Workbook Cum Question Bank with Answers

Botany

Class-XII (CHSE)

SCHEDULED CASTES & SCHEDULED TRIBES
RESEARCH & TRAINING INSTITUTE (SCSTRTI)
ST & SC DEVELOPMENT DEPARTMENT
BHUBANESWAR

BOTANY

WORKBOOK-CUM-QUESTION BANK WITH ANSWERS

CLASS - XII (CHSE)

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UNIT - I : REPRODUCTION

(a) REPRODUCTION IN ORGANISMS

Group - A

I. Select the correct answer from the choices given under each bit :

1. Non motile asexual reproductive units are called:
(a) zoospores (b) buds
(c) gametes (d) conidia

2. When a living organism divides equationally during asexual reproduction, the type of reproduction is called:
(a) fragmentation (b) fission
(c) budding (d) sporulation

3. Yeast generally reproduces by:
(a) Fission (b) budding
(c) sporulation (d) gametangia

4. The cell division process associated with asexual reproduction is:
(a) equational division
(b) reductional division
(c) meiotic division
(d) haplosis

5. *Dahlia* propagates by:
(a) root (b) stem
(c) leaf (d) seed

6. The process in which one plant part is inserted into another to grow a new individual plant is called:
(a) layering
(b) cutting
(c) grafting
(d) micropropagation

7. Ginger is vegetatively propagated through :
(a) rhizome (b) bulbil
(c) stolon (d) offset

8. Isogametes are seen in:
(a) cladophora (b) fucus
(c) ficus (d) cycas

9. The Vegetative propagate of *Bryophyllum* is:
(a) bulbil (b) leafbuds
(c) rhizome (d) offset

10. If a fungal thallus has both male and female reproductive structures, it is called:
(a) heterothallic (b) dioecious
(c) monoecious (d) homothallic

11. Asexual reproduction is seen in members of the kingdom:
(a) monera (b) plantae
(c) animalia (d) all of these

12. Which of the following is not used for vegetative propagation?
(a) bud (b) mulbil
(c) antherozoid (d) turion

13. Banana fruits are seedless because:
(a) auxin is sprayed for rapid development of fruit
(b) the plant propagates vegetatively
(c) most plant varieties are triploid
(d) fruits are artificially ripened

14. The techniques of producing new plants by cells instead of seeds is known as:

(a) biofortification

(b) mutation

(c) tissue culture

(d) biomagnification

15. Which one of the following pair is correctly matched?

(a) Onion-bulb

(b) Ginger-sucker

(c) Chlamydomonas-conidia

(d) Yeast-zoospores

16. The terms homothallic and monoecious are used to denote:

(a) unisexual condition

(b) bisexual condition

(c) staminate flowers

(d) pistillate flowers

17. In grafting the portion grafted on the main plant is called:

(a) stem
(b) stock
(c) scion
(d) adventitious bud

18. External fertilization occurs is the majority of :

(a) algae (b) fungi
(c) mosses (d) liverworts

19. Fleshy buds produced in the axil of leaves which grow to form new plants when shed and fall on ground, are called:

(a) bulbs (b) bulbils
(c) tubers (d) offsets

20. Asexual reproduction in the organisms coming under Protista and Monera occurs by :

(a) Budding
(b) Conidia
(c) Binary fission
(d) Multiple fission

II. Fill in the blanks :

1. In sexual reproduction, the specialized sexual reproductive units are called _____.
2. In sexual reproduction, the fusion products of the reproductive units are called _____.
3. Endogenously borne motile asexual reproductive units are known as _____.
4. In lower plants, when vegetative cells by accidental breakage reproduce vegetatively it is called _____.
5. Bacteria when asexually reproduce by dividing into two identical cells, then the process is known as_____.
6. Yeasts generally reproduce asexually by _____ method.
7. Exogenously borne non motile asexual reproductive units of fungi are known as _____.
8. In grafting the detached plant part is called _____.
9. In the grafting method, the rooted plant to which the detached plant part is joined is called _____.

10. In micropropagation method, the small plant cuttings which are inoculated to the nutrient medium is known as _____.
11. Zoospores are borne inside sac-like structures called_____.
12. In Bryophyllum the adventitious buds are borne on _____.
13. The process of _____ensures the continuity of life on earth.
14. The process of fusion of gametes is called _____.
15. The other name of an egg cell is _____.
16. Amoeba is a _____ celled organism.
17. Amoeba propagates by _____ reproduction.

III. Answer in One/Two Word(s):

1. Mode of reproduction involved in production of offsprings by a single parent.
2. Type of asexual reproduction by which yeasts generally divide.
3. Morphologically and physiologically similar sexual reproductive units.
4. Fusion of two morphologically and physiologically dissimilar gametes.
5. Production of large number of identical plantlets in culture medium under controlled conditions.

IV. Correct the statements if required by changing the underlined word/ words only:

1. Aspergillus reproduces asexually by nonmotile structures called zoospores.
2. Saccharomyces generally propagate by binary fission.
3. Bryophyllum reproduces vegetatively by roots.
4. The sterilized plant cuttings used in tissue culture are known as callus.
5. In grafting the detached plant part which is inserted to a rooted plant is called stock.
6. Endogenously borne nonmotile thin-walled asexual spores produced by certain algae and fungi are called zoospores.
7. Accidental breakage of vegetative cells in lower plant groups that grow into independent units is called fission.
8. Zoospores are borne inside gametangia.
9. The fusion product of sexual reproduction is known as gamete.
10. The technique by which roots are artificially induced to grow on the branches before they are detached from the parent plant is called grafting.

Group - B

I. Write notes on the following in 2 to 3 sentences.

1. Budding
2. Fission
3. Fragmentation
4. Grafting
5. Micropropagation
6. Vegetative propagation
7. Zoospore
8. Asexual reproduction

II. Differentiate between the following with two to three valid points :

1. Fission and Budding
2. Zoospores and Conidia
3. Zoospores and gametes
4. Grafting and Layering
5. Asexual reproduction and Sexual reproduction

Group - C

Long Answer Types Questions

1. Describe the process of sexual reproduction in different plant groups.
2. Give an account of vegetative propagation in angiosperms.
3. Describe the process of micropropagation. Discuss its advantages.

ANSWER KEYS

(a) REPRODUCTION IN ORGANISMS

Group - A

I. Select the correct answer from the choices given under each bit :

1.	(d)	5.	(a)	9.	(b)	13.	(c)	17.	(c)
2.	(b)	6.	(c)	10.	(d)	14.	(c)	18.	(a)
3.	(b)	7.	(a)	11.	(d)	15.	(a)	19.	(b)
4.	(a)	8.	(a)	12.	(c)	16.	(b)	20.	(c)

II. Fill in the blanks :

1. Gametes
2. Zygote
3. Zoospores
4. Fragmentation
5. Fission
6. budding
7. Conidia
8. Scion
9. Stock
10. Explant
11. Sporangia
12. Leaves
13. Reproduction
14. Fertilization
15. Ovum
16. Single
17. Asexual

III. Answer in one word :

1. Asexual reproduction
2. Budding
3. Isogametes
4. Heterogamy
5. Micropropagation

IV. Correct the statements if required by changing the underlined word/ words only:

1. Conidia
2. Budding
3. Leaves
4. Explant
5. Scion
6. Aplanospores
7. Fragmentation
8. Sporangia
9. Zygote
10. Layering

Group - B

I. Write notes on the following in 2 to 3 sentences.

1. Budding

Ans. • Under unfavourable conditions, peripheral portion of yeast (*Saccharomyces*) develop outgrowths, called buds.

• Nucleus and cytoplasm of the mother cell migrate into these buds.

• Gradually the buds segregate and grow into independent organisms.

2. Fission :

Ans. • It is a type of asexual reproduction seen in lower organisms.

Ans. • When the cell mitotically divides into two it is called binary fission as is generally seen in bacteria.

Ans. • When the cell divides amitotically into many daughter cells, it is called multiple fission as in *Plasmodium*.

3. Fragmentation:

Ans. • It is a type of asexual reproduction in which an organism like Spirogyra simply breaks into many individual pieces.

Ans. • These pieces grow into new organism.

Ans. • It happens due to certain external factors like wind, water currents etc.

4. Grafting:

Ans. • It is a mode of vegetative propagation used by horticulturists in certain plants like mango, rose, orange, guava etc.

• This is an artificial method in which a detached plant part called scion is inserted into stem or root system of another plant, called stock.

• The grafting portion is covered by grafting wax to avoid infection. The scion becomes part of the plant into which it is grafted.

5. Micropropagation:

Ans. • This is a method of vegetative propagation of plants for obtaining pathogen- free plantlets in large numbers within a short time span.

• Here, small plant cuttings called explants are taken and grown under controlled asceptic conditions.

• The proliferating shoots grow into new individual plants. Many crop plants have been successfully grown by this method.

6. Vegetative propagation:

Ans. • It is an asexual method of plant propagation where specialized reproductive units are not formed.

• In higher plants it occurs by roots, stems and leaves through fragmentation and regeneration of vegetative parts.

• In lower plants vegetative propagation takes place by accidental breakage, fission and fragmentation.

7. Zoospore

Ans.
- Zoospores are motile endogenously borne asexual reproductive units.
- Zoospores are formed in some protists, bacteria and fungi for their propagation.
- Zoospores possess one or more flagella for their propagation.
- Zoospores possess one or more flagella for their movement and are formed inside sporangia or zoosporangia.

8. Asexual reproduction:

Ans.
- Asexual reproduction is very common among lower plant groups, animal groups and fungi.
- Here the reproductive units are called spores, which can be motile or non-motile.

II. Differentiate between the following with two to three valid points :

1. Fission and Budding

Fission	Budding
• The organism enlarges in size and the nuclear material is divided equationally as in binary fission of bacteria to produce two identical units.	• Enlargement takes place anywhere on the cell surface and the nuclear material migrates along with some cytoplasm into that outgrowth.
• In multiple fission as in *Euglena* and *Amoeba*, the nucleus divides many times and multiple organisms emerge from that.	• These outgrowths called buds get segregated from the parent cell and develop into new organism. The division here is unequal. It is mostly seen in yeasts (*Saccharomyces*).

2. Zoospores and Conidia

Zoospores	Conidia
• Zoospores are motile asexual reproductive units seen in some algae, bacteria and fungi.	• Conidia are non-motile asexual reproductive units seen in some fungi like *Penicillium*.
• They are motile and borne endogenously in sporangia.	• They are exogenously borne on conidiophores.
• They are released from the sporangium when mature and develop into new organisms.	• They are easily disseminated by external agents like air and water to develop new organism.

3. Zoospores and Gametes

Zoospores	Gametes
• Zoospores are agents of asexual reproduction in some algae, bacteria and fungi. • They are borne inside sporangia and may be haploid or diploid. • They are motile in nature as they have flagella	• Gametes are agents of sexual reproduction and are haploid in nature. • They are borne in gametangia and are produced through meiosis or reduction division. • During fertilization male and female gametes fuse to form zygote. They can be motile or non-motile.

4. Grafting and Layering

Grafting	Layering
• It is a type of artificial vegetative propagation in which a young stem or bud (scion) of one plant is inserted into a rooted stem(stock) of another plant. • It is useful in developing more varieties from a single parent with desirable characters. • Examples -mango, lemon	• It is also a type of propagation in which adventitious roots are artificially induced to develop on branches while it is still attached to the plant. • Layering has evolved as a common means of vegetative propagation in many species in natural environment. • Example-rose, Jasmine

5. Asexual reproduction and Sexual reproduction

Asexual reproduction	Sexual reproduction
• Asexual reproduction involves only one parent organism, that results in production of offsprings which are identical to the parent • They are of various types like a) Binary fission b) Budding c) Vegetative propagation d) Sporogenesis e) Fragmentation f) Parthenogenesis g) Apomixis • It is seen in all types of plants and animals.	• Sexual reproduction involves one or two individuals where two reproductive units like gametes fuse during fertilization to form the zygote that develops into a new organism. • In the course of fertilization, gametes formed through meiosis are always haploid and the fertilized embryo is a diploid structure. • It is seen in all types of plants and animals. Syngamy, external fertilization and conjugation.

Group - C

Long Question Answers

1. Describe the process of asexual reproduction in different plant groups.

Ans.
- Asexual reproduction is very common in lower organisms, particularly in the kingdoms of Monera, Protista and Fungi.
- The mode of reproduction that does not involve the fusion of male and female reproductive units or gametes is called asexual reproduction.
- In lower plant groups various types of asexual reproduction are seen and those include
  a) Budding
  b) Binary and multiple fission
  c) Spore formation
  d) Fragmentation
  e) Regeneration etc.
- In higher plants vegetive propagation by roots, stems and leaves, micropropagation under controlled conditions and propagation by artificial methods like cuttings, grafting and layering etc. are also termed as asexual reproduction.

2. Give an account of vegetative propagation in angiosperms.

Ans.
- No specialized reproductive units are produced in vegetative propagation. Any vegetative part like roots, stems and leaves may get separated from the parent plant and grow into new individuals
- *Roots-Roots of Dahlia*, sweet potato etc. become thick and swollen due to storage of food. These roots develop adventitious buds, which can be separated and grown into new plants.
- **Stem-**
  i) Subaerial stems like-
    a) Runners of oxalis
    b) Sucker of banana/*Chrysanthemum*
    c) Stolon of jasmine
    d) Offset of *Eichhornia* and

ii) Underground stems like-

a) Rhizome of ginger

b) Tuber of potato

c) Bulb of onion

d) Corm of *Colocasia* can successly be used to propagate the plants.

- **Leaves –**

  Felshy succulent leaves of *Bryophyllum* bear adventitious buds in their margins, which can be separated and growth into new plants.

3. Describe the process of micropropagation. Discuss its advantages.

Ans.
- Micropropagation is the production of whole plants in large scale from small sections of plant material such as stem tip, node, meristem, embryo or even a seed using tissue culture technique.
- A small plant cutting or explant is sterilized and inoculated into culture vessel containing artificial nutrient medium.
- When incubated at desired regulated temperature the explant develops large number of shoots or a free growing callus.
- The callus is then subjected to hormonal manipulation for development of organs called organogenesis or embryo called embryogenesis.
- The developing shoots / plantlets / embryos can be further maneuvered to develop whole plants, which are then transferred to the field for their normal growth / development.
- **Advantages:-**

  a) Production of plants in large scale which are clones of each other.

  b) Production of species which are otherwise hard to grow.

  c) Can be produced at any time of year and can be stored until needed.

  d) Can be used to produce disease-free plants.

(a) SEXUAL REPRODUCTION IN FLOWERING PLANTS

Group - A

I. Select the correct answer from the choices given under each bit :

1. The end product(s) of sexual reproduction in flowering plants is / are :

(a) gametes (b) spores
(c) zygote (d) sporocarps

2. Which are the two essential whorls of a flower that bear sexual reproductive units ?

(a) calyx and Corolla
(b) corolla and androecium
(c) corolla and gynoecium
(d) androecium and gynoecium

3. The innermost wall layer of a microsporangium is :

(a) endothecium
(b) tapetum
(c) epidermis
(d) endodermis

4. Which one is responsible for the nutrition of developing pollens ?

(a) Tapetum
(b) Endodermis
(c) Epidermis
(d) Columella

5. Which one is the last cell of male sporophytic generation ?

(a) Megaspore mother cell
(b) Megaspore
(c) Microspore mother cell
(d) Microspore

6. Which one is not the characteristic feature of sporopollenin ?

(a) dominant component of pollen wall.
(b) can be easily degraded by enzymes
(c) can not be degraded by enzymes
(d) helps pollen grains to be preserved as fossils

7. Which one is different from other three ?

(a) microspore (b) pollen grain
(c) sperm (d) anther

8. Which is not the characteristic of vegetative cell of the pollen grains ?

(a) Spindle shaped
(b) Abundant reserve food materials
(c) Large irregular shaped nucleus
(d) Bigger than the generative cell

9. The part of the carpel that receives pollen grains is called :

(a) Ovary (b) Ovule
(c) Stigma (d) Style

10. Which are also called ovules ?

(a) Microsporangia
(b) Megasporangia
(c) Nucellus
(d) Anthers

11. Which of the following possess one seeded ovules ?

(a) Wheat, Rice, Mango
(b) Wheat, Rice, Papaya
(c) Wheat, Mango, Orchids
(d) Rice, Mango, Watermelon

12. Which is the correct sequence ?

(a) Thalamus, ovary, stigma and style

(b) Thalamus, ovary, style and stigma

(c) Stigma, ovary, thalamus and style

(d) Style, ovary, thalamus and stigma

13. Which one is the female gametophyte of angiosperms ?

(a) Nucellus (b) Ovary

(c) Ovule (d) Embryo sac

14. Synergids are part of :

(a) Antipodals

(b) Central Cell

(c) Egg apparatus

(d) Polar nuclei

15. Filiform apparatus are prolongation of :

(a) Antipodal cells

(b) Synergids

(c) Polar nuclei

(d) Egg cell

16. A typical embryo sac in angiosperms is 8 nucleate and :

(a) 8 Celled (b) 7 Celled

(c) 6 Celled (d) 4 Celled

17. Which pair shows autogamous pollination ?

(a) Cleistogamous & geitonogamous

(b) Cleistogamous & chasmogamous

(c) Cleistogamous & Xenogamous

(d) Chasmogamous & Xenogamous

18. Which is not a characteristic of Cleistogamous flower ?

(a) never open.

(b) anther and stigma on separate flowers.

(c) anthers and stigma in close contact.

(d) borne in same flower.

19. Indicate the characteristics of wind pollinated flowers ?

(a) Large, coloured, fragrant and have nectar.

(b) Small coloured flowers with light pollen grains carried in water.

(c) Small flowers, light and non-sticky pollen grains produced in large numbers.

(d) Large, Coloured, nectary, pollen grains sticky.

20. Which part of the flower provides nutrition to the insects in the process of pollination ?

(a) Nectar (b) Colour

(c) Scent (d) Size

21. Which is not an outbreeding device ?

(a) Pollen release and stigma receptivity not synchronised.

(b) Anther and stigma placed at different positions.

(c) Bisexual flowers and reproductive organs mature simultaneously.

(d) Flowers are unisexual.

22. Geitonogamy occurs in :

(a) Maize (b) Oxalis

(c) Viola (d) Commelina

23. When in a bisxual flower, pollen matures first and ovary matures later, it is called :

(a) Protogyny

(b) Protandry

(c) Unisexuality

(d) Heteromorphism

24. Which one does divide to form male gamete ?

(a) Tube cell
(b) Antipodal cell
(c) Generative cell
(d) Vegetative cell

25. Which part of the embryo sac does contain filiform apparatus ?

(a) Egg cells (b) Antipodal cell
(c) Central cell (d) Synergids

26. Which one can not be included under Pollen-Pistil interaction?

(a) Pollen recognition
(b) Pollen tube growth
(c) Pollen maturation
(d) Pollen inhibition

27. The process of removal of anthers from flower bud before anther dehisces in order to initiate hybridization is called :

(a) emasculation (b) pollination
(c) geitonogamy (d) bagging

28. In triple fusion, male gamete fuses with:

(a) Synergids (b) Central Cell
(c) Antipodals (d) Egg Cell

29. Which process does result in Zygote?

(a) Syngamy
(b) Triple fusion
(c) Pollen rejection
(d) Pollen incompatibility

30. Which one is a triploid structure ?

(a) egg cell
(b) embryo
(c) zygote
(d) primary endosperm nucleus

31. Which is unrelated pair ?

(a) Syngamy-Zygote
(b) Zygote-Embryo
(c) Primary endosperm nucleus-zygote
(d) Primary endosperm nucleus-endosperm

32. Which one is example of free nuclear endosperm ?

(a) Coconut Kernel
(b) Coconut water
(c) Rice grain
(d) Bean seeds

33. One of the following has no persistent seed coat.

(a) Rice (b) Wheat
(c) Maize (d) Groundnut

34. Which is unrelated pair ?

(a) Stamen - Pollens
(b) Carpel - Ovule
(c) Embryo sac - Egg cell
(d) Pollen grain - Megasporangium

35. Which is unrelated pair ?

(a) Calyx - Tepals
(b) Corolla - Petals
(c) Androecium - Stamens
(d) Gynoecium - Carpels

36. Which is the correct sequence in the formation of nuclear endosperm?

(a) Primary endosperm nucleus → Vacuolation → Free nuclear division → Cell organisation

(b) Cell organization → Primary endosperm nulceus → Vacuolation → Free nuclear division

(c) Primary endosperm nucleus → Free nuclear division → Vacuolation → Cell organisation

(d) Primary endosperm nucleus → Cell organisation → Vacuolation → Free nuclear division

37. Embryo develops from :

(a) Ovule

(b) Zygote

(c) Primary endosperm

(d) Ovary

38. Embryo consists of embryonal axis and :

(a) epicotyl (b) hypocotyl

(c) cotyledons (d) plume

39. Plumule can be called :

(a) roof tip (b) stem tip

(c) radicle (d) cotyledons

40. What is present as cotyledon of grass family ?

(a) scutellum

(b) embryonal axis

(c) hypocotyl

(d) epicotyl

41. Coleorhiza is the covering of :

(a) radicle and roof cap

(b) shoot apex and leaf primordia

(c) radicle and root hairs

(d) radicle and shoot apex

42. Coleoptile is the covering of :

(a) radicle and root cap

(b) shoot apex and leaf primodia

(c) shoot apex and internodes

(d) shoot apex and nodes

43. Fertilized ovule is :

(a) fruit (b) endosperm

(c) embryo (d) seed

44. Which pair is incorrect ?

(a) Non-albuminous seeds - No endosperm

(b) Albuminous seeds - Endospermous

(c) Non-albuminous seeds - Endospermous

(d) Persistent nucellus - perisperm

45. Which pair is unrelated ?

(a) Pea - Nonalbuminous

(b) Maize - Albuminous

(c) Castor - Albuminous

(d) Ground nut - Albuminous

46. Which one has non-albuminous seeds?

(a) Barley (b) Wheat

(c) Beans (d) Rice

47. What are the requirements for a seed to germinate ?

(a) Moisture, Oxygen & Temperature

(b) Moisture & Oxygen

(c) Moisture & Temperature

(d) Moisture, Water and Light

48. Matured ovary is a :

(a) Seed (b) Fruit

(c) Gamete (d) Zygote

49. True fruits develop from :

(a) thalamus (b) integlements

(c) nucellus (d) ovary

50. Which is not a correct statement about seeds?

(a) have better adaptive startegies for dispersal to new habitats.

(b) have sufficient food reserves for young seedlings.

(c) Produce no new genetic combination which may lead to variation.

(d) Provides nourishment till photosynthesis starts in new plant.

51. Seeds formed without fertilization is called :

(a) Panthenocarpy

(b) Apomixis

(c) Syngamy

(d) Triple fusion

52. Which is not an apomictic process ?

(a) Seeds formed by sexual reproduction.

(b) Egg diploid but no sexual reproduction.

(c) Nucellar tissue produce embryo, no sexual reproduction.

(d) Seeds develop but no sexual reproduction.

53. Anemophilous flowers are pollinated by :

(a) Wind (b) Water

(c) Animals (d) Man

54. Male gametes are formed from :

(a) tube cell

(b) generative cell

(c) stalk cell

(d) primordial cell

55. Which cell of embryo sac does form zygote ?

(a) Synergid

(b) Antipodals

(c) Central Cell

(d) Egg Cell

56. Which one does not represent a haploid stage ?

(a) Microspore

(b) Male gamete

(c) Microsporangium

(d) Pollen

57. Which is a diploid stage ?

(a) Megasporangium

(b) Megaspore

(c) Embryo sac

(d) Female gametophyte

58. What are archesporium or archesporial cells?

(a) Endothelium (b) Epidemis

(c) Tapetum (d) Middle layers

59. What is the main component of outer layer (exine) of microspore wall?

(a) Cellulose (b) Chitin

(c) Lipoprotein (d) Sporopollenin

60. Which layer of the microsporangial wall does help in dehiscence of spores ?

(a) Endothecium (b) Tapetum

(c) Epidermis (d) Hypodermis

61. How many nuclei form male gametophyte of angiosperms at the time of fertilization ?

(a) 1 (b) 2

(c) 3 (d) 4

62. Which is not a part of the carpels ?

(a) Ovary (b) Style

(c) Stigma (d) Anther

63. Which type of Ovules are called anatropous?

(a) Upright

(b) Inverted

(c) Horse-shoe shaped

(d) Horizontal

64. Egg apparatus consists of :

(a) Egg Cell + Synergids

(b) Antipodals + Synergids

(c) Antipodals + Egg Cell

(d) Polar nulcei + Synergids

65. Which one normally fuses with male gamete to form zygote ?

(a) Polar nuclei (b) Synergids

(c) Antipodals (d) Egg Cell

66. The bisexual flowers which never open so as to effect self pollination are called _____.

(a) Cleistogamous

(b) Homogamous

(c) Dichogamous

(d) Herkogamous

67. Which are the special characteristics of entomophilous flowers ?

(a) Inconspicuous, light and produced in large numbers

(b) Have colour, nectar and scent.

(c) Provide shelter to the agents of pollination and have nectar.

(d) Flowers never open and homogamous

68. When pollen tube enters through micropyle to effect fertilization in angiosperms, it is called :

(a) Chalazogamy

(b) Mesogamy

(c) Porogamy

(d) Herkogamy

69. What type of endosperm is seen in coconut?

(a) Nuclear
(b) Cellular
(c) Holobial
(d) Cellular and Helobial

70. In which family are endosperms absent ?

(a) Gramineae
(b) Orchidaceae
(c) Cruciferae
(d) Papilionaceae

71. In which case does endosperm contain mainly cellulose?

(a) Coconut
(b) Castor
(c) Black Pepper
(d) Rice

72. What is the major component of aleurone layer ?

(a) Fat
(b) Proteins
(c) Carbohydrate
(d) Oil

II. Fill in the blanks :

1. In flowering plants, the haploid male and female gametes fuse to form the diploid plant body called _____.
2. Microsporangia are borne in _____ part of stamens.
3. Pollen grains are the first cells of _____ Gametophyte.
4. Megaspore _____ cells are the last cells of sporophytic generation.
5. In flowering plants ovules develop into _____.
6. Anther wall layer that helps in dehiscence of microspores is called _____.
7. The innermost layer of anther wall which helps in the nourishment of developing pollens is known as _____.
8. The main component of exine of microspore wall is _____.
9. In insect pollinated flowers, exine is covered by yellowish, viscous and sticky substance called _____.
10. Ovules can be known as _____.
11. Normally, embryosac is seven-celled and _____ nucleated structure.
12. Unicellular zygote of flowering plants develops into multicellular _____.
13. One male gamete fuses with the egg cell of embryosac in the process of fertilization is called _____.
14. As a result of triple fusion, primary _____ cell is formed.
15. In _____ flowers, anthers and stigma mature at the same time.
16. Self pollinating, closed, bisexual flowers are called _____ flowers.
17. When stamens and carpels of the same flower mature at different times to effect cross pollination, then the condition is called _____.

18. After pollination, pollen germinates on _____ of the carpels.
19. When pollen tube enters through he micropyle of the ovule, it is called _____.
20. When pollen tube does not enter through micropyle and chalaza, but by penetrating integuments, it is called _____.
21. Endosperm persists in _____ seeds.
22. Endosperm is totally absent in _____.
23. When fruit develops from unfertilized eggs, it is called _____.
24. Formation of more than one embryo inside the ovule is called _____.
25. When fruit development takes place from other than ovary, it is called a _____ fruit.
26. Parthenogenesis means development of fruit without _____.
27. In some mature seeds, the residual nucellus persists after being consumed by embryo and it is called _____.
28. In ornithophily the agents for cross pollination are _____.
29. The cells present in two sides of egg in the egg apparatus are called _____.
30. Bisexual flowers which never open are called _____ or closed flowers.
31. When calyx and corolla are alike, they are called _____.
32. Androecium and _____ form essential whorls of a flower.
33. A root parasite possessing the largest flowers is _____.
34. When exine is covered by an yellowish viscous and sticky substance, it is called _____.
35. In dichogamous bisexual flower, when gynoecium matures first and androecium later so that cross pollination can be effected, the condition is called _____.
36. Diclinous flowers are also called _____.

III. Answer in one word :

1. Study of pollen grains -
2. Female gamete developing into a new individual -
3. Product of fusion of male and female gamete -
4. Stalk of the flower -
5. Innermost layer of anther wall that provide nourishment -
6. Stalk of ovule -
7. Product of triple fusion -
8. Unfertilized eggs developing into fruits-
9. Recurrent agamospermy -
10. End product of triple fusion -
11. Seeds without endosperm -
12. Fertilized / mature ovule -
13. Fertilized / mature ovary -
14. Product of syngamy -
15. The phase of rest of seeds before germination -
16. Which plants have the smallest flowrers ?
17. What are the plants having male and female flowers borne separately on the same plant called ?
18. The main body of the ovule is called:

IV. Correct the statements, if required by changing the underlined word/ words only :

1. The innermost layer of microsporangium is endothecium.
2. The product of syngamy is endosperm.
3. Embryo is a triploid structure.
4. Entry of pollen tube through micropyle is called misogamy.
5. The ovary is also known as megasporangium.
6. Anemophilous flowers are pollinated by ants and termites.
7. The ovule is attached to the placenta of ovary by means of nucellus.
8. Animals acting as agents of pollination is called anemophily.

V. Answer in one sentence :

1. What is meant by zygote ?
2. What is archesporium or archesporial cell ?
3. What is syngamy ?
4. What is amphimixis ?
5. How does primary endosperm cell develop ?
6. What is pollination ?
7. What is autogamy ?
8. What is the meaning of homogamy ?
9. What is diclinous condition ?
10. What is the meaning of self incompatibility in the process of sexual reproduction?
11. Where is the pollen pistil interactions initiated ?
12. Why is it called double fertilization and triple fusion in angiosperms ?
13. How may cells and how many nuclei are present in the mature embryosac before fertilization ?
14. What is a fruit ?
15. What is a seed ?
16. How does post fertilization development take place in helobial endosperm.
17. What are exalbuminous seeds ?
18. What are endospermous seeds ?
19. What is embryogeny ?
20. What is apomixis ?

Group - B

I. Write notes on the following in 2 to 3 sentences.

1. Parthenogenesis
2. Allogamy
3. Herkogamy
4. Geitonogamy
5. Xenogamy
6. Self sterility
7. Entomophily
8. Embryosac
9. Polyembryony
10. Incompatibility
11. Megasporogenesis
12. Pollination
13. Oubreeding devices
14. Endosperm
15. Apomixis

II. Differentiate between the following with two to three valid points :

1. Pollination and Fertilization
2. Dichogamy and Herkogamy
3. Protogyny and Protandry
4. Self pollination and Cross pollination
5. Embryo and Endosperm
6. Gamete and Zygote
7. Mycropyle and Chalaza
8. Zoophily and Anemophily
9. Double Fertilization and Triple Fusion
10. Porogamy and Chalazogamy
11. Apospory and Apogamy
12. Monocot Embryo and Dicot Embryo
13. Nuclear and Cellular Endosperm
14. Microspore and Megaspore
15. Exine and Intine
16. Egg Apparatus and Synergids
17. Indothecium and Tapetum
18. Auogamy and Geitonogamy
19. Geitonogamy and Xenogamy
20. Parthenocarphy and Parthenogenesis

Group - C

Long Answer Types Questions

1. Describe the development of male gametophyte in angiosperms.
2. Describe the development of female gametophyte in angiosperms.
3. Give an account of double fertilization and triple fusion in angiosperms.

ANSWER KEYS

(a) SEXUAL REPRODUCTION IN FLOWERING PLANTS

Group - A

I. Select the correct answer from the choices given under each bit :

1. (c)	19. (c)	37. (b)	55. (d)
2. (d)	20. (a)	38. (c)	56. (c)
3. (b)	21. (c)	39. (b)	57. (a)
4. (a)	22. (a)	40. (a)	58. (c)
5. (c)	23. (b)	41. (a)	59. (d)
6. (b)	24. (c)	42. (b)	60. (a)
7. (d)	25. (d)	43. (d)	61. (c)
8. (a)	26. (c)	44. (c)	62. (d)
9. (c)	27. (a)	45. (d)	63. (b)
10. (b)	28. (b)	46. (c)	64. (a)
11. (a)	29. (a)	47. (c)	65. (d)
12. (b)	30. (d)	48. (b)	66. (a)
13. (d)	31. (c)	49. (d)	67. (b)
14. (c)	32. (b)	50. (c)	68. (c)
15. (b)	33. (d)	51. (b)	69. (a)
16. (b)	34. (d)	52. (a)	70. (b)
17. (b)	35. (a)	53. (a)	71. (c)
18. (b)	36. (c)	54. (b)	72. (b)

II. Fill in the blanks :

1. sporophyte
2. anthers
3. male
4. mother
5. seeds
6. endothecium
7. Tapetum
8. Sporopollenin
9. pollen kitt
10. Megasporangium
11. eight
12. embryo
13. syngamy
14. endosperm
15. homogamous
16. cleistogamous
17. dichogamy
18. stigma
19. porogamy
20. mesogamy
21. albuminous/endospermous
22. exalbuminous/nonendospermous
23. parthenocarpy
24. polyembryony
25. false
26. fertilization
27. perisperm
28. birds
29. synergids
30. cleistogamous
31. Perianth / Tepals
32. Gynoecium
33. Raflessia
34. Sporopollenin
35. Protogyny
36. Unisexual

III. Answer in one word :

1. polynology
2. parthenogenesis
3. zygote
4. pedicel
5. tapetum
6. funicle
7. endosperm
8. parthenocarpy
9. apospory / diplospory
10. endosperm
11. exalbuminous
12. seed
13. fruit
14. zygote
15. dormancy
16. Duckweed / *Wolffia*
17. Monoecious
18. Nucellus

IV. Correct the statements, if required by changing the underlined word/ words only :

1. tapetum
2. zygote
3. Endosperm
4. porogamy
5. ovule
6. Myrmecophilous
7. funiculus
8. wind

V. Answer in one sentences :

1. Zygote is a post-fertilized product resulted from the fussion of sexual reproductive units.
2. Fertile cells from which microspore, megaspore develop.
3. Syngamy is the fusion of male gamete with the egg cell of embryosac to form a zygote.
4. Fusion between gametes of opposite sexes is called amphimixis.
5. By fusion of second male gamete with the central cell, primary endosperm nucleus is formed in angiosperms.
6. Pollination is the transfer of pollen from an anther of a plant to the stigma of the same or another plant.
7. Transfer of pollen grains to the stigma of the same flower is autogamy.
8. When the stamens and carpels of a flower mature simultaneously, then it is called homogamy.
9. The flowers are unisexual and male and female flowers may be borne on the same plants or different plants.
10. Incompatibility is the inability of centric gametes even from the genetically similar plant speices fuse with each other.
11. It is initiated on stigma.
12. As there are two separate fusion of male gametes taking place within the embryo sac of angiosperms, one with egg cell and other with central cell, it is called double fertilization and triple fusion.
13. 7 cells and 8 nuclei.
14. Mature ovary is a fruit.
15. Matured ovule is a seed.
16. First division is cellular and subsequent divisions are nuclear.
17. Seeds, which store food material in the cotyledons.
18. Seeds which store food material in their endosperms.
19. Process of development of embryo from zygote.
20. The process of development of zygote without meiosis and syngamy is called apomixis.

Group - B

I. Write notes on the following in 2 to 3 sentences.

1. **Parthenogenesis**

Ans. (i) It is a natural form of asexual reproduction found in plants.

(ii) Here growth and development of embryos occur without fertilization.

(iii) Haploid eggs without fertilization develop into embryos and ultimately into viable plants.

2. Allogamy -

Ans. (i) It is a case of cross pollination where pollen grains of one flower is transferred to the stigma of a flower of same or different plant of same spp.

(ii) It is best favoured by dicliny, where flowers are unisexual.

(iv) Xenogamy is also allogamy, but pollination occurs between genetically different anther and stigma.

3. Herkogamy -

Ans. (i) In hermaphroditic angiosperms, it is a strategy to reduce sexual interference between anthers and stigma.

(ii) There is spatial separation of anthers and stigma within flowers.

(iii) The barrier prevents self pollination.

4. Geitonogamy -

Ans. (i) It is a case of pollination of one flower by another growing on same plant.

(ii) Although geitonogamy is functionally cross pollination, genetically it is same as autogamy since pollen grains come from the same plant.

(iii) Example - Maize

5. Xenogamy -

Ans. (i) It is the fertilization of a flower by the pollen of a flower from a different plant.

(ii) Produces genetically modified offsprings.

(iii) Example - grasses, onion etc.

6. Self sterility -

Ans. (i) It is a phenomenon in which a plant is unable to perform successful self fertilization.

(ii) It prevents self pollination.

(iii) It is also known as self incompatibility. Ex. - tobacco, potato.

7. Entomophily -

Ans. (i) It is a form of pollination whereby pollen is distributed by insects, like bees, flies, beetles etc.

(ii) Entomophilous flowers are usually brightly coloured, scented and with nectar. Ex. - Orchids.

8. Embryosac -

Ans. (i) It is the female gametophyte present in the ovule of flowering plants.

(ii) This thin-walled sac contains the egg nucleus and other nuclei

which give rise to endosperm and embryo on fertilization.

(iii) Embryo sac is said to be formed when haploid megaspore nucleus divides. It possesses two haploid nuclei and six haploid cells which do not have cell walls.

9. Polyembryony -

Ans. (i) Occurrence of more than one embryo in a seed is called polyembryony.

(ii) It is due to formation of more than one egg in the embryosac.

(iii) Ex. - Orange, lemon etc.

10. Incompatibility -

Ans. (i) It is a means of controlling breeding behavior among plants.

(ii) It acts to prevent self fertilization and to prevent sterilization of ovules by foreign pollen.

(iii) Incompatibility can be (a) heteromorphic with differences in floral structure or (b) homomorphic, with no floral differences.

11. Megasporogenesis -

Ans. (i) It is the process by which megaspores are formed in the ovule of seed plants.

(ii) Meiotic division of megaspore mother cell leads to formation of haploid megaspores and then the embryosac.

(iii) It take splace in the gynoecium of the flower.

12. Pollination -

Ans. (i) It is the process of transfer of pollen grains from the anther of a flower to the stigma of same or a different flower.

(ii) Pollens are carried by wind, water, insects and animals to the stigma.

(iii) The germination of pollen and penetration of pollen tube into the ovule leads to fertilization and formation of fruits and seeds.

13. Outbreeding devices -

Ans. (i) These are devices to discourage self pollination and encourage cross pollination.

(ii) The mechanisms are :

- unisexuality
- dichogamy
- self sterility
- herkogamy
- heterostyly

14. Endosperm -

Ans. (i) It is the tissue that surrounds and nourishes the embryo in the seeds of angiosperms.

(ii) Following double fertilization, fusion of a male gamete with two polar nuclei leads to formation of endosperm.

(iii) It is triploid (3n) tissue

15. Apomixis -

Ans. (i) It is asexual reproduction without fertilization.

(ii) When diploid egg cell without division developes into embryo, it is diploid apospory.

(iii) Development of fruit from haploid is called apogamy or non-recurrent apomixis.

II. Differentiate between the following with two to three valid points :

1. Pollination and Fertilization

Pollination	Fertilization
(i) Transfer of pollen grains from the anther to the stigma of flower.	(i) Fusion of haploid gametes forming a diploid zygote.
(ii) Part of sexual reproduction in plants	(ii) Also part of sexual reproduction in plants.

2. Dichogamy and Herkogamy

Dichogamy	Herkogamy
(i) Here male and female reproductive organs mature at different times within a single flower or across several flowers.	(i) Here there is spatial separation of authers and stigmas within flowers.
(ii) It encourages cross fertilization and prevents self fertilization. Can be (a) protandry and (b) Protogyny	(ii) It encourages out breding and prevents sefl pollination.

3. Protogyny and Protandry

Protogyny	Protandry
Refers to maturation and development of male parts before female parts. Ex. - Sapota	Refers to maturation and development of female parts prior to male parts. Ex. - Sunflower

4. Self pollination and Cross pollination

Self pollination	Cross pollination
(i) Pollen grains are transferred from the anther to the stigma of the same flower or another flower of the same plant.	(i) Also called allogamy.
(ii) It can be (a) autogamy - same flower or (2) geitonogamy - between flowers of two different plants of same spp.	(ii) Transfer of pollen grains takes place from anther of one plant to the stigma of another plant.

5. Embryo and Endosperm

Embryo	Endosperm
(i) Syngamy leads to development of a diploid zygote. Zygote grows into a multi cellular embryo.	(i) As a result of triple fusion between one male gamete and two polar nuclei a triploid primary endosperm is formed, which grows into endosperm.
(ii) Embryo consists of embryonal axis and cotyledon(s)-(one-monocot, two- dicot)	(ii) It is the nutritive tissue of the embryo.

6. Gamete and Zygote

Gamete	Zygote
(i) These are reproductive cells that take part in sexual reproduction.	(i) Zygote is the product of fusion of male and female gametes.
(ii) These are haploid cells produced by meiosis.	(ii) It is a diploid structure and represents the first cell of the next generation. It carries genetic information from both parents.
(iii) Fusion of male and female gametes leads to formation of a diploid zygote.	

7. Mycropyle and Chalaza

Micropyle	Chalaza
(i) It is a small opening in the integuments of the ovule through which pollen tube enters the embryosac for fertilization.	(i) In ovules, the Chalaza is located opposite the micropyle opening of the integuments.
(ii) It also helps in absorbing water at the time of germination of seeds.	(ii) It is the tissue where the integuments and nucellus are joined.

8. Zoophily and Anemophily

Zoophily	Anemophily
(i) It is the process of pollination by animals.	(i) It is the process of pollination by wind.
(ii) Pollen grains are transferred by birds, bats and other animals.	(ii) Pollen grains are produced in large numbers. The pollens are dry and remain air borne for quite sometime some of them only reach stigmatic surface.

9. Double Fertilization and Triple Fusion

Double Fertilization	Triple Fusion
(i) Of the two male gametes produced at the tip of the pollen tube, one fuses with the egg cell nucleus, called syngamy. (ii) Syngamy results in formation of zygote, a diploid product which ultimately develops into embryo. (iii) The process is called double fertilization.	(i) The second male gamete fuses with definite nucleus (polar nuclei) to from primary endosperm nucleus. This process is called triple fusion. (ii) It is a triploid product (3n), which develops into endosperm. (iii) Endosperm acts as nutritive tissue for the developing embryo.

10. Porogamy and Chalazogamy

Porogamy	Chalazogamy
(i) The entry of pollen tube into the ovule through micropyle is known as porogamy.	(i) The entry of pollen tube into the ovule from Chalazal region is known as Chalazoamy.

11. Apospory and Apogamy

Apospory	Apogamy
(i) This is a process by which a diploid egg cell, without fertilization develops into embryo or 2n gametophyte. (ii) This is also called recurrent agamospermy.	(i) This is a process of development of embryo or sporophyte from a haploid egg cell, without fertilization. (ii) This is also called non-recurrent agamospermy.

12. Monocot Embryo and Dicot Embryo

Monocot Embryo	Dicot Embryo
(i) The embryo consists of one cotyledon, primary axis and rudimentary shoot and root. (ii) The coty leadon occurs at the terminal position. (iii) A protective sheath called coleorhiza covers the radicle. Ex.-grases, cereals, banana etc.	(i) The embryo consists of two cotyleadons, primary axis and rudimentary shoot and root.. (ii) The two cotyleadons occur laterally. (iii) The dicot embryo does not have a coleorhiza. Ex.-Woody plants.

13. Nuclear and Cellular Endosperm

Nuclear Endosperm	Cellular Endosperm
(i) The primary endosperm nucleus (3n) undergoes repeated division within the cytoplasm and they are free. This results in formation of large number of free nuclei in the central cell of the classified as embryosac. Ex. - Coconut water.	(i) The divison of the primary end (-) osperm nucleus is followed by wall formation after every division. (ii) On the basis of orientation of walls following the first two or three divisons, this can be further classified as helobial type, which is in between nuclear and cellular types.

14. Microspore and Megaspore

Microspore	Megaspore
(i) A diploid microspore mother cell divides meiotically to give rise to four haploid microspores. (ii) Microspores develop into male gametophytes contained inside pollen grains of land plants.	(i) A megaspore mother cell (2n) meiotically divides, resulting in production of four megaspores (haploid). (ii) Megaspores develop into female gametophytes, (embryo sac) which produces egg cells.

15. Exine and Intine

Exine	Intine
(i) It is the out layer of pollen grain containing sporopollenin. (ii) Exine is thicker and harder than intine and resistant to external factors like temperature, acid/alkali and enzymes.	(i) Intine is the inner layer of a pollen grain containing cellulose and pectin.

16. Egg Apparatus and Synergids

Egg Apparatus	Synergids
(i) An egg apparatus is a group of three cells present at the micropylar end of the seven-celled embryosac of angiosperms. (ii) It comprises of an egg cell and two associated cells called synergids.	(i) These are the two specialised cells that lie adjacent to the egg cell in the female gametophyte of angiosperms. (ii) They play important role in polen tube guidance and function. After fertilization, the synergids disintegrate.

17. Endothecium and Tapetum

Endothecium	Tapetum
(i) It is the layer of cells lying beneath the epidermis of the anther wall.	(i) It is the innermost cell layer in the anther, which surrounds the sporogenous tissue or the developing pollen mother cells.
(ii) As anther matures, thickening often develops in the cell walls of endothecium which helps in dehiscence.	(ii) It plays an important role in pollen development i.e. nourishment of microspores and formation of exine.

18. Autogamy and Geitonogamy

Autogamy	Geitonogamy
(i) It is self fertilization i.e. pollens from the stamen of a plant reaches the stigma of the carpel of the same plant and fertilizes the egg cell.	(i) It is the transfer of pollen grains from the anther of a flower to the stigma of another flower on the same plant.
(ii) It can be between two flowers of the same plant or between flowers of two different plants of the same spp.	

19. Geitonogamy and Xenogamy

Geitonogamy	Xenogamy
(i) It is the transfer of pollen grains from the anther of a flower to the stigma of another flower on the same plant. The two parents are genetically the same.	(i) It is a type of cross pollination.
	(ii) Here transfer of pollen grain takes place from anther of one plant to the stigma of another plant which are genetically different.

20. Parthenocarphy and Parthenogenesis

Parthenocarphy	Parthenogenesis
(i) It refers to development of fruit without fertilization.	(i) It is the development of an embryo from an unfertilised egg cell.
(ii) It produces sterile or seedless fruits. Ex.- banana, grapes etc.	(ii) It is a method of self reproduction in which egg cells deveop into a new plant.

Group - C

Long Question Answers

1. Describe the development of male gametophyte in angiosperms.

Ans. (i) Microspore is the first cell of the male gametophyte. Describe the developmental changes with diagrams in the microspore.

(ii) Pre-pollination and post-pollination changes.

(iii) Migration of the tube cell nucleus and division of the generative nucleus mitotically leads to formation of a three celled male gametophyte, which is ready for fertilization.

2. Describe the development of female gametophyte in angiosperms.

Ans. (i) Megasporogenesis inside the ovule leads to formation of four megaspores. Only one survives or other three degenerate.

(ii) The functional gamete develops into the female gametophyte.

(iii) Give a structure of embryo sac showing the antipodals, polar nuclei and the egg apparatus. The 8-nucleate and 7-celled female gametophyte forms the embryo sac.

3. Describe what is double fertilization and triple fusion.

Ans. (i) Double fertilization or syngamy leads to formation of zygote/embryo (2n).

(ii) Triple fusion leads to formation of endosperm (3n).

(iii) Give a longitudinal section of the gynoecium showing growth of pollen tube.

UNIT - II : GENETICS AND EVOLUTION

(a) HEREDITY AND VARIATION

Group - A

I. Select the correct answer from the choices given under each bit :

1. Segregation of genes occurs in :

(a) Embryo formation

(b) Anaphase I

(c) Anaphase II

(d) Metaphase II

2. To see the effect of sex inheritance Mendel performed :

(a) Test cross

(b) Out cross

(c) Reciprocal cross

(d) Back cross

3. Which of the following statements is Incorrect ?

(a) Gene is a sequence of nucleotides

(b) During the process of gene expression, DNA is first copied into RNA

(c) Genes can acquire mutations in their sequence

(d) None of the above

4. *Drosophila* of plant kingdom is :

(a) Pink bread mould

(b) Pea

(c) Maize

(d) Green mould

5. Mendel conducted his hybridization experiments with garden pea for :

(a) 6 years (b) 7 years

(c) 8 years (d) Many years

6. From a cross AABb x aaBb, the genotypes AaBB : AaBb : Aabb : aabb are obtained in ratio :

(a) 1:1:1:1 (b) 1:2:1:0

(c) 0:3;1:0 (d) 1:1:1:0

7. A dwarf Pea plant is treated with gibberellin which makes it tall.This plant is crossed with genotypically pure tall plant. Phenotypic ratio in next generation shall be :

(a) 3 tall : 1 dwarf

(b) 50% tall : 50%dwarf

(c) All tall

(d) All dwarf

8. How many genotypes can be produced by two alleles A and a :

(a) 1 (b) 3

(c) 2 (d) 4

9. Which law Mendel would not have proposed, if the phenomenon of linkage was known to him :

(a) Law of Unit Character

(b) Law of Dominance

(c) Law of Segregation

(d) Law of independent assortment

10. The contrasting traits of characters chosen by Mendel were :

(a) Stem height, flower colour, flower position, pod shape, pod colour, seed shape, seed colour

(b) Stem height, flower position, pod length, pod shape, seed size, seed colour

(c) Stem height, flower colour, pod shape, pod colour, seed shape, seed colour, seed size

(d) Plant height, flower position, pod length, pod shape, seed size, seed colour

11. In a dihybrid cross, in F2 generation, the parental types are far greater in number than the recombinants. This is due to :

(a) Linkage
(b) Multiple allelism
(c) Incomplete dominance
(d) Complete dominance

12. The term allele was coined by :

(a) Bateson
(b) Bateson and Punnet
(c) Bateson and Saunders
(d) Morgan

13. The principle of independent assortment of characters is proved by :

(a) Observation that F1 progeny is tall
(b) Appearance of tall and dwarf in 3:1 ratio
(c) Appearance of tall and dwarf in the F2 population
(d) None of the above

14. A trihybrid ratio of 27:9:9:9:3:3:3:1 is obtained because of

(a) Multiple alleles
(b) Interaction genes
(c) Multiple factor inheritance
(d) Independent assortment of genes

15. Mendel started with :

(a) A large number of characters in pea plant
(b) 7 pairs of characters
(c) 14 traits
(d) None of the above

16. In a dihybrid cross when one pair of allele shows incomplete dominance, ratio comes to :

(a) 1:2:1
(b) 2:4:2:1:2:1:1:2:1
(c) 3:6:3:1:2:1
(d) 9:3:3:1

17. The gametes produced by individual with genotypes of aaBBCc are :

(a) 2 (b) 8
(c) 4 (d) 6

18. The number of genotypes in ABO blood groups are

(a) 5 (b) 6
(c) 7 (d) 8

19. Which one of the following is the oldest to be associated with breeding experiments in plants :

(a) Naudin (b) Goss
(c) Kolreuter (d) Knight

20. ABO blood group is an example of:

(a) Co-dominance
(b) Multiple allelism
(c) Epistasis
(d) Both a and b

21. A test cross of AaBbCC produces how many phenotypes :

(a) 16 (b) 12
(c) 8 (d) 4

22. Wrinkle seeds are produced because of :

(a) A wild allele for starch production
(b) A mutant allele with no function towards starch production
(c) A mutant allele with less efficient function towards starch production
(d) A mutant allele with more efficient function towards starch production

23. Number of laws formulated by Mendel is :

(a) 2 (b) 3
(c) 4 (d) 5

24. Incomplete dominance was discovered by :

(a) Correns (b) Bateson
(c) Johansen (d) Mendel

25. A Mendelian experiment consisted of breeding of tall pea plants bearing violet flowers with short pea plants bearing white flowers. The progeny all bore violet flowers but almost half of it were short. This suggests that the genetic makeup of tall parent can be depicted as :

(a) TTWW (b) TTww
(c) TtWW (d) TtWw

26. Two genes R and Y are located very close on the chromosome linkage map of maize plant. When RRYY and rryy genotypes are hybridized the F2 segregation will show :

(a) Segregation in the expected 9:3:3:1 ratio
(b) Segregation in 3:1 ratio
(c) Higher number of parental types
(d) Higher number of recombinant types

27. Person having genotype IA IB would show the blood group as AB. This is because of :

(a) Pleiotropy
(b) Multiple alleles
(c) Co-dominance
(d) Both b and c

28. Which of the following may not result in variations among siblings?

(a) Independent assortment of gene
(b) Crossing over
(c) Linkage
(d) Mutation

29. Which of the following method is more suitable for finding both phenotypic and genotypic ratios in Mendelian/Non-Mendelian crosses?

(a) Punnets square
(b) Pie square
(c) Forked line
(d) All the above

30. Distance between two linked genes is measured in map units that depicts :

(a) Ratio of crossing over between them

(b) Cross-over value

(c) Number of genes between them

(d) Both a and b

31. Inheritance of skin colour in humans is an example of :

(a) Point mutation

(b) Polygenic inheritance

(c) Co-dominance

(d) Chromosomal aberration

32. Which is correct about traits chosen by Mendel ?

(a) Terminal pod is dominant

(b) Constricted pod is dominant

(c) Green coloured pod is dominant

(d) Tall plants are recessive

33. Mendel's Law of independent assortment holds good for genes situated on the :

(a) non-homologous chromosome

(b) homologous chromosome

(c) extra nuclear genetic elements

(d) same chromosome.

34. In *Mirabilis jalapa*, crossing of red flowered and white flowered plants yields pink flowered plants. This is due to :

(a) Crossing over

(b) Complete dominance

(c) Incomplete dominance

(d) Epistasis

35. In the F2 generation of a Mendelian dihybrid cross the number of phenotypes and genotypes are :

(a) phenotypes – 4; genotypes – 16

(b) phenotypes – 9; genotypes – 4

(c) phenotypes – 4; genotypes – 8

(d) phenotypes – 4; genotypes – 9.

36. Occasionally, a single gene may express more than one effect. The phenomenon is called :

(a) multiple allelism

(b) mosaicism

(c) pleiotropy

(d) polygeny

37. The colour based contrasting traits in seven contrasting pairs, studied by Mendel in pea plant were :

(a) 1 (b) 2

(c) 3 (d) 4

38. Which of the following characters was not chosen by Mendel ?

(a) Pod shape

(b) Pod colour

(c) Location of flower

(d) Location of pod

39. What will be the distribution of phenotypic features in the first filial generation after a cross between a homozygous female and a heterozygous male for a single locus ?

(a) 3 : 1 (b) 1 : 2 : 1

(c) 1 : 1 (d) None of these

40. Polygenic inheritance is :

(a) Qualitative
(b) Quantitative
(c) Qualitative or quantitative
(d) None of the above

41. In a monohybrid cross between two heterozygous individuals, percentage of pure homozygous individuals obtained in F1 generation will be :

(a) 25 % (b) 50 %
(c) 75 % (d) 100 %

42. In Bombay phenotype the blood group is closer to :

(a) O
(b) AB
(c) A or B
(d) Any of the groups

43. What is the probability of production of dwarf offspring in a cross between two heterozygous tall pea plants?

(a) Zero (b) 50%
(c) 25% (d) 100%

44. Mendel formulated the law of purity of gametes on the basis of :

(a) monohybrid cross
(b) dihybrid cross
(c) test cross
(d) back cross

45. Erythroblastosis occurs when

(a) Mother is Rh negative father is Rh positive
(b) Father is Rh negative and mother is Rh positive
(c) Both are Rh positive
(d) Both are RH negative

46. The inheritance of flower colour in Antirrhinum (dog flower) is an example of :

(a) incomplete dominance
(b) co-dominance
(c) multiple alleles
(d) linkage

47. In *Antirrhinum* (dog flower), phenotypic ratio in F2 generation for the inheritance of flower colour would be :

(a) 3 : 1 (b) 1 : 2 : 1
(c) 1 : 1 (d) 2 : 1

48. Phenotypic and genotypic ratio is similar in case of :

(a) complete dominance
(b) incomplete dominance
(c) over dominance
(d) epistasis

49. What can be the blood group of offspring when both parents have AB blood group ?

(a) AB only
(b) A, B and AB
(c) A, B, AB and O
(d) A and B only

50. Inheritance of roan coat in cattle is an example of :

(a) incomplete dominance
(b) co-dominance
(c) multiple alleles
(d) none of these

51. ABO blood grouping in human beings illustrates the example of :

(a) incomplete dominance

(b) co-dominance

(c) multiple allelism

(d) Both (b) and (c)

52. How many types of gametes can be produced by a diploid organism who is heterozygous for 4 loci?

(a) 4 (b) 8

(c) 16 (d) 32

53. Which three scientists independently rediscovered Mendel's work ?

(a) Avery, McLeod, McCarty

(b) Sutton, Morgan and Bridge

(c) Bateson, Punnet and Bridges

(d) de Vries, Correns and Tschermak

54. Two crosses between the same pair of genotype or phenotype in which the source of the gametes are reversed in one cross is known as

(a) Reverse cross

(b) Dihybrid cross

(c) Test cross

(d) Reciprocal cross

55. Which of the following are reasons for Mendel's success? (i) Usage of pure lines or pure breeding varieties (ii) Consideration of one character at a time (iii) Maintenance of statistical records of experiments (iv) Knowledge of linkage and incomplete dominance :

(a) (i) and (ii) only

(b) (i), (ii) and (iii)

(c) (i) and (iv) only

(d) (ii), (iii) and (iv)

56. Select the disease which is caused by recessive autosomal genes when present in homozygous conditions.

(a) Alkaptonuria

(b) Albinism

(c) Cystic fibrosis

(d) All of these

57. Which of the following trait is controlled by dominant autosomal gene?

(a) Polydactyly

(b) Huntington's chorea

(c) PTC (phenylthiocarbamide) tasting

(d) All of these

58. Which is correct about the traits chosen by Mendel?

(a) Terminal pod is dominant

(b) Constricted pod is dominant

(c) Green coloured pod is dominant

(d) Tall plants are recessive

59. A recessive trait in garden pea is :

(a) Wrinkled seeds

(b) Tall stem

(c) Round seeds

(d) Coloured seed coat

60. 'Gametes are never hybrid' is a statement of the law of :

(a) Dominance
(b) Segregation
(c) Independent assortment
(d) Random fertilization

61. R is dominant red flower trait while r is recessive white flower trait. Heterozygous Rr (red) is crossed with homozygous red flowered plant. 64 offspring are produced number of white flowered plants is:

(a) 64 (b) 32
(c) 16 (d) 0

62. By cross pollinating certain Tobacco species some fertile hybrids were obtained by :

(a) Mendel (b) Morgan
(c) Kolreuter (d) Khorana

63. Independent assortment is absent in case

(a) Genes located on the same chromosome
(b) Genes located on homologous chromosomes
(c) Genes located on non-homologous chromosomes
(d) All the above

64. When both alleles express their effect on being present together, the phenomenon is called :

(a) Dominance
(b) Co-dominance
(c) Pseudo-dominance
(d) Amphi-dominance

65. Select the statement which is not correct :

a. Polygenic character is controlled by multiple alleles
b. In case of polygenic inheritance thousands of intermediate phenotypes are found between 2-extreme ones
c. Height, weight, skin colour are polygenic
d. Polygenic character is controlled by multiple genes

66. Skin colour inheritance in man is example of

(a) Monogenic
(b) Polygenic
(c) Sex linked
(d) Multiple alleles

67. What type of gametes are produced by RrYy?

(a) RY, Ry, rY, ry
(b) RY, RY, Ry, RY
(c) RY, RY, rY, ry
(d) RY, Ry, rY, ry

68. Law of Mendel which is not completely applicable is :

(a) Law of dominance
(b) Law of segregation
(c) Law of independent assortment
(d) None of these

69. Emasculation is a part of

(a) Hybridization

(b) Mass selection

(c) Pure line selection

(d) Clonal selection

70. On selfing a plant of F1-generation with genotype 'AABbCC' the genotypic ratio of F2 generation will be :

(a) 3:1

(b) 1:1

(c) 9:3:3:1

(d) 27:9:9:9:3:3:3:1

71. Rh factor found in man and Rhesus monkey was discovered by :

(a) Landsteiner and Wiener

(b) William Harvey

(c) De Casstello and Sturli

(d) Rhesus

72. A pregnant woman has an equal chance of her baby being blood group A or blood group AB. Which one of the following shows the possible genotypes of the woman and the father of her child?

(a) IA IA and IB IO

(b) IA IB and IB IO

(c) IA IO and IB IO

(d) IO IB and IA IO

73. What will be the number of chromosomes present in each gamete produced by the plants if the palisade cells of a species of plant contain 28 chromosomes in all?

(a) 56 (b) 28

(c) 14 (d) 4

74. In peas, a pure tall plant (TT) is crossed with a pure short plant (tt). The ratio of pure tall plants to pure short plants in F2 generation will be:

(a) 1 : 3 (b) 3 : 1

(c) 1 : 1 (d) 2 : 1

75. If a hybrid expresses a character, it is called :

(a) Epistasis

(b) Dominant

(c) Co-dominant

(d) Recessive

76. A plant having the genotype AABbCC will produce the following number of gametes :

(a) 5 (b) 4

(c) 3 (d) 2

77. Experimental verification of the chromosomal theory of inheritance was done by:

(a) Sutton (b) Boveri

(c) Morgan (d) Mendel

78. Identify the wrong statement with reference to the gene 'I' that controls ABO blood groups.

(a) A person will have only two of the 3 alleles.

(b) When IA and IB are present together, they express same type of sugar.

(c) Allele 'i' does not produce any sugar.

(d) The gene (I) has three alleles.

79. How many true-breeding pea plant varieties did Mendel select as pairs, which were similar except in one character with contrasting traits :

(a) 2 (b) 14

(c) 6 (d) 4

80. The best example for pleiotropy is:-

(a) Skin colour

(b) Phenylketonuria

(c) Colour Blindness

(d) ABO Blood group

81. The genotypes of a husband and Wife are IAIB and IAi. Among the blood types of their children, how many different genotypes and phenotypes are possible?

(a) 3 genotypes; 4 phenotypes

(b) 4 genotypes; 3 phenotypes

(c) 4 genotypes; 4 phenotypes

(d) 3 genotypes; 3 phenotypes

82. The offspring of mating between two pure strains is called as :

(a) Heterosis

(b) Hybrid

(c) Progeny

(d) Cybrid

83. Mother is homozygous B and father is A; What will be the possible blood group in their family

(a) AB and B

(b) AB and A

(c) A and B

(d) O

84. A human male produces sperms with the genotypes AB, Ab, ab pertaining to two diallelic characters in equal proportions. What is the corresponding genotype of this person :

(a) AaBB (b) AABb

(c) AABB (d) AaBb

85. In pea plant, yellow seeds are dominant to green. If a heterozygous yellow seeded plant is crossed with a green seeded plant what ratio of yellow and green seeded plants would you expect in F1 generation :

(a) 9:1

(b) 1:3

(c) 3:1

(d) 50:50

86. Two genes R and Y are located very close on the chromosomal linkage map of maize plant. When RRYY and rryy genotypes are hybridized the F2 segregation will show :

(a) Segregation in the expected 9:3:3:1 ratio

(b) Segregation in 3:1 ratio

(c) Higher number of parental types

(d) Higher number of recombinant types

87. Incomplete dominance was discovered by :

(a) Correns (b) Johansen

(c) Bateson (d) Mendel

88. AB genes are linked. What is genotype of the progeny in a cross between AB/ab and ab/ab ?

a. AABB and aabb

b. AaBb and aabb

c. AAbb and aaBB

d. AaBb and AaBb

89. The sugars attached to blood cells that remain attached to RBC are :

(a) Either Galactosamine or galactose

(b) Both Galactose or galactosamine

(c) Galactosamine or galactose

(d) Galactose, galactosamine, both galactose or galactosamine or no sugar

II. Fill in the blanks :

1. Segregation occurs in the _____ phage of meiosis
2. The number of phenotypes and genotypes in a Mendel's dihybrid cross are _____ and _____ respectively
3. The theory of *pangenesis* was given by _____.
4. The term gene was coined by _____.
5. The term allele was coined by _____.
6. ABO blood group is an example of _____.
7. _____ number of laws were formulated by Mendel.
8. _____ discovered incomplete dominance.
9. Centi-morgan is a unit used to measure _____.
10. Independent assortment holds good only if gene concerned are located on _____ chromosomes.
11. Cistron, _____, and recon are subunits of gene, as proposed by Benzer.
12. _____ is the genotypic ratio of Mendels dihybrid cross.
13. The phenomenon of single gene expressing more than one character is known as _____.
14. Quantitative inheritance is caused by _____ genes.
15. Recombination occurs in _____ phase of meiotic division.
16. The genotypic ratio of a monohybrid cross in Antirhinum in the F2 generation is _____.
17. Inheritance of roan coat colour in cattle is an example of _____.
18. deVries, _____ and Tschermak independently rediscovered Mendel's work.

19. Alkaptonuria is caused by a _____ autosomal gene.
20. Phenylthiocarbamide (PTC) tasting sensitivity is caused by _____ autosomal gene.
21. Gametes are never hybrids is a statement of the law of _____.
22. When both alleles express their effect on being present together, the phenomenon is called _____.
23. Genotype of a plant showing the dominant phenotype can be determined by _____ cross
24. _____ is the phenotypic ratio of a trihybrid cross.
25. The antigens and antibodies combine by a process called _____.
26. _____ and _____ are the sugars that are determined by the two dominant immunoglobulin that determine blood groups.
27. The factor, that is considered besides the type (A, B and O) of blood group is ____.
28. Pea plant has _____ pairs of chromosomes.
29. Mendel's work was rediscovered in the year _____.

III. Answer in one word :

1. The removal of stamens from a flower during hybridization.
2. A unit of inheritance.
3. The offspring of mating between two pure strains.
4. Phenomenon wherein the heterozygous condition of an intermediate phenotype is observed.
5. The phenomenon of single gene contributing to multiple phenotypic trait.
6. A pair of Mendelian factors that appear at a particular location on a particular chromosome and control the same character.
7. Genes that move together and do not show independent assortment.
8. A cross between the F1 hybrids with any one of the homozygous parent.
9. A cross between the F1 hybrid with the homozygous recessive parent.
10. Breeding heterozygous/homozygous indiviudals among themselves.
11. The process that occurs when a wrong blood is transfused to a person.
12. The bodies formed in a body due to antigen.
13. The amino acid formed by phenylalanine transferase.
14. Father of genetics.
15. Scientist who discovered incomplete dominance.
16. Scientist who discovered co-dominance.
17. Scientist who performed first plant hybridization experiments.
18. Scientist who coined the term pleiotropy.
19. Scientist who discovered ABO blood grouping.
20. Scientist who discovered Rhesus factor.

Group - B

I. Write notes on the following in 2 to 3 sentences.

1. Pure breeding variety
2. Gene
3. Allele
4. Hybrid
5. Wild gene
6. Co-dominance
7. Pleiotropy
8. Pure line
9. Incomplete dominance
10. Segregation

II. Differentiate between the following with two to three valid points :

1. Monohybrid and Dihybrid
2. Gene and allele
3. Dominant and recessive
4. Segregation and independent assortment
5. Back and test cross
6. Phenotype and genotype
7. Multiple alleles and polygenes
8. Selfing and hybridization
9. Phenotype and genotype
10. Homozygous and heterozygous
11. Qualitative and quantitative inheritance

Group - C

Long Answer Types Questions

1. Give an account of Mendel's monohybrid cross. State and explain law of dominance and law of segregation.
2. Describe dihybrid cross experiment with a checker board.
3. State and explain Mendel's laws of inheritance.

ANSWER KEYS

(a) HEREDITY AND VARIATION

Group - A

I. Select the correct answer from the choices given under each bit :

1. (c)
2. (c)
3. (d)
4. (a)
5. (b)
6. (b)
7. (c)
8. (b)
9. (d)
10. (a)
11. (a)
12. (c)
13. (d)
14. (d)
15. (a)
16. (c)
17. (a)
18. (d)
19. (c)
20. (d)
21. (d)
22. (c)
23. (b)
24. (a)
25. (c)
26. (c)
27. (d)
28. (a)
29. (c)
30. (b)
31. (b)
32. (c)
33. (b)
34. (c)
35. (d)
36. (c)
37. (c)
38. (d)
39. (d)
40. (b)
41. (b)
42. (a)
43. (c)
44. (c)
45. (a)
46. (a)
47. (b)
48. (b)
49. (b)
50. (b)
51. (d)
52. (c)
53. (d)
54. (d)
55. (b)
56. (d)
57. (d)
58. (c)
59. (a)
60. (b)
61. (d)
62. (c)
63. (a)
64. (b)
65. (a)
66. (b)
67. (a)
68. (c)
69. (a)
70. (a)
71. (a)
72. (b)
73. (c)
74. (b)
75. (b)
76. (d)
77. (c)
78. (b)
79. (b)
80. (b)
81. (b)
82. (b)
83. (a)
84. (d)
85. (d)
86. (c)
87. (a)
88. (a)
89. (d)

II. Fill in the blanks :

1. Anaphase II
2. 4, 9
3. Charles Darwin
4. Johannsen
5. Bateson and Saunders
6. Co-dominance/Multiple alleles
7. 3
8. Correns
9. Genetic Linkage
10. Non-homologous
11. Muton
12. 1:2:1:2:4:2:1:2:1
13. Pleiotropy
14. Multiple
15. Prophase I
16. 1:2:1
17. Co-dominance
18. Correns
19. Recessive
20. Dominant
21. Segregation
22. Co-dominance
23. Test
24. 27:9:9:9:3:3:3:1
25. Agglutination
26. Galactose and galactosamine
27. Rh
28. 7
29. 1900

III. Answer in one word :

1. Emasculation
2. Gene
3. Hybrid
4. Incomplete dominance
5. Pleiotropy
6. Alleles
7. Linked
8. Back cross
9. Test Cross
10. Selfing
11. Agglutination
12. Antibodies
13. Tyrosine
14. Mendel
15. Correns
16. Mendel
17. Kolreuter
18. Ludwig Plate
19. Landsteiner
20. Landsteiner and Weiner

Group - B

I. Write notes on the following in 2 to 3 sentences.

1. Pure breeding variety

Ans.
- A plant that produces the offspring of its own kind is a pure breed variety.
- A pure breeding individual passes the phenotypic trait to its offsprings down through many generations.
- A true breeding variety is homozygous for the allele with regard to the character under consideration

2. Gene

Ans.
- A gene, also called factor is a hereditary unit that determines the character of an individual
- Chemically a gene is a segment of DNA and was first named by Johansen.
- A gene may have different forms called alleles.

3. Allele

Ans.
- An allele is a form of a gene.
- Usually a gene has a pair of alleles- dominant and recessive.
- The term allele was coined by Bateson and Saunders.

4. Hybrid/Hybridization

Ans.
- A hybrid is an offspring produced by a cross between two pure line plants that have contrasting characters. The formation of hybrid is called hybridization.
- Hybridization is chosen to improve certain characteristics of parent plants in terms of better yield improved nutrient content & disease resistanc etc.

5. Wild gene

Ans.
- The genes that occur in nature are wild genes.
- Wild genes undergo mutation and form a single or multiple alleles.
- Usually wild genes are dominant and the mutated ones are recessive.

6. Co-dominance

Ans.
- Co-dominance is the condition where both alleles present in a hybrid express themselves.
- In other words both the alleles act as dominants thus called co-dominance.
- ABO blood group is the best example of codominance where the presence of A gene and B gene produce a AB blood group, a typical case of co-dominance

7. Pleiotropy

Ans.
- Pleiotropy is the condition where a single gene can express a number of characters.
- This is a deviation to Mendel's laws according to which one gene is responsible for only one character.
- Phenylketonuria is an example of pleiotropy where a single gene is controlling a number of paths leading to the production of tyrosine.

8. Pure line

Ans.
- A plant that produces the offspring of its own kind is a pure line.
- A pure breeding individual passes the phenotypic traits to its offspring down through many generations.
- A true breeding variety is homozygous for the allele with regard to the character under consideration.

9. Incomplete dominance

Ans.
- It is a deviation of Mendelism.
- It was first discovered by Carl Correns.
- Here the process of dominance is not complete and both the genes express themselves and an intermediate phenotype is produced.

10. Segregation

Ans.
- It is the process of separation of the alleles during gametogenesis.
- Mendel described the process of segregation in Pea plants when two traits of the same character, height of the plant (tall/dwarf) were transmitted separately at the time of gametogenesis without any contamination or fusion.

II. Differentiate between the following with two to three valid points :

1. Monohybrid and Dihybrid

Monohybrid	Dihybrid
(i) A hybrid formed by considering one pair of contrasting characters.	(i) A hybrid formed by considering two pairs of contrasting characters.
(ii) The law of dominance and the law of segregation were derived from this cross.	(ii) The law of independent assortment was derived from this.
(iii) The monohybrid phenotypic ratio is 3:1	(iii) The dihybrid phenotypic ratio is 9:3:3:1.
(iv) The monohybrid genotypic ratio is 1:2:1.	(iv) The dihybrid genotypic ratio is 1:2:1:2:4:2:1:2:1.

2. Gene and Allele

Gene	Allele
(i) A gene is a hereditary unit	(i) Alleles are the alternative forms of a gene.
(ii) A gene is a sequence of nucleotides in the DNA that encodes either an RNA or protein.	(ii) A gene has a pair of alleles or a number of alleles.
	(iii) Alleles are either dominant or recessive.

3. Dominant and Recessive

Dominant	Recessive
(i) It is the form of allele of a gene that expresses itself.	(i) It is the form of allele of a gene that remains suppressed in the presence of the dominant gene.
(iii) Normally wild genes are dominant.	(ii) Usually mutant genes are recessive.

4. Segregation and Independent Assortment

Segregation	Independent Assortment
(i) It is the process of separation of the two alleles of a gene in a hybrid.	(i) Independent assortment is the separation of the two different genes.
(ii) Segregation occurs in Anaphase I of meiosis.	(ii) Independent assortment occurs during Anaphase II of meiosis.
(iii) It is universal.	(iii) It is not universal and is limited to genes that are not linked.

5. Back Cross and Test Cross

Back Cross	Test Cross
(i) It is a cross between the hybrid with either of the parent.	(i) It is a cross between the hybrid with the recessive parent.
(ii) It is useful in genetic improvement of breeding programmes.	(ii) It is useful in testing whether a phenotype is homozygous or heterozygous.

6. Phenotype and Genotype

Phenotype	Genotype
(i) It is the external expression of an organism.	(i) It is the internal genetic complement of an organism.
(ii) Phenotypic ratio of monohybrid cross is 3:1.	(ii) Genotypic ratio of a monohybrid cross is 1:2:1.
(iii) Phenotypic ratio of a dihybrid cross is 9:3:3:1.	(iii) Genotypic ratio of a dihybrid cross is 1:2:1:2:4:2:1:2:1.

7. Multiple Alleles and Polygenes

Multiple Alleles	Polygenes
(i) Many alleles of a single gene are involved in controlling a character. (ii) Example: ABO blood groups. (iii) Multiple alleles occupy a single location on homologous chromosomes.	(i) Many independent genes are responsible for one character. (ii) Example: Phenylketonuria. (iii) Polygenes are located on different chromosomes at different loci.

8. Selfing and Hybridization

Selfing	Hybridization
(i) Self-pollination by either natural or artificial means is selfing.	(i) Crossing between two parents differing at least in one pair of contrasting characters is called hybridization.

9. Homozygous and Heterozygous

Homozygous	Heterozygous
(i) Two alleles of a gene are the same i.e. they are either dominant or recessive. (ii) Homozygous condition results in pure line. (iii) No ratio is obtained in the offspring.	(i) Two alleles of a gene are different i.e. one dominant and the other recessive. (ii) Heterozygous condition results in a hybrid. (iii) 3:1 ratio is obtained in the monohybrid cross.

10. Qualitative and Quantitative Inheritance

Qualitative inheritance	Quantitative Inheritance
(i) Here the effect of the genes is cumulative. (ii) Seen in skin colour of humans. (iii) It is always non-mendelian.	(i) Here the effect of the gene is discrete. (ii) Seen in most characters. (iii) It is either Mendelian or non-Mendelians.

Group - C

Long Question Answer Keys

1. Give an account of Mendel's monohybrid cross. State and explain law of dominance and law of segregation.

Ans. (i) Gregor Mendel was an Austrian monk. He used garden pea (*Pisum sativum*) for his experiments. The seven variable characters, Mendel chose were:

- Seed texture (Round / Wrinkled)
- Seed colour (Yellow / Green)
- Flower colour (White / Purple)
- Growth habit (Tall / Dwarf)
- Pod Shape (Pinched / Inflated)
- Flower position (Axial / Terminal)

(ii) When a cross was made taking one pair of contrasting traits (Tall / Dwarf plants) then it is called monohybrid cross.

(iii) In the F1 generation only dominant (Tall) traits/characters are expressed, although genotypically they are heterozygous (Tt)

$$TT \times tt - P$$
$$\downarrow$$
$$Tt \times Tt - F_1$$
$$\downarrow$$
$$TT, Tt, Tt, tt - F_2$$

(iv) In the F_2 generation tall and dwarf plants will be produced in 3:1 ratio, although genotypically the ratio is 1:2:1.

(v) Law of dominance and Law of Segregation may be stated & explained.

2. Describe dihybrid cross experiment with a checker board.

Ans. (i) A cross where two pairs of contrasting characters are considered for study is known as dihybrid cross.

(ii) Mendel took pure homozygous pea plants of (a) round (RR) seed and (b) yellow (YY) cotyledons and crossed it with wrinkled (rr) seeds and green (yy) cotyledons.

(iii) Round /Wrinkled (Rr) seeds and Yellow / Green (Yy) are the two pairs of contrasting characters, where seed round is dominant over wrinkled and cotyedon yellow is dominant over green.

(iv) In the dihybrid cross in F1 generation two kinds of gametes, RY and ry will produce individuals with RrYy genetic composition. The plants phenotypically will be of round seeds and yellow cotyledons. These are heterozygous plants.

(v) When F_1 individuals are self fertilised, in the F_2 generation plants will be produced in following 9:3:3:1 ratio.

(a) Plants with round and yellow seeds - 9

(b) Plants with round and green seeds - 3

(c) Plants with wrinkled and yellow seeds - 3

(d) Plants with wrinkled and green seeds - 1

(vi) 9:3:3:1 is the dyhybrid phenotypic ratio of Mendel.

(vii) Draw a checker board to graphically illustrate the genotypic ratio of 1:2:1:2:4:2:1:2:1.

3. State and explain Mendel's laws of inheritance.

Ans. (i) On the basis of Mendel's experiments and observations on pea plant, Carl Correns formulaed three principles / laws, which are now popularly known as Mendel's Laws of inheritance.

(a) Law of dominance

(b) Law of segregation/purity of gametes

(c) Law of independent assortment

(ii) The first two laws are based on experiments of mnohybrid cross. The law of independent assortment is based on observations from the dihybrid cross.

(iii) Explain the three laws.

(c) MOLECULAR BASIS OF INHERITANCE

Group - A

I. Select the correct answer from the choices given under each bit :

1. Bacterial transformation was discovered by:

(a) Frederick Griffith

(b) Messelson and Stahl

(c) Watson and Crick

(d) Hershey and Chase

2. Avery *et al.* proved that the transforming principle of *Pneumococcus* was:

(a) mRNA

(b) DNA

(c) Protein

(d) Polysaccharide

3. DNA is the genetic material in phages was proved by:

(a) Frederick Griffith

(b) James Watson

(c) Sutton and Bovery

(d) Hershey and Chase

4. Experiment on *Pneumococcus* proved that :

(a) Bacteria do not reproduce asexually

(b) Bacteria undergo binary fission

(c) DNA is the genetic material

(d) RNA may sometimes control production of DNA and protein.

5. RNA contains the sugar:

(a) Hexose (b) Ribose

(c) Fructose (d) Glucose

6. Pyrimidine base present in RNA in place of thymine of DNA is:

(a) Uracil (b) Adenine

(c) Cytosine (d) Guanine

7. Which of the following is the most accurate sequence of intermediates during protein synthesis employed by an RNA tumor virus (retrovirus) after initiating infection ?

(a) RNA → DNA → mRNA → protein

(b) RNA → mRNA → protein

(c) RNA → DNA → protein

(d) DNA → mRNA → protein

8. Given that a nucleic acid has 30% A, 20% G, 30 % T and 20% C, this nucleic acid is most likely:

(a) Double stranded DNA

(b) Single stranded DNA

(c) Double stranded RNA

(d) Single stranded RNA

9. The correct order in terms of molecular weight is:

(a) DNA<tRNA<mRNA<insulin

(b) tRNA<mRNA<rRNA< DNA

(c) rRNA<insulin<cDNA <Z DNA

(d) Insulin<B-DNA<cDNA< Z-DNA

10. Melting of DNA is the process of separation of the complementary strands by heating. Which of the following DNA molecules would melt at the lowest temperature ?

(a) GGACGGCTACCGG
CCTGCCGATGGCC

(b) CTACCGCGCTTCGG
GATGGCGCGAAGCC

(c) ATGGAATTCTTACT
TACCTTAAGAATGA

(d) GGGTCGGAACCCGT
CCCAGCCTTGGGCA

11. Which of the following statements about the base composition of a double-stranded DNA molecule is true? (Each letter refers to the amount of that base in DNA):

(a) A = T within each single strand

(b) C = G within each single strand

(c) A+T=C+G in the double-stranded molecule

(d) A/C = 1 in the double-stranded molecule.

12. Which one of these is true for DNA?

(a) A—T, G—G

(b) A—C, T—C

(c) C—G, T—A

(d) G—C, A—T

13. Which of the nucleotide compositions will be possible, if DNA is double stranded ?

(a) Only A, G and T

(b) Only A and T

(c) Only C and T

(d) Only A and G

14. The two polynucleotide chains in DNA are :

(a) Semiconservative

(b) Parallel

(c) Discontinuous

(d) Antiparallel

15. Nucleotide arrangement in DNA can be seen by :

(a) X-ray crystallography

(b) Electron microscope

(c) Ultra centrifuge

(d) Light microscope

16. If the sequence of bases on one strand of DNA is given as GCTAAGTCGAC, the sequence of bases in the complementary strand is written as:

(a) CGATTCAGCTG

(b) CAGCTGAATCG

(c) GCTAAGTCGAC

(d) CGATTCAGCTG

17. The year 2003 was the 50th anniversary of :

(a) Structure of DNA by Watson

(b) Discovery of cell by Robert Hooke

(c) Determination of structure of insulin

(d) Discovery of genetic code

18. Telomeres control the function of eukaryotic chromosomes because they :

(a) Prevent chromosome loss

(b) Act as replications

(c) Are RNA transcription initiator

(d) Help chromosome pairing

19. ***Escherichia coli*** **fully labelled with ^{15}N is allowed to grow in ^{14}N medium. The two strands of DNA molecule of the first generation of bacteria will have:**

(a) Different density and do not resemble parent DNA

(b) Different density but resemble parent DNA

(c) Same density and resemble parent DNA

(d) Same density but do not resemble parent DNA.

20. **If double stranded DNA with ^{15}N undergoes replication twice in a normal medium, then which of the following is true?**

(a) Half of bacteria contain ^{15}N in DNA

(b) All four contain ^{15}N in DNA

(c) None contains ^{15}N in DNA

(d) 3/5 contains ^{15}N in DNA

21. **The enzyme that catalyzes the elongation of DNA chains in the 5'—3' direction and is template-directed is called DNA:**

(a) Polymerase

(b) Ligase

(c) Helicase

(d) Topoisomerase

22. **Meselson and Stahl in their experiment on DNA replication used the technique of:**

(a) Autoradiography

(b) Starch-gel elecrophoresis

(c) Density-gradient centrifugation

(d) Crystallography

23. **Replication of DNA in eukaryotes begins at :**

(a) One or more specific sites on a chromosome and proceeds unidirectionally

(b) One or more specific sites on a chromosome and proceeds bidirectionally

(c) Random sites along a chromosome and proceeds unidirectionally

(d) The ends of a chromosome and proceeds towards the centromere.

24. **The rate of addition of nucleotides per second by DNA Pol III to a growing strand is :**

(a) 20 (b) 2000

(c) 500 (d) 1000

25. **During DNA replication the bases of two strands separate by :**

(a) DNA polymerase

(b) Topoisomerase

(c) Helicase

(d) Gyrase

26. **The separation of strands at the origin and ahead of the replication fork, helicase catalysis is:**

(a) ATP-independent

(b) Requires ATP for GC pairs only

(c) ATP-dependent

(d) Requires ATP for AT pairs only

27. **DNA replication is aided by:**

(a) DNA polymerase only

(b) DNA ligase only

(c) Both (*a*) and (*b*)

(d) RNA polymerase

28. Semiconservative mode of DNA replication using ^{15}N was demonstrated by:

(a) Messelson
(b) Taylor
(c) Messelson and Stahl
(d) Hershey and Chase

29. Semiconservative replication of DNA was proved by using:

(a) ^{12}P (b) ^{15}N
(c) ^{35}S (d) ^{12}C

30. To form a continuous DNA molecule, the enzyme joins Okazaki fragments:

(a) DNA polymerase
(b) Primase
(c) Ligase
(d) Helicase

31. DNA polymerases are generally used in DNA replication:

(a) To cut the helix at certain places
(b) For proof reading
(c) Adding carbonyl compound
(d) Joining pieces of a DNA strand

32. Semiconservative replication of DNA was first demonstrated in:

(a) *Salmonella typhimurium*
(b) *Drosophila melanogaster*
(c) *Escherichia coli*
(d) *Streptococcus pneumoniae*

33. The main enzyme responsible for new strand synthesis during DNA replication in prokaryotes is:

(a) DNA polymerase I
(b) DNA polymerase II
(c) DNA polymerase III
(d) Topoisomerase

34. The okazaki fragments in DNA chain growth :

(a) Polymerize in the 5'-to-3' direction and explain 3'-to-5' DNA replication
(b) Result in transcription
(c) Polymerize in the 3'-to-5' direction and forms replication fork
(d) Prove semi-conservative nature of DNA replication

35. Beadle and Tatum are known for:

(a) Gene theory
(b) Natural selection theory
(c) Mutation theory
(d) One gene-one enzyme theory

36. One gene-one enzyme relationship was established for the first time in:

(a) *Diplococcus pneumoniae*
(b) *Neurosprora crassa*
(c) *Salmonella typhimurium*
(d) *Escherichia coli*

37. The enzyme in some RNA viruses which has RNA template to synthesize DNA is called:

(a) RNA replicase
(b) Reverse transcriptase
(c) RNA polymerase
(d) Viral nuclease

38. The protein coding part of a gene is :

(a) Muton (b) Recon
(c) Exon (d) Cistron

39. In split genes, the coding sequences are :

(a) Introns (b) Exons
(c) Operons (d) Cistrons.

40. The segment of DNA which acts as the instruction manual for synthesis of the protein is :

(a) Nucleoside (b) Nucleotide

(c) Ribose (d) Gene

41. Which of the following elements is NOT involved in the information transfer from DNA to finished protein?

(a) Ribosome

(b) tRNA

(c) DNA polymerase

(d) RNA polymerase

42. The process of flow of genetic information from DNA to RNA or reverse is called:

(a) Transversion (b) Transcription

(c) Translation (d) Replication

43. All of the following are types of post-transcriptional processing of RNA in the nucleus EXCEPT

(a) The removal of intron segments

(b) Polyadenylation

(c) The addition of a 5' cap

(d) Nucleotide methylation

44. The flow of information from DNA to mRNA and then to protein is called:

(a) Transcription

(b) Translation

(c) Gene expression

(d) Genetic code

45. DNA elements, which can switch their positions, are called:

(a) Exons (b) Introns

(c) Cistrons (d) Transposons

46. During transcription, the strand not transcribed by the RNA polymerase is the :

(a) Coding strand

(b) Noncoding strand

(c) Template strand

(d) Terminator strand

47. Central dogma was proposed by:

(a) Beadle and Tatum

(b) Temin and Baltimore

(c) Klug

(d) F H C Crick.

48. The process by which DNA of a nucleus passes information to RNA is called :

(a) Translocation

(b) Transcription

(c) Translation

(d) Transduction

49. Genetic information in a DNA molecule is stored in the form of :

(a) Sequence of amino acids

(b) Sequence of nucleosides

(c) Sequence of nucleotides

(d) Sequence of sugar and phosphates

50. Which one of the following does not follow the central dogma of molecular biology ?

(a) Chlamydomonas

(b) HIV

(c) Pea

(d) Mucor

51. Transcription begins when one of the following enzymes binds to a promoter site:

(a) DNA plymerase

(b) RNA polymerase

(c) Helicase

(d) Gyrase

52. In eukaryotic cells, the RNA transcribed from DNA is called____.

(a) rRNA

(b) c-DNA

(c) Cistron

(d) heterogenous mRNA

53. Molecular basis of organ differentiation depends on the modulation in transcription by :

(a) Anticodon

(b) RNA polymerase

(c) Ribosome

(d) Transcription factor

54. Teminism is the same as :

(a) Translation

(b) DNA synthesis

(c) Transcription

(d) Reverse transcription

55. Removal of introns and joining the exons in a defined order in a transcript unit is called :

(a) Capping

(b) Splicing

(c) Tailing

(d) Transformation

56. In an mRNA strand the sequence of bases is UGAGCAU. The sequence of bases in the DNA strand which served as template for the synthesis of mRNA strand was :

(a) TCUCAGA (b) CTGCTAT

(c) ACUCGUG (d) ACTCGTA

57. The function of the rho protein is :

(a) To help terminate translation

(b) To help RNA polymerase bind to the DNA

(c) To help RNA polymerase find a promoter

(d) To help terminate transcription

58. The process of translation refers to:

(a) Ribosome synthesis

(b) Protein synthesis

(c) DNA synthesis

(d) RNA synthesis

59. The first codon discovered by Nirenberg and Mathaei was:

(a) GGG (b) CCC

(c) UUU (d) AAA

60. In the genetic code, the number of codons used to code for all 20 aminoacids are :

(a) 60 (b) 20

(c) 64 (d) 61

61. In eukaryotes, the initiation codon for protein synthesis is :

(a) GUA (b) GCA

(c) CCA (d) AUG

62. Whose experiments discovered unequivocally that the genetic code is a "triplet" ?

(a) Beadle and Tatum

(b) Nirenberg and Mathaei

(c) Hershey and Chase

(d) Morgan and Sturtevant

63. The one aspect which is not a salient feature of genetic code, is its being:

(a) Universal (b) Specific

(c) Degenerate (d) Ambiguous

64. What is not true for genetic code ?

(a) It is unambiguous

(b) A codon in mRNA is read in a non-contiguous fashion

(c) It is nearly universal

(d) It is degenerate

65. Termination of a polypeptide chain synthesis is brought about by :

(a) UUG, UAG and UCG

(b) UAA, UAG and UGA

(c) UUG, UGC and UCA

(d) UCG, GCG and ACC

66. The sequence of m-RNA transcribed from a DNA piece having sequence of ATTGCATCT :

(a) UAACGUAGA

(b) TAACTAGA

(c) UAAGCUAGA

(d) TAACTUGA

67. Amino acyl synthetase enzyme takes part in :

(a) Attachment of mRNA of 50 S ribosome

(b) Transfer of activated amino acid to tRNA

(c) Activation of amino acid

(d) Hydrolysis of ATP to AMP

68. All of the following statements about the genetic code are correct EXCEPT:

(a) More than one triplet codes for many of the amino acids.

(b) Some triplets code for more than one amino acid.

(c) The code is not exactly the same in all genetic systems.

(d) Some triplets do not code for any amino acid.

69. Because most of the amino acids are encoded by more than one codon, the genetic code is said to be:

(a) Over lapping

(b) Wobbling

(c) Degenerate

(d) Generate

70. Triplet codon refers to the sequence of three bases on:

(a) mRNA

(b) tRNA

(c) rRNA

(d) SnRNA

71. If t-RNA isolated from E.coli and m-RNA as well as ribosomes isolated from mouse liver cell are incubated with ATP and free amino acids, what may happen?

(a) Protein specific to mouse will be synthesised

(b) Protein specific to E.coli will be synthesised

(c) Protein synthesis will not occur

(d) Charging of tRNA will occur

72. All of the following are possible forms of chromosomal aberration or mutation EXCEPT :

(a) Deletion (b) Duplication

(c) Inversion (d) Transcription

73. What is true about ribosomes?

(a) These are composed of ribonucleic acid and proteins.

(b) These are found only in eukaryotic cells.

(c) These are self - splicing introns of some RNAs.

(d) The prokaiyotic ribosomes are 80S, where "S" stands for sedimentation coefficient.

74. Most RNA in a eukaryotic cell is synthesised in:

(a) Cytoplasm

(b) Nucleoplasm

(c) Nucleolus

(d) Ribosome

75. During protein synthesis, the peptide chain is synthesized in the:

(a) Amino to carboxyl direction

(b) Carboxyl to amino direction

(c) Phosphoryl to hydroxy direction

(d) Hydroxy to phosphoryl direction

76. Polypeptide synthesis in a cell takes place in :

(a) Chloroplast (b) Mitochondria

(c) Chromoplast (d) Ribosomes

77. All of the following are needed for protein synthesis EXCEPT

(a) The attachment of mRNA, initiator tRNA, and initiation factors to the small subunit of a ribosome

(b) The association of the small and large subunits of a ribosome

(c) The recognition of codons on mRNA by anti-codons of tRNA

(d) Continuous RNA synthesis

78. In a polypeptide, the amino acid sequence is determined by the sequence of bases of :

(a) mRNA (b) cDNA

(c) rRNA (d) tRNA

79. Which of the following bonds serves to link an amino acid to the terminal adenosine residue of transfer RNA?

(a) Acyl bond

(b) Phosphodiester bond

(c) Hydrogen bond

(d) Peptide bond

80. Reverse transcriptase is also called:

(a) RNA-dependent DNA polymerase

(b) RNA-dependent RNA polymerase

(c) DNA-dependent-RNA polymerase

(d) DNA-dependent DNA polymerase

81. Genes that are involved in turning on or off the transcription of structural genes are called :

(a) Polymorphic genes

(b) Operator genes

(c) Represser genes

(d) Regulatory genes

81. The DNA of *E.coli* is:

(a) Single stranded and linear

(b) Single stranded and circular

(c) Double stranded and linear

(d) Double stranded and circular

82. If one strand of DNA has the nitrogenous base sequence as ATGTG, what would be the complementary RNA strand sequence?

(a) UACAC

(b) AACTG

(c) ATCGU

(d) TTAGU

83. Which of the following is coded by the least number of codons?

(a) Glycine

(b) Histidine

(c) Methionine

(d) Serine

85. Which one of the following triplet codons is correctly matched with its corresponding amino acid in protein synthesis or as 'start' or 'stop' codon?

(a) UAC—tyrosine

(b) UCG—start

(c) UUU—stop

(d) UGU—Leucine

86. What does "Lac" refer to in what we call lac operon?

(a) The number 1,00,000

(b) Lactose

(c) Lactase

(d) Lac insect

87. In *E.coli*, the lac operon is induced by:

(a) Promoter gene

(b) Lactose

(c) Operator gene

(d) Regulator gene

II. Fill in the blanks :

1. Griffith provided the first evidence of _____ as the genetic material.
2. The nitrogen bases, adenine and guanine are grouped under _____ .
3. Nucleotides joined by phosphodiester bond form _____ structure of DNA.
4. The sum of purines and pyrimidines are equal and this is called _____ rule.
5. Secondary structure of DNA was proposed by Watson and _____.
6. The most stable form of RNA is _____.
7. Clover leaf model of tRNA was proposed by _____.
8. Short sequences of DNA nucleotides on lagging strand are called _____ fragments.
9. RNA dependent _____ synthesis is called reverse transcription.
10. Structural genes are transcribed to ____ which are translated to polypeptides.
11. Genes with coding regions interrupted by noncoding sequences are known as _____ genes.
12. The promoter sequence of DNA towhich transcribing enzyme RNA polymerase binds is known as _____ box.
13. The process that removes the introns from pre-mRNA and joins the protein-coding exons together is called RNA _____.
14. When a single amino acid is coded for by more than one codon, the genetic code is said to be _____.
15. The technique of DNA _____ is used to detect crime.
16. The synthesis of mRNA on a DNA is _____.

III. Answer in one word :

1. The enzyme that catalyzes the degradation of RNA into smaller components -
2. Type of RNA that carries amino acid to the ribosome -
3. A nitrogenous base that is present in DNA, but absent in RNA -
4. Non-coding sequences of genes are called -
5. Coding sequences of genes are called -
6. The triplet codon, AUG codes for the amino acid -
7. Codons that do not code for any amino acid are called -
8. The enzyme that joins okazaki fragments during DNA replication -
9. The RNA molecule that has the shape of a clover leaf -
10. Triplets of bases of DNA -
11. Triplets of bases on one end of tRNA -

IV. Correct the statements, if required by changing the underlined word/ words only :

1. A nitrogenous base and pentose sugar joined together form a nucleotide.
2. The purines in DNA are adenine and thymine.
3. Purines and pyromidines are the nitrogen bases that hold DNA strands together through peptide bonds.
4. The enzyme DNA ligase unwinds the DNA double helix into separates single strands and forms a replication form.
5. Pribnow box is a sequence of six nucleotides TATAAT which is an essential part of terminator site of bacterial DNA.
6. The start codon is UGA.
7. When more than one codon code for the same amino acid, it is called commaless.
8. UAA, UAG and AUG are stop codons.
9. Transcription and transformation collectively account for gene expression.
10. DNA fingerprinting was developed by Khuranna.

Group - B

I. Write notes on the following in 2 to 3 sentences.

1. Transcription
2. Translation
3. Genetic Code
4. Split Gene
5. Operon
6. tRNA
7. DNA replication
8. B-DNA
9. DNA fingerprinting
10. Kornberg enzyme

II. Differentiate between the following with two to three valid points :

1. DNA and RNA
2. mRNA and tRNA
3. Purines and Pyrimidines
4. Transcription and Translation
5. Exon and Intron

Group - C

Long Answer Types Questions

1. Describe the structure of DNA.
2. Give an account of the mechanism of translation in prokaryotes.
3. Describe the semiconservative model of DNA replication.
4. Give an account of operon model.
5. Describe transcription is prokaryotes.

ANSWER KEYS

(c) MOLECULAR BASIS OF INHERITANCE

Group - A

I. Select the correct answer from the choices given under each bit :

1.	(a)	14.	(d)	27.	(c)	40.	(d)	53.	(d)	66.	(a)	79.	(a)
2.	(b)	15.	(a)	28.	(c)	41.	(c)	54.	(d)	67.	(b)	80.	(a)
3.	(d)	16.	(d)	29.	(b)	42.	(b)	55.	(b)	68.	(b)	81.	(c)
4.	(c)	17.	(a)	30.	(c)	43.	(d)	56.	(d)	69.	(c)	82.	(d)
5.	(b)	18.	(a)	31.	(b)	44.	(c)	57.	(d)	70.	(a)	83.	(a)
6.	(a)	19.	(b)	32.	(c)	45.	(d)	58.	(b)	71.	(c)	84.	(c)
7.	(a)	20.	(a)	33.	(c)	46.	(a)	59.	(c)	72.	(d)	85.	(a)
8.	(a)	21.	(a)	34.	(a)	47.	(d)	60.	(d)	73.	(a)	86.	(b)
9.	(b)	22.	(c)	35.	(d)	48.	(b)	61.	(d)	74.	(b)	87.	(b)
10.	(c)	23.	(b)	36.	(b)	49.	(c)	62.	(b)	75.	(a)		
11.	(c)	24.	(d)	37.	(b)	50.	(b)	63.	(d)	76.	(d)		
12.	(d)	25.	(c)	38.	(d)	51.	(b)	64.	(b)	77.	(d)		
13.	(b)	26.	(c)	39.	(b)	52.	(d)	65.	(b)	78.	(a)		

II. Fill in the blanks :

1.	DNA	5.	Crick	9.	DNA	13.	splicing
2.	purines	6.	rRNA	10.	mRNA	14.	degenerate
3.	primary	7.	Holley	11.	split	15.	fingerprinting
4.	Chargaff's	8.	Okazaki	12.	TATA	16.	transcription

III. Answer in one word :

1.	ribonuclease / RNase	5.	exons	9.	tRNA
2.	tRNA	6.	methionine	10.	codon
3.	thymine	7.	nonsense codon	11.	anticodon
4.	introns	8.	ligase		

IV. Correct the statements, if required by changing the underlined word/ words only :

1.	nucleoside	5.	promoter	9.	translation
2.	guanine	6.	AUG	10.	Jeffreys
3.	hydrogen	7.	degenerate		
4.	helicase	8.	UGA		

Group - B

I. Write notes on the following in 2 to 3 sentences.

1. **Transcription -**

Ans. (i) Transfer of genetic information from DNA to RNA is called transcription.

(ii) It is completed in three steps - initiation, elongation and termination.

(iii) A number of enzymes including RNA polymerase, protein factors and the transcribing DNA fragments are involved in this process.

2. Translation -

Ans. (i) It is the process of creating proteins from an mRNA template carried by ribosomes.

(ii) A segment of DNA, messenger RNA (mRNA), tRNA, rRNA and a number of enzymes are involved in the process.

(iii) The entire process is completed in four steps i.e. activation of amino acid, initiation, elongation and termination of the polypeptide chain.

3. Genetic Code -

Ans. (i) It is a set of rules by which information encoded in the genetic material (DNA) is translated into 20 amino acids, which are the building blocks of protein.

(ii) The genetic code is universal, commaless, nonoverlapping and also degenerate.

(iii) It is represented by a triplet (three) codon. AUG is the initiation codon and UAA, UGA and UAG are stop codons.

4. Split genes -

Ans. (i) A split or interrupted gene consists of introns and exons.

(ii) The exons carry genetic information whereas introns do not carry any genetic information.

(iii) Removal or splicing of introns from pre-mRNA is essential for creating a mRNA.

5. Operon -

Ans. (i) It is a functional unit of transcription and genetic regulation.

(ii) It is a segment of DNA containing adjacent genes which include structural genes, operator gene and a regulator gene.

6. tRNA -

Ans. (i) It is a small nucleotide or RNA composed of 76 to 90 nucleotides.

(ii) It serves as the physical link between mRNA and amino acid sequence. It is a two-dimensional clover leaf model as proposed by Holley in 1968.

(iii) It brings amino acids to the ribosome for protein synthesis.

7. DNA replication -

Ans. (i) DNA replication is the process by which a double-stranded DNA molecule is copied to produce two identical DNA molecules.

(ii) The most common is the semiconservative type, where each strand serves as a template to make a new complimentary strand.

(iii) It is completed in four steps like - (a) replication fork formation, (b) primer binding, (c) elongation and, (d) termination. DNA replication is essential for cell division during growth and repair of damaged tissue.

8. B-DNA

Ans. (i) Out of the three forms A, B & Z, B-DNA is a right-handed double helix, most commonly found under normal physiological conditions.

(ii) The structure was discovered by Watson and Crick, based on X'ray diffraction patterns.

(iii) The double-helix is made of two antiparallel strands that are held together by hydrogen bonding in the A-T and G-C base pairs. Each strand is a polynucleotide chain comprising (a) a pentose sugar, deoxyribose, (b) phosphate, and (c) nitrogenous bases (A,T,G&C).

9. DNA fingerprinting -

Ans. (i) It is a laboratory technique used to establish a link between a biological entity and a suspect in a crime investigation.

(ii) A DNA sample taken from a crime scene is compared with the DNA sample of a suspect. It is also used in parentage testing. The procedure employed, for the purpose is either "Southern blot" or Polymerase Chain Reaction (PCR) method.

10. Kornberg enzyme -

Ans. (i) Arther Kornberg discovered the enzyme, now known as DNA Polymerase-I in *Escherichia coli* in 1956.

(ii) DNA polymerases are a group of polymerases that perform DNA replication, repair and in some cases cell diffentiation. Polymerase I and II are involved in DNA repair and proof reading. Polymerase-III is the major polymerase involved in DNA replication in prokaryotes.

II. Differentiate between the following with two to three valid points :

1. DNA and RNA

DNA	RNA
(i) Generally it is double stranded.	(i) It is single stranded
(ii) Pentose sugar is deoxyribose.	(ii) Pentose sugar is ribose.
(iii) Thymine is the pyromidine base alongwith Cytosine.	(iii) Uracil is the pyrimidine base alongwith cytosine.
(iv) Acts as a genetic material.	(iv) Genetic material in some viruses.

2. mRNA and tRNA

mRNA	tRNA
(i) Carries genetic message from gene to ribosomes for protein synthesis.	(i) Transfers amino-acids in the cytoplasm to ribosomes.
(ii) It is longer than tRNA and several thousand nucleotide long.	(ii) Comparatively smaller molecule with only 70-95 nucleotides long.
(iii) It carries codons for protein synthesis.	(iii) It helps decode the mRNA sequence into protein.

3. Purines and Pyrimidines

Purines	Pyrimidines
(i) Purines are two-ringed structure with four nitrogen atoms.	(i) Pyrimidines are single carbon-nitrogen rings with two nitrogen atoms in the ring.
(ii) These are bigger molecules compared to the pyrimidines.	(ii) These are smaller molecules.
(iii) The purine bases Adenine and Guanine are present both in DNA & RNA.	(iii) The pyrimidine base Cytosine is present in boh DNA and RNA, Uracil only in RNA and Thymine only in DNA.

4. Transcription and Translation

Transcription	Translation
(i) It is the first step in gene expression. Here mRNA copies are synthesized from DNA, which works as a template.	(i) It is the 2nd step in gene expression. Proteins are synthesized from RNA copies here.
(ii) It takes place inside the nucleus. Here genetic information is transferred from one strand of DNA to mRNA.	(ii) It takes place in the cytoplasm of the cell. The RNA molecule created in transcription delivers information from DNA to proteins.

5. Exon and Intron

Exon	Intron
(i) Exons are coding sequences of a gene (DNA).	(i) Introns are non-coding sequences of a gene (DNA)
(ii) They collectively make the final RNA molecule.	(ii) Do not appear in mature mRNA molecules.
(iii) Found in both prokaryotes and eukaryotes.	(iii) Found in eukaryotes and located in between two exons.

Group - C

Long Question Answer Keys

1. Describe the structure of DNA.

Ans. (i) DNA has two deoxyribonucleotide chains twisted around each other in the form of a double-helix. The chains run in opposite directions.

(ii) Watson & Crick proposed a double helical model in 1953 for the structure of DNA.

(iii) Detailed specifications of the double helix are to be described alongwith the dimensions thereof.

(iv) The polynucleotide chain is made up of alternate deoxyribose sugar and phosphoric acid molecule which are linked by phosphodiester linkages.

(v) Nitrogen bases are 2 purines - adenine and guanine and 2 pyrimidines - cytosine and thymine.

(vi) There are three different types - B-DNA, A-DNA and Z-DNA. B-DNA is the most common under normal physiological conditions and is a right handed double-helix. Z-DNA is a left-handed double helix. A-DNA is similar to B-DNA, but takes another configuration under dehydrated conditions.

(vii) DNA is the genetic material in almost all living organisms.

2. Give an account of the mechanism of translation in prokaryotes.

Ans. (i) Translation is the process of translating the sequence of a messenger RNA (mRNA) molecule to a sequence of amino acids during protein synthesis by ribosomes.

(ii) The mechanism is completed in four steps :

(a) Activation of amino acids

(b) Initiation of peptide chain

(c) Elongation of polypeptide chain

(d) Termination of polypeptide chain

Each step has to be elaborated and explained in detail with regard to the role of mRNA, tRNA, ribosomes along with the enzymes and other factors.

(iii) The process of translation or protein synthesis is essentially the decoding by ribosome(s) of an mRNA message into a polypeptide or protein product.

3. Describe the semiconservative model of DNA replication.

Ans. (i) The mechanism of semiconservative model of DNA replication means -

a. A double-stranded DNA molecule separates into two separate strands.

b. Each strand serves as a template for the formation of a complimentary strand and together with the template forms a composite molecule.

c. As such every new DNA double helix would be a hybrid that consisted of one strand of old DNA, bound to one newly synthesized DNA.

(ii) Mechanism -

a. Activation of nucleotides

b. Point of origin or initiation point

c. Unwinding of DNA molecule

d. Replicating fork

e. Synthesis of new strands

f. Lagging strand/leading strand

g. Formation of daughter DNA molecules

(iii) Elaborate these points and throw light on participation of important enzymes like helicase, gyrase, primase and ligase.

4. Give an account of operon model.

Ans. (i) Jacob and Monod proposed the operon model in 1961 to explain the induction and repression of gene expression is *E.Coli*.

(ii) An operon is a unit of coordinated control of gene expression in prokaryotes and it consists of an operator gene, which controls the activities of a number of contiguous, structural genes that take part in the synthesis of protein.

(iii) Components : a. A regulatory gene, b. An operator, c. A promoter, d. Structural genes

(iv) Give a graphic presentation of lac operon and explain the role of each component.

5. Describe transcription in prokaryotes.

Ans. (i) It is the process in which a segment of bacterial DNA copies the genetic information into a newly synthesized strand of mRNA by the help of enzyme RNA polymerase.

(ii) Steps: (a) Initiation, (b) Elongation, (c) Termination.

(iii) Elaborate all the steps with suitable graphics.

UNIT - III : BIOLOGY AND HUMAN WELFARE

(b) IMPROVEMENT IN FOOD PRODUCTION

Group - A

I. Select the correct answer from the choices given under each bit :

1. Physical removal of anthers is a process known as -
(a) bagging (b) hybridization
(c) emasculation (d) sterilization

2. Disease resistant crops are produced through-
(a) mutation
(b) bagging
(c) tagging
(d) self pollination

3. What is removed during the process of emasculation?
(a) ovary (b) stigma
(c) ovule (d) anther

4. Plant cells whose cell walls are removed mechanically or enzymatically are known as:------
(a) cybird (b) transplant
(c) protoplasts (d) embryoid

5. Which one should be cultured to obtain haploid plants?
(a) embryo (b) pollen
(c) zygote (d) root tip cells

6. Large scale vegetative propagation of plants by tissue culture technique is called-
(a) biofortification
(b) hybridization
(c) biomagnification
(d) micropropagation

7. Which of the plant tissues can have totipotency?
(a) mature schlerenhyma
(b) xylem
(c) parenchyma
(d) tracheids

8. Which of the following is an algal source of single cell protein?
(a) azospirillum (b) chlorella
(c) fusarium (d) chaetomium

9. Potentiality of a living plant cell to grow into a new plant is called-
(a) cloning
(b) hybrid vigour
(c) totipotency
(d) somatogamy

10. Growing immature embryo *in vitro* into complete plants is called-
(a) micropropagation
(b) embryo rescue
(c) artificial seeds
(d) embryo genesis

11. Which one of the following is a disease of cattle?
(a) Foot and mouth disease
(b) Marek's disease
(c) Bacillary white diarrhea
(d) Newcastle disease

12. Which is not an indigeneous breed of poultry?

(a) Chittagong (b) Kadaknath
(c) Australorp (d) Nicobari

13. Which one system is used by the commercial farmers for large scale production of eggs?

(a) Free-range system
(b) Semi-intensive system
(c) Folding -unit system
(d) Cage system

14. An indigenous milch breed of buffalo is -

(a) Sahiwal
(b) Mehsana
(c) Red sindhi
(d) Tharparkar

15. Which one of the following is an exotic milch breed of cattle?

(a) Rathi (b) Gir
(c) Red Dane (d) Red sindhi

16. The success story of dairy farming in India is called -

(a. Operation flood
(b) Green revolution
(c) White revolution
(d) Blue revolution

17. The main architect of the success of dairy farming in India was-

(a) Dr. Homi Bhaba
(b) Dr. Verghese Kurien
(c) Dr. M.S. Swaminathan
(d) Dr. Meghnad Saha

18. Domestication of honey bee for commercial purpose is known as bee keeping or-

(a) Mariculture (b) Apiculture
(c) Aboriculture (d) Aviculture

19. Which one of the following is not an indigenous milch goat breed?

a. Jamunapuri b. Beetal
c. Gir d. Zalawadi

II. Fill in the blanks :

1. Cross breeding of genetically diverse parents is called_____.
2. Sum total of all alleles of genes present in a particular crop and its related cultivated and wild varieties from _____.
3. The process of physical removal of anthers to avoid self-pollination is known as _____.
4. The process of increasing the micronutrient content of a food crop through selective breeding, genetic modification or use of enriched fertilizers is called _____.
5. The capacity of plant cells and tissues to grow into whole plants is called ____.
6. The tissue taken from a plant body and then placed in a nutrient medium for growth or tissue culture is called _____.
7. Amorphous mass of loosely arranged thin walled parenchymatous cells developed by tissue culture is known as _____.
8. Plant cells, whose cell walls are mechanically or enzymatically removed are called _____.
9. Fusion of a whole cell with a cytoplast or enucleated cell leads to formation of a _____ cell line.

10. Encapsulated plant tissues or somatic embryos that have potential to grow into plants, like seeds, are called __ seeds.
11. The *in vitro* culture technique of growing immature embryos is called _____
12. Triploids can be raised by _____ culture.
13. In the honey bee family, haploid males are known as _____.
14. The characteristic flight of the queen bee during fertilization is known as _____.
15. In the honey bee family, all the diploid females other than the queen are known as _____.

III. Answer in one word.

1. Development of haploid eggs without fertilization.
2. Remaining part of plant cell when the wall is mechanically or enzymatically removed.
3. A ketonic monosaccharide naturally occurring in fruits and honey.
4. The embryos developed from cells of cultured plant tissue during somatic embryogenesis.
5. The process in which flower buds are artificially enclosed to avoid undesired pollination.
6. The process by which the genetic make up of an organism can be changed artificially through use of chemicals or radiation.

IV. Correct the sentences by changing the underlined word/words only.

1. Cross between genetically diverse parents is known as autogamy.
2. During emasculation, ovules are physically removed.
3. New characters can be induced in the offspring by treatment of plants with chemicals/radiation through a process called hybridization.
4. The process of aseptic transfer of explant to the nutrient medium in the culture vessel is called micropropagation.
5. Cross between two species of the same genus is known as intrauarietal hybridization.
6. During protoplast fusion, when one of the two nuclei is lost and does not contribute to the genetic makeup of the new organism, it is called a hybrid.
7. Microbial biomass used as food or feed additives is called single cellcarbohydrate.
8. Using tissue culture techniques, embryos are used to raise haploid plants.
9. The process by which living organisms are completely eliminated from the tissue culture media is called pasteurization.
10. The enzyme ligase is used to remove cell walls from somatic cells.

Group - B

I. Write notes on the following in 2 to 3 sentences.

1. Hybrid vigour
2. Emasculation
3. Biofortification
4. Callus
5. Explant
6. Somatic embryogenesis
7. Protoplast culture
8. Synthetic seeds
9. Embryo rescue
10. Single cell protein
11. Somaclonal variation
12. Bagging
13. Germplasm collection

II. Differentiate between the following with two to three valid points :

1. Callus and Explant
2. Endosperm culture and Anther culture
3. Hybrid and Cybrid
4. Bagging and Tagging
5. Organogenesis and Somatic embryogenesis

Group - C

Long Answer Types Questions

1. Describe the technique of hybridization
2. Give an account of the various steps of plant tissue culture technique.

ANSWER KEYS

(b) IMPROVEMENT IN FOOD PRODUCTION

Group - A

I. Select the correct answer from the choices given under each bit :

1.	(c)	5.	(b)	9.	(c)	13.	(d)	17.	(b)
2.	(a)	6.	(d)	10.	(b)	14.	(b)	18.	(b)
3.	(d)	7.	(c)	11.	(a)	15.	(c)	19.	(c)
4.	(c)	8.	(b)	12.	(c)	16.	(c)		

II. Fill in the blanks :

1. Hybridization
2. Germplasm
3. Emasculation
4. Biofortification
5. Totipotency
6. Explant
7. Callus
8. Protoplast
9. Cybrid /Cytoplasmic hybrid
10. Synthetic / artificial
11. Embryo rescue
12. Endosperm
13. Drones
14. Nuptial flight
15. Worker

III. Answer in one word :

1. Parthenogenesis
2. Protoplast
3. Levulose / fructose
4. Embryoids
5. Bagging
6. Mutation

IV. Correct the statements, if required by changing the underlined word/ words only :

1. Hybridization
2. Anthers
3. Mutation
4. Inoculation
5. Intrageneric
6. Cybrid
7. Protein
8. Pollens
9. Sterilization
10. Cellulase

Group - B

I. Write notes on the following in 2 to 3 sentences.

1. Hybrid Vigour -

Ans.
- Hybrids are produced through breeding between genetically different parents.
- When offsprings show superiority with respect to disease, drought resistance, productivity and nutrient value etc., then it is called Hybrid Vigour.

2. Emasculation -

Ans.
- Physical removal of anthers to avoid self-pollination in plants is called emasculation.
- Other methods like dipping panicles in warm water or exposing to certain chemicals are also adopted for emasculation.
- Emasculation is performed by plant breeders to obtain a desired variety by crossing a particular plant with a desired pollen grain.

3. Biofortification:-

Ans.
- It is the process of increasing the micronutrient content of food crop through selective breeding, genetic modification or use of enriched fertilizer.
- Examples include-iron-biofortified rice, zinc-biofortified wheat and rice and golden rice.
- Golden rice - genetic modification to help accumulate provitamin - A (carotene) in the grain of rice plant makes it a golden rice variety. The rice variety can fight Vitamin - A deficiency (VAD) in children.

4. Callus:

Ans.
- Callus is an amorphous mass of loosely arranged thin-walled parenchymatous cells arising from proliferating parent plant tissue.
- In living plants, callus cells cover a plant wound. In plant tissue culture, tissue samples (explants) are sterilized and put into culture medium, where callus formation is induced, followed by cell division and differentiation.

5. Explant :

Ans.
- A cell, organ or piece of tissue which has been transferred from plant to a nutrient medium.
- It is a plant part, from which a whole plant can be developed through tissue culture technique.

6. Somatic embryogenesis :-

Ans.
- The process of embryo formation from somatic cells of cultured plant tissue is called somatic embryogenesis. Here, embryoids are formed.
- The somatic cell undergoes dedifferentiation. So, that the embryonic stem cell gives rise to an embryo under appropriate nutrient condition.

7. Protoplast culture:-

Ans. • When cell wall of a plant cell is mechanically or enzymatically removed, the resultant naked cell is called the protoplast.

• This biologically active protoplast when induced to grow in culture media, it is called protoplast culture.

8. Synthetic seeds:-

Ans. • Somatic embryoids / plantlets, encapsulated in protective capsules of calcium alginate to prevent desiccation, are known as synthetic or artificial seeds.

Ans. • These seeds are used for rapid propagation of crop plants.

9. Embryo rescue:-

Ans. • In certain plant species, pollination and fertilization are successfully completed, but embryos do not develop after a few initial division.

• These immature embryos are taken out and grown in adequate nutrient culture media, so that they develop into new plantlets. This is called embryo rescue.

10. Single cell protein-

Ans. • Microbial biomass contains very high percentage of protein and this can be utilized to supplement food.

Ans. • These uni or multicellular microorganisms such as algae, bacteria or fungi, can be biotechnologically used to obtain pure protein, called single cell protein, which are used as food additives of human beings or feed of domesticated animals.

11. Somaclonal variation

Ans. • Genetic variability gets marked in the cultured plant cells which are maintained for a long period of time.

• This variation in the cultured tissues/ cells occurs due to spontaneous mutation and variability of the culture environment and is called somaclonal variation.

12. Bagging

Ans. • It is a useful technique in plant breeding programme.

• In this technique the stigma is protected from contamination of undesired pollen by covering the emasculated flower with a butter paper or bag.

• This also ensures pollination by desired pollens as per the breeding protocol.

13. Germplasm Collection

Ans. • Germplasm is the sum total of all the alleles of genes present in any particular crop. It includes the

a) cultivated improved varieties,

b) varieties that are no longer in cultivation,

c) pure line developed by plant breeders and

d) wild related species.

• Collection of these varieties is the first step in any breeding programme for developing a new improved genetic variety.

II. Differentiate between the following with two to three valid points :

1. Callus and Explant

Callus	Explant
• Undifferentiated mass of thin-walled parenchymatous cells, developed as a result of tissue culture is called callus. • It develops from the explant. • By manipulating nutrient media, new plantlets grow from the callus through organogenesis or embryogenesis.	• A cell, organ or piece of tissue, aseptically transferred to the nutrient modia during tissue culture is called the explant. • Further division and differentiation of the cells developed from the explant lead to formation whole plants.

2. Endosperm culture and Anther culture

Endosperm culture	Anther culture
• Endosperm is a triploid tissue, formed by the fusion of one male gamete with the binucleate central cell. • It provides nutrition to the growing embryo. • Endosperm culture is commercially used to grow seedless fruit trees like apple, pear etc.	• A cell, organ or piece of tissue, aseptically transferred to the nutrient modia during tissue culture is called the explant. • Further division and differentiation of the cells developed from the explant lead to formation whole plants.

3. Hybrid and Cybrid

Hybrid	Cybrid
• Conventional hybridization producing hybrids is only limited to very closely related species. • In sexually incompatible and distantly related species hybrids formed through protoplast fusion play a vital role in crop improvement. • Complete fusion of cytoplasm and nuclei take place in the somatic hybrids.	• During protoplast fusion, when a cell is fused with an anucleated (nucleus degenerated) cytoplasm of another cell, a cybrid is formed. • Cybrids are bound by species barriers, since they are sexually compatible with one of the parent species.

4. Bagging and Tagging

Bagging	Tagging
• Bagging is a plant breeding technique for preventing self-pollination in bisexual flowers. • Anthers of bisexual flowers are removed and the flower is then wrapped with a paper bag to protect it against pollen contamination. • This technique is used during artificial hybridization experiments.	• After dusting of the stigma with desired pollen grains of an emasculated flower, it is rebagged and a tag containing relevant information like date of emasculation date of pollination and details of male and female plants etc. is attached. • This is called tagging. It is a useful technique in artificial hybridization experiments.

5. Organogenesis and Somatic Embryogenesis

Organogenesis	Somatic Embryogenesis
• Organogenesis is a method used during plant tissue culture to induce organs like shoot and root from vegetative cells • Under artificial conditions, it proceeds through two hormonal signals to induce shoot and then root separately, resulting in formation of a complete plantlet.	• Somatic embryogenesis is another method used in plant tissue culture to induce development of somatic embryos from vegetative tissue. • Under laboratory conditions, it proceeds through a single hormonal signal, resulting in formation of somatic embryos.

Group - C

Long Question Answer Keys

1. Describe the technique of hybridization

Ans. a) Collection of germplasm- Germplasms of cultivated improved varieties, pure lines developed by breeders, wild related species and other rare varieties which are not cultivated may be collected and maintained in lab conditions.

b) Parent plants may be carefully selected and evaluated.

c) Cross hybridization may be effected among selected parents.

d) In order to obtain healthy and vigourous hybrids, the follow steps may be undertaken.

(i) emasculation, (ii) bagging, (iii) tagging, (iv) dusting or artificial pollination (v) testing and selection of superior recombinants. (vi) testing and release of new varieties for field operations.

2. Give an account of the various steps of plant tissue culture technique.

Ans. i) Sterilization of the glassware and the explant-

ii) Preparation of nutrient or culture medium which ordinarily includes inorganic nutrients, a source of carbon, growth hormones and vitamins.

iii) Inoculation- Transfer of sterilized explants to the culture medium under asepetic conditions.

iv) Callus formation and its culture.

v) Organogenesis- Organ initiation like development of shoots and roots through hormonal manipulation.

vi) Somatic embryogenesis in certain crop plants lie- *Brassica, Carica papaya* etc.

vii) Protoplast Culture and Somatic hybridization- Cell suspension culture and somaclonal variation.

viii) Secondary metabolite production.

ix) Micropropagation

(b) BIOFORTIFICATION

Group - B

I. Write short notes on the following in 2 to 3 sentences.

Ans. • It is the process of breeding crops with higher levels of vitamins, minerals, proteins and fat content.

- Examples include
  - (a) Iron-biofortified rice
  - (b) Zinc-biofortified wheat and rice
  - (c) Golden rice
- Golden rice is a good example of biofortification. Genetic modification to help accumulate provitamin A (-carotene) in the grain of rice plant makes it a golden rice variety. This rice crop can fight Vitamin A Deficiency (VAD) in children.

(c) MICROBES IN HUMAN WELFARE

Group - A

I. Select the correct answer from the choices given under each bit :

1. In curd making, which one is useful in coagulation of milk protein?
(a) *Lactobacillus*
b) *Saccharomyces*
c) *Penicillium*
d) *Aspergillus*

2. Antibiotic, streptomycin is obtained from which species of *Streptomyces*?
a) *S. griseus*
b) *S. aureofaciens*
c) *S. nouresi*
d) *S. ramosus*

3. Which fungus is responsible for the production of citric acid?
a) *Penicillium* spp.
b) *Aspergillus* spp.
c) *Rhizopus* spp.
d) *Saccharomyces* spp.

4. Lipase enzyme is produced by the activity of which microbe on wheat bran?
a) *Trichoderma viridie*
b) *Rhizopus spp.*
c) *Asperigillus* spp.
d) *Saccharomyces cerevisae*

5. Which one of the following is a potential biopesticide?
a) *Pailloma* virus
b) Pox virus
c) *Baculo* virus
d) *Rhizobium*

6. Which organism is used first in the two-stage vinegar production process?
a) *Saccharomyces*
b) *Acetobacter*
c) *Lactobacillus*
d) *Rhizobium*

7. Which one of the following is a first-synthesized bacterial antibiotic?
a) Penicillin
b) Chloromycetin
c) Streptomycin
d) Neomycin

8. Which one can be used as a preservative?
a) Alcohol b) Biogas
c) Acetic acid d) Pectinase

9. What is done in the primary treatment of water?
a) Sterilization
b) Chemical treatment
c) Biological treatment
d) Sedimentation

10. What type of plant is Bt brinjal?
a) Hybrid b) Cybrid
c) Transgenic d) Haploid

11. Which organism gets associated with the plant root system to form mycorrhiza?
a) Algae b) Fungi
c) Bacteria d) Viruses

12. Of the following, which one most appropriately describes Azotobacter?

a) Asymbiotic nitrogen fixer
b) An obligate parasite
c) A transgenic plant
d) A free living nitrogen fixer

13. Which component of milk is coagulated by Lactobacillus?

a) Carbohydrate
b) Protein
c) Fat
d) Vitamins

14. Which nitrogen fixing microbe is associated with the fern Azolla in rice fields?

a) Frankia b) Rhizobium
c) Spirulina d) Anabaena

15. Which vitamin content increases following conversion of milk into curd by lactic acid bacteria?

a) Vitamin C b) Vitamin D
c) Vitamin B_{12} d) Vitamin E

16. Which non-legumunous plant also forms root nodules to fix nitrogen?

a) *Arachis* b) *Pisum*
c) *Alnus* d) *Trifolium*

17. Nitrogen-fixation in root nodues of Alnus is brought about by :

a) *Bradyrhizobium*
b) *Clostridium*
c) *Frankia*
d) *Azorhizobium*

18. *Trichoderma polysporum* is a source of -

a) Cyclosporin A
b) Streptokinase
c) Ethanol
d) Clot buster

19. Which of the following is widely used as biofertilizer in Indian rice fields?

a) *Rhizobium*
b) *Acacia arabica*
c) *Acalypha indica*
d) *Azolla pinnata*

20. Methanogenic bacteria are not found in :

a) Rumen of cattle
b) Gobar gas plant
c) Bottom of water-logged paddy field
d) Activated sludge

21. Which one of the following is not a nitrogen fixing organism?

a) *Anabaena*
b) *Nostoc*
c) *Pseudomonas*
d) *Azotobacter*

22. Which one of the following is the correct representation of the end products formed during anaerobic respiration in yeast?

a) H_2O, CO_2 and energy
b) H_2S, $C_6H_{12}O_6$ and energy
c) CO_2, C_2H_5OH and energy
d) H_2O and CO_2

23. Antibiotics are obtained from :

a) Bacteria
b) Fungi
c) actionomycetes
d) All of these

24. The chemical substances produced by some microbes which can kill or retrard growth of other microbes are called:

a) Antiseptics
b) Antiacids
c) Antibiotics
d) Antioxidants

25. Nif gene occurs in :

a) *Pencillium*
b) *Rhizobium*
c) *Aspergillus*
d) *Streptococcus*

26. A free-living aerobic and non-photosynthetic nitrogen fixing bacterium is :

a) *Anabaena* b) *Clostridium*
c) *Azotobacter* d) *Rhizobium*

27. *Streptococcus* is used in the preparation of :

a) Wine b) Idli
c) Cheese d) Bread

28. Which vitamin content increases following conversion of milk into curd?

a) Vitamin C
b) Vitamin D
c) Vitamin E
d) Vitamin B_{12}

29. BOD of wastewater is estimated by measuring the amount of :

a) Total organic matter
b) Biodegradable organic matter
c) Oxygen consumption
d) Oxygen evolution

30. How organic farmers enrich the soil?

a) Pesticides
b) Chemical fertilisers
c) Compost/Cow dung
d) Antibiotics

II. Fill in the blanks :

1. In the intestine of ruminant cattles, anaerobic digestion of complex organic molecules produces _____ gas.
2. Blue green algae like *Anabaena*, which are responsible for biological nitrogen fixation are also called_____.
3. *Acetobacter* converts ethanol to _____ by aerobic fermentation.
4. *Saccharomyces cerevisiae* is used to produce _____ on commercial scale.
5. Fleming, while working on a bacteria, *staphylococci bacteria*, discovered _____.

III. Answer in one word.

1. Chemical substances produced by some microbes which can kill or retrard growth of disease-causing microbes.
2. An antibiotic the discovery of which led to award of Nobel prize to Fleming and others in 1945.
3. A gas, released during fermentation that gives fluffy appearance to dough .
4. The organisms that are used to increase the fertility of the soil by enriching the soil with nutrients.
5. The commercial name of acetic acid.
6. The association between *Rhizobium* and the root system of legumes.
7. The natural pest killing agents other than artificial chemical substances.
8. The major component of biogas.
9. The bacteria that use to coagulate milk protein and help in the curd making.
10. The first transgenic plant produced in 1982 to obtain antibiotic resistance.

IV. Correct the sentences by changing the underlined word/words only.

1. Antibiotic tetracyclin is obtained from *Penicillium* notatum.
2. *Baculoviruses* are used as potential biofertilizers.
3. The major component of biogas is carbondioxide.
4. The first antibiotic extracted from bacterial culture in nystatin.
5. Industrial production of organic acids occurs through microbial oxidation.
6. Acetic acid is produced by *Lactobacillus* species.
7. *Azotobacter* is a symbiotic nitrogen fixer.
8. Fleming discovered the first antibiotic streptomycin in 1928.
9. The residue that accumulates in sewage treatment plants is called sloth.
10. Atmospheric nitrogen fixing bacteria are called auxotrophs.
11. *Rhizobium* is symbiotically associated with legumes for carbon dioxide fixation.
12. Pectins are large polypeptide molecules present in plant cell walls.

Group - B

I. Write notes on the following in 2 to 3 sentences.

1. Biogas
2. Biopesticides
3. Biofertilizers
4. Microbes in Industry
5. Microbes in antibiotic production
6. Microbes in sewage treatment
7. Diazotrophic bacteria
8. *Rhizobium*
9. Bioreactor
10. Sludge
11. *Bacillus thuringiensis*

II. Differentiate between the following with two to three valid points :

1. Biofertilizers and Biopesticides
2. Bakery and Brewery
3. Symbiotic nitrogen fixation and micorrhizal nitrogen uptake
4. Chemical fertilizers and Biofertilizers

Group - C

LONG ANSWER TYPE QUESTIONS

1. Give an account of industrial application of microbes
2. Describe how microbes are useful in pollution control and production of alternate source of energy.

ANSWER KEYS

(c) MICROBES IN HUMAN WELFARE

Group - A

I. Select the correct answer from the choices given under each bit :

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

II. Fill in the blanks :

1. Methane
2. Cyanobacteria
3. Vinegar / Acetic acid
4. Ethanol
5. Penicillin

III. Answer in one word :

1. Antibiotics
2. Penicillin
3. Carbon dioxide
4. Biofertilizers
5. Vinegar
6. Symbiosis
7. Biopesticides
8. Methane
9. *Lactobacillus*
10. Tobacco

IV. Correct the statements, if required by changing the underlined word/ words only :

1. Penicillin
2. Biopesticides
3. Methane
4. Streptomycin
5. Fermentation
6. Lactic acid
7. Free-living
8. Penicillin
9. Sludge
10. Diazotrophs
11. Nitrogen
12. polysaccharides

Group - B

I. Write short notes on the following in 2 to 3 sentences.

1. Biogas

Ans.
- Biogas is a mixture of gases consisting of methane, CO_2 and hydrogen sulphide produced from agricultural wastes, municipal waste, sewage and food waste etc.
- Biogas is produced when methanogenic bacteria digest organic matter/biomass in the absence of oxygen.
- Methane is the major component of biogas, which is used as a biofuel.

2. Biopesticides

Ans.
- Biopesticides refer to compounds that are used to manage agricultural pests by means of specific biological effects.
- It include natural biocontrol agents or substances of plant, animal and microbial origin and certain minerals.
- *Bacillus thuringiensis* a gram - positive soil bacterium and Baculoviruses are examples of biopesticides. Unlike chemical pesticides they have high pest-specificity and biodegradability.

3. Biofertilizers

Ans.
- Biologically active products that become source of nutrients to plants are biofertilizers.
- Two nutrients like nitrogen and phosphorus are the most essential elements required for plant growth.
- Nitrogen fixing and phosphate solubilizing bacteria and some fungi become rich source of nutrients to plants.

4. Microbes in industry

Ans.
- Microbes are employed in the fermentation industry for production of various chemicals because of their ability to give high yield in a reasonable time. The raw materials for this purpose are readily available and are also very cheap.
- In addition to the production of various foodstuffs and alcoholic beverages, industrial fermentation are now also used to produce antibiotics, enzymes, organic acids, baker's yeast, ethanol, vitamins, steroids and hormones.

5. Microbes in antibiotic production

Ans.
- Antibiotics are antibacterial substances produced by bacteria, actinomyeetes and fungi as secondary metabolites.
- Antibiotics inhibit the growth and multiplication of bacteria and as such are used to treat people suffering from bacterial infection.
- The first natural antibiotic, discovered was penicillin from the fungus *Penicllium notatum* by Alexander Fleming.

6. Microbes in sewage treatment

Ans.
- The waste water received from urban centres, called sewage are required to be treated before they are released to the water bodies.
- The domestic sewage contain good amount of organic compounds which can be degraded by microbes when they are supplied with nutrients, oxygen and other essential elements.
- Treatment of waste water is carried out in different stages. The secondary process involves aerobic microbial degradation in open bioreactors to produce sludge. This sludge is then passed onto bioreactors for anaerobic digestion to produce biogas and manure.

7. Diazotrophic bacteria

Ans.
- Nitrogen fixing bacteria such as *Rhizobium*, *Frankia*, *Azotobacter*, *Clostridium*, *Klebsiella* and cyanobacteria fix atmospheric nitrogen and these nitrogen fixers are called diazotrophic bacteria.
- Some of them are free living, whereas others like *Rhizobium* form root nodules in the legume plants through symbiotic association and fix nitrogen. This is called biological nitrogen fixation.

8. *Rhizobium*

Ans.
- *Rhizobium* is a symbiotic bacterium which fixes atmospheric nitrogen remaining in the root system of legumes.These organisms live with mutual benefit and produce root nodules. These nodules contain a hemeprotein, called leghemoglobin, which is an essential component for nitrogen fixation by legumes.

9. Bioreactor

- Bioreactors are vessels in which biochemical reactions are carried out in order to obtain specific products.
- All the reactions are carried out here under aseptic conditions. These reactions or chemical processes involve organisms or biochemically active substances derived from these microorganisms.

10. Sludge

Ans.
- The residue that accumulates in sewage treatment plants and a range of other industrial processes are called sludge.
- Sludge is composed of both inorganic and organic materials, some plant nutrients, trace elements, some pathogens, insoluble mineral precipitate, and oil.

11. Bacillus thuringiensis

Ans.
- *Bacillus thuringiensis* (Bt) is a species of bacteria that lives in soil. It makes endotoxins (proteins) that are toxic to some insects. Bt is also not toxic to non-target wildlife.
- Genetically modified (GM) crops with insect tolerance genes from *B. thuringiensis* have now been developed and commercially used as food stuff in U.S.A.
- In India Bt cotton has been very widely cultivated and used as a commercially successful cash crop.

II. Differentiate between the following with two to three valid points :

1. Biofertilizers and Biopesticides

Biofertilizers	Biopesticides
• Certain soil borne microbes convert atmospheric nitrogen to utilizable forms and are called biofertilizers. • Bacteria like *Azotobactor* and *Clostridium* can fix nitrogen freely, but Rhizobium can fix it in association with roots of leguminous plants.	• Biopesticides are certain types of pesticides derived from natural sources like animals, plants, microbes and certain minerals. • Compared to chemical pesticides, these are considered reduced-risk pesticide. • They can be biochemical microbial pesticides or plant incorporated protectants. *Bacillus thuringiensis* and *Baculo* viruses are examples of biopesticides.

2. Bakery and Brewery

Bakery	Brewery
• Bakery means bread making industry. It is done by yeast and certain bacteria. • The process of alcoholic fermentation is used here to enhance sponginess of the bread. Alcohol in the waste product.	• Brewery is the wine making industry where different types of starch containing substrates are used to form ethyl alcohol employing the process of alcoholic fermentation. • Predominantly yeasts are used and CO_2 is the byproduct here.

3. Symbiotic nitrogen fixation and Mycorrhizal nitrogen uptake

Symbiotic nitrogen fixation	Mycorrhizal nitrogen uptake
• *Rhizobia* are soil bacteria known for fixing nitrogen inside legume root nodules. • Within the nodules the bacteria convert free nitrogen to ammonia, which the host plant utilizes for its development.	• Arbuscular mycorrhizal fungi are ubiquitous root symbionts that provide plants with nutrients and other benefits. • Mycorrhizae create a vast connection around the soil, which allows the fungus to uptake nutrients like nitrogen and phosphorus for the plant. But they do not fix nitrogen.

4. Chemical fertilizers and Biofertilizers

Chemical fertilizers	Biofertilizers
• They are used as sources of nutrients to improve plant yield. • Chemical fertilizers are chemicals which are extracted and refined before use. • Continuous use of chemical fertilizers decrease the soil fertility and also makes the soil acidic.	• Biofertilizers are also used as sources of nutrients to improve plant yield. • Biofertilizers are minimally processed. • However, biofertilizers like *Anabaena*, Cyanobacteria and mycorrhiza do not decrease the soil fertility. Therefore, they are preferred over chemical fertilizers.

Group - C

Long Question Answer Keys

1. Give an account of industrial application of microbes.

Ans. a) Industrial fermentations are carried out in fermenters for production of food, alcoholic beverages, antibiotics, enzymes, organic acids, ethanol, vitamins, steroids and hormones.

b) Important antibiotics like penicillin, streptomycin, tetracyclin, chloramphenicol are now-a-days being produced industrially from microbes like fungi, bacteria and actionmycetes.

c) Ethanol is produced by using sugar beet, potatoes, corn, cassava and sugar cane through microbial fermentation.

d) Most organic acids such as acetic, citric, gluconic and fumaric acids etc. are produced by microbial fermentation.

e) Microbes are known to excrete enzymes into their growth medium, which are used in pharmaceutical, food and textile industries.

2. Describe how microbes are useful in pollution control and production of alternate source of energy.

Ans. a) Microbes are used to breakdown a range of organic compounds and absorb inorganic substances. Bioremediation uses micro organisms to reduce pollution. Microbes are capable of cleaning up polluted air, soil and water and provide clean environment.

b) Waste water and domestic sewage released from industrial and urban centres are subjected to aerobic and anerobic degradation by specific microorganisms in treatment plants for removal of degradable pollutants before they are released to water bodies.

c) Biogas produced by methanogenic bacteria from muncipal sewage, urban and agricultural waste is a rich source of energy. Biogas is a complex mixture of methane and CO_2 and other gases. It is an inflammable gas that has 50-60% of methane. Biogas is used for cooking and lighting purposes, therefore, is an alternate source of energy.

UNIT - V : ECOLOGY AND ENVIRONMENT

(a) ORGANISMS AND ENVIRONMENT

Group - A

I. Select the correct answer from the choices given under each bit :

1. Which is the correct order of the biological organisations ?

(a) Individuals → Ecosystems → Population → Communities → Biomas

(b) Individuals → Population → Communities → Ecosystem → Biomas

(c) Individuals → Community → Population → Ecosystem → Biomas

(d) Individuals → Biomass → Population → Ecosystem → Communities

2. Ecology at the organism level does not essentially include.

(a) Physiological ecology

(b) Adaptation to the environment for survival

(c) Adaptation for reproduction

(d) Formation of habitats.

3. Which is not a major biome ?

(a) Compost pit

(b) Desert

(c) Rain-forest

(d) Tundra

4. Which one leads to formation of wide variety of habitats within each biome?

(a) Orbiting of our planet

(b) Occurence of distinct seasons

(c) Regional and local variation

(d) Annual precipitation

5. Which is not a physico-chemical component of a habitat ?

(a) Water (b) Predator

(c) Light (d) Soil

6. Which is a biotic component of a habitat ?

(a) Water (b) Railfall

(c) Parasite (d) Light

7. Which is an abiotic component of the habitat ?

(a) Producer (b) Pathogen

(c) Parasite (d) Water

8. Where can average temperature be >100^{0}C ?

(a) Thermal springs

(b) Tundra

(c) Arctic region

(d) Polar region

9. The organisms which can adopt to wide range of temperature are called :

(a) Isothermal

(b) Stenothermal

(c) Heterothermal

(d) Eurythermal

10. Where can you find temperature more than 50^0C ?

(a) Poles

(b) Tropical deserts

(c) High altitudes of mounains

(d) Arctic regions

11. Which factor does influence the life of a fresh water organism in sea water?

(a) Nutrient supply

(b) pH

(c) Water availability

(d) Less salt supply

12. In land habitats the Sun is the source of both

(a) Energy and temperature

(b) Temperatue and wind

(c) Energy and food

(d) Energy and light

13. Photoperiod denotes :

(a) light intensity and light quality

(b) light intensity and its duration

(c) light duration and period

(d) Day and night duration

14. Photoperiod in plants is not associated with :

(a) Flowering

(b) Photosynthesis

(c) Reproduction

(d) Pigment formation

15. The process by which the living organisms maintain constant body temperature is called :

(a) Osmoregulation

(b) Thermoregulation

(c) Eurythermy

(d) Stenothermy

16. The organisms which can not maintain their constant internal body temperature are known as :

(a) Poikilotherms

(b) Regulators

(c) Heterothermal

(d) Escapees

17. Which group of organisims do not have the mechanism to maintain constant body temperature ?

(a) Humans (b) Birds

(c) Arctic animals (d) Plants

18. The phenomenon of temporary departure from stressful habitat to more hospitable area is called :

(a) Nudation (b) Migration

(c) Immigration (d) Mortality

19. Dormancy of seeds means :

(a) Suspension of metabolic activity

(b) Death of plant propaganda

(c) Formation of thick walled spores

(d) Instant germination

20. What can winter sleep of bears be called ?

(a) Aestivation (b) Migration

(c) Hiberation (d) Diapause

21. In which case diapause is seen ?

(a) Fresh water zooplanktons

(b) Phytoplanktons

(c) Mesophytes

(d) Xerophytes

22. Indicate the unrelated pair ?

(a) Bacteria - Zoospore

(b) Frog - Hibernation

(c) Snails - Aestivation

(d) Fresh water zooplanktons - Diapause

23. Which is a physiological adaptation of the xerophytes ?

(a) Thick cuticle

(b) Sunken stomata

(c) CAM

(d) Well developed vascular system

24. Which is not relaed to a population?

(a) Constitute a species

(b) Live in a particular geographical area

(c) Interbreed freely

(d) Belong to different species

25. Which are the attributes of a population?

(a) Birth and death

(b) Birth and death rate

(c) Birth rate and death

(d) Birth rate and death rate

26. Which is not an attribute of a population ?

(a) Migration (b) Birth rate

(c) Death rate (d) Sex ratio

27. The size of a population is impacted by:

(a) Prey organisms

(b) Predater organisms

(c) Autotrophs

(d) Number of Industries

28. Which are the two main factors that contribute towards population growth?

(a) Natality and mortality

(b) Natality and immigration

(c) Mortality and migration

(d) Mortality and immigration

29. How does population density increase rapidly in a new habitat ?

(a) Birth rate (b) Death rate

(c) Immigration (d) Emigration

30. Under which condition can population growth be exponential?

(a) famine

(b) limited resource

(c) unlimited resource

(d) small habitat

31. What does carrying capacity of a habitat denote ?

(a) Unlimited resource

(b) Maximum number of individuals of a population, than can be accomodated

(c) Competition among population

(d) Various restraints for a population

32. To form a biological community, the organisms that interact together are :

(a) Plants, animals and microbes

(b) Plants and microbes

(c) Animals and microbes

(d) Plants and animals

33. When both organisms benefit in an assocaition, it is called :

(a) Parasitism (b) Mutualism

(c) Predation (d) Competition

34. When one organism lives at the cost of other, it is called :

(a) Mutualism

(b) Commensalism

(c) Parasitism

(d) Amensalism

35. What is the association in which one organism is benefited and other neither benefited nor harmed called?

(a) Mutualism

(b) Parasitism

(c) Commensalism

(d) Predation

36. When in an association, one species is harmed whereas other is unaffected, it is called :

(a) Commensalism

(b) Amensalism

(c) Parasitism

(d) Predation

37. When a non-native, foot spreading exotic species is introduced to a new habitat, it is called?

(a) Indigenous species

(b) Natural species

(c) Invasive species

(d) Seral Community

38. By which mechanism does some animal species change its colour to escape from thepredator ?

(a) Camouflage

(b) Mimicry

(c) Chemical emission

(d) Presence of spines

39. Superficial resemblance of one organism to another or to the natural objects among which it secures concealment, protection from predation is called:

(a) Camoutlage

(b) Concealment

(c) Mimicry

(d) Chemical omission

40. Which type of defence system is seen with spines of Opuntia ?

(a) Morophological
(b) Chemical
(c) Biochemical
(d) Physiological

41. Homeostasis is

(a) tendency to change with change in environment
(b) tendency to resist change
(c) disturbance in regulatory control
(d) plants and animals living together

42. The size of population tells us lot about

(a) Environment (b) Sex-ratio
(c) Age pyramid (d) Habitat

43. Under limited resources the competitively superior species will eventually eliminate the other species, what is that condition called?

(a) Competitive inclusion
(b) Parasitism
(c) Competitive predation
(d) Competitive exclusion

44. Due to the presence of a competitively superior species, the distribution of one species becomes restricted to a small geographical area. But once the dominant species experimentally removed, the distribution of other species get, dramatically increased. What is that condition ecologically termed ?

(a) Competitive exclusion
(b) Competitive inclusion
(c) Competitive release
(d) Competitive predation

45. If two species compete for the same resource, they could avoid competition by changing their habit, What is that condition called :

(a) Resource partitioning
(b) Resource distribution
(c) Resource sharing
(d) Resource competition

46. Which one may not be considered as an ectoparasite ?

(a) grows on the host and draws nourishment
(b) only harbours the host
(c) growth and reproduction process completed and host becomes weak
(d) lives at the cost of host

47. Certain birds lay eggs in the nest of some other birds and the eggs are incubated there. What is the parasitism called here ?

(a) Ectoparasitism
(b) Endoparasitism
(c) Competitive parasitism
(d) Brood parasitism

48. What is the function of fungal component in mycorrhizae association?

(a) absorption of water and mineral
(b) reproduction
(c) participate in metabolism
(d) photosynthetic production of sugars

II. Answer in one word :

1. Light loving plants.
2. Shade loving plants.
3. Aquatic plants.
4. Plants growing in water-stress or physiologically dry condition.
5. Plants growing in saline marshy places.
6. Symbiotic association between plant roots and fungi.
7. Biologial interaction where one organism kills and eats another organism, its prey.
8. An organism that lives on, or gets its food from, or at the expense of its host.
9. Birth rate of population.
10. Physiological potential of a female to bear children.
11. Seasonal movement of animals from one habitat to another for food or reproductive needs.

III. Correct the statements by changing the underlined words only :

1. Inward movement which results in over population is known as migration.
2. Maximum population size of a biological species that can be sustained in a particular geographical area is called community.
3. Plants with sunken stomata are usually seeen in hydrophytes.
4. Aerenchyma which provides buoyancy to the plants is usually found in xerophytes.
5. A highly productive ecological zone in the sea floor is called the pelagic zone.
6. Energy enters an ecosystem when consumers carry out photosynthesis.
7. Study of communities and their relationship with environment is called autoecology.
8. Drought escape (DE) in annual grasses by completing the life cycle quickly during favourable conditions is often called an enduring strategy.
9. Diatoms, dinoflagellates and desmids conssitute a group of free-floating microalgae called zooplanktons.
10. A spongy, multilayered tissue that covers the roots of some epiphytes is called leghemoglobin.
11. A large naurlaly occuring community of flora and fauna ocupying a major habitat is called ecotone.

12. Plants with thick fleshy tissues adapted to water storage as in cactus are called esculents.

13. The maximum potential reproductive output of a female individual over its lifetime is called fertility.

14. A transition area between two biological communities, where they meet and integrate is an ecosystem.

15. Reduction of mechanical tissue like sclerenchyma is a characteristic feature of xerophytes.

Group - B

I. Write notes on the following in 2 to 3 sentences.

1. Habitat
2. Hydrophytes
3. Mutalism
4. Predation
5. Parasitism
6. Population density
7. Edapnic factor
8. Biomes
9. Abiotic factors
10. Xerophytes

II. Differentiate between the following with two to three valid points :

1. Habitat and Niche
2. Mutualism and Parasitism
3. Hydrophytes and Xerophytes
4. Birth rate and Death rate
5. Fertility and Fecundity
6. Logarithemic Growth and Exponential Growth

Group - C

LONG ANSWER TYPE QUESTIONS

1. What is population density ? Describe the factors that contribute towards population growth.
2. Explain the terms : mutualism, parasitism, predation and ammensalism
3. Discuss the adaptations in plants and animals to prevent predation.
4. Explain the terms : competitive exclusion, competitive release, resource partitioning.

ANSWER KEYS

(a) ORGANISMS AND ENVIRONMENT

Group - A

I. Select the correct answer from the choices given under each bit :

1.	(b)	13.	(b)	25.	(d)	37.	(c)
2.	(d)	14.	(d)	26.	(a)	38.	(a)
3.	(a)	15.	(b)	27.	(b)	39.	(c)
4.	(c)	16.	(a)	28.	(a)	40.	(a)
5.	(b)	17.	(d)	29.	(c)	41.	(b)
6.	(c)	18.	(b)	30.	(c)	42.	(d)
7.	(d)	19.	(a)	31.	(b)	43.	(d)
8.	(a)	20.	(c)	32.	(a)	44.	(c)
9.	(d)	21.	(a)	33.	(b)	45.	(a)
10.	(b)	22.	(a)	34.	(c)	46.	(b)
11.	(b)	23.	(c)	35.	(c)	47.	(d)
12.	(a)	24.	(d)	36.	(b)	48.	(a)

III. Answer in one word :

1.	Heliophytes	4.	Xerophytes	7.	Predation	10.	Fecundity
2.	Sciophytes	5.	Halophytes	8.	Parasite	11.	Migration
3.	Hydrophytes	6.	Mycorrhiza	9.	Natality		

III. Correct the statements, if required by changing the underlined word/ words only :

1.	Immigration	6.	producers/green plants	11.	biome
2.	Carrying capacity	7.	Synecology	12.	succulents
3.	Xerophytes	8.	ephimeral	13.	Fecundity
4.	hydrophytes	9.	Phytoplanktons	14.	ecotone
5.	benthic zone	10.	Velamen	15.	hydrophytes

Group - B

I. Write notes on the following in 2 to 3 sentences.

1. Habitat

Ans.
- Habitat is the physical area where an organism lives.
- Climatic, edaphic and topographic factors influence the habitat.
- (a) Climatic factors - light, temperature, precipitation, humidity and wind.
  (b) Edaphic factors- relating to soil.
  (c) Topographic factors - Slope, attitude and others relating to earth's surface.

2. Hydrophytes

Ans.
- Hydrophytes grow in abundance of water or in wet places.
- They are partially or wholly submerged in water. In wet places their roots or rhizomes are exposed to sufficient water.
- Basing on their relation to water and air, hydrophytes are categorised as :
  (a) Submerged hydrophytes - *Ex.-Hydrilla.*
  (b) Floating hydrophytes - Ex. - *Eichhornia*
  (c) Amphibious hydrophytes - Ex. - *Sagittaria*
- The aquatic environment brings in certain morphological and anatomical changes in the plant, known as ecological adaptations.

3. Mutualism

Ans.
- Mutualism is a type of obligate association of two organisms where both live together and can not live separately. Lichens and Mycorrhiza are two such examples.
  (a) Lichen - Here, algae prepare food through phtosynthesis; whereas fungi absorb nutrients and provide support.
  (b) Mycorrhiza - It is an association between plant roots & fungi.
- There are some plant animal associations also. The plants require insects for pollination & seed dispersal; whereas the insects collect nectars and honey from the plants.

  Ex. - Wasp / Fig Plant

4. Predation

Ans.
- Predation is a relationship, established between a predator and a prey. Here, the predator is benefited, but the prey is killed.
- The predators keep the prey population in control, so that ecosystem balance is maintained.
- To escape the notice of each other, the predators and the preys undertake many adaptations, which are unique to each one of them.

5. Parasitism

Ans. • The relationship where one organism is benefited at the cost of the other is called parasitism. It is a harmful interaction between two individuals.

- It is mainly a food co-action, but the parasite derives shelter and protection from the host, too.
- The parasites, ordinarily, do not kill their hosts but the host may die due to secondary infections, as in microbial infection of human beings.
- There can be ectoparasites or endoparasites and they may also be host-specific.

6. Population density

Ans. • It is a measurement of the number of people per unit area at a given time.

- The parameters like (a) abundance, i.e. absolute number of individuals, (b) numerical density, i.e. number of individuals per unit area, and (c) biomass density are taken as the criteria to measure population density.
- Population of a particular area at a given time depends on its (a) rate of reproduction, and (b) mortality alongwith emigration and immigration.

7. Edaphic factor

Ans. • The factors which relate to structure and composition of soil are called edaphic factors.

- Soil is a complex medium. Minerals, organic matter, water and air are present in the soil in the ratio of 40% : 10% : 15% : 25%.
- This is an abiotic factor, which is associated with plants having roots/ root system. Plants derive minerals/ water from the soil. Microorganisms, like bacteria, fungi etc., lichens, earthworms and nematodes modify the soil fertility.

8. Biomes

Ans. • Biome is a large area, characterized by its vegetation, soil, climate and wildlife.

- There are five major types of biomes like (a) aquatic, (b) grass land, (c) forest, (d) desert and tundra. These can be further subdivided like freshwater, marine, tropical rainforest etc.
- Marine biomes cover approx 3/4th of the earth's surface. They include the ocean, coral reefs, esuaries etc.

9. Abiotic factors

Ans. • It is the non-living part of an ecosystem that shapes its enviornment.

- Abiotic factors in a terrestrial ecosystem include temperatue, light, precipitation and soil etc.
- In a marine ecosystem, it would include salinity and ocean currents. Abiotic and biotic factors work together to create a unique ecosystem.

10. Xerophytes

Ans.
- Xerophytes are plants that live in conditons of water scarcity.
- Basing on their adaptation to water scarcity or drought conditions, xerophytes can be :

  a) drought resistant

  b) drought enduring

  c) drought escaping
- Basing on the capacity to store water, Xerophytes can be succulents (*Opuntia*) and non-succulents (*Calotropis*). They undertake adaptations for increased water intake, limited water loss and efficient water storage. They have thick cuticles, finely divided leaves and reduced stoma etc.

II. Differentiate between the following with two to three valid points :

1. Habitat and Niche

Habitat	Niche
(i) It is the place where an organism lives.	(i) It is the organisms role within that environment.
(ii) Examples of habitat are deserts Ocean, Mountains, grass land, forest etc.	(ii) The niche of a species depends on both biotic and abiotic factors.

2. Mutualism and Parasitism

Mutualism	Parasitism
(i) It is an obligate association between two organism, where both live together and can not live separately.	(i) It is a relationship where are organism is benefited at the cost of the other.
(ii) Mutualism is for mutual benefit. Ex. Lichen, Rhizobium - leguminous root nodules.	(ii) Ordinarily, it is for food coaction, but in certain cases the parasite kills the host. Ex.-*Cuscuta* on plants. Worms/flukes in the digestive systems of humans.

3. Hydrophytes and Xerophytes

Hydrophytes	Xerophytes
(i) These plants need maximum water to grow and hence live in water. (ii) The leaves have a waxy coating on them, that gives them protection against water. (iii) The roots are reduced since water is plentily available. Ex. - *Hydrilla*	(i) These plants grow on land, which are dry and have a scarcity of water. (ii) The leaves are either fleshy or are reduced to spines so as to reduce water loss. (iii) The roots of these plants are very long which can reach water deep in the soil. Ex.- *Cactus*

4. Birth rate and Death rate

Birth rate	Death rate
(i) Birth rate or natality is the number of babies born every year per 1000 people in a population.	(i) Death rate or mortality is the number of deaths every year per 1000 people in a population.

5. Fertility and Fecundity

Fertility	Fecundity
(i) It is the actual number of offsprings produced and not the rate of reproduction.	(i) It is the capability of an individual or population to produce offspring.

6. Logarithmic Growth and Exponential Growth

Logarithmic Growth	Exponential Growth
(i) In microbiology, the rapidly growing exponential growth phase of a cell culture is called the logarithmic growth. (ii) It starts fast and then gets slower & slower.	(i) Exponential growth starts slowly and then speeds up faster and faster. (ii) Otherwise it is the phase of explosive growth.

Group - c

Long Question Answer Keys

1. What is population density? Describe the factors that contribute towards population growth.

Ans.

- The population density means the size in relation to unit space at a particular time. The size may be measured in several ways such as - abundance (absolute number in population), numerical density (number of individuals per unit area) and biomass density (biomass per unit area).
- Density of a population in a given habitat during a given period fluctuates due to changes in four basic processes, two of which (natality and immigration) contribute to an increase in population density and two (mortality an emigration) to a decrease.

(a) Natality - number of births during a given period in the population that are added to initial density.

(b) Mortality - the number of deaths during a given period.

(c) Immigration - the number of individuals of the same species that have come into habitat from elsewhere during a particular time.

(d) Emigration - the number of individuals of the population who left the habitat during a given period.

2. Explain the terms : mutualism, parasitism, predation and ammensalism.

(a) Mutualism

Ans.

- When two organisms live with mutual benefit, neither interfering with the life processes of the other, then it is called mutualism. Example - Lichens. Here, the two partners are fungi and algae. Algae provide nourishment to fungi and fungi give protection and support to algae so that they form a complex organism called Lichen.

(b) Parasitism

Ans.

- The process by which one organism lives at the cost of the other is called parasitism. Here one organism is always benefited and the other is always harmed. Most of the fungi, bacteria and viruses are parasites to plants and animals including man.

(c) Predation

Ans.

- When one animal kills another animal or plant for food, then it is called predation. Here one species called predator and it is always benefited and the interaction is detrimental for the other species, i.e. prey. Example - Tiger and Deer.

(d) Amensalism

Ans. • Here one species is harmed where as the other is unaffected. Example - *Penicillium* secretes Penicillin which inhibits growth of various kinds of bacteria.

3. Discuss the adaptations in plants and animals to prevent predation.

Ans. • **Animals**

• *Camouflage* - There are some animal species who can change their colour to escape from predators.

• *Chemical emission* - Some animal species emit poisonous chemicals from their body to evade predators.

• *Mimicry* - It refers to resemblance of one organism to another or to the natural objects among which it lives that secures concealment, protection and other advantages.

• **Plants**

• The plants have adapted more to effect morphological and chemical defence mechanism against their predators.

• Spines and thorns are present in xerophytes; Poisonous chemicals like glycosides develope in *Calotropis*. Chemicals like caffeine, quinine, strychnine etc. are examples of chemicals produced for defence in plants.

4. Explain the terms : competitive exclusion, competitive release, resource partitioning.

Ans. • Two closely related species competing for the same resource cannot co-exist indefinitely and competitively inferior will be ultimately eliminated.

• Competitive release : A species, whose distribution is restricted to a small geographical area because of the presence of a competitively superior species is found to expand its distributional range dramatically, when the competing species is experimentally removed.

• Resource Partitioning : In interspecific competition, the species facing competition, might evolve mechanims that promote co-existence rather than exclusion by resource partitioning. In this case, species may live in the same place by using different foods or using it different times.

(b) ECOSYSTEMS

Group - A

I. Select the correct answer from the choices given under each bit :

1. Which one is a manmade ecosystem?
(a) Lake
(b) Ocean
(c) Grassland
(d) Cultivated field

2. Microorganisms are called:
(a) Consumers
(b) Decomposers
(c) Producers
(d) Herbivores

3. Herbivores are always:
(a) Producers
(b) Carnivores
(c) Primary consumers
(d) Omnivoves

4. Each step of food chain is called:
(a) Trophic level
(b) Biotic community
(c) Population
(d) Hierarchy

5. Approximately what percentage of energy is passed on to the successive trophic level?
a 01 b 10
c 20 d 50

6. Net primary productivity is equal to:
(a) Gross primary productivity
(b) Gpp + loss due to respiration
(c) Loss due to respiration
(d) Gpp - loss due to respiration

7. Minerals present in plant and animal debris are released by the action of:
(a) Producers
(b) Consumers
(c) Decomposers
(d) Omnivoves

8. Which one of the following is a type of food chain produced by decomposers?
(a) Parasitic (b) Detritus
(c) Aquatic (d) Xerophytic

9. Which one is not an abiotic component of photosynthesis?
(a) Chlorophyl ll (b) CO_2
(c) Light (d) Water

10. The process of establishing a community successfully in a new environment is:
(a) Pioneer (b) Propagules
(c) Nudation (d) Ecesis

11. The process by which a bare area is created for succession is :
(a) Nudation (b) Ecesis
(c) Migration (d) Reaction

12. The largest ecosystem of the earth is:
(a) Biosphere
(b) Hydrospehere
(c) Lithosphere
(d) biome

13. In an ecosystem, energy:

(a) Is released (b) Is absorbed

(c) Flows (d) Is created

14. The flow of energy in a food chain is :

(a) Multidirectional

(b) Unidirectional

(c) Reversible

(d) None of the above

15. Eutrophication in a lake is caused due to presence of :

(a) Dissolved oxygen and bacteria

(b) BOD and COD

(c) Chromium and Mercury

(d) Nitrogen and phosphorus

16. The second trophic level in a lake is:

(a) Fungi

(b) Benthos

(c) zooplankton

(d) Phytoplankton

17. Which one of the following describes not only the physical space occupied by an organism but also its functional role in the community of organisms?

(a) Ecotone

(b) Ecological niche

(c) Habitat

(d) Home range

18. Which of the following is not an artificial ecosystem?

(a) Reservoir of a dam

(b) Paddy field

(c) Forest

(d) Garden

19. Which one is the most stable ecosystem?

a Ocean b Forest

c Mountain d Desert

20. Coal, limestone, petroleum and animal shells, all are related to :

(a) Oxygen cycle

(b) Phosphorus cycle

(c) Nitrogen cycle

(d) Carbon cycle

21. An ecosystem consists of :

(a) Chemical & physical components

(b) Biotic and abiotic components

(c) Physical and social components

(d) Biotic and antibiotic components

22. Which one is a biotic component of our biosphere?

(a) sunlight (b) air

(c) microbes (d) soil

23. Which one of the following is not a part of the ecosystem?

(a) Soil (b) Algae

(c) Plastic (d) Rainfall

24. Food chain starts with :

(a) Nitrogen fixation

(b) Decay of dead organisms

(c) Photosynthesis

(d) Respiration

25. Which one of the following has the largest population in a food chain?

(a) Secondary consumers

(b) Primary consumers

(c) Decomposers

(d) Producers

II. Fill in the blanks:

1. Biotic component of ecosystem is comprised of producers, consumers and _____.
2. Energy enters the ecosystem through producers by a process called _____.
3. In the ecosystem _____ are the producers.
4. Herbivores are always the primary _____.
5. Organisms in a food chain having similar mode of nourishment form _____ levels.
6. In the ecosystem, flow of _____ is unidirectional.
7. The pyramid of _____ is inverted in a pond or lake ecosystem.
8. The transition area between two adjacent ecological communities is called ____.
9. Development of a bare site uninhabited by any organisms is called _____.
10. The process of successful establishment of a plant and animal species in a habitat which was barren previously is called _____.

III. Answer in one/two words:

1. The process of creation of a bare area where plant succession can start.
2. The process by which energy is primarily lost from living organisms.
3. The type of ecological pyramid that is never inverted.
4. The succession which begins in dry habitat and reaches a climax.
5. The type of succession that occurs in aquatic environment and in which water gradually disappears.
6. Movement of nutrients through biotic and abiotic components of ecosystem.
7. A biotic component of the ecosystem that breaks down dead remains of organisms and other organic waste products.

IV. Correct the statements by changing the underlined words only:

1. Forests, grasslands and deserts are examples of terrestrial community.
2. Pyramid of biomass is always upright and can never be inverted.
3. In a lithosere, foliose lichen stage is the first stage of ecological succession.
4. Ecological pyramid concept was proposed by Odum.
5. The pyramid of energy is inverted in a pond or lake ecosystem.
6. The pyramid of numbers is based on the organic weight of organisms at each trophic level.
7. The process by which an ecological bare area is created is called invasion.

8. In an ecosystem, nutrient flow is unidirectional.
9. Net primary productivity = Gross primary productivity - photosynthesis.
10. The efficiency of energy transfer from one trophic level to the next tropic level is approximately 50% as per Lindemann's law of trophic efficiency 10.

Group - B

I. Write notes on the following in 2 to 3 sentences.

1. Ecosystem
2. Producers
3. Consumers
4. Productivity
5. Decomposers
6. Food chain
7. Food web
8. Ecological pyramids
9. Pyramid of energy
10. Pyramid of numbers
11. Pyramid of biomass
12. Nutrient cycling
13. Ecesis
14. Nudation
15. Plant succession
16. Species diversity
17. Phytoplankton

II. Differentiate between the following with two to three valid points :

1. Consumer and Decomposer
2. Producer and Consumer
3. GPP and NPP
4. Energy flow and Nutrient cycling
5. Primary succession and Secondary succession
6. Nudation and Invasion
7. Biotic components and Abiotic components
8. Food chain and food web
9. Parasite and saprophyte
10. Species diversity and species dominance

Group - C

Long Answer Types Questions

1. What is Ecosystem? Describe the different components of ecosystem.
2. Give an account of energy flow in an ecosystem.
3. Write a note on ecosystem services.

ANSWER KEYS

(b) ECOSYSTEMS

Group - A

I. Select the correct answer from the choices given under each bit :

1.	(d)	6.	(d)	11.	(a)	16.	(c)	21.	(b)
2.	(b)	7.	(c)	12.	(a)	17.	(b)	22.	(c)
3.	(c)	8.	(b)	13.	(c)	18.	(c)	23.	(c)
4.	(a)	9.	(a)	14.	(b)	19.	(a)	24.	(c)
5.	(b)	10.	(d)	15.	(d)	20.	(d)	25.	(c)

II. Fill in the blanks :

1. Decomposers
2. Photosynthesis
3. Green plants
4. Consumers
5. Trophic
6. Energy
7. Biomass
8. Ecotone
9. Nudation
10. Ecesis

III. Correct the statements, if required by changing the underlined word/ words only :

1. Nudation
2. Respiration
3. Pyramid of energy
4. Xerosere
5. Hydrosere
6. Nutrient cycle/biogeochemical cycle
7. Decomposers

IV. Correct the statements by changing the underlined words only:

1. Ecosystem
2. Energy
3. Crustose lichen
4. Elton
5. Biomass
6. Biomass
7. Nudation
8. Energy
9. Respiration
10. 10%

Group - B

I. Write notes on the following in 2 to 3 sentences.

1. Ecosystem :

Ans.
- Ecosystem comprises of structural and functional units of living organisms and non-living substances.
- Structural living components include producers, consumers and decomposers; whereas non-living components include inorganic nutrients, organic compounds and environmental factors.
- Functional components include productivity, decomposition, energy flow and nutrient cycling etc.

2. Producers :

Ans.
- Green plants in the presence of sunlight synthesize organic compounds during the process of photosynthesis. In this process light energy is converted to chemical energy and is stored in the bonds of carbohydrate molecules.
- Besides the green plants, certain photosynthesizing bacteria also convert inorganic molecules into organic compounds.
- These organisms are therefore the autotrophs and are called the producers in a food chain.

3. Consumers:

Ans.
- In a food chain animals utilize organic materials from producers directly or indirectly. They are, therefore the heterotrophs and are called consumers.
- Consumers can be primary, secondary or tertiary. Primary consumers are the herbivores which directly consume plants of plant materials.
- Secondary and tertiary consumers feed on herbivores/carnivores. Omnivores feed both on plants and animals.

4. Productivity :

Ans.
- Producers convert solar energy into chemical energy, which is utilized in their metabolic process. In this process biomass is accumulated.
- Accumulation of biomass is called productivity.
- Productivity can be discussed in terms of gross primary productivity (GPP) and net primary productivity (NPP). GPP-respiration = NPP.

5. Decomposers:

Ans.
- Organisms like fungi, bacteria and protozoa help breaking down of complex organic molecules into simpler inorganic molecules. These organisms are called decomposers.
- Dead remains of plants and animals and waste materials are decomposed and disintegrated by these organisms to form detritus, which starts a new food chain.

6. Food Chain:

Ans. • It is a linear sequence of organisms which shows how nutrients and energy are transferred from one organism to another in an ecosystem.

• Based on their food habit or nutrition organisms occupy a specific place called trophic level in any food chain.

• Producers belong to the first trophic level.

7. Food web:

Ans. • Food chains do not exist in isolation, because organisms feed on a variety of ways at a particular trophic level.

Ans. • Thus, a network of trophic relationships is established in an ecosystem. This is called food web.

• Food web provides strength and stability to the ecosystem.

8. Consumers:

Ans. • An ecological pyramid is a graphic representation of the relationship between different organisms at different trophic levels in a quantitative manner.

• Based on the principle of number of organisms, biomass and transfer of energy, there are three types of pyramids

a) The pyramid of numbers,

b) The pyramid of biomass and

c) The pyramid of energy

9. Pyramid of energy:

Ans. • It shows the rate of flow of energy from one trophic level of community to another.

• It is measured in terms of the amount of energy at each trophic level of a food chain i.e. energy per area per time (KJm-2 year-1).

• Pyramid of energy can never be inverted.

10. Pyramid of numbers:-

Ans. • Pyramid of numbers show the relative number of organisms at each trophic level in a food chain.

• In a grazing food chain, the number goes down at each successive trophic level and the pyramid is upright.

• In the parasitic food chain the pyramid will be inverted.

11. Pyramid of biomass:

Ans. • Biomass is the amount of living material in an organism. It is very difficult to determine the actual biomass of organisms at any particular trophic level.

• The pyramid of biomass is upright in a forest ecosystem, whereas it is inverted in a pond or ocean ecosystem.

12. Nutrient cycling:

Ans. • An ecosystem requires constant supply of nutrients and the movement of mineral nutrients is cyclic.

• Nutrients are not lost from the ecosystem, rather they move through different constituents and come back again to the producers.

• Mineral cycles include carbon cycle, sulfur cycle, nitrogen cycle, water cycle, oxygen cycle and phosphorus cycle etc.

13. Ecesis:

Ans. • Ecesis is the process of successful establishment of a species in a bare area.

• The propagules/spores that reach the area, are not always successful in establishing themselves in the new environment.

• Only one among a few becomes successful and it is called the pioneer.

14. Nudation:

Ans. • It is the process by which a bare area is created.

Ans. • The reasons for this may be topographic like soil erosion, land slides, volcanic eruptions, or climatic -like glaciations, storms etc. or biotic /anthropogenic activities.

15. Plant succession:

Ans. • It is the process of gradual replacement of one plant community by another one over a period of time.

• Primary succession passes through various steps like nudation, invasion, competition/ reaction and stabilization.

• The causes of plant succession can be biotic or climatic factors that affect the area.

16. Species diversity:

Ans. • It refers to the number of species in a population in a given space and time.

• It is measured by species richness, species composition and its relative abundance.

• IUCN recognizes three types of species diversity-alpha, beta and gamma diversities.

17. Phytoplankton:

Ans. • Phytoplankton are part of ocean or fresh water ecosystems. They include diatoms, cyanobacteria and dinoflagellates etc.

• They are autotrophic and synthesize their own food through photosynthesis.

• They take part in cycling of inorganic and organic nutrients and atomospheric gas composition.

II. Differentiate between the following with two to three valid points :

1. Consumer and Decomposer

Consumer	Decomposer
• They depend on other organisms for food and energy. • They are, therefore heterotrophs that include all animals, fungi, many bacteria and even some plants. • They can be herbivores, carnivores and omnivores.	• They breakdown the dead remains of plants and animals and other waste materials. • They release simple inorganic molecules back to the environment to be used by producers. • They include microbes and other detrivores like earth worms, millipedes etc. They bring stability to the ecosystem.

2. Producer and Consumer

Producer	Consumer
• They produce food for themselves and also for others. • They use energy and simple inorganic molecules to produce complex organic compounds. The stability of producers in vital to ecosystem. • They can be photoautotrophs like plants, algae and some bacteria, or chemoautotrophs like some bacteria that prepose food by chemosynthesis.	• They depend on other organisms for food and energy. • They are, therefore heterotrophs that include all animals, fungi, many bacteria and even some plants. • They can be herbivores, carnivores and omnivores.

3. GPP (Gross Primary Productivity) and NPP (Net Primary Productivity)

GPP (Gross Primary Productivity)	NPP (Net Primary Productivity)
• It is the measure of total amount of organic matter produced through photosynthesis in an ecosystem.	• All organisms including the autotrophs respire. During respiration some amount of energy is lost. NPP = GPP- Energy lost due to respiration in plants

4. Energy flow and Nutrient cycling

Energy flow	Nutrient cycling
• Energy fixed by producers is passed onto successive trophic levels. • It is estimated that only about 10% of energy is passed on form one trophic level to the next level. • The energy flow is always unidirectional.	• Every organism needs nutrients for its growth and survival. • With the death of plants and animals, the complex organic compounds are broken down into simpler molecules by the decomposers, which can be available to the green plants, the producers.

5. Primary Succession and Secondary Succession

Primary Succession	Secondary Succession
• It starts on a substratum where there is no life. • It is colonized for the first time by living organisms. • The group of organisms that colonize this barren land are called pioneers. They are usually lichens, algae and fungi.	• It is a type of ecological succession that occurs in an environment which had already established an ecosystem, but got destroyed due to some natural calamities or manmade disasters like fire, hurricane etc. • The time taken for secondary succession is less than the primary one.

6. Nudation and Invasion

Nudation	Invasion
• The process by which a bare area is created is called nudation. • Reasons for nudation may be topographic, climatic or biotic.	• The process by which new species reach and establish in a bare area is called invasion. • IThree stages of invasion are:- a) migration b) ecesic and c) expansion or aggregation

7. Biotic components and Abiotic components

Biotic components	Abiotic components
• Biotic components of an ecosystem are the living beings like plants, animals, bacteria etc. • They are classified into a) Producers-the green plants b) Consumers-usually the animals, and c) Decomposers-organisms like bacteria and fungi.	• Abiotic or non-living components include water, soil, atmosphere. • The biotic factors shape the environment and vary in different types of ecosystems. • In a terrestrial ecosystem while temperature, light and water are very important; in the marine ecosystem salinity and ocean currents are most important.

8. Food Chain and Food Web

Food Chain	Food Web
• Food chain is a linear sequence of organisms in an ecosystem, which starts from the producer and ends with the decomposer species. • No food chain can operate in isolation; hence it is not natural. • Food chain follows a single path.	• Food web is a network of multiple food chains . • it operates naturally and provides stability to the ecosystem. • Food web follows multiple paths.

9. Parasite and Saprophyte

Nudation	Invasion
• Parasites obtain their nutrition, from other living organism, the hosts. • They harm the body of the host, while feeding on them. • Cuscuta, Rafflesia are examples of plant porosities.	• Saprophytes obtain their nutrition from dead decaying organic matter. • They do not require a host, rather they are the cleaning agents. • Fungi are good examples of saprophyte.

10. Species Diversity and Species Dominance

Species Diversity	Species Dominance
• It is a measure of species richness combined with evenness found in a community or ecosystem. • It not only takes into account how many species are present, but also how evenly distributed the numbers of each species are.	• Species that have high abundance relative to other species in a community have a proportionate effect on environmental conditions, community diversity and ecosystem function.

Group - C

Long Questions Answer Keys

1. What is an ecosystem? Describe the different components of ecosystem.

Ans. Ecosystem comprises of structural and functional units of living organisms and non-living substances interacting with each other.

Components

The structural components may be biotic and abiotic.

a) Biotic components

i) Producer- Green plants and some bacteria

ii) Consumer-mostly animals

iii) Decomposer- Microorganisms

b) Abiotic components-

i) Inorganic nutrients - carbon, nitrogen and hydrogen

ii) Organic compounds-

iii) Environmental factors

The functional attributes are productivity, decomposition, energy flow and nutrient cycling.

2. Give an account of energy flow in an ecosystem.

Ans. Transfer of energy from green plants (producers) to a series of other organisms constitutes the food chain. Depending on the type of ecosystem, there may be 3 to 6 trophic levels through which energy and organic material pass. An example can be -

Grass $\rightarrow$ grass hopper $\rightarrow$ frog $\rightarrow$ snake $\rightarrow$ eagle

Elaberate on -

a) Food chain

b) Food web

c) Energy flow efficiency

d) Ecological pyramid

a) Pyramid of biomass

b) Pyramid of numbers

c) Pyramid of energy

3. Write a note on ecosystem services.

Ans. Ecosystem services are the benefits people obtain from the ecosystem.

a) Provisioning services- Genetic resources, food, fibre and fresh water.

b) Regulating services- Carbon sequestration, waste decomposition, purification of air and water, crop pollination and pest/disease control.

c) Support services- Nutrient cycling, seed dispersal and primary production.

d) Cultural services- Cultural, intellectual and spiritual inspiration, recreational benefits & scientific discovery.

(c) BIODIVERSITY

Group - A

I. Select the correct answer from the choices given under each bit :

1. Which of the following countries has the highest biodiversity ?

(a) Brazil (b) South Africa

(c) Russia (d) India

2. What percentage of the earth's land area do the biodiversity hotspots host their ecosystems on ?

(a) 12 (b) 16

(c) Less than 5 (d) More than 20

3. Hotspots are biogeographic regions with significant levels of :

(a) pollution

(b) human activity

(c) human population

(d) biodiversity threatened with destruction

4. Which one of the following is a biodiversity hotspot in India ?

(a) Sundarbans

(b) Gangetic plain

(c) Western Ghats

(d) Eastern Ghats

5. Which one is an extinct species ?

(a) Red Panda

(b) Dodo

(c) One horned rhinoceros

(d) Sparrow

6. Alpha diversity refers to :

(a) diversity of species within a community

(b) diversity of species among communities

(c) diversity across wider geographical range.

(d) genetic diversity

7. Red data book conains data of :

(a) all plant species

(b) all animal species

(c) economically important species

(d) threatened speices

8. Which one is the first biosphere reserve in India ?

(a) Similipal (b) Nilgiri

(c) Panna (d) Manas

9. How many biosphere reserves are there in India ?

(a) 10 (b) 12

(c) 15 (d) 18

10. How many biosphere reserves of India ae connected to the world network?

(a) 05 (b) 10

(c) 12 (d) 15

11. Which one is the largest biosphere reserve in India ?

(a) Gulf of Mannar

(b) Sundarbans

(c) Panchmarhi

(d) Great Rann of Kutch

12. Which one is the smallest biosphere reserve in India ?

(a) Dihang - Dibang

(b) Nokrek

(c) Dibru - Saikhowa

(d) Nanda Devi

13. Which one is the lone biosphere reserve is Odisha?

(a) Similipal

(b) Bhitarkanika

(c) Chilka

(d) Mahendragiri

14. IUCN is also called as :

(a) World Conservation Consortium

(b) World Conservation Union

(c) Worldwide Conservation Union

(d) Worldwide Fund for Nature

15. Which of the following region has maximum diversity ?

(a) mangroves

(b) temperate rain forest

(c) taiga

(d) coral reefs

16. IUCN headquarters is at :

(a) Morges, Switzerland

(b) Paris, France

(c) Viena, Austria

(d) New York, USA

17. Dodo is :

(a) endangered

(b) critically endangered

(c) rare

(d) extinct

18. Approximately half of the total world speceis are present in the:

(a) tropical rain forest

(b) temperate rain forest

(c) temperate deciduous forest

(d) coral reefs

19. Biodiversity

(a) increases towards the equator

(b) decreases towards the equator

(c) remains the same throughout the planet

(d) has no effect on change in latitude

20. Conservation within natural habitat is :

(a) insitu conservation

(b) exsitu conservation

(c) invivo conservation

(d) exvivo conservation

21. Which one is the largest living primate found in Congo, which is declared critically endangered by IUCN?

(a) Western Gorilla

(b) Bornean Orangutang

(c) Sumatran Orangutang

(d) Eastern Gorilla

22. Which one is an example of ex-situ conservation ?

(a) Sacred groves

(b) Wildlife sanctuary

(c) Seed bank

(d) National Park

23. Which has the maximum genetic diversity in India?

(a) Potato (b) Tea

(c) Mango (d) Teak

24. Which of the following is defined as the number of species represented in a specific region, landscape or an ecological community?

(a) Coevolution

(b) Commensalism

(c) Species richness

(d) Population density

25. When the last individual in a particular species dies, it is known as :

(a) speciation

(b) extinction

(c) phylogenetic diversity

(d) adaptation

26. Which one of the following is a biodiversity hotspot in India ?

(a) Gangetic plain

(b) Sundarbans

(c) Eastern Ghats

(d) Western Ghats

27. Nandan Kanan Zoo is known for which of the following ?

(a) Hippo

(b) Nilgiri Tahr

(c) White tiger

(d) Whale

28. One species the presence or absence of which can make a huge difference to an entire ecosystem is called :

(a) extinct species

(b) endemic species

(c) keystone species

(d) endangered species

29. Different breeds of dogs are the example of which biodiversity?

(a) ecosystem (b) habitat

(c) genetic (d) species

II. Fill in the blanks :

1. The term biodiversity was coined by _____ in 1980.
2. The three levels of biodiversity i.e. genetic diversity, organismal diversity and ecological ecosystem/diversity are also called as the _____ of biodiversity.
3. There are _____ megabiodiversity countires in the world.
4. India has _____ number of biodiversity hotspots.
5. The Wildlife Protection Act was enacted in _____.
6. The UN Conference on Human Environment was held in _____ in 1972.
7. IUCN stands for _____.
8. The first national park of India is _____.
9. Odisha has _____ number of national parks.
10. There are _____ number of Wildlife Sanctuaries in Odisha.
11. India has _____ number of biosphere reserves.
12. The concept of biosphere reserve was made a beginning under _____ programme of UNESCO.
13. A species that originated in one place and is not found anywhere else is called _____.
14. An organism whose living representative is not to be found anywhere is said to be _____ .
15. A biogeographic region with high endemism and habitat destruction is called a _____ .
16. An inventory of global conservation status of biological species prepared by IUCN is know as _____.

III. Correct the statements, if required by changing the underlined word/ words only :

1. Variation of genetic material is the basis of <u>species</u> diversity.
2. Variation among the species of wide geographical range is called <u>beta</u> diversity.
3. Latitude and longitude are two important <u>climatic</u> factors for uneven distribution of diversity.
4. In the tropical region, <u>genetic</u> diversity is to be found the maximum.
5. <u>Introduction</u> of keystone species is considered critical for the stability of an ecosystem.
6. <u>Wild LifeSanctuaries</u> come under category-V - (Protected landscape/sea scape) of the six categories of protected areas designated by WCPA.

7. Great Panda is an extinct species.
8. Indian cheetah is a(n) volunerable species.
9. National Parks, wildlife sanctuaries are examples of ex-situ conservation of biodiversity.
10. One-horned Rhinoeeros, a critically endangered species is found in the Indo-Buma region, which is one of the four biological hotspots of India.
11. In Odisha, Bhitarkanika is the only biosphere reserve.

Group - B

I. Write notes on the following in 2 to 3 sentences.

1. Hierarchy of biodiversity
2. Species reichness
3. Sacred groves
4. Importance of biodiversity
5. Biodiversity hotspot
6. IUCN
7. Red Data Book
8. Biosphere Reserve
9. National Park
10. Wild Life Sanctuary
11. MAB Programme

II. Differentiate between the following with two to three valid points :

1. Genetic diversity and Ecological diversity.
2. National Park and Biosphere Reserve.
3. Genetic Diversity and Species Diversity

Group - C

Long Answer Types Questions

1. Describe the major causes of species loss in a geographical region. / Describe the causes of loss of biodiversity in an area.
2. Write a note on importance of biodiversity.
3. Describe the important features of a biosphere reserve.
4. Describe the important features of a national park.
5. Give and account of the MAB programme.

ANSWER KEYS

(c) BIODIVERSITY

Group - A

I. Select the correct answer from the choices given under each bit :

1.	(a)	9.	(d)	17.	(d)	25.	(b)
2.	(c)	10.	(c)	18.	(a)	26.	(d)
3.	(d)	11.	(d)	19.	(a)	27.	(c)
4.	(c)	12.	(c)	20.	(a)	28.	(c)
5.	(b)	13.	(a)	21.	(d)	29.	(c)
6.	(a)	14.	(b)	22.	(c)		
7.	(d)	15.	(d)	23.	(c)		
8.	(b)	16.	(a)	24.	(c)		

II. Fill in the blanks :

1. Lovejoy
2. hierarchy
3. 17
4. 04
5. 1972
6. Stockholm (Sweden)
7. International Union for Conservation of Nature
8. Corbett National Park / Hailey's
9. 02
10. 19
11. 18
12. MAB
13. endemic
14. extinct
15. biodiversity hotspot
16. Red Data Book/IUCN Red List

III. Correct the statements, if required by changing the underlined word/ words only :

1. genetic
2. gamma
3. geographic
4. species
5. Extinction
6. Biosphere Reserves
7. endangered
8. extinct
9. in-situ
10. The Eastern Himalaya
11. Similipal

Group - B

I. Write notes on the following in 2 to 3 sentences.

1. **Hierarchy of biodiversity**

Ans. Biologists most often define biodiversity as the "totality of genes, species and ecosystems of a region". The three components or levels at which biodiversity can be identified is called the hierarchy of biodiversity. They are :

(a) Genetic diversity - within species

(b) Organizational diversity - among species or populations

(c) Ecological diversity - among communities.

2. Species reichness

Ans. It is the number of different species represented in any community. It is a simple count of species and does not take into account the abudance of any species or species evenness.

3. Sacred groves

Ans. Sacred groves are parts of forest that are left untouched by local and have trees which are considered socially, culturally, medicinally and religiously important. Common examples are - *Ficus benghalensis* and *Ficus religiosa* etc.

India has well over 13,000 documented Sacred Groves. These forest patches are mostly protected for deites, but provide vital ecosystem services to the local people.

4. Importance of Biodiversity

Ans. Biodiversity provides many ecosystem services, like clean air and water, supply of oxygen, pollination of plants, pest control, waste water treatment and many other recreational activities.

An ecosystem rich in biodiversity stabilizes the net productivity and maintains the food chain. A healthy food chain helps in energy flow in successive trophic levels.

5. Biodiversity Hotspot

Ans. A biodiversity hotspot is a biogeographic region with significant levels of biodiversity that is threatened with destruction. It must meet the following two criteria -

(a) It must contain atleast 0.5% or 1500 species of vascular plants as endemics.

(b) It has to have lost at least 70% of its primary vegetation.

Norman Myers in the year 1988 identified 25 such biodiversity hotspots. After that 11 more have been added to this list making it 36.

6. IUCN

Ans. IUCN stands for International Union for Conservation of Nature. It was established on October 5, 1948. It works with governments and civil society organizations to protect nature. It is the world's oldest and largest

global environmental organization. It works to mobilize communities for biodiversity conservation and sustainable development. It is also known as World Conservation Union.

7. Red Data Book

Ans. Red Data Book or the IUCN Red List is the World's most comprehensive inventory of the global conservation status of biological species. It uses a set of criteria to evaluate the extinction risk of different species. The list recognizes several categories like :

(a) Extinct (EX)

(b) Threatened
  (i) Critically endangered (CR)
  (ii) Endangered (EN)
  (iii) Vulnerable (VU)

(c) Lower Risk
  (i) Near threatened (NT)
  (ii) Conservation dependent (CD)
  (iii) Least concern (LC)

8, Biosphere Reserve

Ans. Biosphere reserves are protected areas meant for the conservation of plants and animals. They conserve biodiversity of that area. In 1980, IUCN evolved a conservation strategy for sustainable use of biological resources. They designated six different categories of land as protected areas for conservation of all ecosystems operating there. A biosphere reserve comes under category-V of the protected areas. There are 18 biosphere reserves in India. Odisha has the lone biosphere reserve in Similipal.

9. Natioal Park

Ans. National Park is a category-II type IUCN protected area. It is a large area set up by a National Government for preservation of natural environment. From the date of notification, all rights and privileges including forestry operations and grazing of domestic animals are completely stopped. However, general public may enter into it with valid permission.

10. Wild Life Sanctuary

Ans. It comes under category-IV of the IUCN protected areas. A wildlife sanctuary is a protected area under which wild life is protected from hunting, predation and poaching. Unlike national parks, wild life sanctuaries do not have properly marked boundaries.

11. MAB Programme

Ans. Man and Biosphere (MAB) programme is an intergovernmental scientific programme launched by UNESCO in 1971. The MAB programme provides a unique platform for cooperation in research and development, capacity building and networking on three interlinked issues - biodiversity loss, climate change and sustainable development.

II. Differentiate between the following with two to three valid points :

1. Genetic diversity and Ecological diversity

Genetic diversity	Ecological diversity
It arises through genetic combination during sexual reproduction and mutation. It leads to origin of new species. Diversity within species is necessary to maintain diversity among species.	It is about different types of ecosystems present in the biosphere. It includes the variation in both terrestial and aquatic ecosystems.

2. National Park and Biosphere Reserve

National Park	Biosphere Reserve
National Park is a category-II type protected area of IUCN. It is a large area set aside for protection of natural environment. Corbett National Park (formerly Hailey's) in Uttarakhand is the first national park established in India. There are 103 national parks in India and 02 in Odisha.	A biosphere reserve comes under category-V of the six protected areas, recognised by IUCN. These are protected areas meant for conservation of all ecosysems operating there. There are 18 biosphere reserves in India. Odisha has the lone biosphere reserve in Similipal.

3. Genetic Diversity and Species Diversity

Genetic Diversity	Species Diversity
It arises through genetic combination during sexual reproduction and mutation. It leads to origin of new species. Diversity within species is necessary to maintain diversity among species.	It is also known as organismal diversity. It is measured by species richness i.e. number of species in a given area, species composition i.e. list of species and their relative abundance i.e. number of individuals in different species.

Group - C

Long Questions Answer Keys

1. Describe the major causes of species loss in a geographical region. / Describe the causes of loss of biodiversity in an area.

Ans. (i) Loss of habitat

(ii) Over exploitation

(iii) Invasion of alien species

(iv) Coextinction

(v) Pollution

(vi) Climate change

(vii) Population growth

(viii) Unanthorised wildlife trade

2. Write a note on importance of biodiversity.

Ans. (i) Ecosystem services -

(a) Protection of soil and water resources

(b) recycle of nutrients

(c) breakdown and absorption of pollutants

(d) maintenance and stability of ecosystem

(ii) As biological resources -

(a) Food, medicine, clothing, timber

(b) raw material for industry

(c) biocontrol of pests and diseases

(iii) Social benefits -

(a) Ornamental value

(b) recreation and ecotourism

(c) cultural values

3 Describe the important features of a biosphere reserve.

Ans. (i) In 1980, IUCN evolved a conservation strategy for sustainable use of biological resources and designated six different categories of land as protected areas. A biosphere reserve comes under category-V of the protected areas.

(ii) There are 18 biosphere reserves in India and one in Odisha i.e. Similipal.

(iii) Under the Man And Biosphere (MAB) Programme of UNESCO conservation programmes are integrated into developmental activities.

(iv) Biosphere reserves are divided into three zones i.e. core zone, buffer zone and transitional zone for regulating different activities.

4. Describe the important features of a national park.

Ans. (i) It is a category-II type IUCN Protected Area, set aside by a national Government for protection.

(ii) From the date of notification, all rights and privileges including forestry operations and grazing of domestic animals are completely stopped.

(iii) The site should have a natural landscape of great importance or should have geological/scientific/educational/recreational importance.

(iv) The Government should have taken steps to prevent exploitation/ occupation of the area, so as to enforce conservation.

(v) There are 103 national parks in India and 02 in Odisha i.e. Bhitarkanika and Similipal.

5. Give an account of the MAB programme.

Ans. (i) Man And Biosphere Programme is an intergovernmental scientific programme launched by UNESCO in 1971.

(ii) It provides a unique platform for cooperation on research and development, capacity building and networking on three interlinked issues - biodiversity loss, climate change and sustainable development.

(iii) It ensures that natural resources are efficiently utilized and are not destroyed.

(iv) The programme predicts the consequences of today's actions on tomorrow's world and thereby facilitates sustable development of the area.

(d) ENVIRONMENTAL ISSUES

Group - A

I. Select the correct answer from the choices given under each bit :

1. Which gases are responsible for acid rain ?

a. NO_2 and SO_2

b. O_2 and SO_2.

c. CO and NO_2.

d. O_2 and NO_2.

2. Which gas absorbs UV rays?

a. O_2 b. O_3

c. CO d. CO_2

3. Which gas is emitted during digestion of ruminants ?

a. CO_2 b. CO

c. O_2 d. CH_4

4. Which is not an effect of lead poisoning ?

a. Liver damage

b. Damage of Central nervous system

c. Bone deformity

d. Infertility.

5. Which one is a secondary pollutant?

a. PAN

b. Smoke

c. Particulate matter

d. Dust.

6. What type of poisoning leads to spotted skin disease ?

a. Lead b. Arsencic

c. Mercury d. Fluoride

7. Algal bloom is due to :

a. Global warming

b. Biomagnification

c. Eutrophication

d. Pesticide use

8. Global Warming is a consequence of:

a. Acid rain

b. Green house effect

c. Ozone depletion

d. Radioactive emission

9. Most harmful waste pollutant like plastic is :

a. Biodegradable

b. Corrosive

c. Inflammatory

d. Nonbiodegradable.

10. Which one of the following is not an environmental problem?

a. Genetic modification of food

b. Afforestation

c. Acid rain

d. Loss of biodiversity

11. Acid rain is mainly a mixture of :

a. Sulphuric Acid and Nitric Acid

b. Hexane and Methane

c. Acetic Acid and Bromine

d. Acetic Acid and Citric Acid

12. Which of the following is not a cause of air pollution?

a. Mining operations

b. Acid rain

c. Agricultural activities

d. Burning of fossil fuels

13. Which one of the following is not a green house gas?

a. Methane

b. Nitrogen

c. Water Vapour

d. Carbon dioxide

14. Which one of the following fuels causes minimum environmental pollution?

a. Diesel b. Petrol

c. Hydrogen d. Coal

15. Water Pollution in the rivers is measured by :

a. Amount of dissolved chlorine

b. Amount of dissolved ozone

c. Amount of dissolved nitrogen

d. Amount of dissolved oxygen

16. Which one of the following is not among the three 'R'$_s$ to save enviornment ?

a. Reduce b. Recover

c. Recycle d. Reuse

17. Ozone layer in the stratosphere :

a. Prevents infrared radiation from sun

b. Helps infrared rays reflected from earth from escaping earth's atmosphere

c. Prevents ultraviolet rays from sun

d. Reflects back radio waves

18. Which gas leaked from Union Carbide's pesticide plant in December, 1984 is responsible for Bhopal Gas Tragedy ?

a. Methyl salicylate

b. Methyl isocyanate

c. Ammonia

d. Hydrogen sulphide

19. Minamata Disease is caused by the Consumption of fish contaminated with :

a. Lead b. Copper

c. Zinc d. Mercury

20. The toxic metal used as an anti-knocking agent in petrol for automobiles is :

a. Chelated copper

b. Tetraethyl lead

c. Iron sulphide

d. Lead chloride

21. Bone and tooth decay disease is caused by drinking water contaminated with :

a. Fluoride b. Borate

c. Silicate d. Aluminium

II. Fill in the blanks :

1. The environmental protection Act was enacted in the year _____.
2. The common refrigerant responsible for the depletion of Ozone layer of the atmosphere is _____.
3. Carbon monoxide binds with haemoglobin forming _____.
4. Depletion of ozone layer is speeded up by the _____ atom present in CFC.
5. Smoke given out by vehicles causes _____ pollution.
6. Harmful gases of sulphur and nitrogen mixed with water drops in the atmosphere leads to _____ rain.
7. Ozone depletion is mainly caused by the _____ atoms generated from CFC in the presence of UV radiation.
8. Ozone is formed when heat and sunlight cause chemical reactions between oxides of _____and hydrocarbons.
9. A globally acclaimed movement led by S. Bahuguna and C.P. Bhat in Tehri Garhwal for conservation of forests is known as _____ movement.
10. A global agreement to protect the stratospheric ozone layer by phasing out ozone depleting substances (ODS) was signed in 1987, called ___ protocol.

III. Answer in one word :

1. Removal of toxic substances from water by using living organisms.
2. Toxic compound formed by the reaction of carbon monooxide with haemoglobin in the blood.
3. Enrichment of water bodies with excess amount of nutrients as a result of run off from surrounding land leading to overgrowth of plants and algae.
4. A secondary air pollutant formed by the mixing of smoke and fog in the air.
5. A green house gas expelled from the digestive tract of ruminants.

IV. Correct the statements, if required by changing the underlined word/ words only :

1. Each year 5th June is observed as World <u>DNA</u> day.
2. Enrichment of water bodies with excess nutrients leading to overgrowth of plants and algae is called <u>biomagnification.</u>
3. Sunlight reacting with volatile organic compounds and nitrogen oxides forms a mixture of pollutants called <u>acid rain.</u>
4. Stockholm convention recommended a global ban on <u>Peroxy Acetyl Nitrate (PAN)</u> in 2001.
5. Leakage of <u>methane</u> gas in the Union Carbide's pesticide factory in 1984 is considered a major industrial disaster and is popularly known as Bhopal Gas Tragedy.
6. Stratospheric ozone is a potential green house gas.

Group - B

I. Write notes on the following in 2 to 3 sentences.

1. Bhopal Gas Tragedy
2. Particulate Matter
3. Eutrophication
4. Smog
5. Peroxy Acetyl Nitrate (PAN)
6. Biomagnification
7. Chipko Movement
8. Bioremediation
9. Plastic as waste material
10. Green house effect
11. Global warming
12. Ozone hole
13. Montreal Protocol
14. Deforestation

II. Differentiate between the following with two to three valid points :

1. Aerosol and Photochemical smog
2. Peroxy Acetyl Nitrate and Smog
3. Primary Pollutants and Secondary Pollutants
4. Bioremediation and Biomagnification
5. Renewable resources and Non-renewable resources

Group - C

Long Answer Types Questions

1. What are green house gases ? Write about their effect on the environment.
2. Write the causes of surface water pollution and state how this can be controlled.
3. Give an account of secondary airpollutants.

ANSWER KEYS

(d) ENVIRONMENTAL ISSUES

Group - A

I. Select the correct answer from the choices given under each bit :

1.	(a)	8.	(b)	15.	(d)
2.	(b)	9.	(d)	16.	(b)
3.	(d)	10.	(b)	17.	(c)
4.	(c)	11.	(a)	18.	(b)
5.	(a)	12.	(b)	19.	(d)
6.	(b)	13.	(b)	20.	(b)
7.	(c)	14.	(c)	21.	(a)

II. Fill in the blanks :

1. 1986
2. CFC
3. Carboxyhemoglobin
4. Chloride
5. Air
6. Acid
7. Chlorine
8. Nitrogen
9. Chipko
10. Montreal

III. Answer in One Word :

1. Bioremediation
2. Carboxyhemoglobin
3. Eutrophication
4. Smog
5. Methane

IV. Correct the statements, if required by changing the underlined word/ words only :

1. Environment
2. Eutrophication
3. Photochemical Smog
4. Persistent Organic Pollutants (POPs)
5. Methyl Isocyanate (MIC)
6. Tropospheric

Group - B

I. Write notes on the following in 2 to 3 sentences.

1. Bhopal Gas Tragedy:

Ans.
- A very toxic methyl isocyanate (MIC) gas leaked from the pesticide plant of Union Carbide in Bhopal in the night of 2nd October, 1984.
- More than 8000 people died and 5,00,000 people suffered from cancer and other ailments extending to 2 - 3 generations, due to this killer gas.
- It is considered a major industrial disaster of the world.

2. Particulate Matter :

Ans.
- These are atmospheric aerosol particles suspended in the air.
- They are microscopic in nature and are 10 μm or less in diameter.
- These are also called suspended particulate matter (SPM) and more finer particles with dimension less than 2.5 μm are called respirable suspended particulate matter (RSPM).

3. Eutrophication :

Ans.
- Excess nutrients like nitrates and phosphates drained in the run off from the nearby agricultural fields reach the water bodies.
- These nutrients cause extensive growth of algal or algae bloom.
- Algal bloom cause depletion of disolved oxygen and production of toxins making it impossible for acquatic life to survive. This process is called eutrophication.

4. Smog :

Ans.
- When smoke coming from burning of coal comes in contact with fog during winter, smog is formed.
- It is a secondary pollutant, that causes severe air pollution.
- This smog is different from photochemical smog which is produced when nitrogen oxides come in contact with VOC in presence of sunlight.

5. Peroxy Acetyl Nitrate (PAN) :

Ans.
- It is a secondary pollutant present in photochemical smog.
- It is a secondary pollutant.
- It is a highly unstable oxygenated compound present only in the atmosphere and a key intermediate in the formation of tropospheric ozone.

7. Chipko Movement :

Ans.
- It is a secondary pollutant present in photochemical smog.
- It is a secondary pollutant.
- It is a highly unstable oxygenated compound present only in the atmosphere and a key intermediate in the formation of tropospheric ozone.

8. Bioremediation:

Ans.
- This is an innovative process of biotechnology where genetically engineered hydrocarbon - eating bacteria are used sucessfully in clearing waste.
- This process is used particularly in converting hydrocarbon wastes into utilisable form.

9. Plastic as Waste Material :

Ans.
- We use plastic materials in many of our day to day activities.
- They are nonbiodegradable and remain in the environment for a quite long time when thrown out after use.
- Plastic carry bags thrown outside are blown away to distant places and can accumulate in the form of solid waste, choke sewage system and affect aquatic / marine life.

10. Green House Effect :

Ans.
- A green house is a building with glass walls and glass roof. it remains warm during winter and is used to grow plants.
- Green house effect is a process that occurs when atmospheric gases like CO_2, methane, nitrous oxide etc. in the earth's atmosphere trap the sun's heat radiated back from the earth.
- Exchange of in-coming and outgoing radiation that warms the planet works like a green house and makes the earth habitable for life forms.

11. Global Warming :

Ans.
- The average temperature of earth's atmosphere is increasing continuously because of increase in concentration of green house gases called global worming.
- This increase in temperature, if not checked will have disastrous consequences as predicted by scientists.
- Global warming will lead to climate change, that will have severe impact on life supporting system on the earth.

12. Ozone Hole :

Ans.
- Ozone layer present in the stratosphere of earth's atmosphere acts as a shield against sun's harmful ultraviolet rays.
- Depletion of Ozone layer at certain places like Antarctic region or presence of a ozone hole was detected by scientists in 1970s.
- Release of ozone depleting substances (ODS) like CFC, halons etc. to the atmosphere in large quantities made this possible. Hence use of these substances are now banned.

13. Montreal Protocol :

Ans.
- Montreal protocol is an international treaty signed in 1987 designed to protect the ozone layer by phasing out all the ozone depleting substances over a period of time.
- 96 of such ozone depleting substances like CFC halon etc. were listed for being completely phased out.
- It is legally bending on all signatory contries.

14. Deforestation:

Ans.
- Forest ecosystem provides us with timber, food, fuel etc. and acts as a carbon sink and helps us in nutrient cycling.
- Purposeful clearing of forested land is called deforestation.
- Deforestation leads to increased frequency of land slides, forest fire and other natural calamites. It also contributes towards global warming and climate change.

II. Differentiate between the following with two to three valid points :

1. Aerosol and Photochemical Smog :

Aerosol	Photochemical Smog
• Aerosol is a suspension of fine solid particles or liquid droplets in air. • It can be natural or anthropogenic. • Fog or mist and dust are examples of natural aerosol, whereas smoke or perfume spray are examples of anthropogenic aerosols.	• It is a secondary pollutant, which tends to occur more often during summer. • Photochemical smog is formed when sunlight reacts with nitrogen oxides (NO_X) and any one volatile organic compound (VOC) in the atmosphere. • It looks like a brown haze above major urban centres.

2. Peroxy Acetyl Nitrate and Smog

Peroxy Acetyl Nitrate	Smog
• Non-methane hydrocarbons react with nitrogen oxides in presence of sunlight to form Peroxy Acetyl Nitrate (PAN). • Vehicular emissions contain various primary pollutants, which react among themselves to form PAN.	• When water vapours surround smoke, dust, soot particles in the atmosphere, smog is formed. It remains suspended in air for quite some time. • A combination of smoke and fog during winter often forms smog.

3. Primary Pollutants and Secondary Pollutants

Primary Pollutants	Secondary Pollutants
• These are directly emitted from the source. • Many hazardous gases like CO, CO_2, SO_2, SO_3, CFC, NO_2, N_2O etc. are emitted from various sources alongwith dust, carbon soot etc. to the atmosphere. • These particulate matters are called primary pollutants.	• They are not directly emitted from any source. • Primary Pollutants often interact with themselves and with other factors like water vapour, sunlight etc. to form secondary pollutants. • Examples are PAN, smog, acid rain etc.

4. Bioremediation and Biomagnification

Bioremediation	Biomagnification
• This is an innovative process of biotechnology where genetically engineered hydrocarbon eating bacteria are used sucessfully in clearing waste. • This process is used particularly in converting hydrocarbon wastes into utilisable form.	• Excess use of pesticides in the agricultural fields leads to run off carrying such toxic substances to nearby water bodies. • These hazardous wastes instead of getting decomposed get magnified while passing through different trophic levels in the food chain, this is called biomagnification.

5. Renewable Resources and Non-renewable Resources

Renewable Resources	Non-renewable Resources
• Renewable resources are natural resources that are naturally replaced and can be used repeatedly. • They include biomass, geothermal energy, hydropower, wind and solar energy etc.	• A non-renewable resource is a natural resource that can not be readily replaced by natural means. • They include crude oil, coal, ground water, nuclear fules etc.

Group - C

Long Questions Answer Keys
(Salient Points only)

1. What are green house gases ? Write about their effect on the environment.

Ans. i) The gases that have a property to trap the heat in the earth's atmosphere and cause global warming are known as green house gases. they are :-

a) Carbon dioxide

b) Methane

c) Nitrous oxide

d) Nitrogen dioxide

e) Chlorofluoro carbons

f) Fluorinated gases

g) Tropospheric ozone

h) Water vapour

ii) They are responsible for global warming that has wide ranging effects on :-

a) climate

b) oceans and coasts

c) glaciers and ice caps

d) water and agriculture

e) plants and animals

2. Write the causes of surface water pollution and state how this can be controlled.

Ans. i) Water pollution is the contamination of surface water sources like rivers and lakes etc. by toxic materials which make them unsuitable for human consumption.

ii) Pollution comes from (a) point sources or (b) non-point sources.

iii) Point sources are sewers and untreated industrial effluents discharged directly to water bodies.

iv) Non-point sources are from all around the water body like rain water, run-off carrying pesticides and fertilizers from agricultural fields, human faecal matter from open defecation etc. Here there is no fixed point of discharge.

v) Pollutants

a) Suspended Solids

b) Domestic Sewage

c) Toxic Chemicals

d) Disease causing organism /germs

e) Radioactive Waste

vi) Control measures

a) Purification for domestic use

b) Waste water treatment

c) Bioremediation

3. Give an account of secondary air pollutants.

Ans. i) Secondary air pollutants are produced by chemical reactions among primary pollutants in the atmosphere.

ii) Pollutants

a) Tropospheric Ozone

b) Peroxyacetyl Nitrate (PAN)

c) Photochemical Smog

d) Acid Rain