet potato

Select the correct option.

	a	**b**	**c**	**d**
(A)	1	4	2	3
(B)	2	1	4	3
(C)	4	2	1	3
(D)	3	1	4	2

70. Which of the following crop cultivars is incorrect matched? **[Pg-173,E]**
(A) Sonora 64 and Lerma Rojo: Wheat (B) TN 1, IR8, IR 28: Rice
(C) P 1542, Rachna: Linseed (D) C251, K12: Barley

71. Which of the following rice cultivar is incorrectly matched with its land of origin? **[Pg-173,E]**
(A) IR 8: International Rice Research Institute (IRRI), Philippines (B) Taichung Native-1: Taiwan
(C) Jaya: India (D) Ratna: Mexico

72. The _____ and _____ were the rust resistant high yielding varieties of wheat introduced in India from Mexico.**[Pg-173,E]**
(A) Kalyan Sona and Sonalika (B) TN-I and Sonalika
(C) IR-8 and Kalyan Sona (D) IR-8 and TN-1

73. **[Pg-173,M]**
(a) The semi dwarf wheat and rice varieties that made India selfsufficient in food grains were lodging resistant, responsive to the application of fertilizer and high yielding.
(b) The rice varieties were resistant to all three rusts and other prevalent diseases.
Select the correct option.
(A) Both (a) and (b) are true. (B) (a) is true but (b) is false.
(C) Both (a) and (b) are false. (D) (a) is false but (b) is true.

74. The photoperiod insensitive wheat and rice varieties are beneficial because **[Pg-173,E]**
(A) they are disease resistant. (B) It allows the late planting of the crop.
(C) these varieties could be grown in non-traditional regions.
(D) both (B) and (C)

75. The scientific name of Indian canes is **[Pg-173,E]**
(A) *Saccharum officinarum* (B) *Saccharum spontaneum*
(C) *Saccharum munja* (D) *Saccharum barberi*

76. Match the Column-I with Column-II. **[Pg-173,M]**

Column-I	**Column-II**
(a) *Saccharum barberi*	(1) South Indian cane with thicker stems and higher sugar content
(b) *Saccharum officinarum*	(2) High yield, thick stems, high sugar and adapted to grow in North India
(c) Noblized canes	(3) Resistant to water stress

(d) Hybrid millets (4) North Indian cane with poor sugar content and yield

Select the correct option

	a	b	c	d
(A)	4	1	2	3
(C)	2	4	1	3

	a	b	c	d
(B)	2	1	4	3
(D)	2	3	4	2

77. The objective/s of development of disease resistance in crop plants is/are **[Pg-173,E]**
(A) to reduce or prevent the invasion, growth, and development of pathogen
(B) to reduce dependence on the use of fungicides and bacteriocides
(C) to realize the maximum crop production
(D) all the given choices are correct

78. Which of the following sets of plant diseases include all fungal diseases? **[Pg-173,E]**
(A) Turnip mosaic, black rot of crucifers and brown rust of wheat
(B) Black rot of crucifers, brown rust of wheat and red rot of sugarcane
(C) Brown rust of wheat, red rot of sugarcane and late blight of potato
(D) Tobacco mosaic, black rot of crucifers and brown rust of wheat

79. Which of the following statement correctly differentiates conventional breeding techniques for the disease resistance in plants from the mutational breeding? **[Pg-174,M]**
(A) Mutational breeding screens germplasm for the source of disease resistance genes.
(B) Conventional breeding includes the introduction of disease resistance genes in plants by induced mutations.
(C) Mutational breeding induces mutations in plants to introduce disease resistance in them.
(D)Mutational breeding cannot be applied to crop plants.

80. Breeding for disease resistance in crop plants is carried out by conventional techniques or by mutational breeding. Which of the following crop was not bred by conventional techniques for disease resistance? **[Pg-174,E]**
(A) Resistance to white rust in Brassica (B) Resistance to bacterial blight in cowpea
(C) Resistance to hill bunt in wheat (D) Resistance to powdery mildew in mung bean

81. Which of the following is a wheat variety bred by conventional breeding techniques to develop resistance to leaf and stripe rust in them? **[Pg-174,E]**
(A) Himgiri (B) Pusa swarnim
(C) Pusa Shubhra (D) Pusa Snowball K-1

82. Pusa komal variety of cowpea is resistant to _____ while Pusa sadabahar variety of chilly is resistant to _____ **[Pg-174,E]**
(A) Bacterial blight and Leaf curl (B) White rust and Tobacco mosaic virus
(C) Black rot and Chilly mosaic virus (D) Bacterial blight and hill bunt

83. Plant breeding for disease resistance by conventional techniques has limited success due to **[Pg-174,E]**
(A) Time consuming screening of germplasm
(B) Limited availability of disease resistance genes the collected germplasm
(C) The tedious process of evaluation of developed cultivars
(D) Limited knowledge about the pathology of plant disease

84. When a source of disease resistance gene is not available or not known, _____ is followed to produce disease resistant mutants plants. **[Pg-174,E]**
(A) Conventional breeding (B) Mutagenesis
(C) Plant breeding (D) Germplasm screening

85. Consider the following statements: **[Pg-174,M]**
(a) Disease resistant somaclonal variants may serve as a source of disease resistance for plant breeding.
(b) Recombinant DNA technology develops the disease resistant transgenic crop plants by transferring the disease resistance gene in crops from any other source.
Select the correct option.
(A) Both (a) and (b) are true. (B) (a) is true but (b) is false.
(C) Both (a) and (b) are false. (D) (a) is false but (b) is true.

86. Which of the following is a yellow mosaic virus resistant variety of *Abelmoschus esculentus*? **[Pg-174,E]**
(A) TN-1 (B) Prabhani kranti (C) Himgiri (D) Pusa komal

87. Which of the following set of examples represent insect resistance due to morphological features?

[Pg-175,E]
(A) Resistance to jassids in cotton and cereal leaf beetle in wheat
(B) Stem borer resistance in maize
(C) Rust resistance in wheat
(D) Rot resistance in cauliflower

88. Cereals are the staple source of nutrition in human diet. Which of the following is a man made cereal? [HOTS] **[Pg-175,M]**
(A) Triticum (B) Triticale (C) Sorghum (D) Bajra

89. Select the incorrect statement about insect pest resistance in crop plants. **[Pg-175,M]**
(A) Solid stems of wheat are not preferred by stem sawflies.
(B) The presence of smooth leaves and no nectar makes the cotton varieties resistant to bollworms.
(C) High aspartic acid and low nitrogen in maize impart stem borer resistance.
(D)Maize varieties with high sugar content are resistant to maize stem borers.

90. Pusa gaurav is the _____ resistant variety of _____ plants bred by conventional hybridization techniques. **[Pg-175,E]**
(A) Wheat, stem borer (B) Jassids, cotton
(C) Aphids, rapeseed mustard (D) Jassids, beans

91. Pusa sem 2 and Pusa Sem 3 varieties of the flat bean are resistant to **[Pg-175,E]**
(A) bollworms and jassids (B) stem sawfly and aphids
(C) leaf beetle and fruit borer (D) jassids, aphids and fruit borer

92. Which of the following are the shoot and fruit borer resistant varieties of Okra? **[Pg-175,E]**
(A) Pusa Gaurav (B) Pusa Sem 3 (C) Pusa Sem 2 (D) Pusa A-4

93. Which of the following set correctly represents the three major food crops that feed most of the world population? **[Pg-175,E]**
(A) Maize, wheat, and rice (B) Maize, jowar, and bajra
(C) Corn, soybean, and wheat (D) Corn, soybean, and rice

94. Which of the given statements is incorrect about the nutritional quality of food crops? **[Pg-175,E]**
(A) Cereals are generally low in protein content.
(B) Legumes tend to be low in tryptophan amino acid.
(C) Corn, wheat, and rice are low in lysine amino acids.
(D) Rice is a rich source of proteins and vitamin A.

95. Select the option that correctly represents some of the essential micronutrients required by the human body. **[Pg-175,E]**
(A) Iron, nitrogen, oxygen and phosphorus
(B) Iron, vitamin A, iodine and zinc
(C) Iron, vitamin A, carbon and potassium
(D)Manganese, copper, nitrogen and carbon

96. Parents often complain about fatigue and weakness in their children despite the proper intake of food. Which of the following could be a reason behind the same? **[Pg-175,E]**
(A) Hidden hunger (B) Over consumption of proteins
(C) Obesity (D) Over consumption of carbohydrates

97. Which of the following micronutrients is correctly matched with its respective deficiency disorder? **[Pg-175,E]**
(A) Vitamin A – anemia (B) Iron – night blindness
(C) Iodine – goiter (D) Zinc – beriberi

98. Application of breeding or biotechnological processes to improve the nutrient levels of crop plants is known as **[Pg-176,E]**
(A) biogeochemistry (B) biofortification
(C) biomagnification (D) plant breeding

99. Which of the following components determine the nutritional quality of food crops? **[Pg-176,E]**
(A) Protein content and balance of amino acids (B) Oil content and fatty acid composition
(C) Vitamin and mineral content (D) All the given choices are correct

100. To improve the protein content of cultivated wheat, the high protein content gene from _____ was transferred into _____. This improved wheat variety exhibited higher protein content with no

reduction in its yield. **[Pg-176,E]**

(A) Atlas 56, Lancota (B) Atlas 66, Lancota

(C) Lancota, Atlas 66 (D) Lancota, Atlas 56

101. Which of the following food/vegetable crop is incorrectly matched with the nutrients for which they were bred? **[Pg-176,E]**

(A) Maize: Lysine and tryptophan

(B) Carrots, spinach, pumpkin: Vitamin A

(C) Bitter gourd, bathua, mustard, tomato: Vitamin C

(D) Spinach and bathua: Lysine and phenylalanine

102. **Assertion:** Limited land availability for agriculture was the major reason for food production in India before the greenrevolution.

Reason: High yielding and disease resistant varieties of cereal crops made India self-sufficient in food production.**[Pg-172,H]**

(A) Both assertion and reason are true but reason is the correct explanation of assertion.

(B) Both assertion and reason are true but reason is not the correct explanation of assertion.

(C) Assertion is true but reason is false.

(D) Both assertion and reason are false.

103. **Assertion:** The presence of genetic variability is a prerequisite for plant breeding techniques.

Reason: Conventional breeding use existing genes for desired traits as parents for hybridization. **[Pg-174,H]**

(A) Both assertion and reason are true but reason is the correct explanation of assertion.

(B) Both assertion and reason are true but reason is not the correct explanation of assertion.

(C) Assertion is true but reason is false. (D) Both assertion and reason are false.

104. **Assertion:** Saccharum barberi was the south Indian sugarcane with higher sugar content and yield.

Reason: Saccharum officinarum was grown in north India and had thicker stems but poor sugar content. **[Pg-173,H]**

(A) Both assertion and reason are true but reason is the correct explanation of assertion.

(B) Both assertion and reason are true but reason is not the correct explanation of assertion.

(C) Assertion is true but reason is false. (D) Both assertion and reason are false.

105. **Assertion:** The random changes in the genome of living beings are called mutations.

Reason: Mutations introduce new genes/alleles and add variations. **[Pg-174,H]**

(A) Both assertion and reason are true but reason is the correct explanation of assertion.

(B) Both assertion and reason are true but reason is not the correct explanation of assertion.

(C) Assertion is true but reason is false. (D) Both assertion and reason are false.

106. **Assertion:** Mutation breeding uses artificial mutations to obtain the plants with desired genetic traits.

Reason: Yellow mosaic virus resistance variety of mung bean was developed by mutation breeding. **[Pg-174,H]**

(A) Both assertion and reason are true but reason is the correct explanation of assertion.

(B) Both assertion and reason are true but reason is not the correct explanation of assertion.

(C) Assertion is true but reason is false. (D) Both assertion and reason are false.

107. **Assertion:** Cereals are a poor source of carbohydrates.

Reason: Legumes are rich in tryptophan amino acid. **[Pg-176,H]**

(A) Both assertion and reason are true but reason is the correct explanation of assertion.

(B) Both assertion and reason are true but reason is not the correct explanation of assertion.

(C) Assertion is true but reason is false. (D) Both assertion and reason are false.

108. Which of the following microorganisms serve in the production of single-cell protein? **[Pg-176,E]**

(A) Bacteria (B) Yeast (C) Algae (D) All of these

109. A bulk of dead and dry cell microbes that possess high levels of proteins and is grown on varieties of carbon sources is known as **[Pg-176,E]**

(A) hyphae (B) single cell protein (C) colony (D) microbial mount

110. Consider the following statements:

(a) Single cell proteins are rich sources of essential amino acids such as lysine and tryptophan which are scarce in plant and animal proteins.

(b) Around 60%–82% of dry cell weight of single cell protein is protein.
Select the correct option. **[Pg-176,M]**
(A) Both (a) and (b) are true. (B) (a) is true but (b) is false.
(C) Both (a) and (b) are false. (D) (a) is false but (b) is true.

111. Consider the following statements.**[Pg-176,M]**
(a) A shift from grain to meat diet creates more demand for grains.
(b) Only 10% energy of one trophic level is available for the next trophic level.
Select the correct option.
(A) Both (a) and (b) are true. (B) (a) is true but (b) is false.
(C) Both (a) and (b) are false. (D) (a) is false but (b) is true.

112. Single cell proteins as an alternative to human food sources is an environmentfriendly approach because **[Pg-176,E]**
(A) microbes are a good source of protein (B) microbes have higher reproduction rates
(C) microbes are grown on the organic waste matter
(D) conventional breeding programs cannot meet the demand for food

113. Single cell proteins are being produced using waste organic matter. Which of the following set correctly represents the organic waste materials used for the purpose? **[Pg-176,E]**
(A) Wastewater from potato processing plants, straw, molasses
(B) Animal manure, sewage, antibiotics
(C) Sewage, industrial waste, waste from nuclear reactors
(D) Hydrocarbon, straw, volcanic eruptions

114. Consider the following statements.
(a) More than 50% of the human population is suffering from hunger and malnutrition.
(b) Single cell protein is also known as microbial protein or bio protein.
Select the correct option. **[Pg-176,M]**
(A) Both (a) and (b) are true. (B) (a) is true but (b) is false.
(C) Both (a) and (b) are false. (D) (a) is false but (b) is true.

115. Match Column-I with Column-II.**[Pg-176,M]**

Column-I	**Column-II**
(A) Cucumber and orange peel	(1) Bacterial
(B) *Methanomonas*	(2) Algae
(C) *Spirulina*	(3) Fungus
(D) *Aspergillus*	(4) Production of single cell proteins

Select the correct option.

	A	**B**	**C**	**D**
(a)	1	4	2	3
(b)	4	1	2	3
(c)	4	2	1	3
(d)	3	1	4	2

116. Which of the following represents the production of single cell proteins? **[Pg-176,E]**
(A) Production of *Saccharomyces cerevisiae* from molasses in World War I.
(B) Production of Torula yeast on sulphite liquor waste from paper production plants during World War II.
(C) Growing cell biomass of *Saccharomyces cerevisiae* on fruit peels.
(D) All the given choices are correct.

117. 250 g of *Methylophilus methylotrophus* can obtain as much as _____ of proteins as compared to 250 kg cow that produces only 200 g of proteins. **[Pg-176,H]**
(A) 250 tonnes (B) 25 tonnes (C) 2.5 tonnes (D) 12 tonnes

118. Select the incorrect match from the given examples of single cell protein microbes. **[Pg-176,E]**
(A) Bacteria: *Methanomonas, Pseudomonas, Bacillus*
(B) Yeast: *Candida utilis, S. cereviseae, Pichia pastoris*
(C) Fungi: *Fusarium, Aspergillus, Penicillium*
(D) Algae: *Spirullina, Chiarella, Hydrogenomonas*

119. **Assertion:** Microbes have higher growth rates and produce more biomass in less time.
Reason: Some microbial species are rich sources of essential amino acids.**[Pg-176,H]**
(A) Both assertion and reason are true but reason is the correct explanation of assertion.
(B) Both assertion and reason are true but reason is not the correct explanation of assertion.

(C) Assertion is true but reason is false. (D) Both assertion and reason are false.

120. **Assertion:** Algae are autotrophs and produce organic matter by the process of photosynthesis.
Reason: Spirulina and Scenedesmus are the most commonly used bacterial sources of single cell proteins. **[Pg-176,H]**
(A) Both assertion and reason are true but reason is the correct explanation of assertion.
(B) Both assertion and reason are true but reason is not the correct explanation of assertion.
(C) Assertion is true but reason is false. (D) Both assertion and reason are false.

121. Growth of tissues or cells in an artificial medium under sterile conditions is known as **[Pg-177,E]**
(A) Callus (B) Tissue culture (C) Somatic hybridization (D) Somatic hybrid

122. The excised plant tissue or organ is grown in a test tube under aseptic conditions to generate whole plants is known as **[Pg-177,E]**
(A) meristem (B) explant (C) hybrids (D) stem cells

123. Which of the following plant parts serve as source of explant for tissue culture? **[Pg-177,E]**
(A) Petal, leaves and flower buds (B) Ovaries and anther
(C) Seeds and nodal segment (D) All of these

124. Consider the following statement: **[Pg-177,M]**
(a) A totipotent cell contains a complete set of genetic information to direct the development of an entire organism.
(b) A pluripotent cell is a stem cell that can produce many but not all the cell types in an organism. Select the correct option.
(A) Both (a) and (b) are true. (B) (a) is true but (b) is false.
(C) Both (a) and (b) are false. (D) (a) is false but (b) is true.

125. Concept of totipotency was given by **[Pg-177,E]**
(A) Morgan (B) Haberlandt (C) MS Swaminathan (D) Norman Borlaug

126. Given below are the various steps of plant tissue culture. Arrange them in correct order and select the correct option. **[Pg-177,M]**
(I) Preparation of instrument and nutrient culture medium (II) Preparation of explant
(III) Sterilization of culture medium
(IV) Acclimatization of plantlets and transfer to pots
(V) Inoculation of explant and incubation for growth
(A) I, III, II, V, IV (B) II, I, III, V, IV (C) I, II, III, V, IV (D) I, III, II, IV, V

127. Sterilization of tissue culture apparatus is done by **[Pg-177,E]**
(A) autoclave only
(B) autoclave and washing with chromic acid and detergent
(C) autoclave and washing with detergent
(D) surface treatment with chromic acid

128. During the 1950s, _____ and _____ performed various experiments that led to the development of synthetic growth medium to stimulate growth and division in explants. **[Pg-177,E]**
(A) Miller and Morgan (B) Miller and Skoog
(C) Morgan and Mendel (D) Hugo de Vries and Morgan

129. The basic requirements for tissue culture techniques are **[Pg-177,E]**
(A) Aseptic conditions (B) Synthetic growth medium (C) Explant (D) All of these

130. Consider the following statements about tissue culture. **[Pg-177,M]**
(a) A tissue culture medium provides minerals and growth regulators to the growing cells.
(b) It serves as a source of organic compounds but does not provide physical support.
Select the correct option.
(A) Both (a) and (b) are true. (B) (a) is true but (b) is false.
(C) Both (a) and (b) are false. (D) (a) is false but (b) is true.

131. Which of the following growth regulators is incorrectly matched with its effect on the growing explant in a synthetic medium? **[Pg-177,H]**
(A) Naphthalene acetic acid (NAA) and indole-3-butyric acid (IAA): Induce rooting
(B) 2, 4-diclorophenoxyacetic acid (2, 4- D): Induce rooting
(C) Kinetin: Induces shoot formation
(D) Higher auxin to cytokinin ratio:Promotes shoot formation

132. A callus is **[Pg-177,M]**
(a) undifferentiated mass of cells formed on an explant.
(b) aggregation of totipotent cells that can be manipulated to develop into any plant part.
Select the correct option.
(A) Both (a) and (b) are true. (B) (a) is true but (b) is false.
(C) Both (a) and (b) are false. (D) (a) is false but (b) is true.

133. Based on their ability to give rise to new cell types, how would you classify zygote and spermatogonia in humans? **[Pg-177,E]**
(A) Totipotent and pluripotent respectively (B) Totipotent and unipotent respectively
(C) Unipotent and pluripotent respectively (D) Pluripotent and pluripotent respectively

134. A synthetic growth medium should provide all the nutrients required for the development of a new plant. Select the nutrient category that is correctly matched with its representative. **[Pg-177,E]**
(A) Carbon source: vitamins (B) Inorganic nutrients: Sucrose
(C) Growth regulators: Minerals (D) Salts: Sulfates

135. Match Column-I with Column-II. **[Pg-177,M]**

Column-I	Column-II
(a) Micropropagation	(1) Apical and axillary
(b) Somaclones	(2) Protoplast fusion
(c) Somatic hybrids	(3) In vitro clonal propagation of plants
(d) Meristem	(4) Genetically identical plants produced by tissue culture

Select the correct option.

	a	b	c	d
(A)	4	1	2	3
(B)	2	3	4	2
(C)	3	4	2	1
(D)	3	1	4	2

136. Rapid clonal propagation of explant to obtain genetically identical plants is known as **[Pg-177,E]**
(A) somatic hybridization (B) micropropagation
(C) protoplasts (D) meristem culture

137. Micropropagation is advantageous over sexual reproduction in orchids as
(a) It is a rapid process and reduces the dependency on seeds for reproduction.
(b) It maintains the desirable genetic traits present in the parent plant. **[Pg-177,M]**
Select the correct option.
(A) Both (a) and (b) are true. (B) (a) is true but (b) is false.
(C) Both (a) and (b) are false. (D) (a) is false but (b) is true.

138. Production of virus-free plants from a virus-infected plant is done by meristem culture because **[Pg-177,M]**
(A) meristem culture is a technique of rapid clonal propagation.
(B) some of the progeny from the meristem culture may be virus-free.
(C) it produces a large number of plants from a small explant.
(D)meristems are virus-free plant tissues.

139. Protoplast is [NEET-2015] **[Pg-177,M]**
(A) a plant cell without a cell wall (B) a plant cell without a cell membrane
(C) a plant cell undergoing division (D) a plant cell without a nucleus

140. Which of the following options represents the correct sequence of steps in somatic hybridization? **[Pg-177,M]**
A) Isolation of plant cells → Fusion of protoplasts from different plant varieties → Production of somatic hybrids → Digestion of cell wall.
(B) Isolation of plant cells → Digestion of cell wall → Fusion of protoplasts from different plant varieties → Production of somatic hybrids.
(C) Isolation of plant cells → Fusion of protoplasts from different plant varieties → Digestion of cell wall → Production of somatic hybrids.
(D) Isolation of plant cells → Fusion of protoplasts from different plant varieties → Production of somatic hybrids.

141. A technique of micropropagation is [NEET-2015] **[Pg-177,E]**
(A) somatic embryogenesis (B) protoplast fusion
(C) embryo rescue (D) somatic hybridization

142. Which of the following enhances or induces the fusion of protoplasts? [NEET-2015] **[Pg-177,M]**
(A) IAA and kinetin (B) IAA and gibberellins
(C) Sodium chloride and potassium chloride (D) Polyethylene glycol and sodium nitrate

143. Select the mismatch from the given options. **[Pg-177,E]**
(A) Tissue culture: Jaya and Ratna (B) Somatic hybridization: Pomato
(C) Micropropagation: Tomato, banana, apple (D)Meristem culture: Banana, sugarcane, potato

144. **Assertion:** Totipotency is the ability of explants to give rise while plant.
Reason: The cells of explants contain a complete set of genetic information.**[Pg-177,H]**
(A) Both assertion and reason are true but reason is the correct explanation of assertion.
(B) Both assertion and reason are true but reason is not the correct explanation of assertion.
(C) Assertion is true but reason is false. (D) Both assertion and reason are false.

145. **Assertion:** Meristems are the localized regions of active cell division in a plant body.
Reason: Somaclones are genetically identical plants. **[Pg-177,H]**
(A) Both assertion and reason are true but reason is the correct explanation of assertion.
(B) Both assertion and reason are true but reason is not the correct explanation of assertion.
(C) Assertion is true but reason is false. (D) Both assertion and reason are false.

146. **Assertion:** Pomato is an intergeneric somatic hybrid.
Reason: Cybrids are the somatic hybrids with the nuclear genome from both the parent plants.**[Pg-177,H]**
(A) Both assertion and reason are true but reason is the correct explanation of assertion.
(B) Both assertion and reason are true but reason is not the correct explanation of assertion.
(C) Assertion is true but reason is false. (D) Both assertion and reason are false.

NEET PREVIOUS YEARS QUESTIONS

1. A 'new' variety of rice was patented by a foreign company, though such varieties have been present in India for a long time. This is related to: **[2018]**
(a) Co-667 (b) Sharbati Sonora (c) Basmati (d) Lerma Rojo

2. Homozygous purelines in cattle can be obtained by: **[2017]**
(a) mating of unrelated individuals of same breed. (b) mating of individuals of different breed.
(c) mating of individuals of different species. (d) mating of related individuals of same breed.

3. A system of rotating crops with legume or grass pasture to improve soil structure and fertility is called: **[2016]**
(a) Ley farming (b) Contour farming (c) Strip farming (d) Shifting agriculture

4. Which part of the tobacco plant is infected by *Meloidogyne incognita*? **[2016]**
(a) Flower (b) Leaf (c) Stem (d) Root

5. Outbreeding is an important strategy of animal husbandry because it: **[2015]**
(a) is useful in producing purelines of animals.
(b) is useful in overcoming inbreeding depression.
(c) exposes harmful recessive genes that are eliminated by selection.
(d) helps in accumulation of superior genes.

6. Which of the following enhances or induces fusion of protoplasts? **[2015]**
(a) Polyethylene glycol and sodium nitrate (b) IAA and kinetin
(c) IAA and gibberellins (d) Sodium chloride and potassium chloride

7. A technique of micropropagation is: **[2015]**
(a) somatic embryogenesis (b) protoplast fusion
(c) embryo rescue (d) somatic hybridisation

8. To obtain virus - free healthy plants from a diseased one by tissue culture technique, which part/parts of the diseased plant will be taken: **[2014]**

(a) Apical meristem only (b) Palisade parenchyma
(c) Both apical and axillary meristems (d) Epidermis only

9. Select the incorrect statement :- **[NEET-2019]**
(1) Inbreeding increases homozygosity
(2) Inbreeding is essential to evolve purelines in any animal
(3) Inbreeding selects harmful recessive genes that reduce fertility and productivity
(4) Inbreeding helps in accumulation of superior genes and elimination of undesirable genes

10. Select the incorrect statement regarding inbreeding **[NEET-2019 ODISSA]**
(1) Inbreeding helps in elimination of deleterious alleles from the population
(2) Inbreeding is necessary to evolve a pureline in any animal
(3) Continued inbreeding reduces fertility and leads to inbreeding depression
(4) Inbreeding depression can not be overcome by out-crossing

11. In mung bean, resistance to yellow mosaic virus and powdery mildew were brought about by : **[NEET-2019 ODISSA]**
(1) Mutation breeding (2) Biofortification (3) Tissue culture (4) Hybridization and selection

12. Inbreeding depression is - **[NEET-2020 COVID]**
(1) Reduced motility and immunity due to close inbreeding
(2) Decreased productivity due to mating of superior male and inferior female
(3) Decrease in body mass of progeny due to continued close inbreeding
(4) Reduced fertility and productivity due to continued close inbreeding

13. By which method was a new breed 'Hisardale' of sheep formed by using Bikaneriewes and Marinorams? **[NEET-2020]**
1) Inbreeding 2) Out crossing 3) Mutational breeding 4) Cross breeding

14. Which of the following is not a step in Multiple Ovulation Embryo Transfer Technology (MOET) **[NEET-2021]**
1) Cow yields about 6-8 eggs at a time
2) Cow is fertilized by artificial insemination
3) Fertilized eggs are transferred to surrogate mothers at 8-32 cell stage
4) Cow is administered hormone having LH like activity for super ovulation

15. Match **List – I** with **List –II.** **[NEET-2021]**

List – I		**List – II**	
(a)	Protoplast fusion	(i)	Totipotency
(b)	Plant tissue culture	(ii)	Pomato
(c)	Meristem culture	(iii)	Somaclones
(d)	Micropropagation	(iv)	Virus free plants

Choose the **correct** answer from the options give below.

	(a)	**(b)**	**(c)**	**(d)**
1)	(ii)	(i)	(iv)	(iii)
2)	(iii)	(iv)	(i)	(ii)
3)	(iv)	(iii)	(ii)	(i)
4)	(iii)	(iv)	(ii)	(i)

16. Which of the following is not an objective of Biofortification in crops? **[NEET-2021]**
1) Improve resistance to diseases 2) Improve vitamin content
3) Improve micronutrient and mineral content 4) Improve protein content

17. Breeding crops with higher levels of vitamins and minerals or higher proteins and healthier fats is called: **[NEET-2022]**
1) Bio-magnification 2) Bio-remediation
3) Bio-fortification 4) Bio-accumulation

NCERT LINE BY LINE QUESTIONS – ANSWERS

1) D	2) A	3) A	4) D	5) A	6) B	7) D	8) C	9) D	10) D
11) D	12) B	13) A	14) D	15) A	16) B	17) B	18) C	19) B	20) B
21) B	22) A	23) C	24) D	25) B	26) B	27) B	28) A	29) D	30) B
31) A	32) D	33) C	34) B	35) B	36) A	37) D	38) D	39) A	40) C
41) D	42) A	43) B	44) D	45) D	46) A	47) B	48) C	49) D	50) B
51) A	52) C	53) A	54) A	55) A	56) D	57) B	58) C	59) A	60) B
61) A	62) A	63) D	64) A	65) A	66) B	67) C	68) C	69) B	70) C
71) D	72) A	73) B	74) D	75) D	76) A	77) D	78) C	79) C	80) D
81) A	82) A	83) B	84) B	85) A	86) B	87) A	88) B	89) D	90) C
91) D	92) D	93) A	94) D	95) B	96) A	97) C	98) B	99) D	100) A
101) D	102) B	103) A	104) D	105) A	106) B	107) D	108) D	109) B	110) A
111) A	112) C	113) A	114) D	115) B	116) D	117) B	118) D	119) B	120) C
121) B	122) B	123) D	124) A	125) B	126) A	127) B	128) B	129) D	130) B
131) D	132) A	133) B	134) D	135) C	136) B	137) A	138) D	139) A	140) B
141) D	142) D	143) A	144) A	145) B	146) D				

NEET PREVIOUS YEARS QUESTIONS-ANSWERS

1 (c) **2** (d) **3** (a) **4** (d) **5** (b) **6** (a) **7** (a) **8** (c) **9** (3) **10** (4)
11 (1) **12** (4) **13** (4) **14** (4) **15** (1) **16** (1) **17** (3)

NEET PREVIOUS YEARS QUESTIONS-EXPLANATIONS

1. (c) In 1997, an American company got patent rights on Basmati rice through the US patent and trademark office that was actually been derived from Indian farmer's varieties. The diversity of rice in India is one of the richest in the world, 27 documented varieties of Basmati are grown in India. Indian basmati was crossed with semi-dwarf varieties and claimed as an invention or a novelty. Sharbati sonora and Lerma Rojo are varieties of wheat.

2. (d) Inbreeding increases homozygosity. So, mating of the related individuals of same breed will give homozygous purelines.

3. (a) The growing of grass or legumes in rotation with grain or tilled crops as a soil conservation measure is called Ley farming.

4. (d) *Meloidogyne incognita* is a nematode (roundworm) in the family Heteroderidae. It is commonly called the "southern root-knot nematode" or the "cotton rootknot nematode".

5. (b) Outbreeding is useful in the problem of inbreeding depression.

6. (a) Polyethylene glycol and sodium nitrate play an important role in the fusion of protoplasts from the same or different species. It is done for the formation of somatic hybrid cells. This process is adopted when normal sexual reproduction is not possible for the production of hybrids.

7. (a) Development of embryo like structure from explant by the method of tissue culture is called somatic embryogenesis.

8. (c) To obtain virus - free healthy plants from a diseased one by tissue culture technique, both apical and axillary meristems of the diseased plant will be taken. Plant tissue culture is used to maintain or grow plant cells, tissues or organs under sterile conditions on a nutrient culture medium of known composition. Plant tissue culture is widely used to produce clones of a plant in a method known as micro propagation.

13. Hisardale is a new breed of sheep developed in Punjab by crossing Bikaneri-ewe and Marino rams. In cross-breeding, superior male of one breed are mated with superior females of another breed.

14. Multiple Ovulation Embryo Transfer Technology is used for herd improvement in short time.

* Cows are administered hormones, with FSH-like activity for superovulation.
* 8-32 celled embryos are transferred to surrogate mothers.
* 6-8 eggs are produced per cycle.
* Cows can be fertilised by artificial insemination

15. Protoplast fusion – Pomato , Plant – tissue culture – Totipotency
Meristem culture – Virus free plants ,
Micropropagation – Somaclones
16. Biofortification improves vitamin content, protein content and micronutrient and mineral content. It does not create resistance in plants against diseases.
17. Bio fortification