CLASS-XII (CBSE)



Workbook Cum Question Bank with Answers



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



BOTANY Workbook Cum Question Bank with Answers

CLASS-XII (CBSE)

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CHAPTER - 1

REPRODUCTION IN ORGANISMS MULTIPLE CHOICE QUESTIONS (MCQ)

Choose the correct answer :

- 1. Why are single celled organisms called immortal?
 - a. They live as saprophytes
 - b. Their life spam is very long.
 - c. They have no natural death.
 - d. They live as parasites.
- 2. Which does maintain the continuity of living species?
 - a. Birth b. Growth
 - c. Death d. Reproduction
- 3. Which process of reproduction does normally require two parents?
 - a. Asexual b. Sexual
 - c. Vegetative d. Grafting
- 4. Clone denotes offsprings, who are:
 - a. Morphologically and genetically similar
 - b. Morphologically similar
 - c. Genetically similar.
 - d. Dissimilar.
- 5. When the organism reproduces by dividing into two equal halves or by simple cell division, it is called :
 - a. Budding b. Fragmentation
 - c. Fission d. Sporulation
- 6. Budding is seen frequently in :
 - a. Conidia b. Zoospores
 - c. Aplanospores d. Ascospores

- 7. What are the endogenously borne motile asexual reproductive unity called?
 - a. Conidia b. Zoospores
 - c. Aplanospores d. Ascospores
- 8. Exogenously borne noamotile asexual reproductive units are called :
 - a. Conidia b. Zoospores
 - c. Bud d. Aplanospores
- 9. Which of the following reproduce by root?
 - a. Potato b. Ginger
 - c. Banana d. Dahlia
- 10. Which of the following reproduce by buds present on leaves?
 - a. Dahlia b. Ginger
 - c. Bryophyllum d. Carrot
- 11. Fusion products of gametes are called :
 - a. Zoospore b. Zygote
 - c. Ascospore d. Ovary
- 12. Which characteristics of sexual reproduction is different from asexual reproduction?
 - a. Offsprings produced
 - b. Offsprings produced from single individual
 - c. Reproductive units produced
 - d. Offsprings are not alike

- 13. In which type of plants are that clear cut vegetative, reproductive and senescent phases?
 - a. Annuals & Biennials
 - b. Biennials & Perennials
 - c. Perennial & Annual
 - d. Perennials & Parasites
- 14. Which plant does flower once in life time?
 - a. Mango b. Jackfruit
 - c. Apple d. Bamboo
- 15. Which animal does show cyclical changes in reproduction?
 - a. Man b. Tiger
 - c. Apes d. Monkey

16. Who are called continuous breeders?

- a. Man b. Tiger
- c. Cow d. Sheep
- 17. Why are wild animals called seasonal breeders?
 - a. Show menstrual cycle
 - b. Reproduce throughout reproductive phase.
 - c. Bear Placenta
 - d. Showing reproduction under favourable conditions
- 18. Which is the correct sequence of sexual reproduction?
 - a. Gametes \rightarrow Fusion gametes \rightarrow Zygote formation \rightarrow Embryogenesis
 - b. Gametes \rightarrow Zygote ferities \rightarrow Fission of gametes \rightarrow Embryogenesis
 - c. Gametes \rightarrow Embryogenesis \rightarrow Fusion of gametes \rightarrow Zygote formation
 - d. Zygote formation \rightarrow Gametes \rightarrow Embryogenesis \rightarrow Fusion gametes

- 19. When both male and female gametes are present in the same individual, the organism is called :
 - a. Dioecious b. Monoecious
 - c. Heterothallic d. Pistillate
- 20. In which case are haploid plant bodies seen?
 - a. Gymnosperms & Angiosperms
 - b. Angiosperms & Pteridophytes
 - c. Fungi & Angiosperms
 - d. Monera & Algae
- 21. Which are transferred to stigma is pollination?
 - a. Ovules b. Anther
 - c. Pollen grains d. Zoospores
- 22. In which cases does external fertilization occur?
 - a. Petridophytes b. Angiosperms
 - c. Bryophytes d. Amphibians
- 23. Which is the first cell of diploid generation?
 - a. Zygote b. Zoospore
 - c. Gametes d. Sperms
- 24. In which types of plants do zygote undergo reduction division immediately after its formation?
 - a. Gymnosperms & Angiosperms
 - b. Angiosperms & Fungi
 - c. Fungi & Algae
 - d. Algae & Angiosperms
- 25. Which oviparous organisms do lay eggs with calcareous cells?
 - a. Reptiles & birds
 - b. Reptiles & mammals
 - c. Birds & mammals
 - d. Birds & Sponges

26.	Which one does mature to form seeds?				
	a.	Ovary	b.	Ovule	
	C.	Carpel	d.	Stigma	
27.	From which part of the flower do				
	frι	its develop?			
	a.	Ovule	b.	Style	
	C.	Anther	d.	Ovary	
28.	Which is better mode of reproduction?				
	a.	Asexual	b.	Sexual	
	C.	Vegetative	d.	Fragmentation	
29.	Which one is formed inside anther?				
	a.	Ovary	b.	Ovule	
	C.	Pollen grain	d.	Seed	
30.	The envelope of fruits are called:				
	a.	Seed	b.	Thalamus	
	C.	Integument	d.	Pericarp	

	l			0				
1.	(c)	11.	(b)	21.	(c)			
2.	(d)	12.	(d)	22.	(d)			
3.	(b)	13.	(a)	23.	(a)			
4.	(a)	14.	(d)	24.	(b)			
5.	(c)	15.	(b)	25.	(a)			
6.	(c)	16.	(a)	26.	(b)			
7.	(b)	17.	(d)	27.	(d)			
8.	(a)	18.	(a)	28.	(b)			
9.	(d)	19.	(b)	29.	(c)			
10.	(c)	20.	(d)	30.	(d)			

LONG ANSWER TYPE QUESTIONS

- 1. What is life span?
- 2. How does the continuity of living organisms maintained ?
- 3. Explain the meaning and types of reproduction.
- 4. Give an account of asexual reproduction in lower organisms.
- 5. How does vegetative reproduction take place in higher plants ?
- 6. How does water hyacinth spread in water bodies? What harm does it cause to water bodies ?
- 7. How do higher plants divide vegetatively?
- 8. What are the advantages of asexual method of reproduction?
- 9. How does zygotes formed? Write the stages of development of zygotes into an adult.
- 10. How is diversity seen in animals in reproduction?

- 11. How do variability is seen in sexual reproduction of some plants?
- 12. What are the main events of sexual reproduction?
- 13. Explain Gametogenesis, Homogametes and Hetrogametes.
- 14. Differentiate :
 - (i) Homothallic & Heterothallic
 - (ii) Monoecious & Dioecious
 - (iii) Unisexual and Bisexual
 - (iv) Haploid and Diploid
- 15. How male gametes are transferred to female gametes to effect fertilizations?
- 16. What is Parthenogenesis?
- 17. What are differences between external and internal fertilization?
- 18. What are zygotes? How are they formed?
- 19. Describes how embryogenesis does take place embryogenesis?
- 20. Differentiate oviparous and viviparous organisms.

Answer Keys

1. What is life span?

Ans. • The Period from birth to the natural death of an organism is called life span.

2. How does the continuity of living organisms maintained?

Ans. • Excepting the unicellular organism, all the species of living world maintain their continuity through the process called reproduction.

3. Explain the meaning and types of reproduction.

Ans. Reproduction is a biological process in which the organism gives rise to offsprings which are similar to itself. The offsprings after their birth continue to grow, mature and in turn, produce new offsprings. Thus, there is a cycle of birth, growth and death. Reproduction enables the continuity of the species generation after generation. There is a great diversity of the living organisms. Each organism has evolved its own mechanism to multiply and produce offspring. The habitat of the concerned organism, its internal physiology and several other facts are collectively responsible for its process of reproduction. Based on the participation of one or two organisms in the process of reproduction, it is of two types. Where offspring is produced by a single parent and no sexual reproductive units are involved, it is called the asexual reproduction. In sexual reproduction two parents or a single parent possessing sexual reproductive units separates may be involved.

4. Give an account of asexual reproduction in lower organisms.

- Ans. In asexual method of reproduction, offsprings are produced from single individual. Asexual reproduction is common among unicellular organisms and in plants and animals with relatively simple organizations.
 - In protists and Monerans, the parent cell divided into two to given rise to new individuals. Thus, cell division itself is the mode of reproduction in these organisms. Many organisms reproduce by binary fussion. Here the cell divides into two halves and each grows into an adult. (Example- Amoeba, Bacteria etc.)
 - In yeast, the division is unequal and small buds are produced which remain adhered to the parent body but lata, gets separated into new yeast. (Fig. 1.2 a.b. from the Text Book.)
 - Members of the kingdom, Fungi and some plants, belonging to algae reproduce by special reproductive units, called Zoospores. Most common asexual reproductive units there is zoospores. Zoospores are endogenous motile asexual reproductive units. These can grow into new individual. (Fig .-3a from the Text Book)
 - Other common asexual reproductive units are conidia. These are exogenously borne nonmotile reproductive units. (Fig. 3b from the Text Book)

5. How does vegetative reproduction take place in higher plants?

Ans. In some higher plants, no specialized reproductive units, are produced and the vegetative cell itself may take part in reproduction. This is called vegetative propagation. Such units are in the form of runner sucker, tuber offset, bulb etc. and they are capable of giving rise to new individual.

6. How does water hyacinth spread in water bodies? What harm does it cause to water bodies?

Ans. • Water hyacinth plant introduced to India by Englishmen because of its beautiful flowers and shape of leaves. Because the plant offset can easily divide vegetatively, the plant can spread over the standing water of the water bodies very easily.

7. How do higher plants divide vegetatively?

Ans. It is observed many times that the small plants emerging from the bud (called eye) of the potato tuber, from rhizomes of banana and ginger. The site of origin of these new plants are nodes present on these modified stems. When nodes come in contact of the damp soil or water, they produce roots and new plant. Similar activity is seen in the notches of leaves of *Bryophyllum*.

8. What are the advantages of asexual method of reproduction?

- **Ans.** It is a relatively simple means of reproduction.
 - Large number of offsprings can be produced by this method orthic a short time.

9. How does zygotes formed? Write the stages of development of zygotes into an adult.

Ans. Sexual reproduction involves formation of male and female gametes. Fusion products of these gametes are called Zygote. The organisms produce gametes where they achieve maturity. The period of growth of an organism from its birth to the maturity is called the juvenile phase or the vegetative state. The end of the juvenile phase marks the beginning of matured phase. At this stage, gametes are produced.

10. How is diversity seen in animals in reproduction?

- Ans. Some animals lay eggs throughout the year. Example Chickens. Other living in nature do lay eggs seasonally.
 - The female of placental mammals exhibit cyclical changes in the activities of ovaries and accessory duck as well as hormones during reproductive phase. Such cyclical

change during reproduction is called Oestrus cycle (seen in nonprimates like Cows, Sheep, Rats, Deer, Dogs etc.)

In primates (Monkeys, apes and humans) it is called menstrual cycle. Many mammals
especially those living in natural, wild conditions exhibit such cycles only during
favourable conditions in their reproductive phase and are therefore called seasonal
breeders. Many other mammals are reproductively active throughout their reproductive
phase and hence are called continuous breeders.

11. How do variability is seen in sexual reproduction of some plants?

Ans. Some plants produce fruits seasonally Jackfruit, Mango. Hence, they show seasonal flooring. Other plants flowers once or very rarely in their life cycle. Ex- Bamboo flowers once as the 50-100 years. Another plant, *Strobilanthus Kunthiana* flowers one in 12 years. There are plants which flower throughout the year and some others show seasonal flowering. Thus, the plants are called annuals, biennials, perennials on that basis.

12. What are the main events of sexual reproduction?

Ans. It is elaborate and complex, follow a regular sequence. Sexual reproduction involves plasmogamy, karyogamy and meiosis. In plasmogamy, the fusion of sexual reproductive units, called gametes, occur. Then, their nuclei fuse in karyogamy. They undergo meiosis to produce those gametes again where the organisms mature. Again, sexual reproduction involves pre-fertilization, fertilization and post fertilization events.

13. Explain Gametogenesis, Homogametes and Hetrogametes.

Ans. Gametogensis is the process of formation of two types of gametes male and female. Gametes are haploid cells.Where male and female gametes are morphologically similar, they are Homogametes. When the gametes produced are two morphologically distinct types, they are called heterogametes. In such organisms, male gametes are antherozoids, or sperms and female are called eggs or ovums.

14. Differentiate :

- (i) Homothallic & Heterothallic
- (ii) Monoecious & Dioecious
- (iii) Unisexual & Bisexual
- (iv) Haploid & Diploid

Ans. (i) Homothallic & Heterothallic

• This the term used in fungi, algae and many other plants, when male and female gametes are borne on the same plant and they are self-fertile, i.e.; Zygote can be produced by their fusion, then it homothallic.When male and female gametes borne on that same thallus or same plant are self-sterile but cross fertile the condition is called heterothallism.

(ii) Monoecious & Dioecious

When staminate and pistillate flowers are borne on the same plant it is monoecious.
 Ex.-Cucurbita.But when Staminate and Pitillate flowers are borne on different plants, the plants are called dioecious. Ex.- Date Palm.

(iii) Unisexual and Bisexual

• When an individual bears only male or female sex organs, they are unisexual. When a flower beans only stamens but no canpel, it is male flower. The vice versa is applied to bisexual, i.e., the organism bears both male and female gametes or both stamens and carpels are borne on the same flower.

(iv) Haploid and Diploid

 Gametes are haploid but the body of the organism is developed from that gamete is haploid but when it develops from zygote, it is diploid.Example:- Monera, Fungi, algae and bryophytes-haploid but Gymnosperms, angiosperms and most of the animals including humans are diploid.

15. How male gametes are transferred to female gametes to effect fertilizations?

- **Ans.** In majority of cases, the male gametes are motile and female gametes are stationary. Exceptions are seen in some algae and fungi, where both the gametes are motile.
 - In several simple plants like algae, fungi and bryophytes are the motile male gametes are transferred in the medium of water. A large number of male gametes fail to reach the female gametes due to environmental and other conditions. To compensate this, large number of male gametes are produced in these plants.
 - In seed plants, microspores called pollen grains are passively transferred to the stigma of the female reproductive organs. This transfer of pollen grains is called pollination. Falling on the stigma, the pollen grains develop pollen tube, which pass through the style of the carpels. Before fertilization nucleus present in the pollen tubes develop two male gametes which effect the process of fertilization.

16. What is Parthenogenesis?

Ans. In some organisms male and female reproductive organs develop and they mature, but they fail to effect the process of fertilization. However, the female gamete develops into a new organism without the act of fertilization. This is called syngamy. Ex- Honey bees, Turkey etc.

17. What are differences between external and internal fertilization?

- Ans. In most aquatic organisms such are majority of algae and fishes, the syngamy occur outside the involved organism's body. This is called external fertilization. In this process, the development and release of gametes of both sexes show remarkable synchrony. A major disadvantage is here the offsprings become highly vulnerable to predators.
 - In many terrestrial organisms like fungi, higher animals like reptiles, birds mammals and plants such as bryophytes, Gymnosperms and angiosperms, the syngamy occurs inside the body of the organisms. Hence, this is called internal fertilization.

18. What are zygotes? How are they formed?

Ans. • Zygotes is a post fertilized product, hence are Div.In haplontic life cycle showing organisms, the zygote develops thick wall. After the period of rest, they develop into new organisms with or without undergoing reduction division.

19. Describes how embryogenesis does take place embryogenesis?

- Ans. The process of formation of embryo is called embryogenesis. During entry to embryogenesis, zygote undergoes cell division and cell differentiation.
 - The cell division increases the number of cells in the developing embryo, cell differentiation helps groups of cells to undergo certain modification to form specialized tissues and organs to form an organism.

20. Differentiate oviparous and viviparous organisms.

Ans. In Oviparous organisms, the development zygote takes place outside the body of the female parent. In some oviparous organisms eggs laid down are thick walled. In viviparous organisms the development young children, takes place inside the body.

CHAPTER - 2

SEXUAL REPRODUCTION IN FLOWERING PLANTS

MULTIPLE CHOICE QUESTIONS (MCQ)

Choose the correct answer :

- 1. The end products of sexual reproduction in flowering plants are :
 - (a) gametes (b) spores
 - (c) zygote (d) sporocarps
- 2. Which are the two important sexual reproductive units of a flower ?
 - (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 is not applicable for sporopollenin ?
 - (a) dominant component of pollen wall.
 - (b) can be degraded by enzymes
 - (c) can not be degraded by enzymes
 - (d) helped pollen grains to be preserved as fossils
- 7. Which one is different from other three ?
 - (a) microspore (b) pollen grain
 - (c) male gamete(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 in size
- 9. The part of the carpel that receives pollen grains is called :
 - (a) Ovary (b) Ovule
 - (c) Stigma (d) Style
- 10. Which are called ovules ?
 - (a) Microsporangia
 - (b) Megasporangia
 - (c) Nucellus
 - (d) Anther

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 parts of :

- (a) Antipodals
- (b) Central Cell
- (c) Egg apparatus
- (d) Polar nuclei
- 15. Filiform apparatus are special thickenings of :
 - (a) Antipodal cells (b) Synergids
 - (c) Polar nuclei (d) Egg cell
- 16. A typical embryo sac in angiosperms are 8 nucleate and :
 - (a) 8 Celled (b) 7 Celled
 - (c) 6 Celled (d) 4 Celled
- 17. Which are the flowers to share typical autogamy ?
 - (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, fragrants flowers 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 one of a flower does provide 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) Flower 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, the phenomenon is called :
 - (a) Protogyny
 - (b) Potandry
 - (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 nuclear

31. Which is unrelated pair ?

- (a) Syngamy-Zygote
- (b) Zygote-Embryo
- (c) Primary endosperm nucleuszygote
- (d) Primary endosperm nucleusendosperm

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 a correct sequence ?

- (a) Megaspore mother cell \rightarrow Megaspore \rightarrow Embryo sac \rightarrow Egg cell
- (b) Embryo sac → Megaspore
 → Embryo sac → Megaspore
 Mother Cell
- (c) Megaspore \rightarrow Embryo sac \rightarrow Megaspore mother cell \rightarrow Egg
- (d) Egg \rightarrow Megaspore \rightarrow Megaspore mother cell \rightarrow Embryo sac

35. Which is unrelated pair ?

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

36. Which is unrelated pair ?

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

37. Which is the correct sequence is 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

38. Embryo develops from :

- (a) Ovule
- (b) Zygote
- (c) Primary endosperm
- (d) Ovary

39. Embryo consists of embryonal axis and :

- (a) epicotyl (b) hypocotyl
- (c) cotyledons (d) plume

40. Plumule can be called :

- (a) roof tip (b) stem tip
- (c) radicle (d) cotyledons

41. What is present as cotyledon of grass family ?

- (a) scutellum (b) embryonal axis
- (c) hypocotyl (d) epicotyl

42. Coleorrhiza is the covering of :

- (a) radicle and root cap
- (b) shoot apex and leaf primordia
- (c) radicle and root hairs
- (d) radicle and shoot apex

43. Coleoptile is the covering of :

- (a) radicle and rof cap
- (b) shoot apex and leaf primodia
- (c) shoot apex and internodes
- (d) shoot apex and nodes

44. Fertilized ovule is :

- (a) fruit (b) endosperm
- (c) embryo (d) seed

45. Which pair is incorrect?

- (a) Non-albuminous seeds -No endosperm
- (b) Albuminous seeds -Endospermous
- (c) Non-albuminous seeds -Endospermous
- (d) Persistent nucellus perisperm

46. Which pair is unrelated ?

- (a) Pea Nonalbuminous
- (b) Maize Albuminous
- (c) Castor Albuminous
- (d) Ground nut Albuminous
- 47. Which one has non-albuminous seeds?
 - (a) Barley (b) Wheat
 - (c) Beans (d) Rice

- 48. What are the requirements for a seed to germinate ?
 - (a) Moisture, Oxygen & Temperature
 - (b) Moisture & Oxygen
 - (c) Moisture & Temperature
 - (d) Moisture, Water & Light
- 49. Matured ovary is a :
 - (a) Seed (b) Fruit
 - (c) Gamete (d) Zygote
- 50. True fruits develop from :
 - (a) thalamus (b) integlements
 - (c) nucellus (d) ovary
- 51. 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.
- 52. Seeds formed without fertilization is called :
 - (a) Panthenocarpy
 - (b) Apomixis
 - (c) Syngamy
 - (d) Triple fusion

53. Which is not 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.

- 54. Anemophilous flowers are pollinated by :
 - (a) Wind (b) Water
 - (c) Animals (d) Man

55. Male gametes are formed from :

- (a) tube cell
- (b) generative cell
- (c) stalk cell
- (d) primordial cell
- 56. Which cell of embryo sac does form zygote ?
 - (a) Synergid (b) Antipodals
 - (c) Central Cell (d) Egg Cells

1.	(c)	15.	(b)	29.	(a)	43.	(b)
2.	(d)	16.	(b)	30.	(d)	44.	(d)
3.	(b)	17.	(b)	31.	(c)	45.	(c)
4.	(a)	18.	(b)	32.	(b)	46.	(d)
5.	(c)	19.	(c)	33.	(d)	47.	(c)
6.	(b)	20.	(a)	34.	(a)	48.	(a)
7.	(d)	21.	(c)	35.	(d)	49.	(b)
8.	(a)	22.	(a)	36.	(a)	50.	(d)
9.	(c)	23.	(b)	37.	(c)	51.	(c)
10.	(b)	24.	(c)	38.	(b)	52.	(b)
11.	(a)	25.	(d)	39.	(c)	53.	(a)
12.	(b)	26.	(c)	40.	(b)	54.	(a)
13.	(d)	27.	(a)	41.	(a)	55.	(b)
14.	(c)	28.	(b)	42.	(a)	56.	(d)
1							

LONG ANSWER TYPE QUESTIONS

- Give a diagrammatic presentation of LS of a complete flower and describe its different parts.
- Draw neat labeled diagram of a stamen and describe its parts and their functions.
- Give the structure of microsporangia and describe the microsporogenesis in angiosperms.
- 4. Describe the post-pollination changes in a microspore.
- 5. Give the structure of a pollen grains and write the function of its parts.
- 6. Draw labeled diagram of a typical ovule and describe its different parts.
- Describe the development of a megaspore into an embryo sac.
- 8. Draw labeled diagram of an embryo sac.
- 9. What is meant by pollination? Describe different types of pollination.
- 10. Give an account of the agents responsible for pollination.

- What are the advantages of outbreeding over inbreeding in angiosperms.
- 12. Describe the outbreeding devices in angiosperms.
- 13. Give an account of the pollen-pistil interactions.
- 14. Write notes on emasculation and bagging.
- 15. Describe double fertilization and triple fusion in angiosperms.
- 16. Describe the post-fertilization changes primary endosperm nucleus.
- 17. Describe embryo structure and development in angiosperms.
- Write notes on : Albuminous seeds, Exalbuminous seeds, Perisperm.
- 19. Differentiate between
- (i) Perisperm and Pericarp
- (ii) Parthenogenesis and Parthenocarpy
- 20. Give an account of apomixis and polyembryony in angiosperms.

Answer Keys

1. Give a diagrammatic presentation of LS of a complete flower and describe its different parts.

- **Ans.** L.S. of a complete flower is given in the text book page 20, i.e. Fig. 2.1.
 - Different parts like thalamus, Calyx, Corolla, and roecium and gynoecium with their different parts are to be described. Also, include under it their inessential and essential functions.
 - Inessential whorls are Calyx and Corolla their functions include photosynthesis, protection to young flower and devices to attract insects for pollination.
 - Essential whorls are androecium and gynoecium and their function is mainly completion of sexual reproduction for perpetuation of the species.

2. Draw neat labeled diagram of a stamen and describe its parts and their functions.

- **Ans.** Draw labeled diagram as given in textbook page 21, Fig. 2.2.
 - Individual members of androecium are called stamens. It has two parts filament and anther. Filament is a long and slender stalk. Generally, it terminates with anather. Anther is generally bilolbed.
 - The basal end of the filament is attached to the thalamus or the petal of flower. Number and length of the stamens varies with species.
 - Anther is bilobed and each lobe has two theca. Often longitudinal grooves, separating the theca.
 - The anther is a 4-sided structure and this tetragonal structure consisting of four microsporangia located at four cornors, two in each lobe.

3. Give the structure of microsporangia and describe the microsporogenesis in angiosperms.

Ans. Structure of microsporangium and microsporogenesis

- In T.S. of microsporangium, it appears circular in outline (Fig. 2.3 a & b from the textbook).
- Typical microsporangium has four wall layers : (1) outermost layer epidermis protective layer. (2) Following if endothecium it is protective layer. Besides it comprises of fibrous outgrowths and that helps in pollen dispersal. (3) Middle layers are 2 to 3 layered uniform cells protective function. (4) Innermost layer is tapetum it nourishes the developing pollen grains.

• When anther is young, it is circular in outline and comprises of homogenous mass of compactly arranged parenchymatous cells. The central portion of it is occupied by the sprogenous tissue.

Microsporogenesis

- At hypodermal region of the anther, a mass of tissue becomes differentiated from the rest by heir larger size, radial elongation and more prominent nuclei. It is known as the archesporial cell. The archesporial cells divide periclinally forming outer primary wall cells and primary sporogenous cells. The primary wall cell divides and redivides and finally forms a five layered wall. The outermost of it is known as epidermis and following it are endodermis, middle layers and tepetum respectively.
- The primary sporogenous cells divide and redivide and finally forms the spore mother cells. The spore mother cells are the last cells of sporophytic generation. This divides reductionally to form the microspore tetrad or pollen grains.

4. Describe the post-pollination changes in a microspore.

- Ans. The pollen grains represent the first cell of the male gametophyte. When pollen grains are mature, it contains two cells, the vegetative cell and the generative cell.
 - In most of the cases, the pollen grains are shed at this 2-celled stage. In few cases, the generative may undergoes another division before their dehiscence from the parent plant.
 - Once pollens are shed, they have to land on the stigma before their viability for fertilization is lost.
 - When pollens reach stigma and they are compatible, the pollens settle down. Then, the pollens germinate on stigma, produce pollen tube through one of the germ pores.
 (Fig. 2.12 of the textbook). The contents of the pollen move into the pollen tube, passes through stigma and style.
 - If pollens are shed at 2-celled stage, its fertile cell called, generative cell, divides once to produce male gametes. In plants, where pollen dehiscence occurs at 3-celled stage, gametes are only carried through pollen tubes and finally, the two gametes effect the fertilization.

5. Give the structure of a pollen grains and write the function of its parts.

Ans. • Pollen grains are spherical structures, about 25-50 mµ in diameter. It has a 2-layered wall, outer exine - made up sporopollenin. It is the most resistant organic material known and can withstand the effect of strong acids and alkali. No enzyme can degrade it. But the exine is a discontinuous structure and has prominent apertures called germ pores.

- The inner wall is called intine (Fig. 2.5 of the textbook). This is thin, continuous layer made up cellulose and pectin.
- The cytoplasm of the pollen grain is surrounded by a memberane called plasma membrane. When pollen grains are mature, it comprises of two cells the vegetative cell and generative cell. The vegetative cell is bigger, has abundant food reserve and a large irregularity shaped nucleus.
- The generative cell is small and floats in the cytoplasm of vegetative cell. It is spindle shaped with dense cytoplasm and a nucleus.
- The vegetative cell after pollination grows into pollen tube and genereative cell undergoes one division so as to produce to 2 male gametes. These male gametes carry out the double fertilization and triple fusion in angiosperms.

6. Draw labeled diagram of a typical ovule and describe its different parts.

- Ans. Fig. 2.7 (d) of the textbook
 - Main body of the ovule is nucellus. Ovule is attached to the placenta by stalk called funicle. The body of the ovule fuses with funicle in the region of hilum. Each ovule has a protective envelopes known as integuments. Integuments encircle the nucellus excepting a small opening called the micropyle. Opposite to the microphyalan end, the basal part of the ovule, called chalaza is located. Inside the nucellus, the megasporogenesis occurs and form 7 celled embryo sac. They form the female gametophyte of angiosperms.

7. Describe the development of a megaspore into an embryo sac.

- Ans. Like microsporogenesis, the megasporogenesis stats from certain archesporial cells of the nucleus. They get differentiated from the rest by their larger size, radial elongation and more prominent nuclei.
 - These anchesporial cells divide and redivide to finally form megaspore mother cells. Megaspore mother cells divide meiotically to form megaspores in linear tetrads. Out of these, only the lowermost only survive and others disintegrate. These develop into female gametophyte.
 - Fig. 2.8 (a-c may be drawn) of the textbook
 - The nucleus of the functioning megaspore divides mitotically into two nuclei. They move to the opposite poles, forming 2-nucleate embryo sac. It is followed 2 more nuclear divisions, 8 nucleate embryo sac is formed. Here, mitotic divisons and free nuclear and there is no immediate wall formation.
 - At 8 nucleate stage, walls are laid down six of the 8 nuclei are surrounded by cell walls and organized into cells. The remaining two nuclei called polar nuclei, move towards centre and form binucleade central cell.

- Three cells positioned at the micropylan end form the egg apparatus. Out it, middle one is egg cell and two lateral one at two sides are the synergits.
- The cells at the chalazal end from the antipodal cells or antipodals. Thus, matured typical ovules comprise of 7 celled and 8-nucleate structure.

8. Draw labeled diagram of an embryo sac.

Ans. • Fig. 2.8 c of the textbook.

9. What is meant by pollination? Describe different types of pollination.

Ans. • Pollination is a process of transference of pollen grows from the anther of a flower to the stigma of same or different flower borne by the same plant or plant of the same species.

Types :

- (i) Autogamy Transfer of pollen grains to the stigma of the same flower. Commelina
- (ii) **Geitonogamy -** Transference of pollen grains to the stigma of other flower borne by the same plant. Ex. Cucurbita.
- (iii) **Xenogamy -** Transference of pollen grains from anther to the stigma of a diffeent plant. Example *Onion*.

10. Give an account of the agents responsible for pollination.



Mechanism of pollination by all these agents are to be described

11. What are the advantages of outbreeding devices over inbreeding in angiosperms.

- Ans. Continued inbreeding causes inbreeding depression. So, there are various devices for outbreeding :
 - (a) Pollen release and stigma receptivity not synchronized in many.
 - (b) Anther and stigma are placed in different positions.
 - (c) Inbreeding incompatibility this is a genetic device.
 - (d) Unisexuality of flowers.

12. Describe the outbreeding devices in angiosperms.

- **Ans.** Always results in healthier offsprings.
 - Produced offsprings are better adapted.
 - Hybrids are produced due to xenogamy.
 - More abundant and viable seeds are produced which store greater quantity of food material.
 - Process eliminates defective characters and its helpful in producing new varieties.

13. Give an account of the pollen-pistil interactions.

Ans. To elaborate the following four points where Pollen-pistil interactions occur

- Landing of Pollen on the stigma which recognises the compatible pollen.
- Germination of pollen and formation of pollen tube where the pollens release its contents.
- Pollen tube growth through style of pistil towrds ovary and then ovule.
- Entry of the pollen tube containing male gametes into embryo sac of ovule and then to synergid.

14. Write notes on emasculation and bagging.

- Ans. Removal of anthers from a flower bud before the anther dehisces using a pair of forceps is referred to as emasculation. This is necessary for crop improvement programme.
 - Bagging is the protection of emasculated flower from contamination by undesirable pollens. Here, the flowers are covered by bags, till the flowers attain receptivity.

15. Describe double fertilization and triple fusion in angiosperms.

- Ans. Two male gametes are formed by the division of generative nucleus present in the growing pollen tube.
 - The pollen tubes may enter the Ovule through microphyle called porogamy or through chalaza called chalazogamy or through the funiculus known as mesogamy.
 - One of the male nuclei fuse with binucleate central cell to effect triple fusion and other is directed towards the egg cell. Finally, it effects the fertilization to form the zygote (Fig. 2.12 C and describe it from the germination of pollen grain on stigma).

16. Describe the post-fertilization changes primary Endosperm nucleus.

- Ans. Endosperm development precedes zygote. The primary endosperm cell divides repeatedly and form a triploid endosperm tissue.
 - The cells of this tissue is filled with reserve food materials and are used for nutritious of the developing embryo.
 - In general type of endosperm development, primary endosperm nucleus devides successively and produces a large number of free nuclei. This is called the free nuclear stage.
 - Subsequently wall formation takes place in centripetal manner, i.e. from the periphery towards the centre. As this process may not be complete, majority of the cells in central position may remain free nuclear.
 - There may be cellular and helobial type of endosperm development in certain angiosperms. In cellular type, every nuclear divsion is followed by wall formation, whereas in helobial type, the first diviosn of the primary endosperm nucleus is cellular and subsequent ones are free nuclear.

17. Describe embryo structure and development in angiosperms.

- **Ans.** Zygote develops to embryo at the micropylar end.
 - Zygote gives rise to globaular heart shaped and matured embryo (Fig. 2.14 of the textbook)
 - Dicot embryo consists of embryonal axis and two cotyledans.
 - Embryonal axis is above Cotyledons.

18. Write notes on : Albuminous seeds, Exalbuminous seeds, Perisperm.

- Ans. A seed consists of seed coat cotyledons and embryonal axis. The cotyledons of embryo are simple structures, generally thick and swollen due to food storage.
 - Albuminous seeds retain a part of endosperm since it is not completely used up.
 Ex. Wheat, Maize, Barley etc.
 - In exalbuminous seeds, endosperm is completely used up. Ex. Pea and Ground nut.
 - Occasionally in some seeds, the remnants of nucellus are persistent. This residual persistent nucellus is called perisperm.

19. Differentiate between

Ans. (i) Perisperm and Pericarp

- Perisperm is the remnants of persistent nucellus in a seed. This is an occasional seed structure.
- When ovule matures into seed and the ovary matures into fruit, the wall of the ovary is known as pericarp.

(ii) Parthenogenesis and Parthenocarpy

 Parthenogenesis is the development of female gamete, i.e. egg into new individual plant without the act of fertilization. In this process, the haploid plants are grown. However, in panthenocarpy embryos abort and do not germinate into viable plants. Parthenocarpy is generally practiced in horticulture and seedless fruits are developed.

20. Give an account of apomixis and polyembryony in angiosperms.

- Ans. Fertilization process comprises of plasmogamy, karyogamy or syngamy and meiosis. In apomixis, seed are produced without the act of syngamy and meiosis. Hence, apomixis is a type of asexual reproduction. It may be described under vegetative reproduction and agamospermy.
 - Agamospermy may occur in 3 ways -
 - (a) Recurrent agamospermy (Recurrent apomixis, Apospory and Diplospory).
 - (b) Nonrecurrent agamospermy and
 - (c) Adventive embryony (Adventive Polymbryony). (These points may be elaborated while answering such question).
 - Polyembryony occurs when more than one embryos from diploid nucellar or integument tissue develops besides the fertilized egg cell. Example *Citrus*.

CHAPTER - 5

PRINCIPLES OF INHERITANCE AND VARIATION

MULTIPLE CHOICE QUESTIONS (MCQ)

Choose the correct answer :

- 1. Which is incorect statement about outbreeding ?
 - (a) Increases hybrid vigour
 - (b) Increases adaptations
 - (c) Reduces expression of lethal genes
 - (d) Produces weaker progenies
- 2. Heredity lies within a :
 - (a) species (b) genus
 - (c) class (d) kingdom

3. Segregation of genes occurs in :

- (a.) Embryo formation
- (b) Prophase I
- (c) Anaphase II
- (d) Metaphase II
- 4. To see the effect of sex on inheritance Mendel performed :
 - (a) Test cross
 - (b) Out cross
 - (c) Reciprocal cross
 - (d) Back cross
- 5. 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) Genes are extra-chromosomal materials.

- 6. Which is popularly known as Drosophila of plant kingdom ?
 - (a) Neurospora (b) Pea
 - (c) Maize (d) Penicillium
- 7. Mendel conducted his hybridization experiments with garden pea for :
 - (a) 6 years (b) 7 years
 - (c) 8 years (d) 15 years
- 8. 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
- 9. 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
- 10. Tall and dwarf, round and wrinkled, yellow and green etc. are :
 - (a) Characters
 - (b) Traits
 - (c) Are both characters and traits
 - (d) genotypes

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- 11. How many genotypes can be produced by two alleles A and a :
 - (a) 1 (b) 3
 - (c) 2 (d) 4
- 12. 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
- 13. In his final selection Mendel had the following number of varieties :
 - (a) 7 (b) 14
 - (c) 28 (d) Many
- 14. Who rediscovered Mendel's findings?
 - (a) Darwin (b) Schleiden
 - (c) Nageli (d) De Vries
- 15. How many reprints of Mendel's original paper were possibly sent by him to different scientists and/or societies ?
 - (a) 20 (b) 30
 - (c) 40 (d) 50
- 16. Who was the scientist to rediscover Mendel's contribution in American Context ?
 - (a) De Vries (1900)
 - (b) Tschemark (1900)
 - (c) Correns (1900)
 - (d) Spillman (1901)

- 17. Who was responsible for the theory of pangenes ?
 - (a) Malphighi (1673)
 - (b) Darwin (1868)
 - (c) Lamarck (1867)
 - (d) Aristotle (504-433 BC)

18. Two allelic genes are located on the :

- (a) Same chromosome
- (b) Two homologous chromosomes
- (c) Two non-homologous chromosomes
- (d) Any two different chromosomes

19. 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
- 20. In F2 generation on a dihybrid cross, 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

- 21. Can brown eyed parents have blue eyed babies" If yes, the genotype of parents must be :
 - (a) BBxBB (b) BBxBb
 - (c) BbxBb (d) BBxbb

22. The term allele was coined by

- (a) Bateson
- (b) Bateson and Punnet
- (c) Bateson and Saunders
- (d) Morgan
- 23. 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. Dihybrid cross

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

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

25. Wild genes are :

- (a) Dominant
- (b) Unmutated
- (c) Neither dominant not recessive unless there is mutation
- (d) Either dominant or recessive depending on the type of mutation

- 26. Expected children of blue eyed (recessive) woman and brown eyed (dominant) man who had blue eyed mother are likely to be :
 - (a) All brown eyed
 - (b) All blue eyed
 - (c) One blue eyed and one brown eyed
 - (d) Three blue eyed and one brown eyed

27. Mendel started with :

- (a) A large number of characters in pea plant
- (b) 7 pairs of characters
- (c) 14 traits
- (d) 20 tracts
- 28. 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
- 29. The gametes produced by individual with genotypes of aaBBCc are :
 - (a) 2 (b) 8
 - (c) 4 (d) 6
- 30. A mutant allele usually produces :
 - (a) A normal or less efficient enzyme
 - (b) A non-functional enzyme
 - (c) No enzyme at all
 - (d) Any of the above

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- 31. The number of genotypes in ABO blood groups are :
 - (a) 5 (b) 6
 - (c) 7 (d) 8
- 32. Who was the earliest worker to be associated with breeding experiments in plants ?
 - (a) Naudin (b) Goss
 - (c) Kolreuter (d) Knight
- 33. The idea of blending inheritance was weakened by :
 - (a) Atavism
 - (b) Serendipity
 - (c) Teleology
 - (d) Connecting links

34. ABO blood group is an example of :

- (a) Co-dominance
- (b) Incomplete dominance
- (c) Multiple allelism
- (d) Both a and c
- 35. A test cross of AaBbCC produces how many phenotypes :
 - (a) 16 (b) 12
 - (c) 8 (d) 4
- 36 Wrinkled seeds are produced because of :
 - (a) A wild allele for starch production
 - (b) Unmutated allele with no function towards starch production
 - (c) A mutant allele with less efficient function towards starch production
 - (d) A mutant allele with less efficient function towards starch production

- 37. Number of laws formulated by Mendel is :
 - (a) 2 (b) 3 (c) 4 (d) 5
- 38. A man with brown eyes and dark hair (whose father was blue eyed) marries a woman with blue eyes and dark curly hair (whose mother was red straight haired). They have 4 children. What is the genotype of children :
 - (a) Bb:BbRr:bbRR:bbrr
 - (b) BbRR:BbRr:bbRR:bbRr
 - (c) Bb:BbRr:BbRR:bbrr
 - (d) BBRR:bbrr
- 39. Incomplete dominance was discovered by :
 - (a) Correns (b) Bateson
 - (c) Johansen (d) Mendel
- 40. 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
- 41. In sickle cell anaemia, glutamic acid is replaced by valine. Which one of the following triplets codes for valine?
 - (a) GGG (b) AAG
 - (c) GAA (d) GUG

- 42. Drosophila completes its life cycle in about :
 - (a) 3 days (b) 7 days
 - (c) 14 days (d) 21 days
- 43. 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
- 44. The most appropriate symbol used for wild gene for vestigial wings of Drosophila is :
 - (a) V (b) v
 - (c) v+ (d) V+
- 45. Person having genotype IA IB would show the blood group as AB. This is because of :
 - (a) Pleiotropy and Co-dominance
 - (b) Pleitropy and Incomplete dominance
 - (c) Multiple alleles and Pleitropy
 - (d) Codominance and Multiple alleles

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

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

- 47. Which of the following method is more suitable for finding both phenotypic and genotypic ratios in Mendelian/Non-Mendelian crosses :
 - (a) Chi square
 - (b) Pie square
 - (c) Forked line
 - (d) Schematic diagram
- 48. 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
- 49. Inheritance of skin colour in humans is an example of :
 - (a) Point mutation
 - (b) Polygenic inheritance
 - (c) Co-dominance
 - (d) Chromosomal aberration
- 50. 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
- 51. Mendel's Law of independent assortment holds good for genes situated on the :
 - (a) non-homologous chromosome
 - (b) homologous chromosome
 - (c) extra nuclear genetic element
 - (d) same chromosome.

- 52. 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
- 53. Scientist who was awarded Nobel prize for confirming genes to be linearly arranged on the chromosome :
 - (a) Sutton (b) Morgan
 - (c) Sturtevant (d) Boveri
- 54. 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
- 55. Occasionally, a single gene may express more than one effect. The phenomenon is called :
 - (a) multiple allelism
 - (b) mosaicism
 - (c) pleiotropy
 - (d) polygeny
- 56. Chromosome map unit is :
 - (a) Recombination frequency
 - (b) Crossover value
 - (c) Crossover frequency
 - (d) All the above

- 57. Map unit is also called :
 - (a) Angstrom unit
 - (b) Morgan unit
 - (c) Chromosome unit
 - (d) Sturtevant unit
- 58. The colour based contrasting traits in seven contrasting pairs, studied by Mendel in pea plant were :
 - (a) 1 (b) 2
 - (c) 3 (d) 4
- 59. Which of the following characters was not chosen by Mendel ?
 - (a) Pod shape
 - (b) Pod colour
 - (c) Location of flower
 - (d) Location of pod
- 60. 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) 9:3:3:1
- 61. Polygenic inheritance is :
 - (a) Qualitative
 - (b) Quantitative
 - (c) Qualitative or quantitative
 - (d) Linked
- 62. 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%

63. Recombination of genes occurs at:

- (a) Prophase in mitosis
- (b) Prophase I in meiosis
- (c) Prophase II in meiosis
- (d) Metaphase II in meiosis-

64. The distance between two genes is expressed in :

- (a) Nanometer (b) Micrometre
- (c) Angstrom (d) Percent
- 65. In Bombay phenotype the blood group is closer to :
 - (a) O
 - (b) AB
 - (c) A or B
 - (d) Any of the groups
- 66. A couple has six daughters. What is the possibility of their having a girl next time?
 - (a) 10 % (b) 50 %
 - (c) 90 % (d) 100 %
- 67. 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 %
- 68. Mendel formulated the law of purity of gametes on the basis of :
 - (a) monohybrid cross
 - (b) dihybrid cross
 - (c) test cross
 - (d) back cross

- 69. Crossig over during meiosis occurs at which of the following stages :
 - (a) Diakinesis (b) Leptotene
 - (c) Zygotene (d) Pachytene

70. 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
- 71. The inheritance of flower colour in Antirrhinum (dog flower) is an example of :
 - (a) incomplete dominance
 - (b) co-dominance
 - (c) multiple alleles
 - (d) linkage
- 72. The actual calculated ratio of Mendel's dihybrid cross was :
 - (a) 1:1:1:1
 - (b) 7:1:1:7
 - (c) 9:3:3:1
 - (d) 9.8:3.2:3.4:1.0
- 73. 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

- 74. Phenotypic and genotypic ratio is similar in case of :
 - (a) complete dominance
 - (b) incomplete dominance
 - (c) over dominance
 - (d) epistasis
- 75. 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
- 76. Inheritance of roan coat in cattle is an example of :
 - (a) incomplete dominance
 - (b) co-dominance
 - (c) multiple alleles
 - (d) none of these
- 77. ABO blood grouping in human beings cites the example of :
 - (a) incomplete dominance
 - (b) co-dominance
 - (c) multiple allelism
 - (d) Both (b) and (c)
- 78. 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

- 79. 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
- 80. 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
- 81. Experimental verification of 'chromosomal theory of inheritance' was done by :
 - (a) Sutton and Boveri
 - (b) Morgan et al
 - (c) Henking
 - (d) Karl Correns.
- 82. What is true about the crossing over between linked genes?
 - (a) No crossing over at all
 - (b) High percentage of crossing over
 - (c) Hardly any crossing over
 - (d) Chromosomal aberration
- 83. Chromosome maps/genetic maps were first prepared by :
 - (a) Sutton and Boveri (1902)
 - (b) Bateson and Punnett (1906)
 - (c) Morgan (1910)
 - (d) Sturtevant (1911)

- 84. The distance between the genes is measured by :
 - (a) Angstrom (b) map unit
 - (c) Dobson unit (d) Millimetre
- 85. Which of the following is suitable for experiment on linkage?
 - (a) aaBB x aaBB
 - (b) AABB x aabb
 - (c) AaBb x AaBb
 - (d) AAbb x AaBB
- 86. If linkage was known at the time of Mendel then which of the following laws, he would not have been able to explain :
 - (a) Law of dominance
 - (b) Law of independent assortment
 - (c) Law of segregation
 - (d) Law of purity of gametes
- 87. 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)

- 88. 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

89. 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

90. All genes located on the same chromosome :

- (a) form different groups depending upon their relative distance
- (b) form one linkage group
- (c) will not form any linkage groups
- (d) form interactive groups that affect the phenotype.

91. Distance between the genes and percentage of recombination shows:

- (a) a direct relationship
- (b) an inverse relationship
- (c) a parallel relationship
- (d) no relationship
- 92. Which is connected with multiple phenotypes :
 - (a) Epistasis
 - (b) Pleiotropy
 - (c) Polygenic inheritance
 - (d) Mutations

93. If both parents are albino all the offspring shall be :

- (a) Albino
- (b) Some albino, some normal
- (c) Homozygous normal
- (d) Heterozygous normal
- 94. Albinism is due to non-synthesis of melanin on account of absence of :
 - (a) Melaninase (b) Luciferase
 - (c) Tyrosinase (d) Lysine
- 95. 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
- 96. A recessive trait in garden pea is :
 - (a) Wrinkled seeds
 - (b) Tall stem
 - (c) Round seeds
 - (d) Coloured seed coat
- 97. 'Gametes are never hybrid' is a statement of the law of :
 - (a) Dominance
 - (b) Segregation
 - (c) Independent assortment
 - (d) Random fertilization
- 98. The symbol empty circles used in pedigree analysis represents :
 - (a) Normal females
 - (b) Normal males
 - (c) Affected females
 - (d) Affected males

- 99. 23 pairs of chromosomes in humans can give rise to how many combinations ?
 - (a) 8.6 million (b) 7.6 million
 - (c) 6.6 million (d) 5.6 million
- 100. 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
- 101. By cross pollinating certain Tobacco species some fertile hybrids were obtained by :
 - (a) Mendel (b) Morgan
 - (c) Kolreuter (d) Khorana
- 102. 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
- 103. In Pea, wrinkling of seeds is due to non-formation of starch because of the following enzyme :
 - (a) Amylase
 - (b) Invertase
 - (c) Starch branching enzyme
 - (d) Diastage

- 104. 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
- 105. 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

106. Skin colour inheritance in man is example of :

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

107. 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

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

- (a) Co-dominance
- (b) Law of segregation
- (c) Law of independent assortment
- (d) Law of dominance

109. Emasculation is a part of :

- (a) Hybridization
- (b) Mass selection
- (c) Pure line selection
- (d) Clonal selection
- 110. On selfing a plant of F1-generation with genotype 'AABbCC' the genotypc ratio of F2 generation will be :
 - (a) 3:1
 - (b) 1:1
 - (c) 9:3:3:1
 - (d) 27:9:9:3:3:3:1

111. 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

112. A colour blind daughter will be born when :

- (a) Father is colour blind
- (b) Both parents are colour-blind
- (c) Mother is carrier and father is colour blind
- (d) Both b and c

113. Which is the main category of mutation :

- (a) Genetic mutation
- (b) Zygotic mutation
- (c) Somatic mutation
- (d) All the above
- 114. In the human blood grouping, the four basic blood types are type A, type B, type AB, and type O. They are :
 - (a) Simple dominant and recessive traits
 - (b) Co-dominant traits
 - (c) Recessive traits
 - (d) Inherited traits
- 115. 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
- 116. 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

- 117. 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
- 118. If a hybrid expresses a character, it is called :
 - (a) Epistasis (b) Dominant
 - (c) Co-dominant(d) Recessive
- 119. A plant having the genotype AABbCC will produce the following kinds of gamete :
 - (a) 5 (b) 4
 - (c) 3 (d) 2
- 120. Experimental verification of the chromosomal theory of inheritance was done by:
 - (a) Sutton (b) Boveri
 - (c) Morgan (d) Mendel
- 121. 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 (l) has three alleles.
- 122. 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
- 123. The best example for pleiotropy is:
 - (a) Skin colour
 - (b) Phenylketonuria
 - (c) Colour Blindness
 - (d) ABO Blood group
- 124. 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
- 125. The number of linkage groups in *E. coli* are :
 - (a) 4 (b) 3
 - (c) 1 (d) 5
- 126. The offspring of mating between two pure strains is called as :
 - (a) Heterosis (b) Hybrid
 - (c) Progeny (d) Cybrid
- 127. Genetic recombination can occur during :
 - (a) Meiosis (b) Mitosis
 - (c) Amitosis (d) a and b

- 128. Anil is colour blind. What is the chance of his son inheriting colour blindness:
 - (a) 0% (b) 50%
 - (c) 100% (d) 25%
- 129. 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
- 130. Telomere repetitive DNA sequences control the function of eukaryote chromosome because they :
 - (a) Help chromosome pairing
 - (b) Prevent chromosome loss
 - (c) Act as replicons
 - (d) Are RNA transcription initiator
- 131. 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
- 132. 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
- // 34 //

- 133. 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
- 134. Incomplete dominance was discovered by :
 - (a) Correns (b) Johansen
 - (c) Bateson (d) Mendel
- 135. 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
- 136. Albinsim and phenylketonuria are disorders due to :
 - (a) Recessive autosomal genes
 - (b) Dominant autosomal genes
 - (c) Dominant sex genes
 - (d) Recessive genes

- 137. If there is complete linkage in F2 generation the :
 - (a) parental combinations and recombinants appear in equal ratio
 - (b) Recombinants are less than parental types
 - (c) Recombinants are more than parental type
 - (d) There will be only parent types
- 138. Cross over frequency is proportional to :
 - (a) Phenotypic recombinant frequency
 - (b) Genotypic recombinant frequency
 - (c) Haploid number of chromosomes
 - (d) Diploid number of chromosomes

139. In Drosophila

- (a) Red eye is recessive
- (b) Red eye is mutant
- (c) White eye is recessive
- (d) Both white eye and red eye show co dominanc

140. 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

					WER KE	YS				
1	(d)	00			(1.)	05	(1.)		0	
1.	(a)	29.	(a)	57.	(D)	85.	(b)	11	3.	(a)
2.	(a)	30.	(d)	58.	(c)	86.	(b)	11	4.	(b)
3.	(c)	31.	(b)	59.	(d)	87.	(b)	11	5.	(c)
4.	(c)	32.	(c)	60.	(c)	88.	(d)	11	6.	(c)
5.	(d)	33.	(a)	61.	(a)	89.	(d)	11	7.	(c)
6.	(a)	34.	(d)	62.	(b)	90.	(b)	11	8.	(b)
7.	(b)	35.	(d)	63.	(b)	91.	(a)	11	9.	(d)
8.	(b)	36.	(d)	64.	(d)	92.	(b)	12	0.	(c)
9.	(c)	37.	(c)	65.	(a)	93.	(a)	12	1.	(b)
10.	(b)	38.	(b)	66.	(b)	94.	(c)	12	2.	(b)
11.	(b)	39.	(a)	67.	(c)	95.	(c)	12	3.	(b)
12.	(d)	40.	(c)	68.	(c)	96.	(a)	12	4.	(b)
13.	(b)	41.	(d)	69.	(d)	97.	(b)	12	5.	(c)
14.	(d)	42.	(b)	70.	(a)	98.	(a)	12	6.	(b)
15.	(c)	43.	(c)	71.	(a)	99.	(a)	12	7.	(a)
16.	(d)	44.	(d)	72.	(d)	100.	(d)	12	8.	(b)
17.	(b)	45.	(d)	73.	(b)	101.	(c)	12	9.	(a)
18.	(b)	46.	(c)	74.	(b)	102.	(a)	13	0.	(b)
19.	(a)	47.	(c)	75.	(b)	103.	(c)	13	1.	(d)
20.	(a)	48.	(d)	76.	(b)	104.	(b)	13	2.	(d)
21.	(c)	49.	(b)	77.	(d)	105.	(a)	13	3.	(c)
22.	(c)	50.	(c)	78.	(c)	106.	(b)	13	4.	(a)
23.	(d)	51.	(b)	79.	(d)	107.	(a)	13	5.	(a)
24.	(d)	52.	(c)	80.	(d)	108.	(a)	13	6.	(a)
25.	(b)	53.	(b)	81.	(b)	109.	(a)	13	7.	(d)
26.	(c)	54.	(d)	82.	(c)	110.	(a)	13	8.	(a)
27.	(a)	55.	(c)	83.	(d)	111.	(a)	13	9.	(c)
28.	(c)	56.	(d)	84.	(b)	112.	(d)	14	0.	(d)

LONG ANSWER TYPE QUESTIONS

- 1. Give an account of Mendel's laws of inheritance.
- 2. Describe inheritance of one gene as per Mendel's experiments.
- 3. Differentiate between :
 - (a) Genes and Alleles.
 - (b) Homozygous and Heterozygous
 - (c) Dominant and Recessive factors
 - (d) Genotype and Phenotype
 - (e) Monohybrid and Dihybrid cross
 - (f) Back cross and Test cross
 - (g) Law of Dominance and Law of Segregation
- 4. Give and account of Mendel's laws of inheritance.
- 5. With an example, discuss incomplete dominance of characters.
- 6. Explain the concept of dominance of character.

- 7. With example, describe the codominace of character.
- 8. What is multiple allelism ?
- 9. Explain with chequer board, the dihybrid cross.
- 10. Describe the chromosomal theory of inheritance.
- 11. How did Morgan prove the genes do not segregate independently?
- 12. What are autosomes and sex linked chromosome ?
- 13. Describe sex determination in humans.
- 14. What mutation ?
- 15. Give an account of Mendelian disorders.
- 16. Describe the chromosomal disorders that occur in humans.

Answer Keys

1. Give an account of Mendel's laws of inheritance.

- **Ans.** From 1856-63, Gregor Mendel conducted experiments on Garden Pea Plans and proposed laws of inheritance in living organisms.
 - Uniqueness of Mendel's Experiments :
 - (a) Statistical patterns and mathematical logic were applied to the problems of biology.
 - (b) His experiments had large sampling of size which gave greater credibility to the data collected.
 - (c) Experiments were done on successive generations which confirmed his inferences.
 - (d) He selected one pair of contrasting characters at a time and then proceeded further with more than one character.
 - (e) His choice of Pea plants was also another cause of his success. This can be self pollinated or cross pollinated by artificial means.
 - With one pair of contrasting characters, he did the monohybrid cross experiments, proposed two principles and one law, named principle of unit character, Principle of dominance and the law of segregation. (These may be explained).
 - Then, he proposed laws of independent assortment with 2 pairs of contrasting characters. This is called dihybrid cross. (These may be elaborated and the results of dihybrid cross, i.e. 9:3:3:1 given).

2. Describe inheritance of one gene as per Mendel's experiments.

- Ans. Let us take the example of one such hybridization experiment carried out by Mendel.
 - (a) He crossed tall and dwarf Pea plants to study the inheritance of one gene.
 - (b) He collected seeds from this cross and grew then to generate plants of the first hybrid of generation. This generation is also called first filial - F1 generation.
 - (c) Mendel observed here that all progeny of the cross were tall plants. F1 always resembled trait of one parents and trait of the other parent was not seen.

- (d) Mendel the self pollinated it and produced F2 generation F2. He found that some of the offsprings were dwarf. Is proportion was ¼ and ¾ of the plants were tall. The tall and dwarf plants were identical parental type and more showed blending of characters.
- (e) Similar results were obtained in his other traits.
- (f) Based on these, Mendel proposed that something was being stably passed down unchanged, from parents to offsprings. He called these as factors. Now, it is known as genes.
- (g) Genes are therefore, the units of inheritance. They contain the information that is required to express a particular trait, in an organism. Genes which code for a pair of contrasting characters are known as alleles.
- (h) He expressed it is alphabetical symbols like T and t. T stands for tall and t stands for dwarf. T and t are alleles. (Thus monohybrid cross may be shown). Using these, he developed law of dominance and law of segregation. (These may be elaborated).
- (i) To prove his laws, he did test cross with a double recessive parent (tt). By the method, the genotype of the organism can be easily predicted.

3. Differentiate between :

(a) Genes and Alleles

- **Ans.** Genes are units of inheritance. They are actually the parts of chromosomes which carry information to express trait in an organism.
 - Genes which code for a pair of contrasting traits are alleles, i.e. they are slightly different forms of the same gene. The heterozygous tall plant carries two similar alleles (TT) and heterozygous tall plant carries two different alleles (Tt).

(b) Homozygous and Heterozygous

- Ans. True breeding characters like TT or tt are the Pea varieties which cary identical or homozygous pair of genes for height (TT or tt).
 - The presence of two different alleles at a particular locus shows heterozygousity. A heterozygous genotype may include one normal allele and one mutated allele or two different mutated alleles.

(c) Dominant and Recessive factors

Ans. In a cross between two true breeding alleles, the factor which expresses itself is dominnat one and the factor which is not expressed is recessive. For example, in the cross of true breeding tall (TT) and dwarf (tt) Pea plants, TT expresses itself and hence, it is dominant and tt remains unexpressed in F1 generation. Hence, it is the recessive factor.

(d) Genotype and Phenotype

- **Ans.** The genetic make up of an organism which is responsible for expression of characters is known as genotype.
 - The morphological expression of a character is phenotype.
 - The genotype with respect to the height of pea plant, dwarf in case of tall and dwarf offspring, TT, Tt, tt can be used.

(e) Monohybrid and Dihybrid cross

- Ans. When hyrbidization experiments are conducted with one pair of contrasting characters so as to arrive at a conclusion from its outcome, it is called monohybrid cross.
 - Instead, when two pairs are contrasting characters are taken and its results were observed in succeeding geneations, it is called dihybrid cross.

(f) Back cross and Test cross

- Ans. Back cross is a cross between F1 hybrid with one of the homozygous parents. When F1 hybrid is crossed with homozygous dominant parent, then all offsprings will be with dominant phenotype. When F1 hybrid is crossed with recessive parent, the dominant and recessive offsprings phenotypes will be in equal proportion.
 - It dominnat phenotype has unknown genotype, it is crossed with recessive one, this cross is known as the test cross. After crossing, if F2 phenotype is all dominant, then the test plant gentotype is dominant, i.e. tall. If the dominant : recessive proportion is 50:50, then test plant genotype is recesive.

(g) Law of Dominance and Law of Segregation

Ans. The law of dominance is used to explain the expression of only one of the parental characters in a monohybrid cross in F1 geneation and expession of both in the F2. It states that the proportion is 3:1 at the F2.

- The law is based on the fact that the alleles do not show any blending and that the both characters appear at F2 generation. However, at F1 stage, one character is suppresed in phenotypic expression.
- Though the parents, contain two alleles during gamete formation, the factors of a pair segregate from each other so that the gametes receive one of the two factors.

4. Give an account of Mendel's laws of inheritance.

- **Ans.** Mendel's laws of inheritance with one pair of alleles
 - (a) Law of dominance TT x tt \rightarrow Tt
 - (b) Law of segregation. Tt x Tt \rightarrow TT, Tt, tT, tt = 3:1
 - Mendel's laws of inheritance with two pairs of alleles
 - (c) Law of independent assortment

TTRR x ttrr

↓ TtRr - (F1) → 9 : 3 : 3 : 1 (F2)

(These points are to be elaborated)

5. With an example, discuss incomplete dominance of characters.

Ans. • When Mendel's experiments on Peas were repeated using other traits in other plants, it was found that sometimes the F1 had a phenotype that did not resemble either of two parents and was in between the two.

Example - Snapdragen - *Antirrhinum* Sp. A cross between tree breeding red flower (RR) and tree breeding white flowered (rr) plant, the F1 (Rr) was pink. When F1 was self pollinated, F2 ratio was, Red (RR)-1, pink - Rr-2, white (rr)-1. Although genotype was as per Mendelian observation, phenotype ratios were changed. (Chequer board be given).

• **Explanation :** Alleles need not be identical in a heterozygote. One of them may be different due to some changes. It is definitely due to the action of genes which are expressed in form of enzymes. Once allele modified there will be alternation in gene function. Which are expressed through enzymes (Explain it is detail).

6. Explain the concept of dominance of character.

Ans. Every gene contains the information to express a particular trait. In a diploid organism, there are two copies of each gene, i.e. as a pair of alleles. Now, these alleles need not always be identical, particularly in a heterozygote. Because of some changes, one may be different and this modifies the information that particular allele contains. (Here, an enzyme may be given as example and it may be explained).

7. With example, describe the codominace of character.

Ans. • In case of co-dominance, F1 generation resemble both parents.

Example, ABO blood groups, it is controlled by I gene. The plasma membrane of red blood cells has sugar polymers that protrude from the surface and the kind of the sugar is controlled by the gene I.

IA, IB and i - three alleles

IA, IB - produce slightly different form of sugar and

i - no sugar

Humans diploid each person any 2 of the three I gene alleles, IA & IB are dominant, i - recessive when IA & IB present both express, hence, co-dominant.

8. What is multiple allelism ?

Ans. • When more than two alleles governing the same character are present, it is called multiple allelism.

Example - ABO blood group - (Explain it)

9. Explain with chequer board, the dihybrid cross.

Ans. • Dihybrid Cross

Seeds of Pea



	RY	Ry	уΥ	ry	
RY RRYY		RRYy	RrYY	RrYy	
1		2	3	4	
Ry	RRYy	RRyy	RrYy	Rryy	
	5	I	6	II	
rY	RrYY	RrYy	rrYY	rrYy	
	7	8	x 1	x 2	
ry	RrYy 9	Rryy III	rrYy x 3	rryy	
Round	yellow -	9 (1-9)	Round green	- 3 (I - III)	
Wrinkle	ed yellow -	3 (X1 - X3)	Wrinkled green	- 1	

(Explain the chequer board)

10. Describe the chromosomal theory of inheritance.

- Ans. Points to be explained
 - 1865 Mendel published his work factors responsible traits.
 - 1900 Mendelism and its significance rediscovered by three scientist, de Vries, Correns and Tschermak.
 - Advancement of microscopy, chromosomal theory of heredity was worked out by 1902.
 - Sutton and Boveri Behaviour of chromosomes was parallel to behaviour of genes.
 - Anaphase of Meiosis I (explain the behaviour of chromosomes)
 - Pairing and separation of pair of chromosomes would lead to separation of pair of factors carried.
 - (Explain experimental verification by Morgan using *Drosophila*.)

11. How did Morgan prove the genes do not segregate independently?

Ans. Morgan saw in a dihybrid cross, when two genes were situated on the same chromosome, the proportion of parental gene is much higher than the non parental type. Morgan coined the word linkage to describe physical assocaition of genes. (Explain with diagram).

12. What are autosomes and sex linked chromosome ?

- **Ans.** Describe Henking's work
 - 'X' bodies, X-chromosomes and other chromosomes called autosomes.
 - Describe X & Y chromosomes

13. Sex determination in humans

- **Ans.** Out of 23 pairs of chromosomes in humans, 22 are autosomes and 1 pair is sex chromosomes, XX in females and XY in males.
 - Describe how in spermatogenesis and oogenesis, X and Y chromosomes are segregated.
 - In fertilization, zygotes may be male and female depending on the fusion of X & Y chromosomes of male persons.

14. What mutation ?

Ans. • Mutation is a sudden heritable change that occurs in the genotypes. Once there is alteration in genotype, then it leads in the change of the phenotype and it is transferred to succeeding generations.

15. Give an account of Mendelian disorders.

- Ans. Genetic disorders are grouped under two categories Mendelian disorders and chromosomal disorder.
 - Mendelian disorders are mainly determined by alteration in the single gene. These changes are transmitted to offsprings and follow the principle of inheritance.
 - Under this Haemophilia, Sickle Cell anaemia and Phenylketonuria may be discussed.

16. Describe the chromosomal disorders that occur in humans.

- Ans. Chromosomal disorder is due additoin or deletion of abnormal arrangement of one or more chromosomes.
 - Under this Down's syndrome, Klinefelter syndrome and Turner's syndrome may be described.

CHAPTER - 6

MOLECULAR BASIS OF INHERITANCE

Multiple Choice Questions (MCQ)

- 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 as 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 as exually
 - (b) Bacteria undergo binary fission
 - (c) DNA is 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 \rightarrow mRNA \rightarrow protein
 - (c) RNA \rightarrow DNA \rightarrow protein
 - (d) DNA \rightarrow mRNA \rightarrow protein
- 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<ZDNA
 - (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, Gand 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) ACGATTCAGCTG
 - (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 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 ¹⁵N is allowed to grow in ¹⁴N medium. The two strands of DNA molecule of the first generation of bacteria 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 ¹⁵N undergoes replication twice in a normal medium, then which of the following is true?
 - (a) Half of bacteria contain ¹⁵N in DNA
 - (b) All four contain ¹⁵N in DNA
 - (c) None contains ¹⁵N in DNA
 - (d) 3/5 contains ¹⁵N 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. Cells were cultured in a medium containing heavy isotope of phosphorus, ³²P till the entire DNA complement had only this isotope. Subsequently some cells were transferred to a medium with the normal isotope, ³⁰P. After a certain period, some cells were harvested and analysed for heavy phosphorous. It was found that only 6.25% of phosphorous in DNA was heavy. How many times the cells must have divided?
 - (a) Twice (b) 10 times
 - (c) 8 times (d) 4 times

- 24. 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.
- 25. The rate of addition of nucleotides per second by DNA Pol III to a to a growing strand is :
 - (a) 20 (b) 2000
 - (c) 500 (d) 1000
- 26. During DNA replication the bases of two strands separate by :
 - (a) DNA polymerase
 - (b) Topoisomerase
 - (c) Helicase
 - (d) Gyrase
- 27. 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
- 28. DNA replication is aided by:
 - (a) DNA polymerase only
 - (b) DNA ligase only
 - (c) Both (a) and (b)
 - (d) RNA polymerase

- 29. Semiconservative mode of DNA replication using ¹⁵N was demonstrated by:
 - (a) Messelson
 - (b) Taylor
 - (c) Messelson and Stahl
 - (d) Hershey and Chase
- 30. Semiconservative replication of DNA was proved by using:
 - (a) ¹²P (b) ¹⁵N
 - (c) ${}^{35}S$ (d) ${}^{12}C$
- 31. To form a continuous DNA molecule, the enzyme joins Okazaki fragments:
 - (a) DNA polymerase
 - (b) Primase
 - (c) Ligase
 - (d) Helicase
- 32. 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
- 33. Semiconservative replication of DNA was first demonstrated in:
 - (a) Salmonella typhimurium
 - (b) Drosophila melanogaster
 - (c) Escherichia coli
 - (d) Streptococcus pneumoniae
- 34. 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

- 35. During DNA replication, the synthesis of lagging strand involves the activity of following enzymes:
 - i. DNA polymerase I (exonuclease)
 - ii. DNA polymerase III
 - iii. DNA Ligase

iv. RNA Primase The correct order in which they act is:

- (a) iv \rightarrow ii \rightarrow i \rightarrow iii
- (b) iv \rightarrow i \rightarrow ii \rightarrow iii
- (c) $iii \rightarrow ii \rightarrow i \rightarrow iv$
- (d) ii \rightarrow iv \rightarrow i \rightarrow iii
- 36. 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

37. Beadle and Tatum are known for:

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

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

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

- 39. The idea that genes control the production of enzymes was given by:
 - (a) E. L. Tatum
 - (b) T. H. Morgan
 - (c) Archibald E. Garrod
 - (d) R. D. Kornberg
- 40. 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
- 41. The protein coding part of a gene is :
 - (a) Muton (b) Recon
 - (c) Exon (d) Cistron
- 42. In split genes, the coding sequences are :
 - (a) Introns (b) Exons
 - (c) Operons (d) Cistrons.
- 43. The segment of DNA which acts as the instruction manual for synthesis of the protein is :
 - (a) Nucleoside (b) Nucleotide
 - (c) Ribose (d) Gene
- 44. 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

- 45. The process of flow of genetic information from DNA to RNA or reverse is called:
 - (a) Transversion (b) Transcription
 - (c) Translation (d) Replication
- 46. All of the following are types of posttranscriptional 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
- 47. Which of the following sequences of DNA could code for a stem-loop structure (only the template strand is shown)?
 - (a) 3'—G-G-C-C-T-T-G-G-A-A-A-C-C-A-A-G-G-G-C-C—5'
 - (b) 3'—G-G-C-C-C-T-T-G-G-A-A-A-A-G-G-T-T-C-C-C-G-G—5'
 - (c) 3'—G-G-C-C-C-T-T-G-G-T-T-T-G-G-C-C-C-T-T-G-G—5'
 - (d) None of the above
- 48. The flow of information from DNA to mRNA and then to protein is called:
 - (a) Transcription
 - (b) Terminalization
 - (c) Gene expression
 - (d) Genetic code
- 49. The part a of gene that contains complete information for a polypeptide is :
 - (a) Replicon (b) Cistron
 - (c) Recon (d) Muton

- 50. The diagram shows an important concept of genetic implication of DNA. Fill in the blanks A to C. DNA <u>A mRNA B protein C Proposed</u>
 - (a) A transcription B translation C -Francis Crick
 - (b) A- translation B extension C -Rosalind Franklin
 - (c) A transcription B replication C -James Watson
 - (d) A translation B transcription C -Erwin Chargaff
- 51. DNA elements, which can switch their positions, are called:
 - (a) Exons (b) Introns
 - (c) Cistrons (d) Transposons
- 52. During transcription, the strand not transcribed by the RNA polymerase is the :
 - (a) Coding strand
 - (b) Noncoding strand
 - (c) Template strand
 - (d) Terminator strand
- 53. Central dogma was proposed by:
 - (a) Beadle and Tatum
 - (b) Temin and Baltimore
 - (c) Klug
 - (d) FHCCrick.
- 54. The process by which DNA of a nucleus passes information to RNA is called :
 - (a) Translocation (b) Transcription
 - (c) Translation (d) Transduction

- 55. 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
- 56. Which one of the following does not follow the central dogma of molecular biology ?
 - (a) Chlamydomonas
 - (b) HIV
 - (c) Pea
 - (d) Mucor
- 57. Transcription begins when one of the following enzymes binds to a promoter site:
 - (a) DNA plymerase
 - (b) RNA polymerase
 - (c) Helicase
 - (d) Gyrase
- 58. In eukaryotic cells, the RNA transcribed from DNA is called......
 - (a) rRNA
 - (b) c-DNA
 - (c) Cistron
 - (d) heterogenous mRNA
- 59. Molecular basis of organ differentiation depends on the modulation in transcription by :
 - (a) Anticodon
 - (b) RNA polymerase
 - (c) Ribosome
 - (d) Transcription factor

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- 60. Removal of RNA polymerase III from nucleoplasm will affect the synthesis of :
 - (a) hn RNA (b) m RNA
 - (c) r RNA (d) t RNA
- 61. Teminism is the same as :
 - (a) Translation
 - (b) DNA synthesis
 - (c) Transcription
 - (d) Reverse transcription
- 62. An alteration in the genetic material that eventually gives rise to mutant progeny may originate in which of the following?
 - (a) Either the sense strand or the antisense strand of DNA
 - (b) The sense strand of the DNA only
 - (c) The antisense strand of DNA only
 - (d) Only the sense strand and the antisense strand of DNA simultaneously
- 63. During transcription, RNA polymerase holoenzyme binds to a gene promoter and assumes a saddle-like structure. What is it's DNA-binding sequence?
 - (a) TATA (b) TTAA
 - (c) AATT (d) CACC
- 64. 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

- 65. 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) CTCGTAT
 - (c) ACUCGUG (d) ACTCGTA
- 66. Which of the following sequences of mRNA will not translate completely?
 - (a) 5' AUG UUC AGC UCG UGA 3'
 - (b) 5' AUG CCA UAC GAC UAG 3'
 - (c) 5'AUG UUA CUC GCG UAA 3'
 - (d) 5'AUG AAC UAA CCA CUC 3'
- 67. 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
- 68. The unusual bases found in transfer RNAs:
 - (a) Are added during transcription
 - (b) Help the tRNAs to bind to DNA
 - (c) Ensure that the tRNA stays linear in solution
 - (d) Are normal bases that have been modified after transcription
- 69. Which of 'the following is the correct representation of primary RNA (pre m-RNA) transcript ?
 - (a) Exon-intron-exon-intron-poly A signal
 - (b) Promoter -enhance-exon- intronexon-intron
 - (c) Exon-intron-exon-intron-poly Asequence
 - (d) Start codon-exon-exon-stop codonpoly Atail

- 70. Molecular biologists clone and manipulate the DNA sequences upstream of eukaryotic cistrons for which of the following reasons?
 - (a) These upstream non-transcribed regions are responsible for the regulation of gene activity.
 - (b) These upstream non-transcribed regions are the site of gene replication.
 - (c) These upstream transcribed regions are ultimately responsible for the initiation of protein synthesis.
 - (d) These upstream transcribed regions are responsible for the regulation on hnRNA processing.

71. The process of translation refers to:

- (a) Ribosome synthesis
- (b) Protein synthesis
- (c) DNA synthesis
- (d) RNA synthesis
- 72. The first codon discovered by Nirenberg and Mathaei was:
 - (a) GGG (b) CCC
 - (c) UUU (d) AAA
- 73. H. G. Khorana first deciphered the triplet codons of :
 - (a) Serine and isoleucine
 - (b) Cysteine and valine
 - (c) Tyrosine and tryptophan
 - (d) Phenylalanine and methionine
- 74. In the genetic code, the number of codons used to code for all 20 aminoacids are :
 - (a) 60 (b) 20
 - (c) 64 (d) 61

- 75. In eukaryotes, the initiation codon for protein synthesis is :
 - (a) GUA (b) GCA
 - (c) CCA (d) AUG
- 76. Whose experiments cracked the DNA and 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
- 77. The one aspect which is not a salient feature of genetic code, is its being:
 - (a) Universal (b) Specific
 - (c) Degenerate (d) Ambiguous
- 78. What is not true for genetic code ?
 - (a) It is unambiguous
 - (b) A codon in mRNA is read in a noncontiguous fashion
 - (c) It is nearly universal
 - (d) It is degenerate
- 79. Degeneration of genetic code is attributed to the:
 - (a) Third base of a codon
 - (b) First base of a codon
 - (c) Second base of a codan
 - (d) All bases of the codon
- 80. 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

- 81. The sequence of m-RNA transcribed from a DNA piece having sequence of ATTGCATCT :
 - (a) UAACGUAGA
 - (b) TAACTAGA
 - (c) UAAGCUAGA
 - (d) TAACTUGA
- 82. During translation initiation in prokaryotes, a GTP molecule is needed in :
 - (a) Association of 50S subunit of ribosme with initiation complex
 - (b) Formation of formyl-met-tRNA
 - (c) Binding of 30 S subunit of ribosome with mRNA
 - (d) Association of 30 S-mRNA with formyl-met-tRNA
- 83. During peptide elongation, the charged tRNA is added at the:
 - (a) P site of the ribosome
 - (b) A site of the ribosome
 - (c) Active site of the tRNA-aminoacyl synthetase
 - (d) Signal peptidase
- 84. 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

- 85. 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.
- 86. Because most of the amino acids are encoded by more than one codon, the genetic code is said to be:
 - (a) Overlapping (b) Wobbling
 - (c) Degenerate (d) Generate
- 87. Triplet codon refers to the sequence of three bases on:
 - (a) mRNA (b) tRNA
 - (c) rRNA (d) SnRNA
- 88. 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
- 89. All of the following are possible forms of chromosomal aberration or mutation EXCEPT :
 - (a) Deletion (b) Duplication
 - (c) Inversion (d) Transcription

- 90. Ribosomal RNA is synthesized in:
 - (a) Nucleolus (b) Nucleoplasm
 - (c) Ribosomes (d) Lysosomes

91. Which one of the following also acts as a catalyst in a bacterial cell?

- (a) snRNA (b) hnRNA
- (c) 23S rRNA (d) ssrRNA

92. 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 prokaryotic ribosomes are 80S, where "S" stands for sedimentation coefficient.
- 93. Most RNA in a eukaryotic cell is synthesised in:
 - (a) Cytoplasm (b) Nucleoplasm
 - (c) Nucleolus (d) Ribosome
- 94. The start codon for translation in prokaryotes is:
 - (a) 3' A U G 5'
 - (b) 5' U U A 3'
 - (c) 5' A U G 3'
 - (d) 3' M E T 5'
- 95. 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

- 96. During protein synthesis, how many equivalents of ATP are used for each peptide bond?
 - (a) 1 (b) 2
 - (c) 3 (d) 4
- 97. The step in translation that does not consume high energy phosphate bond is:
 - (a) Translocation
 - (b) Peptidyl transferase reaction
 - (c) Amino acid activation
 - (d) Binding of amino acyl tRNA to A-site
- 98. Protein synthesis in animal cells take place:
 - (a) Only in the cytoplasm
 - (b) In the nucleus as well as in the cytoplasm
 - (c) In cytoplasm as well as in mitochondria
 - (d) Only on ribosomes attached to the nuclear envelope
- 99. Polypeptide synthesis in a cell takes place in :
 - (a) Chloroplast (b) Mitochondria
 - (c) Chromoplast (d) Ribosomes

100. A heritable mutation can be produced if there is an alteration of the:

- (a) DNA subunit structure in either a somatic or a germ cell
- (b) Protein structure in the chromosome of a germ cell
- (c) DNA subunit structure in a somatic cell only
- (d) DNA subunit structure in a germ cell only

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- 101. There are 64 codons in genetic code because:
 - (a) There are 64 types of tRNAs found in the cell
 - (b) There are 44 meaningless and 20 codons for amino acids
 - (c) There are 64 amino acids to be coded
 - (d) Genetic code is triplet

102. 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
- 103. In a polypeptide, the amino acid sequence is determined by the sequence of bases of :
 - (a) mRNA (b) cDNA
 - (c) rRNA (d) tRNA
- 104. 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

105. A newly synthesized RNA chain (primary transcript) isolated from the nucleus of a eukaryotic cell is usually several times longer than the mRNA molecule derived from it. Which of the following statements best explains this observation?

(a) The poly A tail at the end of the primary transcript is removed

(b) The primary transcript is the template for more than one polypeptide chain.

(c) The several expressed regions of the primary transcript have equal numbers of base pairs

(d) Intervening sequences in the primary transcript are excised

106. 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

107. Some viruses have RNA instead of DNA. This shows that :

(a) Their nucleic acid must combine with host DNA before replication

- (b) They can not replicate
- (c) There is not hereditary information
- (d) RNA can act as genetic material.

108. Which of the following alterations in DNA sequence TACGCC is most deletorious :

- (a) TACGTT
- (b) ATTGCC
- (c) TACAAAGCC
- (d) TACCGC

- 109. A DNA with ATT sequence when transcribed to mRNA serves as codon for:
 - (a) Polypeptide initiation
 - (b) Polypeptide chain termination
 - (c) Incorporation of phenyl alahine
 - (d) Incorporation of glycine
- 110. 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

111. 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
- 112. 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
- 113. A sequential expression of a set of human genes occurs when a steroid molecule bind to the:
 - (a) Ribosome
 - (b) Transfer RNA
 - (c) Messenger RNA
 - (d) DNA sequence

- 114. Which of the following is coded by the least number of codons?
 - (a) Glycine (b) Histidine
 - (c) Methionine (d) Serine
- 115. 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
- 116. What would happen if in a gene encoding a polypeptide of 50 amino acids, 25th codon (UAU) is mutated to UAA?
 - (a) A polypeptide of 25 amino acids will be formed
 - (b) A polypeptide of 24 amino acids will be formed
 - (c) Two polypeptides of 24 and 25 amino acids will be formed
 - (d) A polypeptide of 49 amino acids will be formed.
- 117. Would an oligopeptide result from m-RNA sequence given below? How many amino acids would be in it? 5'UGGCCTAUGCACAGGUAGACCTAG 3'
 - (a) No
 - (b) Yes, 8 amino acids
 - (c) Yes, 4 amino acids
 - (d) Yes, 3 amino acids

118. Eukaryotic protein synthesis starts with Methionine coded by AUG and terminates at sequence UAA or UAG or UGA in mRNA. The longest polypeptide chain formed by DNA sequence given below will have: 5'-TATGAGGATACCACACAGC TAGTTCTAAGCCTATTAGCGCTG-3'

(a) 9 amino acids (b) 11 amino acids

(c) 8 amino acids (d) 7 amino acids

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

- (a) The number 1,00,000
- (b) Lactose
- (c) Lactase
- (d) Lac insect

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

- (a) Promoter gene (b) Lactose
- (c) Operator gene (d) Regulator gene

					Answer	Key	s			
1.	(a)	21.	(a)	41.	(d)	61.	(d)	81.	(a)	101. (d)
2.	(b)	22.	(c)	42.	(b)	62.	(a)	82.	(b)	102. (d)
3.	(d)	23.	(d)	43.	(d)	63.	(a)	83.	(a)	103. (a)
4.	(c)	24.	(b)	44.	(c)	64.	(b)	84.	(b)	104. (a)
5.	(b)	25.	(d)	45.	(b)	65.	(d)	85.	(b)	105. (d)
6.	(a)	26.	(c)	46.	(d)	66.	(d)	86.	(c)	106. (a)
7.	(a)	27.	(c)	47.	(a)	67.	(d)	87.	(a)	107. (d)
8.	(a)	28.	(c)	48.	(c)	68.	(d)	88.	(c)	108. (b)
9.	(b)	29.	(c)	49.	(b)	69.	(c)	89.	(d)	109. (b)
10.	(c)	30.	(b)	50.	(a)	70.	(a)	90.	(b)	110. (c)
11.	(c)	31.	(c)	51.	(d)	71.	(b)	91.	(c)	111. (d)
12.	(d)	32.	(b)	52.	(a)	72.	(c)	92.	(a)	112. (a)
13.	(b)	33.	(c)	53.	(d)	73.	(d)	93.	(b)	113. (d)
14.	(d)	34.	(c)	54.	(b)	74.	(d)	94.	(c)	114. (c)
15.	(a)	35.	(a)	55.	(c)	75.	(d)	95.	(a)	115. (a)
16.	(d)	36.	(a)	56.	(b)	76.	(b)	96.	(c)	116. (b)
17.	(a)	37.	(d)	57.	(b)	77.	(d)	97.	(d)	117. (d)
18.	(a)	38.	(b)	58.	(d)	78.	(b)	98.	(c)	118. (a)
19.	(b)	39.	(c)	59.	(d)	79.	(a)	99.	(d)	119. (b)
20.	(a)	40.	(b)	60.	(d)	80.	(b)	100.	(d)	120. (b)

LONG ANSWER TYPE QUESTIONS

- 1. Give salient features of DNA double helix.
- 2. Differentiate between :
 - (a) Purines and pyrimidines
 - (b) Nucleosides and Nucleotides
 - (c) DNA and RNA
- 3. How does packaging of DNA helix occur in eukaryotes?
- 4. Give an account of Griffith's transforming principle experiment and its biochemical characterstics.
- 5. 'DNA is the genetic material' give Hershey and Chase experiment on it.
- 6. Why is DNA is predominant genetic material?
- 7. Which was the first genetic material ? Give evidences.
- 8. Give experimental proofs regarding semi-conservative replication of DNA.
- 9. Give an account of enzyme, DNA polymerases.
- 10. Describe how DNA replication occurs.
- 11. Why both strands of DNA do not act as template in translation?

- 12. Differentiate between
 - (a) Template strand and coding strand
 - (b) Promoter and Terminator
 - (c) Exon and Intron
 - (d) Replication and Transcription
 - (e) Transcription and Translation
 - (f) mRNa and tRNA
 - (g) tRNA and rRNA
 - (h) Heterochromatin and Euchromatin
- 13. Describe the mechanism of transcription in prokaryotes.
- 14. Give an account of genetic code and point out the salient features of genetic code.
- 15. Why does sickle cell anemia occur?
- 16. Give the structure of tRNA. Write the function of its different parts.
- 17. Describe the process of translation.
- 18. Give an account of the regulation of gene expression.
- 19. Discuss the Operon concept.

Answer Keys

1. Give salient features of DNA double helix.

- **Ans.** Made of two polynucleotide chains, the backbone is sugar-phosphate and bases project inside.
 - Two chains are antiparallel in polarity. It means if one chain has polarity 5'-3', then the other has 3'-5'.
 - Two chains are paired by hydrogen bonds forming base pairs. Adenine forms two hydrogen bonds with thymine from opposite strand and Vice Versa. Similarly, guanine is bounded with cytosine with three H-bonds. As a result, always a purine is paired with pyrimidune.
 - This generates approximately uniform distance between the two strands of helix.
 - Two chains are coiled in a right handed fashion. The pitch of the helix is 3.4 nm and there are roughly 10 base pairs. As a result, the distance between each base pair in a helix is 0.34 mm. (Diagram 6.2 & 6.3 from the textbook)

2. Differentiate between :

(a) Purines and pyrimidines

Ans. • Purines and pyrimidines are hetrocyclic nitrogenous compounds. Purines - adenine and guanine are present in both DNA and RNA molecule. But, Cytosine, Uracil and Thymine are Pyrimidine bases. Cytosine is common in both types of nucleic acid. But thymine is the other pyrimidine base in DNA and uracil is absent in it. Similalry, Uracil, Pyrimidine base is present in RNA molecule and thymine is absent in it.

(b) Nucleosides and Nucleotides

- Ans. A nucleotide has three components nitrogenous base, a pentose sugar and a phosphate group. A nitrogenous base is linked to pentose sugar through N-glycosidic linkage to form a nucleoside. Nitrogenous base may be a purine (adenine guanine) and pyrimidine (Cytosine, Uracil and Thymine).
 - Then, in case of adenine with pentose sugar form the nucleoside, i.e. adenosine for RNA and deoxyadenosine for DNA.
 - When a phosphate group is linked to 5'-OH of the nucleoside through phosphoester linkage, a corresponding nucleotide (deoxynucleotide for DNA) formed. Two nucleotides are linked by phosphodiester linkage to form dinucleotide.

(c) DNA and RNA

Ans. • Full form of DNA is Deoxyribonucleic acid and RNA is Ribonucleic acid. Both comprise of a sugar, nitrogenous base and a phosphate group.

- In RNA, pentose sugar is ribose, but in DNA, the sugar is deoxyribose. In pyrimidine base, thymine is present in DNA but uracil is absent and Vice Versa happens in RNA.
- DNA is double helix, hence a stable compound. But RNA comprises of single polynucleotide chain.

3. How does packaging of DNA helix occur in eukaryotes.

- Ans. Distance between two base pairs is 0.34 nm (0.34 x 10⁻⁹ m), then in a typical mammalian cell the length of the helix will be 6.6 x 109bp x 0.34 x 10⁹ m/bp, i.e. appromiately 2.2 m. A length for greater than the dimension of typical nucleus (approximately 10-6m).
 - In prokaryotes, such as *E. Coli*, no definite nucleus is present, but DNA is not scattered throughout the cell. DNA is held by some proteins, the region is called nucleoid. The DNA, here, in nucleoid is organized in large loops held by proteins.
 - In eukaryotes, organization is much more complex. A set of positively charged basic proteins called histones are there. Histones are organized into histone octamer. The negatively charged DNA is wrapped around the positively changed histone octamer to form a structure called nucleosome. (Fig. 6.4 a of the book). A typical nucleosome contain 200 bp of the double helix. Nucleosomes constitute the repeating unit of a structure in a structure called chromatin. Chromatin are thread like coloured bodies in nucleus.
 - The beads-on-string structure in chromatin is packaged to form chromatin fibres. These are further coiled and condensed at metaphase state of cell division to form chromosome.

4. Give an account of Griffith's transforming principle experiment and its biochemical characterstics.

- **Ans.** Experimental material *Streptococcus pneumoniae* Pneumonia causing bacteria, Mice.
 - S Strain of the bacteria produce smooth, shiny colonies (S) on culture plate.
 - R strain. Rough colonies
 - S strain have mucous coat of polysaccharide.
 - R strain does not develop mucous coat
 - S strain Injected to mice \rightarrow Mice die
 - R strain Injected to mice \rightarrow Mice alive.
 - Griffith killed bacteria by heating. Heat killed

Such S - strain bacteria could not kill the mice.

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S - strain \rightarrow Injected to mice \rightarrow Mice alive (heat killed)

S - strain + R - strain \rightarrow Injected to mice \rightarrow Mice killed (heat killed) (alive)

Again, he recovered S-bacteria from the dead mice.

 He concluded that R - strain of the bacteria transformed by heat killed S - strain bacteria. Some transforming principle transferred from S - strain that enabled to synthesize a smooth polysaccharide coat and made if virulant. This must be the genetic malerial.

Biochemical Charactersitcs

- Avery, Macheod and McCarty (1933-34) determined the biochemical nature of the transforming principle.
- (i) Purified proteins, DNA, RNA etc. from heat killed S-cells to find R-cells transformed to S-cells.
- (ii) Used proteases, RNAase that is protein and RNA digesting enzymes and found that the transformation in R-Cells occurring and the mice got killed. But when they used DNase, i.e. DNA digesting enzyme, the mice remained alive and transformation inhibited.

5. 'DNA is the genetic material' give Hershey and Chase experiment on it.

- **Ans.** They worked on bacteriophages.
 - Bacteriophages attaches to bacteria → genetic material enters into bacteria. Bacterial cell uses viral genetic material as its own and subsequently synthesizes more viral particles.
 - Hershey and Chase wanted to prove whether protein or DNA enters the bacterial cells.
 - Grew viruses in a medium with radioactive phosphorus and some other with radioactive sulphur.
 - Viruses in the presence of radioactive phosphorus contained radioactive DNA but not radioactive protein because DNA contains, phosphorus but protein does not similarly in radioactive sulphur, viral proteins contained sulphur but not DNA becaue sulphur is not a component of DNA.
 - Radioactive phases were allowed to attach E. Coli bacteria. Then, as infection proceeded, the viral coats were removed by using a electronic blender. The viral particles were separated from bacteria by centrifuge.

- Bacteria which were infected with viruses that had radioactive DNA, were radioactive. This means its transfer from virus to bacteria.
- Bacteria that were infected with viruses that had radioactive proteins were not radioactive. This shows that proteins do not enter bacteria from virus but DNA actually enters. (Fig. 6.5 of the book)

6. Why is DNA is predominant genetic material?

- Ans. In certain cases, it was proved that RNA is the genetic material instead of DNA. But later, it was proved that DNA is the predominant genetic material, whereas RNA performs dynamic functions of messenger and adapter. Differences between chemical structure of molecules were responsible for it.
 - A molecule can act as a genetic material must fulfill following conditions -
 - (i) It should be able to replicate
 - (ii) It should be structurally stable
 - (iii) It should provide scope for slow changes that are required for evolution.
 - (iv) It should be able to express itself in the form of Mendelian Character.

(Examine above characters one by one, it will justify DNA as the predominant genetic materials)

7. Which was the first genetic material ? Give evidences.

- Ans. There are enough evidences to suggest essential life processes such as metabolism, translation, splicing etc. evolved are used RNA. RNA used as genetic material as well as catalysts. But RNA being a catalyst, was reactive and hence, unstable.
 - Therefore, DNA has evolved from RNA with chemical modifications that make it more stable.
 - DNA being double stranded and having complementary strands further resists changes by evolving the process of base pairing.

8. Give experimental proofs regarding semi-conservative replication of DNA.

- **Ans.** Matthew Messelson and Franklin Stahl, in 1958 gave following experiment to prove semiconservative replication in DNA
 - (i) Grew *E. Coli* in a medium containing ¹⁵NH₄Cl (¹⁵N is the heavy isotope of nitrogen) as only nitrogen source for many generations. As a result, ¹⁵N was incorporated into newly synthesized DNA.

The heavy DNA molecule can be distinguished from normal DNA by centrifugation in cesium chloride density gradient.

- (ii) Then, they transferred the cell into a medium with normal ¹⁴NH₄Cl and took samples at various definite time intervals as the cells multiplied and extracted the DNA that remained double stranded helices. The various samples were separated independently on CsCl gradients to measure the densities of DNA
- (iii) Thus, the DNA that was extracted from the culture one generation after the transfer from ¹⁵N to ¹⁴N medium (20 minutes - the generation time of *E. Coli* - 20 minutes) had a hybrid of intermediate density.

DNA extracted from the culture after another generation was composed by equal amount of hybrid DNA and light DNA.

9. Give an account of enzyme DNA polymerases.

- **Ans.** The enzyme polymerizes DNA is referred to as DNA dependent DNA-polymerase. Since it uses a template to catalyze the polymerization of deoxyribonucleotides.
 - Enzyme is highly efficient and polymerises a large number of nucleotides in a short time. Example - E. coli has 4.6 x 106 bp and here replication is completed in 22 minutes, that means approximately 2000 bp per second.
 - (ii) Catalyse the reaction in high degree of accuracy. Any mistake would result in mutations.

10. Describe how DNA replication occurs.

Ans. Enzymes, replication fork - leading - continuous strand, lagging strand (discontinuous strand), Template and coding strand. (Figure 6.8 from the book may be given and explained).

11. Why both strands of DNA donot act as template in translation?

Ans. If both strands act as template, they would code for RNA molecules with different RNA sequence and in turn, different proteins.

This would complicate the genetic information machinery.

• Two RNA molecules, if produced, then they would be complementary to each other, hence would form double stranded RNA.

This would prevent RNA being translated into protein and exercise of transcription will be futile.

12. Differentiate between

(a) Template strand and coding strand

Ans. • For a particular RNA, defined sequence of DNA act as template. On template strand, RNA is synthesized on the principle of base complementarily. The strand has 3'-5' base polarity. • The complementary strand of that DNA sequence is called coding strand for that RNA.

(b) **Promoter and Terminator**

- Ans. Promoter is located 5'-end of structural gene. It is the DNA sequence that provides binding site for RNA polymerase and it is the presence of promoter that defines the template and coding strand.
 - The terminator is located towards 3'end of the coding strand and it usually defines the end of the process of transcription.

(c) Exon and Intron

- **Ans.** The coding sequences or expressed sequences one defined as exons. Exons are sequences believed to appear in mature or processed RNA.
 - Exons are interrupted by Introns. Introns are intervening sequences that donot appear is mature or processed RNA.

(d) Replication and Transcription

- Ans. DNA replication is a biological process of producing two identical copies of DNA from one original molecule. DNA replication occurs in all living organisms, acting as the most essential part of biological inheritance.
 - The process of copying genetic information from one strand of DNA into RNA is called transcription. Here also, the principle of base complementarily, is followed except the adenosine forms base pair with uracil instead of thymine.

(e) Transcription and Translation

- **Ans.** The process of copying genetic information from one strand of DNA into RNA is transcription.
 - Translation is a process of polymerization of amino acid to form a polypeptide. The order and sequence of amino acids is determined by the sequence of the base of mRNA.

(f) mRNa and tRNA

- Ans. The process of protein synthesis of translation starts with formation of mRNA in nucleus. It is short lived. DNA transfers genetic information to ribosomes through this type of RNA.
 - It is the smallest form of RNA. It transfers the amino acids from cytoplasm to the ribosome during protein synthesis.

(g) tRNA and rRNA

- Ans. In the process of translation, tRNA molecules take part in transfer of amino acids from the cytoplasm to the specific sites of ribosome. As a result, polypeptides are formed.
 - rRNAs are the most stable forms of RNA 80% of cellular RNA is of this type. It may have some folds to form complex structure. rRNA units along with protein constitute the protein synthesizing machinery or the ribosome.

(h) Heterochromatin and Euchromatin

- **Ans.** In a typical nucleus, some region of chromatin are loosely packed and are referred to as euchromatin.
 - The chromatin that is more densely packed and stained dark are heterochromatin.
 - Euchromalin is said to be transcriptionally active chromatin, whereas heterochromatin are inactive.

13. Describe the mechanism of transcription in prokaryotes.

- **Ans.** Points to be dealt in the answer.
 - (i) Process of transcription and its significance.
 - (ii) Transcription unit promoter, structural gene, terminator.
 - (iii) The enzymes invovled.
 - (iv) Steps Initiation, elongation and Termination. Labelled diagram, Fig. 6.10 of the book.

14. Give an account of genetic code and point out the salient features of genetic code.

- Ans. Points to be dealt
 - (i) Meaning
 - (ii) Significance
 - (iii) Triplet discovery and 64 triplets
 - (iv) Salient features of Genetic code

15. Why does sickle cell anemia occur ?

Ans. • Due to point mutation, single base pair in the gene for beta globin chain that results change in amino acid residue, glutamate to valine is caused. It results in sickle cell anemia.

16. Give the structure of tRNA. Write the function of its different parts.

- **Ans.** Clover leaf model proposed by Holley (Fig. 6.12 of the book)
 - Anticodon arm D-arm, Acceptor arm, T Ψ C arm, Extra arm.
 - Mention their functions.

17. Describe the process of translation.

Ans. Translation is completed in 6 steps. They are : (1) Binding of mRNA to ribosome. (2) Aminoacylation, (3) Initiation, (4) Elongation, (5) Termination and (6) Post translational modification.

(Elaborate the points and draw diagram of Fig. 6.13 from the book)

18. Give an account of the regulation of gene expression.

- **Ans.** Regulation is exerted at
 - (i) Transcriptional level (formation of primary transcript)
 - (ii) Processing level (regulation of splicing)
 - (iii) Transport of mRNA from nucleus to cytoplasm.
 - (iv) Translational level

(Elaborate the points)

19. Discuss the Operon concept.

- Ans. An operon is a unit of co-ordinated control of gene expression in bacteria (prokaryotes) including structural gene and the controlling sequences of DNA recognised by regulator gene product.
 - An operon consists of (1) Operator gene sequence of which control the activities of a number of centiguous structural genes that take part in protein synehsis. The structural gene, syntesize mRNA molecules under the operational control of operator. The operator under the control of repressor molecule synthesized by regulator gene which is not a part of operon.
 - Lac operon is an example (Fig. 6.14 of the book for description of the process refer the text book).

CHAPTER - 9

PLANT BREEDING IN FOOD PRODUCTION MULTIPLE CHOICE QUESTIONS (MCQ)

Choose the correct answer :

1. By which method of cultivation can increase food yield to a very large extent?

- a. Traditional
- b. Increase in acreage
- c. Increase in management practices
- d. Plant breeding technology

2. What is meant by green revolution?

- a. Traditional farming
- b. Increase in milk production
- c. Quantum jump in food production
- d. Involvement local people in afforestation

3. Green revolution is dependent on :

- a. Improved plant breeding technique
- b. Choice of traditional crop
- c. Afforestation
- d. Traditional farming
- 4. Which is used as a tool in modern plant breeding method?
 - a. Hybridization in pure lines
 - b. Molecular biology
 - c. Pure line hybridization
 - d. Artificial selection.

5. Which is used in classical plant breeding method?

- a. Pure line selection
- b. Tissue culture
- c. Manipulation of genetic make up
- d. Application of molecular biology

- 6. Which are the two primary characters that breeders always try to incorporate in plant breeding?
 - a. Increase tolerance to environmental stress and pathogens.
 - b. Increased tolerance to stress and Crop-yield
 - c. Crop-yield and pest tolerance
 - d. Crop-yield and improved quality the crop of.
- 7. The entire collection, having all the diverse alleles for all genes in a given crop is called:
 - a. Gene pool
 - b. Genome
 - c. Germ plasm collection
 - d. Genetic variability
- 8. Which is not a pre-requisite for the effective exploitation of natural genes available in the populations?
 - a. Collection and preservation of all the different wild varieties
 - b. Collection and preservation of all the wild species
 - c. Collection and preservation of all the wild relatives
 - d. Collection and preservation of all the different cultivated species.

- 9. The entire collection of plants or seeds having all the diverse alleles for all genes in a given crop is called:
 - a. Germ-plasm collection
 - b. Plant breeding
 - c. Genotype
 - d. Genebank
- 10. For which purpose is the germ plasm evaluated?
 - a. To know its efficacy is multiplication
 - b. To be assured of its desirable combination of characters
 - c. To have higher production
 - d. To know it origin
- 11. Which is a drawback for hybridization experiments in plant breeding exercise?
 - a. Healthy offspirngs produced
 - b. Offsprings of high nutrition value produced.
 - c. Time consuming exercise
 - d. Difficult of to obtain desired pollens for experiment.
- 12. Why are the recombinants selfpollinated for several generations to obtain a specific character?
 - a. Offsprings made heterozygous
 - b. Offsprings made better yielding
 - c. Offspirngs made heterokaryotes
 - d. Offsprings made homozygous
- 13. Which are two dwarf varieties of wheat introduced in India during 1963?
 - a. Sonalika and Kalyansona
 - b. Sonalika and IR-8
 - c. Kalyausona and Taichung
 - d. Taichung and IR -8

- 14. Which were semidwarf high yielding varieties of rice developed in India?
 - a. Taichung & IR 8
 - b. IR8 & Jaya
 - c. Jaya & Ratna
 - d. Ratna & Taichung
- 15. What was the feature of sugarcane crop grown, in north India before the developed varieties?
 - a. Higher sugar content
 - b. Thick stems
 - c. High yield
 - d. Poor sugar content
- 16. Dependence on which were reduced to eliminate diseases to plants by plant breeding?
 - a. Fungicides & Bacteriocides
 - b. Disease causing agents
 - c. Fertilizers & manures
 - d. Irrigation and traditional varieties
- 17. Which are the correct sequence, of the conventional methods of breeding for disease resistance?
 - a. Screening germplasm for resistance sources \rightarrow Selection and evaluation of hybrids \rightarrow Hybridization of selected parents \rightarrow Release of new varieties
 - b. Screening germplasm for resistance sources → Hybridization of selected parents → Selection and evaluation of hybrids → Release of new varieties
 - c. Releases of new varieties →
 Screening germplasm of selected
 parents → Selection and
 evaluation of hybrids.
 - d. Selection and evaluation of hybrids

 → Screening of germplasm for
 resistance sources → Selection
 and evaluation of hybrids

- 18. What is the limitation of conventional breeding methods for disease resistance?
 - a. Wide availability of disease resistant genes
 - b. Disease resistant genes easily identified
 - c. Occurrence of large number of disease resistant genes
 - d. Limited availability of disease resistance genes and their identification.
- 19. A sudden change in characters in the offsprings and these characters when become heritable we called:
 - a. Mutation b. Polyplindy
 - c. Variation d. Segregation
- 20. Which one does not happen due to mutation?
 - a. Changes occur in base sequence
 - b. New character created
 - c. New character not heritable
 - d. Trail not found in parents
- 21. Which one of the following is an example of morphological resistance forensicates?
 - a. Hairy laves
 - b. Absence of nectar secretion
 - c. Higher aspartic acid content
 - d. Low sugar content

22. Which type of collection of cotton plants do not attached to Boll Worms

- a. Hairy leaved
- b. Smooth leaved
- c. Nectar secreting
- d. Solid stemmed

23. Bio-fortification is done not to increase:

- a. Food production
- b. Protein production
- c. Vitamin content
- d. Micronutrient & mineral component
- 24. Which of the following algae can be grown in waste water from single cell protein?
 - a. Chlamydomonas
 - b. Volvox
 - c. Chana
 - d. Spirulina
- 25. Which of the following can serve as delicious food as well as the source of single cell protein?
 - a. Chlamydomonas
 - b. Spirulina
 - c. Mushrooms
 - d. Methylophilus
- 26. Which one of the following not related to explants?
 - a. Part of living tissue of plant
 - b. Can be grown in test tube to raise plant
 - c. Special nutrient medium is required
 - d. Part of the dead tissue of the plant
- 27. Which of the following cells show totipotency?
 - a. Cork cells b. Meristems
 - c. Xylem ssels d. Phloem fibers
- 28. What is the method of producing thousands of plants, through tissue culture called?
 - a. Micropropagation
 - b. Hybridization
 - c. Grafting
 - d. Biofertification
- 29. When plants grown by tissue culture are genetically identical to their parents they are called :
 - a. Hybrids b. Cybrid
 - c. Somaclone d. Explants

30. What is plant cell without cell wall called ?

- a. Cytoplasm b. Protoplasm
- c. Protoplast d. Coconut

			Answ					
(d)	7.	(c)	13.	(a)	19.	(a)	25.	(b)
(c)	8.	(d)	14.	(c)	20.	(a)	26.	(d)
(a)	9.	(a)	15.	(d)	21.	(a)	27.	(b)
(b)	10.	(b)	16.	(a)	22.	(a)	28.	(b)
(a)	11.	(c)	17.	(b)	23.	(a)	29.	(c)
(d)	12.	(d)	18.	(d)	24.	(c)	30.	(c)
	(d) (c) (a) (b) (a) (d)	 (d) 7. (c) 8. (a) 9. (b) 10. (a) 11. (d) 12. 	(d)7.(c)(c)8.(d)(a)9.(a)(b)10.(b)(a)11.(c)(d)12.(d)	(d) 7. (c) 13. (c) 8. (d) 14. (a) 9. (a) 15. (b) 10. (b) 16. (a) 11. (c) 17. (d) 12. (d) 18.	(d) 7. (c) 13. (a) (c) 8. (d) 14. (c) (a) 9. (a) 15. (d) (b) 10. (b) 16. (a) (a) 11. (c) 17. (b) (d) 12. (d) 18. (d)	ANSWER KEYS(d)7.(c)13.(a)19.(c)8.(d)14.(c)20.(a)9.(a)15.(d)21.(b)10.(b)16.(a)22.(a)11.(c)17.(b)23.(d)12.(d)18.(d)24.	ANSWER KEYS(d)7.(c)13.(a)19.(a)(c)8.(d)14.(c)20.(a)(a)9.(a)15.(d)21.(a)(b)10.(b)16.(a)22.(a)(a)11.(c)17.(b)23.(a)(d)12.(d)18.(d)24.(c)	(d)7.(c)13.(a)19.(a)25.(c)8.(d)14.(c)20.(a)26.(a)9.(a)15.(d)21.(a)27.(b)10.(b)16.(a)22.(a)28.(a)11.(c)17.(b)23.(a)29.(d)12.(d)18.(d)24.(c)30.

LONG ANSWER TYPE QUESTIONS

- 1. What is plant breeding?
- 2. Differentiate classical plant breeding and modern plant breeding.
- 3. List the traits as characters to which a plant breeder does try to incorporate in crop plants.
- 4. Give an outline of steps in breeding a new genetic variety in the breeding programme.
- 5. What is meant by germ-plasm collection?
- 6. Why cross hybridization among the selected plants is done? Why is it time consuming process?
- 7. How release and commercialisation of new cultivars done?
- 8. What is green revolution? What are the varieties of wheat and rice used for this?

- 9. How plant breeding for disease resistance done?
- 10. Discuss the methods of plant breeding for disease resistance?
- 11. Describe how plant breeding is used for developing resistance to insect pests.
- 12. Why is breeding for improvement of food quality done?
- 13. Describe biofortification with examples.
- 14. What is meant by Single cell Protein? Give examples.
- 15. What is totipotency?
- 16. What are components present in tissue culture medium?
- 17. Write notes on : Explants, Micropropagation, and Sonaclones.
- 18. What are somatic hybrids?

Answer Keys

1. What is plant breeding?

Ans. Plant breeding is manipulation of plant species in order to create desired plant types. These are better suited for cultivation, give greater yields and higher disease resistance.

2. Differentiate classical plant breeding and modern plant breeding.

Ans. Classical plant breeding involves crossing or hybridization of pure lines followed by artificial selection to produce plants with desirable traits of higher yield, nutrition and resistance to diseases. Modern plant breeding techniques carried out by using molecular genetics tools with advancement in genetics, molecular biology and tissue culture.

3. List the traits as characters to which a plant breeder does try to incorporate in crop plants.

- **Ans.** Traits incorporated by a breeder
 - a) Increased crop yield and improved quality
 - b) Increased tolerance to environmental stress.
 - c) Increased tolerance to insects pests.

4. Give an outline of steps in breeding a new genetic variety in the breeding programme.

- Ans. The main steps as:
 - a) Collection of viability Germplasm collection. It is the root of all breeding programme. It involves: collection, preservation all the different wild varieties of concerned crops species and related cultivated species. Thereby the natural genes will be available and it will be exploited for crop production.
 - b) Evaluation and Selection of parents
 - c) Crop hybridization among the selected parents.
 - d) Selection and testing of superior recombinants
 - e) Testing, release and commercialization of new cultivars. (These points are to be elaborated)

5. What is meant by germ-plasm collection?

Ans. Genetic variability is the root of any breeding programme. In many crops pre-existing genetic variability is available in the wild varieties of the crop. Collection and preservation of all the different wild varieties, species, and relatives of the cultivated species is a pre-requisite for effective exploitation of natural genes available in the populations. Such complete collection of plants/seeds having all the diverse alleles for all genes in a given crop is called germplasm collection.

6. Why cross hybridization among the selected plants is done? Why is it time consuming process?

Ans. In plant breeding experiments, the desired characters have very often to be combined from two parental plants. This done by cross hybridizing the two parents to produce hybrids that genetically combine the desired characters in one plant. It is a time-consuming process. Because of their pollen grains from the desirable plant chosen as male parent have to be collected and placed on the stigma of the flowers selected as female flower. Also, it is not necessary that hybrids do combine the desirable characters usually only one in a few hundred to a thousand crosses shows the desirable combination.

7. How release and commercialisation of new cultivars done?

Ans. The newly selected lines are evaluated for their yield and other agronomic traits of quality, disease resistance etc. This evaluation is done by growing these in the research fields and recording their performance under ideal fertilizer application, irrigation and other crop management practices. The evaluation in the research fields is followed by testing the materials in crop fields. This is done for at least, three seasons at several locations in the country representing all the agroclimatic zones where crop is usually grown. Then the yield is compared with a local cultivar-which is used as the reference.

8. What is green revolution? What are the varieties of wheat and rice used for this?

- Ans. Green revolution denotes quantum jump in food production due to use high yield semidwarf varieties of crop plants, particularly wheat and rice.
 - Semi-dwarf wheat varieties in India used Sonalika and Kalyan Sona.
 - Semi-dwarf rice varieties in India used IR8, Taichung, Jaya & Ratna.

9. How plant breeding for disease resistance done?

Ans. A wide range of Fungal, Bacterial and Viral Pathogens affect the yield of crop plants. Crop losses may be 20-30 percent and sometimes, it may be total. In this scenario breeding and development of cultivars resistant to disease enhances the food production. This reduces the application of pesticides in the crop fields. This also reduces the overdependence on use of pesticides. Resistance in the host plant is the ability to prevent pathogen from causing disease and it is determined by the genetic constitution of the host plant.

10. Discuss the methods of plant breeding for disease resistance?

Ans. It is done by conventional breeding practices or by mutation breeding. Conventional method-Hybridization and Selection. Here the sequence of steps are: Screening of germplasm for disease resistance, hybridization of selected parents, selection and evaluation of hybrids and testing and release of new varieties.

Need for mutation breeding

Conventional breeding is sometimes constrained by the availability of limited number of disease resistant genes. Induction of mutations in the parents through diverse means and then screening the plant materials for resistance sometimes leads to desirable genes being identified.

Plants with these desirable characters can there be either multiplied directly or can be used for breeding.

Mutation breeding

It is the process by which genetic variations are created through changes in base sequence within genes. This results in the creation of new character of trait not found in parented type. Mutations can be induced artificially through use of chemicals or radiations. Then the offsprings created are selected. Where the plants have desirable characters, they are used and the process is called mutation breeding.

11. Describe how plant breeding is used for developing resistance to insect pests.

- Ans. Another major cause for large scale crop plant and crop produce is insect and pest attack. But certain plants have undertaken adaptations to avoid the insect root attack. These adaptations may be due to morphological, biochemical or physiological characteristics of the plants. Hairy leaves in several plants are associated with resistance to insect pest. Ex- Cereal leaf beetle in wheat. In wheat, solid stems lead to non-preference to stem sacofly and smooth leaved nectar-less cotton varieties do not attract boll worms. High aspartic acid, low nitrogen and sugar content in maize leads to resistance to maize stem borers.
 - Breeding programme for pest resistance is devised in such a way that resistant agronomic traits are incorporated in the new plants. Thus, the sources of resistant genes may be cultivated varieties, a germ plasm collection of the crop or their wild relatives.

12. Why is breeding for improvement of food quality done?

Ans. Hundreds and thousands of people around the world do not meet their daily food and nutritional requirements. Again, more than three billion people suffer from micronutrient protein and vitamin deficiency. They suffer from hidden hunger because they cannot afford to buy enough fruits, vegetables, legumes, fish and meat. Again, these diets lacking in micronutrients particularly iron Vitamin A, iodine and zinc-increase the risk for disease, reduce life span and the mental abilities.

13. Describe biofortification with examples.

- **Ans.** In order to increase the vitamin and mineral or protein and healthier fat contents, breeding for crop plants is done. Hence for biofortified crops, the breeding is done to enhance the following nutrients:-
 - (i) Protein content and quality
 - (ii) Oil content and quality
 - (iii) Vitamin content
 - (iv) Micronutrients and mineral content

Examples:

- (i) Maize hybrids that had twice the amount of amino-acids, lysine and tryptophan, compared to existing maize hybrids were developed.
- (ii) Wheat variety Atlas 66, having high protein content has been used as a donor for cultivated wheat.
- (iii) Iron fortified rice variety containing over five times as much iron in commonly consumed varieties.

14. What is meant by Single cell Protein? Give examples.

Ans. Single Cell Protein - SCP refers to dead and dry cells of microorganisms like yeasts, bacteria, fungi and algae. These SCPs are used for food and feed supplement and can be alternative of conventional proteins source.

Example:-

Microbes like Spirulina can be grown easily on materials like waste water from potato processing plants, straw, molasses, animal manure and even sewage. Its produced large quantities and can serve as food rich in protein, minerals, fats, carbohydrates and vitamins.

Mushrooms are the good source of single cell protein.

15. What is totipotency?

Ans. When explants are taken out and grown in test tube under sterile conditions in special nutrient media, it become active and grains into a plant. This capacity to regenerate a whole plant from any living cell or explant is called tissue culture.

16. What are components present in tissue culture medium?

Ans. A carbon source like, sucrose inorganic salts, vitamins, amino acids and growth regulators like allxins, Cytokinins are taken in a tissue culture medium.

17. Write notes on : Explants, Micropropagation, and Sonaclones.

Ans. Explants - The part of the part which comprises living tissues when used in tissue culture, that part is called explants.

Micropropagation - In process of tissue culture, hundreds of plants can be produced within a very short space of life. This process of producing large number of plants is called micropropagation.

Soma-clones- Plants produce by tissue culture have genetic similarity. Each of these, genetically identical plants are called soma-clones.

18. What are somatic hybrids?

Ans. Cells without cell walls are called protoplasts. Isolated plants from two different varieties of plants - each having desirable character- can be fused to get hybrid protoplast. This is a living entity and it can be further grown to form a new-plants. This hybridization is called somatic hybrid.

CHAPTER - 10

MICROBES IN HUMAN WELFARE MULTIPLE CHOICE QUESTIONS (MCQ)

Choose the correct answer :

- 1. The microbes are predominant forms in Kingdom :
 - (a) Plantae and Animalia
 - (b) Monera and Protista
 - (c) Plantae and Fungi
 - (d) Fungi and Animals
- 2. Which of the following microbes are unicellular eukaryotes ?
 - (a) Bacteria (b) Bryophytes
 - (c) Protozoa (d) Viruses
- 3. Which are included in a cellular prokaryotic microbes ?
 - (a) Bacteria
 - (b) Protozoa
 - (c) Chlamydomenas
 - (d) Ferns
- 4. We prepared some artificial cltures for growing organisms. Which of the following will grow faster in a suitable culture ?
 - (a) Fungi (b) Plant tissue
 - (c) Animal tissue (d) Bacteria
- 5. Lactic acid bacteria can digest :
 - (a) Casein (b) Lactose
 - (c) Starch (d) Milk Powder
- 6. Beside converting milk to curd, the Lactic acid bactrium increases its nutritional quality by increasing :
 - (a) Vitamin C (b) Vitamin D
 - (c) Vitamin B_{12} (d) Vitamin B_2

- 7. Which gas does give puffed up appearance to dough ?
 - (a) CO_2 (b) BO_2
 - (c) H₂ (d) CO
- 8. Which organism is used in bread making ?
 - (a) Lactobacillus
 - (b) Saccharomyces
 - (c) Mucor
 - (d) Candida
- 9. Dosa and Idli are also fermented by bacteria. It appears puffed up due to the production of CO₂ gas, where from these bacteria come from ?
 - (a) Air (b) Rice
 - (c) Dal (d) Water
- 10. 'Roquefort Cheese' is ripened by growing specific :
 - (a) Bacterium (b) Protozoa
 - (c) Algae (d) Fungus
- 11. What are the large vessels for production of beverages and antibiotics called ?
 - (a) Flasks (b) Containers
 - (c) Formentors (d) Culture tubes
- 12. Which is called baker's yeast?
 - (a) Saccharomyces cerevisiae
 - (b) Schizosaccharomyces octosporus
 - (c) Saccharomycodes ludwigii
 - (d) Candida albicans

13. Which is a nonalcoholic beverage?

- (a) Wine (b) Beer
- (c) Tea (d) Whisky
- 14. Which are undistiled alcoholic beverages ?
 - (a) Wine and Beer
 - (b) Wine and Whisky
 - (c) Wine and Brandy
 - (d) Wine and Rum
- 15. Which one is undistilled alcoholic beverage ?
 - (a) Whisky (b) Beer (Wine)
 - (c) Rum (d) Brandy
- 16. Which organism could not grow in Alexander Fleming's unwashed petridish ?
 - (a) Chlrococcus
 - (b) Streptococcus
 - (c) Streptobacillus
 - (d) Staphylococcus
- 17. From which organism first antibiotic was obtained ?
 - (a) Penicillium notatum
 - (b) Penicillium roqueforti
 - (c) Penicillium chrysogenum
 - (d) Saccharomyces cerevisiae
- 18. Which are the two organisms needed to convert glucose to acetic acid ?
 - (a) Yeast & Acetobacter
 - (b) Acetobacter & Aspergillus
 - (c) Aspergillus & Lactobacillus
 - (d) Lactobacillus & Clostridium
- 19. Which enzymes are used for clarification of fruit juice ?
 - (a) Lipase & Amylase
 - (b) Protease & Pectinase
 - (c) Pectinase & Amylase
 - (d) Amylase & Protease

- 20. Which enzymes is used to remove oily stains from the laundry ?
 - (a) Lipase (b) Nucleare
 - (c) Protease (d) Lipase
- 21. Which enzyme is called clot buster?
 - (a) Fructokinase (b) Streptokinase
 - (c) Ribonuclease (d) Nuclease
- 22. Which immunosuppressive agent is used in organ transplantation ?
 - (a) Streptokinas A (b) Cyclosporine
 - (c) Penicillin (d) Chloromycetin
- 23. Which organism is commercialised for blood-cholesterol lowering agent?
 - (a) Trichoderma polysporum
 - (b) Clostridium butylicum
 - (c) Monascus purpureus
 - (d) Aspergillus niger
- 24. Which are removed in primary treatment of waste water ?
 - (a) Floating debris & grit
 - (b) Gases & chemicals
 - (c) Biogas & oxygen
 - (d) Floating debris & Gases
- 25. Which is the processes that constitute primary treatment of waste water?
 - (a) Gasification
 - (b) Filtration & Sedimentation
 - (c) Anaerobic fermentation and microbial treatment
 - (d) Anaerobic & aerobic fermentation
- 26. In which treatment of waste water purification are microorganisms grown ?
 - (a) Primary (b) Secondary
 - (c) Tertiary (d) Quaternery

27. Which condition high polluting potential ?

- (a) BOD more
- (b) BOD less
- (c) Sludge material completely accumulated
- (d) Maximum growth of microorganisms
- 28. What are the soft, wet mud or semi solid viscous mixture liquid that arise due to treatment by sewage called :
 - (a) flocs (b) sludge
 - (c) slurry (d) compost
- 29. What is the major component of biogas ?
 - (a) CO_2 (b) CO
 - (c) Sulphur (d) CH₄
- 30. What are the masses bacteria with fungal filaments when form a mesh like structure during secondary treatment of wet water called ?
 - (a) Colony (b) Sludge
 - (c) Flocs (d) Slurry
- 31. Some bacteria produce CO₂ gas as end product during fermentation while others produce predominantly methane. The type of gas production depends on :
 - (a) Microbes and organic substrates
 - (b) Temperature and organic substrates
 - (c) Temeprature and microbes
 - (d) Substrate and pH
- 32. What is the main component in cow dung ?
 - (a) CO_2 (b) O_2
 - (c) NO (d) CH₄

33. Which is not a character of chemical control agents ?

- (a) Toxic chemicals
- (b) Polluting to the environment
- (c) Does not kill non-target pests
- (d) Comprises of pesticides and insecticides
- 34. Which one is not assocaited with bicontrol of pests ?
 - (a) Control of pests by natural predation
 - (b) Biodiversity is maintained in the field
 - (c) Chemicals are introduced to central pests
 - (d) Pests are not eradicated but are managed by complex system of checks & balances

35. What is disadvantage of use of chemical pesticides in agriculture ?

- (a) enhances crop production
- (b) completely elimates the harmful pests
- (c) crop plants grow profusely
- (d) useful and harmful life forms are killed indiscriminately
- 36. Gene from which organism is introduced by genetic engineering in Bt-Cotton Plant ?
 - (a) Trichoderma viridiae
 - (b) Baculovinus
 - (c) Bacillus thuringensis
 - (d) Nucleo polyhedra virus

37. Which one is not related to Baculo virus?

- (a) Species specific
- (b) Broad infection insecticidal action
- (c) Noninfection insecticidal action
- (d) Included in genus Nucleopolyhadra virus

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38.	. What are the main sources of biofertilizers?						What is main function of genus Glomus in the mycorrhizal association ?						
	(a) Pla	ants, anir	nals ar	nd their deb	ris		(a) absorbs phosphorus						
	(b) Ba	cteria, fu	ngi and	d cyanobac	ters		(b) resistance to root bone pathogens						
	(c) Ba	cteria, pl	ants ar	nd animals			(c) salinity tolerana						
	(d) Fu	ngi, Bact	teria ar	d animals			(d) drought tolerance						
39.	9. Which one of the following shows symbiotic association with legume?						Which organism is used as the biofertilizer in paddy fields ?						
	(a) Azo	ospirillus	(b)	Azotobact	er		(a) F	ungi	(b)	Bacteria			
	(c) Co	stridium	(d)	Rhizobium	ı		(c) V	iruses	(d)	Cyanoba	acteria		
	Answer Keys												
1.	(b)	8.	(b)	15.	(b)	22.	(b)	29.	(d)	36.	(b)		
2.	(c)	9.	(a)	16.	(d)	23.	(c)	30.	(c)	37.	(b)		
3.	(a)	10.	(d)	17.	(a)	24.	(a)	31.	(a)	38.	(a)		
4.	(d)	11.	(c)	18.	(a)	25.	(b)	32.	(d)	39.	(d)		
5.	(b)	12.	(a)	19.	(b)	26.	(b)	33.	(c)	40.	(a)		
6.	(c)	13.	(c)	20.	(a)	27.	(a)	34.	(c)	41.	(d)		
7.	(a)	14.	(a)	21.	(b)	28.	(b)	35.	(d)				

LONG ANSWER TYPE QUESTIONS

- 1. Where can we find microbes ?
- 2. Which are the organisms called microbes?
- 3. How is curd prepared?
- 4. How are microbes used in bread making industry?
- 5. Describe the household products prepared by microbes.
- 6. What is a fermenter?
- 7. How are alocoholic beverages prepared using microbes?
- 8. How was penicillin discovered ?
- 9. Give an account of chemicals, enzymes and bioactive molecules prepared from microbes.

- 10. How sludge is produced by primary treatment of sewage?
- 11. Discuss the process of secondary treatment of waste water.
- 12. How is biogas produced and which microbe is responsible for this?
- 13. How is Bt Cotton raised? What are the advantages of biocontrol agents ?
- 14. How are Baculoviruses used as biocontrol agents?
- 15. What are biofertilizers ? Give two examples of with their uses.
- 16. What is mean by mycorrhiza ? How is the association beneficial to the plants ?

Answer Keys

1. Where can we find microbes ?

- **Ans.** Microbes are present everywhere, in soil, water, air, inside our bodies and that of other animals and plants.
 - They are present at the sites where possibly no other life form can exist like hot thermal springs, deep in the soil, under several layers of snow and highly acidic environment.

2. Which are the organisms called microbes?

Ans. Protozoa, bacteria, fungi, microscopic viruses, viroids and also the prions.

3. How is curd prepared?

Ans. Small amount curd is added to luke warm milk. The lactic acid bacteria present in the mother curd can convert the milk to curd within 24 hours.

4. How are microbes used in bread making industry?

Ans. Dough which is used for making foods like dosa and idli can be fermented by bacteria. The puffed up appearance is due to CO_2 gas. Dough is fermented by baker's yeast.

5. Describe the household products prepared by microbes.

- **Ans.** (a) Diary products Curd, butter, cheese.
 - (b) Fermentation products Idli, Jalebi, drinks.
 - (c) Bread making

6. What is a fermenter ?

Ans. For production of beverages and antibiotics in industrial scale, require growing microbes in very large vessels called fermenters.

7. How are alocoholic beverages prepared using microbes?

Ans. Alcoholic beverages prepared by fermenting malted cereals and fruit juices, to produce ethanol. Depending on the type of raw materials and type of processing different types of alcoholic drinks were prepared.

8. How was penicillin discovered ?

Ans. Alexander Fleming was working on *Staphylococci* bacteria, once observed that a mould growing in one of his unwashed culture plates did not allow *Staphylococci* to grow around it. This is, he determined due to the mould producing certain chemicals and he named it penicillin. The mould concerned was *Penicillium notatum*.

9. Give an account of chemicals, enzymes and bioactive molecules prepared from microbes.

Ans. Citric acid, lactic acid, ethanol, pectinase, lipases, proteases, streptokinase, cyclosporine A, statins. (Mention organisms involved, chemicals obtained and their uses).

10. How sludge is produced by primary treatment of sewage?

Ans. In sewage treatment plants (STPs) - waste water is treated with heterotrophic microbes. In primary treatment, waste water is filtered and sedimentation of it done. By sequential treatment, floating debris is removed and then, grit is removed by sedimentation. All solids settle in form of primary sludge.

11. Discuss the process of secondary treatment of waste water.

Ans. Useful aerobic microbes were used in secondary treatment, microbes use organic matter present in it and reduced the BOD of the water.

12. How is biogas produced and which microbe is responsible for this?

- **Ans.** Biogas is produced by methanogenic bacteria. These bacteria are found in anaerobic sludge during sewage treatment.
 - Also, biogas is produced in biogas plants. (Describe a biogas plant and the figure 10.8).

13. How is Bt Cotton raised? What are the advantages of biocontrol agents ?

- **Ans.** Because of the development of genetic engineering in recent years the scientists have introduced *B. thuringiensis* toxin genes into plants, such plants are resistant to attack of insect pests.
 - Bt Cotton for example is cultivated in some states of India for more than a decade.
 - *Advantages* Reduce dependence on chemical pesticides which have adverse effect on environment and human beings.

14. How are Baculoviruses used as biocontrol agents ?

Ans. • Baculovirus attack insects and anthropods. Hence, used as excellent biocontrol agent for species specific, narrow spectrum insecticidal applications. They have no negative impact on plant, animals, man, birds, fish or even on non-target insects.

15. What are biofertilizers ? Give two examples of it with their uses.

- **Ans.** Biofertilizers are organisms that enrich the nutrient quality of the soil. The main sources of biofertilization are bacteria, fungi and cyanobacteria.
 - *Rhozobium* is symbiotic association with root system of legumes fix atmospheric nitrogen.
 - Azotobacter and clostridium are two free living fixers.
 - Cyanobacteria are autotrophic microbes widely distributed in aquatic and terrestrial environments. Many of these organisms can fix atmospheric nitrogen, e.g. *Anabaena, Nostoc, Oscillatoria* etc. In rice fields Cyanobacteria serve as an important biofertilizer.
 - Blue green algae also add organic matter to the soil and increase its fertility.

16. What is mean by mycorrhiza ? How is the association beneficial to the plants ?

- **Ans. Mycorrhiza :** Fungi in symbiotic association with root systems of plant form an association called mycorrhiza.
 - **Benefit to plants :** Resistance against root borne pathogens, tolerance to salinity and draught and overall increase in plant growth and development.

CHAPTER - 13

ORGANISMS AND POPULATIONS

MULTIPLE CHOICE QUESTIONS (MCQ)

Choose the correct answer :

- 1. Which is the correct order of the biological organisations ?
 - (a) Individuals \rightarrow Ecosystems \rightarrow Population \rightarrow Communities \rightarrow Biomes
 - (b) Individuals \rightarrow Population \rightarrow Communities \rightarrow Ecosystems \rightarrow Biomes
 - (c) Individuals \rightarrow Community \rightarrow Population \rightarrow Ecosystems \rightarrow Biomes
 - (d) Individuals \rightarrow Biomes \rightarrow Population \rightarrow Ecosystems \rightarrow 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. How are habitats formed in a major biome?
 - (a) Orbiting of our planet
 - (b) Occurrence 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 be average temperature >100°C ?
 - (a) Thermal springs
 - (b) Tundra
 - (c) Arctic regional
 - (d) Polar region

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- 9. The organisms who can adopt to wide range of temerature are called :
 - (a) Isothermal
 - (b) Stenothermal
 - (c) Heterothermal
 - (d) Eurythermal
- 10. Where can you find temperature more than 50°C ?
 - (a) Poles
 - (b) Tropical deserts
 - (c) High altitudes of mounains
 - (d) Arctic regions
- 11. Which factor does influence the life of an fresh water organism in sea water?
 - (a) Nutrient supply
 - (b) pH
 - (c) Water availability
 - (d) Water scarcity
- 12. In land habitats the Sun is the source of both
 - (a) Light and temperature
 - (b) Temperature and wind
 - (c) Energy and food
 - (d) Oxygen and light
- 13. Photoperiod denotes :
 - (a) light intensity and light quality
 - (b) light intensity and its duration
 - (c) light duration and plant condition
 - (d) Dark condition and night duration

- 14. Photoperiod in plants is not assocaited with :
 - (a) Flowering
 - (b) Photosynthesis
 - (c) Reproduction
 - (d) Pigment formation
- 15. Which factor in the body does not alter due to homeostasis ?
 - (a) Biochemical reactions
 - (b) Morphological features
 - (c) Optimal temperature outside
 - (d) Osmotic concentration of habitat
- 16. The process by which the living organisms maintain constant body temperature is called :
 - (a) Osmoregulation
 - (b) Thermoregulation
 - (c) Eurythermy
 - (d) Stenothermy
- 17. The organisms who can not maintain their constant internal body temperature are known as :
 - (a) Conformers
 - (b) Regulators
 - (c) Heterothermal
 - (d) Escapees

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- 18. Which group of organisims do not have mechanism to maintain their constant body temperature ?
 - (a) Humans
 - (b) Birds
 - (c) Arctic animals
 - (d) Plans
- 19. The phenomenon of temporary departure from stressful habitat to more hospitable area is called :
 - (a) Nudation (b) Migration
 - (c) Immigration (d) Mortality
- 20. Dormany of seeds means :
 - (a) Suspension of metabolic activity
 - (b) Death of plant propagules
 - (c) Formation of thick walled spores
 - (d) Instant germination
- 21. What can be winter sleep of bears called ?
 - (a) Aestivation (b) Migration
 - (c) Hiberation (d) Diapause
- 22. In which case is diapause seen ?
 - (a) Zooplanktons
 - (b) Phytoplanktons
 - (c) Mesophytes
 - (d) Xerophytes

23. Indicate the unrelated pair ?

- (a) Bacteria Zoospore
- (b) Frog Hiberation
- (c) Snails Aestivation
- (d) Zooplanktons diapause

24. Which is a physiological adaptation of the xerophytes ?

- (a) Thick cuticle
- (b) Sunken stomata
- (c) CAM
- (d) Well developed vascular system

25. 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

26. Which are the attributes of population?

- (a) Birth and death
- (b) Birth and death rate
- (c) Birth rate and death
- (d) Birth rate and death rate
- 27. Which is not an attribute of a population ?
 - (a) Habitat (b) Birth rate
 - (c) Death rate (d) Sex ratio

28. A population may become extinct by over exploitation of its :

- (a) Prey organisms
- (b) Predater organisms
- (c) Autotrophs
- (d) Decomposers

- 29. Which are the two factors that contribute towards increase in population?
 - (a) Natality and mortality
 - (b) Natality and immigration
 - (c) Mortality and natality
 - (d) Mortality and immigration
- 30. How does the population density increase rapidly in a new habitat ?
 - (a) Birth rate (b) Death rate
 - (c) Immigration (d) Emigration

31. Under which condition can population growth be exponential?

- (a) Famine
- (b) Limited resource
- (c) Unlimited resource
- (d) Small habitat
- 32. What does carrying capacity of a habitat denote?
 - (a) Unlimited resource
 - (b) The maximum number of individuals of a population can accommodate
 - (c) Competition among population
 - (d) Various restraints for a population
- 33. To form a biological community, the organisms interact together are :
 - (a) Plant, animals and microbes
 - (b) Plants and microbes
 - (c) Animal and microbes
 - (d) Plants and animals

- 34. When both organism benefit in an assocaition, it is called :
 - (a) Parasitism
 - (b) Mutalism
 - (c) Predator
 - (d) Competition
- 35. When one organism lives at the cost of other, it is called :
 - (a) Mutualism
 - (b) Commensalism
 - (c) Parasitism
 - (d) Amensalism
- 36. What is the association in which one organism is benefitted and other neither benefitted nor harmed called?
 - (a) Mutualism
 - (b) Parasitism
 - (c) Commensalism
 - (d) Amensalism
- 37. When in an assocaition, one species is harmed where othre is unaffected it is called :
 - (a) Commensalism
 - (b) Amensalism
 - (c) Parasitism
 - (d) Predator

- 38. What are the prolific spreading exotic species introduced a new habitat called?
 - (a) Indigenous species
 - (b) Natural species
 - (c) Invasive species
 - (d) Seral Community
- 39. By which mechanism do some animal species change its colour to escape from the predator ?
 - (a) Camouflage
 - (b) Mimicry
 - (c) Chemical emission
 - (d) Presence of spines
- 40. Resemblance of one organism to another or to the natural objects among which it secures concealment, protection or other advantage is called:
 - (a) Camoutlage
 - (b) Concealment
 - (c) Mimicry
 - (d) Chemical omission
- 41. Which type of defence system is seen with spines of Opuntia ?
 - (a) Morophological
 - (b) Chemical
 - (c) Biochemical
 - (d) Physiological

42. 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
- 43. The size of population tells us lot about :
 - (a) Environment
 - (b) Sex-ratio
 - (c) Age pyramid
 - (d) Habitat
- 44. Under the limited resources the competitively superior species will eventually eliminate the other species what is that condition called ?
 - (a) Competitive inclusive
 - (b) Parasitism
 - (c) Competitive predation
 - (d) Competitive exclusion
- 45. 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 othre species get, dramatically increased. What is that condition ecologically formed?
 - (a) Competitive exclusion
 - (b) Competitive inclusion
 - (c) Competitive release
 - (d) Competitive predator

- 46. 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) Reserve sharing
 - (d) Resource competitoin
- 47. 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) superficially lives at the cost of the host

- 48. 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
- 49. What is the function of fungal component in mycorrhizae association?
 - (a) absorption of mineral
 - (b) reproduction
 - (c) water absorption
 - (d) photosynthetic products

Answer Keys									
1.	(b)	14.	(d)	27.	(a)	40.	(c)		
2.	(d)	15.	(d)	28.	(b)	41.	(a)		
3.	(a)	16.	(b)	29.	(b)	42.	(b)		
4.	(c)	17.	(a)	30.	(b)	43.	(d)		
5.	(b)	18.	(d)	31.	(c)	44.	(d)		
6.	(c)	19.	(b)	32.	(b)	45.	(c)		
7.	(d)	20.	(a)	33.	(a)	46.	(a)		
8.	(a)	21.	(c)	34.	(a)	47.	(b)		
9.	(d)	22.	(a)	35.	(c)	48.	(d)		
10.	(b)	23.	(a)	36.	(c)	49.	(a)		
11.	(b)	24.	(c)	37.	(b)				
12.	(a)	25.	(d)	38.	(c)				
13.	(b)	26.	(d)	39.	(a)				

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LONG ANSWER TYPE QUESTIONS

- 1. Which four levels of biological organizations are included in ecology?
- How are the major biomes formed ? Give examples.
- 3. Give examples of certain extreme habitats?
- 4. What are the key elements of a habitat?
- 5. Write the meaning of eurythermal and stenothermal.
- 6. How pH can be the determining factor for life forms in aquatic habitats ?
- 7. What is photoperiod ? How does it influence the life in a habitat ?
- 8. What is homeostasis ?
- 9. How are the mammals regulate their homeostasis.
- 10. 'Plants are conformers' justify.
- 11. Why does migration occur ? Give example.
- 12. Differentiate between hibernation and diapauses.
- 13. Define aestivation with example.
- 14. How micro-organisms withstand adverse environmental conditions in a habitat?

- 15. What are the adaptations of mammal in colder climates ?
- 16. Why do we feel altitude sickness ?What are its symptoms?
- 17. What are the adaptations of desert lizards?
- Give an account of the attributes of a population.
- 19. What is population density?
- 20. Describe the factors that contribute towards population growth.
- 21. Describe different population growth models.
- 22. What is r value of populations ?
- 23. Explain the terms :
 - (a) Mutualism
 - (b) Parasitism
 - (c) Predation
 - (d) Amensalism
- 24. Discuss the adaptations in plants and animals to prevent predation.
- Explain the terms : competitive exclusion, competitive release, Resource partitioning.

ANSWER KEYS

1. Which four levels of biological organizations are included in ecology?

Ans. • Four levels are - Organisms, population, communities and biomes.

2. How are the major biomes formed ? Give examples.

- Ans. Rotation of our planet around the Sun and the tilt in its axis cause annual variations in intensity and duration of temperature, resulting in distinct seasons.
 - These variations together with annual variation in precipitation account for the formation of major biomes.
 - Examples Desert, Rainforest and Tundra.

3. Give examples of certain extreme habitats?

Ans. • Scorching Rajasthan desert, perpetually rain soaked Meghalaya forests, deep ocean trenches, torrential streams, permafrost polar regions, high mountain tops, boiling thermal springs, stinking compost pits etc. may be cited as example.

4. What are the key elements of a habitat?

Ans. • Temperature, water, light and soil. These form the physio-chemical components of a habitat. Habitats also include biotic components, pathogens, parasites, predators and competitors of the organism with which they interact constantly.

5. Write the meaning of eurythermal and stenothermal.

- Ans. Organisms who can tolerate and thrive in a wide range of temperature are called eurythermals. Ex. Mammals.
 - Stenothermal Organisms who can live at a narrow range of temperature. Ex. Reptiles.

6. How pH can be the determining factor for life forms in aquatic habitats ?

- Ans. Quality of water becomes determining factor for organisms in aquatic habitats. pH is important here. In inland water, salt concentration is less than 5%, 30-35% in sea and more than 100% in hyper saline lagoons.
 - Therefore many fresh water organisms cannot live for long time in saline or high pH water.

7. What is photoperiod ? How does it influence the life in a habitat ?

Ans. Photoperiodism is developmental responses of plants to relative lengths of light and dark periods. Flowering of many plants are dependent on photoperiodism. For many animals too, light is important is that they use the diurnal and seasonal variations of light intensity and duration as use for timing their foraging, reproductive and migrating activities.

8. What is homeostasis ?

Ans. During the course of millions of years of their existence, many species would have evolved a relatively constant internal (within body) environment that permits all biochemical reactions and physiological functions to proceed with the maximal efficiency and thus enhance, overall, fitness of the species. This constancy may be in terms of optimal temperature and osmotic concentration of body fluids. This endeavour in the part of the organism to maintain constancy of environment in the face of varying external environmental conditions is called homeostasis.

9. How are the mammals regulate their homeostasis.

Ans. Mammals body temperature is around 37°C. In summer, when outside temperature is more than the body temperature, we sweat profusely. This results in evaporative cooling. In winter, when temperature is much lower than body temperature, we start to shiver, a kind of exercise which produces heat and raises the body temperature. This is how homeostasis is maintained in human body.

10. 'Plants are conformers' - justify.

Ans. Their body temperature changes with ambient temperature. In aquatic environment, osmotic concentration of the body fluids change with hat of ambient osmotic concentration.

11. Why does migration occur ? Give example.

Ans. The conformer organisms can move away temporarily from the stressful habitat to a more hospitable habitat and return when stressful period is over. In winter season, migrating birds from Siberia move to Chilika lake in order save themselves from extreme cold conditions of that region.

12. Differentiate between hibernation and diapauses.

- Ans. Some conformer organisms unable to migrate from inhospitable to hospitable habitats, might avoid the stress by escaping in time.
 - Example Lizards go into hibernation during winter to escape the stressful cold conditions.
 - Some Zooplanktons species in lakes and ponds enter a stage of suspended development. This is known as diapause.

13. Define aestivation with example.

- **Ans.** In order to escape the summer related problems such as heat and desiccation, some organism undertake summer sleep. This is known as aestivation.
 - Example Snails and some types of fish.

14. How micro-organisms withstand adverse environmental conditions in a habitat?

Ans. In bacteria, fungi and lower plants various kinds of thick walled spores are formed.
 Under this condition, they withstand unfavourable conditions. The germinate when favourbale conditions are set in.

15. What are the adaptations of mammal in colder climates?

Ans. • Mammals from colder climates generally have shorter ears and limbs to minimize heat less. In the polar seas, aquatic mammals like seals have a thick layer of fat below their skin that acts as an insulator and reduces less of body heat.

16. Why do we feel altitude sickness ? What are is symptoms?

- Ans. The symptoms of altitude sickness include nausea, fatigue and heart palpitations.
 This is because in the low pressure of high altitudes, the body does not get enough oxygen.
 - The body compensates low oxygen availability by increasing red blood cell production, decreasing binding affinity of hemoglobin and by increasing breathing rate.

17. What are the adaptations of desert lizards ?

Ans. • Desert lizards lack the physiological ability that mammals have to deal with the high temperature of the habitat but manage to keep their body temperature constant by behavioural means. They bask in the Sun and absorb heat when heir body temperature drops belong the favourable zone but more into shade when ambient temperature starts increasing.

18. Give an account of the attributes of a population.

- Ans. Birth rates and death rates, i.e. the change in number with respect to members in population. Supposing, a pond has 20 lotus plants. Their number increased to 28 in one year. Hence, the rate of their increase in population 28-20=8/20=0.4 offspring of lotus per year.
 - Another attribute is sex ratio and
 - Age pyramid
 - Population size

19. What is population density?

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).

20. Describe the factors that contribute towards population growth.

- Ans. Density of a population is a given habitat during a given period, fluctuates due to changes in four basic processes, two of which (natality and immigration) contribute 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.

21. Describe different population growth models.

- Ans. (a) Exponential growth : When resources in a habitat is unlimited, each spp. has the ability to realize fully its innate ability to grow in number. Then the population grows in exponential or geometric fashion.
 - Here the population will reach enormous population. (Here an example may be given).

- (b) Logistic growth : No population of any species in nature has its disposal unlimited resource to permit exponential growth. This leads to competition between individuals for limited resource. Eventually, the fittest will survive.
- In nature, a given habitat has enough resources to support a maximum possible number, beyond which no further growth is possible. This is called carrying capacity (K) for that species in the habitat.
- Since resources for growth for the most animal populations are finite and become limiting sooner or later, the logistic growth model is considered a more realistic one.

22. What is r - value of populations ?

Ans. • r denotes intrinsic rate of natural increase in population and this important parameter is used in assessing impacts of any biotic or abiotic factors on population growth.

Hence
$$r = \frac{Birth - death}{Populatin Size}$$

- 23. Explain the terms :
- (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, two partners are fungi and algae. Algae partner provides nourishment to fungi and fungi gives 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 benefitted and 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 animals or plant for food, then it is called predation.
 Here one species called predator and it is always benefitted and the interaction is detrimental for other species, i.e. prey. Example - Tiger and Deer.

(d) Amensalism

Ans. • Here one species is harmed where as other is unaffected. Example - *Penicillium*, secretes Penicillin which inhibits growth of various kinds of bacteria.

24. Discuss the adaptations in plants and animals to prevent predation.

Ans. • Animals

- *Camouflage* There are source 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 effect morphological and chemical defence mechanism against their predators.
- Species and thorns are present in Xerophytes poisonous chemicals like glycosides in *Calotropis*. Chemical like Coffine, quinine, strychnine etc. are examples of chemicals produced for defence in plant.

25. Explain the terms : competitive exclusion, competitive release, Resource partitioning.

- **Ans.** Two closely related species competing for the same resource cannot co-exist in definitely and competitively inferior will be ultimately excluded.
 - Competitive release : A species whose distribution is restricted to small geographical area because of the presence of a competitively superior species, it found to expand its distributional range dramatically, when the competing species is experimentally removed. (One example to be given).
 - 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. (Example may be given).

CHAPTER - 14

ECOSYSTEM

Multiple Choice Questions (MCQ)

- 1. Which ecosystem is different from other three?
 - a. Forest b. Grassland
 - c. Wet land d. Pastures
- 2. Which is an example of man-made ecosystem?
 - a. River b. Wetland
 - c. Reserve forest d. Aquarium
- Identification and enumeration of plant and animal species of an ecosystem gives rise to its :
 - a. Species composition
 - b. Species diversity
 - c. Stratification
 - d. Ecosystem
- 4. What is vertical distribution of different species occupying different levels called?
 - a. Speciation
 - b. Species diversity
 - c. Stratification
 - d. Ecosystem

5. What is a structural component of ecosystem?

- a. Productivity b. Food chain
- c. Energy flow d. Nutrient cycling

6. Which are the consumers is a pond eco system?

- a. Zooplanktons
- b. Green plants
- c. Free swimming alage
- d. Phytoplankton
- 7. The rate of biomass production in an ecosystem is called :
 - a. Primary productivity
 - b. Production
 - c. Productivity
 - d. Net primary productivity
- 8. The rate production of organic matter during photo synthesis is called?
 - a. Productivity
 - b. Gross productivity
 - c. Net primary productivity
 - d. Secondary productivity

9. What is secondary productivity?

- a. Rate of organic matter production during photosynthesis
- b. Rate of biomass production
- c. Gross primary productivity minus respiration
- d. Formation organic matter by consumers
- 10. Which system has the highest annual primary productivity?
 - a. Oceaus b. Deserts
 - c. Forests d. Lands

- 11. Which is the correct sequence of decomposition?
 - a. Fragmentation \rightarrow Leaching \rightarrow Catabolism \rightarrow Humification \rightarrow Mineralization
 - b. Fragmentation \rightarrow Mineralization \rightarrow Humification \rightarrow Leaching \rightarrow Catabolism
 - **c.** Fragmentation \rightarrow Humification \rightarrow Mineralization \rightarrow Catabolism \rightarrow Leaching
 - d. Fragmentation \rightarrow Humification \rightarrow Mineralization \rightarrow Catabolism \rightarrow Leaching

12. Which work is done by delivers?

- a. Catabolism b. Fragmentation
- c. Leaching d. Mineralization
- 13. In which mean do the saprobes degrade the simpler organic substances?
 - a. Catabolism b. Fragmentation
 - c. Leaching d. Mineralization
- 14. Which is not applicable to decomposers?
 - a. Form detritus food chain
 - b. Saprobes
 - c. Parasites
 - d. Degrade organic matter
- 15. GFC and DFC are connected by :
 - a. Producers b. Omnivores
 - c. Carnivores d. Herbivores

16. Who are the primary consumers?

- a. Producers b. Carnivores
- c. Herbivores d. Detrivores

17. What is called standing crop in an ecosystem ?

- a. Biomass of producers
- b. Biomass of living organisms
- c. Biomass of consumers
- d. Biomass of Omnivores

18. The secondary consumers like birds, fishes to belong to :

- a. Fourth trophic level
- b. First trophic level
- c. Second trophic level
- d. Third trophic level

19. Which ecological pyramids may be both upright and inverted?

- a. Pyramid of number & pyramid of biomass
- b. Pyramid of number & pyramid of energy
- c. Pyramid of biomass & pyramid of energy
- d. Pyramid of energy
- 20. When organisms in different trophic level inter connected in such a way that they become complex. It is called:
 - a. Food chain
 - b. Food web
 - c. Ecological pyramid
 - d. Standing crops
- 21. The community that is in near equilibrium with the environment is called:
 - a. Seral Community
 - b. Pioneer Community
 - c. Climax Community
 - d. Ecological Community

22. Where does secondary succession occur?

- a. Bare rock
- b. Freshly cooled lava
- c. Burnt forest
- d. Newly created ponds
- 23. The species that invade bare areas are called:
 - a. Climax species
 - b. Pioneer species
 - c. Hydrophytes
 - d. Xerophytes
- 24. Which are the pioneers of primary succession of water bodies?
 - a. Phytoplanktons
 - b. Free floaters
 - c. Rooted hydrophytes
 - d. Grasses
- 25. Which is not related to primary succession :
 - a. Slow process
 - b. Takes thousand of years
 - c. Quick process
 - d. Ultimately climax community formed
- 26. Which is not the part of gaseous cycle in ecosystem?
 - a. Carbon b. Nitrogen
 - c. Sulphur d. Oxygen
- 27. The amount of nutrients such as nitrogen, phosphorus, calcium etc. present in the soil at a given time is called:
 - a. Nutrient cycling
 - b. Biogeochemical cycle
 - c. Sedimentary cycle
 - d. Standing state

- 28. Which element is present in the highest amount in the living organisms?
 - a. Carbon b. Oxygen
 - c. Nitrogen d. Sulphur
- 29. How is carbon fixed in the biosphere?
 - a. Respiratory
 - b. Decomposition
 - c. Photosynthesis
 - d. Burning of fessil fuols
- 30. Which is not the natural cause for increase of carbon compounds?
 - a. Rapid deforestation
 - b. Fossil fuel burning
 - c. Transport
 - d. Respiration
- 31. In which character does the carbon and phosphorus cycle has similarity?
 - a. Respiratory release
 - b. Nucleic acid component
 - c. Part of gaseous cycle
 - d. Atmospheric input

32. Natural scavengers are :

- a. Phytophnkton & Zooplanktons
- b. Lion & Tiger
- c. Bacteria & Fungi
- d. Insects & Amoeba
- 33. Which is the most critical element after nitrogen?
 - a. Sulphur b. Oxygen
 - c. Phosphorus d. Carbon
- 34. Pioneer Community established on barren rock is :
 - a. Mosses
 - b. Ferns
 - c. Phytoplanktons
 - d. Lichens

- 35. Hydrosphere is composed of biotic and abitic components present in:
 - a. Water b. Soil
 - c. Air d. Space
- 36. In an ecosystem dominated by trees the pyramid of numbers is of __ type
 - a. Upright
 - b. Inverted
 - c. Both upright and inverted
 - d. Zigzag
- 37. In aquatic ecosystems, the limiting factor for productivity is :
 - a. Sunlight
 - b. Availability of CO₂
 - c. Water
 - d. Consumers
- 38. The major reservoir of carbon on earth is _____
 - a. Forests b. Grassland
 - c. Cropfields d. Oceans

- 39. Fragmentations of organic wastes in the soil is done by :
 - a. Detrivores b. Plants
 - c. Animals d. Molluscs
- 40. Which has the largest population is the food chain?
 - a. Primary consumers
 - b. Secondary consumers
 - c. Producers
 - d. Carnivores
- 41. The second trophic level is lakes is :
 - a. Phytoplankton
 - b. Zooplankton
 - c. Benthes
 - d. Fishes

42. Secondary consumers are :

- a. Producers
- b. Herbivors
- c. Carnivores
- d. Decomposers

ANSWER RETS												
1.	(c)	8.	(b)	15.	(b)	22.	(c)	29.	(c)	36.	(b)	
2.	(d)	9.	(d)	16.	(c)	23.	(b)	30.	(d)	37.	(a)	
3.	(a)	10.	(d)	17.	(b)	24.	(a)	31.	(b)	38.	(d)	
4.	(c)	11.	(a)	18.	(d)	25.	(c)	32.	(c)	39.	(a)	
5.	(b)	12.	(b)	19.	(a)	26.	(c)	33.	(C)	40.	(c)	
6.	(a)	13.	(a)	20.	(b)	27.	(d)	34.	(d)	41.	(b)	
7.	(c)	14.	(c)	21.	(d)	28.	(c)	35.	(a)	42.	(c)	

LONG ANSWER TYPE QUESTIONS

- 1. What is an ecosystem?
- 2. Ecosystems are variable Justify.
- 3. What are characteristics of each type of ecosystem?
- 4. What are species composition and stratification?
- 5. What are the structural and functional components of an ecosystem?
- Taking pond as an example of ecosystem, describe its structural and functional components.
- 7. What are primary production, productivity, Gross primary productivity, net primary productivity and secondary productivity?
- 8. Why Earthworm is called Farmer's Friend?
- 9. What are the important steps of mineralization?
- 10. Describe how the process of mineralization is completed?
- 11. Describe the factors that regulate decomposition.
- 12. How the sunlight is useful for the living world?

- 13. How does energy flow in the ecosystem?
- 14. What are food chain, food web and trophic level?
- 15. What are standing crop and biomass?
- 16. What are ecological pyramids? Describe different ecological pyramids.
- 17. What are climax community? How does ecological succession take place?
- 18. What are seres and seral stages?
- Where does succession start?
 Describe primary and secondary succession with examples.
- 20. What are Hydrarch and Xerarch succession?
- 21. What are pioneer species? Give examples. Discuss the process in water and dry place.
- 22. What is standing state?
- 23. What is meant by nutrient cycling? Mention the types of nutrient cycles?
- 24. Give an account of ecosystem services.

ANSWER KEYS

1. What is an ecosystem?

Ans. An ecosystem is functional unit of nature. Here, the living organisms interact among themselves and also with its surrounding physical environment.

2. Ecosystems are variable Justify.

- Ans. Ecosystems varies greatly in size from a small pond to a large forest or a sea. Many ecologists regard the entire biosphere as global ecosystem, as a composite of all local ecosystems of earth.
 - Since this ecosystem is too much big and complex to be studied at one time, it is convenient to divide it into two basic categories, such as terrestrial and aquatic.
 - Forests, grassland and desert are some examples of terrestrial ecosystem; pond, lake, river, estuary are some examples of aquatic ecosystems. Cropfield and aquarium may be considered as man-made ecosystem.

3. What are characteristics of each type of ecosystem?

Ans. Interaction of biotic and abiotic components result in a physical structure that is a characteristic for each type of ecosystem.

4. What are species composition and stratification?

Ans. Identification and enumeration of plant and animal species of an ecosystem gives rise to its species composition. Vertical distribution different species occupying different levels called stratification. For example, trees occupy the top vertical strata or layer of a forest. Shrubs the second and herbs and grasses occupy the bottom layer.

5. What are the structural and functional components of an ecosystem?

Ans. Structural Components

i)

- Food chain i) Productiv
 - i) Productivity
- ii) Food web
- iii) Abiotic components

ii) Decomposition

Functional Components

- iii) Energy flow
- iv) Nutrient cycling

(Elaborate these Points)

- 6. Taking pond as an example of ecosystem, describe its structural and functional components.
- Ans. A pond is a shallow water body in which all the basic components of ecosystem are exhibited.

- The abiotic components is the water with all the dissolved inorganic and organic substances and rich soil deposit at the bottom of the pond. The solar input, the cycle of temperature, day length and other climatic conditions regulate the rate of functions of the entire pond.
- The autotrophs components include-phytoplankton, some algae and the floating, submerged and marginal plants. The consumers are composed of zooplanktons, free swimming and bottom dwelling forms.
- The decomposers are fungi, bacteria and flagellates. The system performs all the functions of any ecosystem and biosphere as a whole. These include conversion of inorganic into organic with the help of radiation energy of the sun by autotrophs; consumption of autotrophs by heterotrophs decomposition and mineralization. This process is repeated again and again.

7. What are primary production, productivity, Gross primary productivity, net primary productivity and secondary productivity.

- Ans. Primary production is defined as the amount of biomass or organic matter produced per unit area over a time period by plants during photosynthesis. It is expressed in terms of weight (g)⁻² or energy (Kcal m⁻²).
 - The rate of biomass production is called productivity and are expressed in g⁻² yr⁻¹ or (Kcal m⁻²) yr⁻¹.
 - Productivity can be divided into Gross Primary Productivity (GPP) and Net Primary Productivity (NPP). Gross Primary Productivity of an ecosystem is the rate of production of organic matter during photosynthesis.
 - A major amount energy thus fixed, is utilized by respiration. The remaining amount of energy is NPP. GPP= R=NPP.
 - Net Primary Productivity is the available biomass for consumption of heterotrophs. Secondary Productivity is defined on the rate of formation of new organic matter by consumers.

8. Why Earthworm is called Farmer's Friend?

Ans. Complex organic matters like leaves, bark, flowers, and dead remains of animals in the soil remain in organic form. These are broken-down and the soil is loosened by the earth-worms. Therefore, they are called Farmer's Friend.

9. What are the important steps of mineralization?

Ans. The steps of mineralization are fragmentation leaching, catabolism, humification and mineralization.

10. Describe how the process of mineralization is completed?

- Ans. Dead plant remains such as leaves, bark, flowers, and dead remains of animals, including fecal matter, constitute detritus. These are raw materials for mineralization.
 - Detritus is broken-down by detrivores into small particles. This process is called fragmentation which done mainly by earthworms.
 - By the process of leaching, water soluble inorganic nutrients go down the soil horizon and get precipitated as unavailable salts. Soil bacteria and fungi secrete enzymes to degrade the detritus into simple inorganic substances. This process is called catabolism.
 - Humification and mineralization occur during decomposition of the soil. Humification leads to accumulation of a dark-coloured amorphous substance called humus. It is highly resistant to microbial action and undergoes decomposition at an extremely slow rate. Being colloidal in nature, it serves as are reservoir of nutrients. The humus is further degraded by microbes and release inorganic nutrients occur by the process of mineralization.

11. Describe the factors that regulate decomposition.

- Ans. Decomposition is largely an oxygen requiring process. The rate of decomposition is controlled by chemical composition of detritus and climatic factors. In a particular climatic condition, the rate of decomposition is slower if the detritus is rich in lignin and chitui, Again the rate of decomposition will be quicker if the detritus is rich in nitrogen and water-soluble substances like sugar.
 - Temperature and soil moisture are the most important climatic factors that regulate decomposition through their effects on activities of soil microbes, Warm and moist environment favour decomposition whereas the temperature and absence of aeration inhibit decomposition. As a result, it leads to build up of organic materials.

12. How the sunlight is useful for the living world?

Ans. PAR stands for Photosynthetically Radiation. We know, that green plants and photosynthetic and chemosynthetic bacteria fix suns radiant energy to make food from simple inorganic materials. Plants capture only 2-10 percent of photosynthetically activity radiation and this small amount of energy sustains the entire living world.

13. How does energy flow in the ecosystem?

Ans. • The green plants are called producers because they convert solar energy into the chemical energy and in the process inorganic substances like H₂O and CO₂ are utilized. Animals depend on these green plants directly or indirectly for their food. Hence, they are called Consumers or Heterothophic Organisation. If the consumers only feed on green plants, they are called primary consumers and the animals eat the primary consumers, they are then, secondary consumers. Herbivores are always

primary consumers and carnivores may be secondary or tertiary consumers. Producer herbivores, carnivores for their feeding habits from specific trophic levels.

- Green plants fix certain amount of solar energy and convert it to chemical energy in form of food substances.
- They use their synthesized food substances for their metabolic activity and only a small amount of energy is transferred to the carnivores that form the next trophic level likewise happen for the next higher trophic level. Hence, there is always less of energy in each level of food chain and it has been presumed that only 10% is available to the higher trophic level. This is called one way flow of energy.

14. What are food chain, food web and trophic level?

- **Ans.** A food chain is a linear sequence of organisms through which nutrients and energy pass as one organism feed upon the other.
 - Food web consists of many interconnected food chains and are more realistic presentation of consumption relationships.
 - Organisms occupy a place in the natural surroundings according to their feeding relationship with other organisms. Based on the source of their nutrition or food, organisms occupy specific place in food chain and that is known as trophic level. (fig. 14.2 from the book)

15. What are standing crop and biomass?

Ans. Each trophic level has a certain mass of living material at a particular time. That is called the standing crop. The standing crop is measured as the mass of living organism called biomass or the number in unit area. The biomass of a species is expressed in terms of fresh or dry weight.

16. What are ecological pyramids? Describe different ecological pyramids.

- Ans. When we consider the number, biomass or energy relationships between the trophic levels of an ecosystem. We normally find its shape is like a pyramid. Thus, they are expressed as (a) Pyramid of number, (b) Pyramid of biomass and (c) Pyramid of energy
 - The base of each pyramid represent, producers or the first trophic level with the top representing top consumer.
 - Any calculation of energy content, biomass or number has to include the organisms at that trophic level.
 - In most ecosystems, all pyramids i.e., of number of biomass and of energy are upright, i.e., producers are more in number and biomass than herbivores and herbivores are more in number and biomass than the carnivores. Also, energy content of the lower trophic level is more than the higher trophic level.

- There are exceptions to these generalisations. There are more insects in a big tree and then, the number of small birds depending on these insects and the number of larger birds eating smaller. The pyramid of number may be inverted here. Likewise pyramid of biomass may be inverted.
- However, pyramid of energy is always upright. Because when energy flows from one trophic level to the next trophic level, some energy is always lost as heat at each step. Each bar in the energy pyramid indicates the amount of energy present at each trophic level in a given time or annually per unit area. (Fig.14.4 a, b, c & d from the text book)

17. What are climax community? How does ecological succession take place?

Ans. An important characteristic of all communities is that to the composition and structure constantly change in response to environmental conditions. These changes fairly lead to a community that is near equilibrium with environment and that is called climax community. This gradual and fairly predictable change in the species composition of a given area is called ecological succession.

18. What are seres and seral stages?

Ans. The entire sequence of communities that successively change in a given area are called seres. The individual transitional communities are formed as seral stages. In successive seral stages, there is a change in the diversity of the species of organisms, increase in the number of species and organisms as well as increase in biomass.

19. Where does succession start? Describe primary and secondary succession with examples.

- Ans. Succession starts at a place where no living organisms exist-it may be a bare rock, where no living organisms existed or areas that somehow, lost all its living organisms which existed before. The former is called primary succession while latter is termed secondary succession. Examples of Primary Succession – Newly cooled lava, bare rock, newly created pond or reservoir.
 - Succession Farm lands, burnt or cut forests, lands that have been flooded. Here natural biotic communities are destroyed due to natural or manmade interventions.

20. What are Hydrarch and Xerarch succession?

- Ans. Based on the nature of habitat -whether it is water (or very wet areas) or its is only areas-succession of plants is called Hydrarch or Xerarch; respectively.
 - Hydrarch succession takes place in wetter areas and successional series progren from hydric to the mesic conditions. However, xerarch succession takes place in dry areas and the series progress from xeric to mesic conditions.

21. What are pioneer species? Give examples. Discuss the process in water and dry place.

- Ans. The species that invade a bare area are called pioneer species. In primary succession on rocks, these are usually lichens which are able to secrete acids to dissolve rock, helping in weathering and soil formation.
 - The later pave way to some very small plants like bryophytes. Bryophytes grow there in small amount of soil. With passage of time, bryophytes are succeeded by bigger plants and several more stages occur there. Ultimately, a stable climax forest community is formed.
 - In Primary succession in water, the pioneers are the small phytoplanktons, they are replaced with time by free-floating angiosperms, then by rooted hydrophytes, sedges, grasses and finally trees. The climax is again formed by forests.

22. What is standing state?

Ans. The organisms that form an ecosystem need a constant supply of nutrients to grow, reproduce and regulate body functions. The amount of nutrients such as carbon, nitrogen, phosphorus, calcium etc present in the soil at any given time is referred to as the standing state.

23. What is meant by nutrient cycling? Mention the types of nutrient cycles?

Ans. Nutrients are never lost from ecosystem they are recycled again and again indefinitely. The movement of nutrient elements through the various components of an ecosystem is called nutrient cycling. They are otherwise, called as biogeochemical cycles. Nutrients cycles are of two types (a) gaseous cycle-carbon,oxygen, nitrogen etc. (i) Sedimentary cycle sulphur, phosphorus etc. Reservoir of sedimentary cycle is Earth crust. On the other hand, the reservoir of gaseous cycles is atmosphere. Environmental factors like soil, moisture pH, temperature etc. regulate the ratee of release of nutrients to atmosphere.

24. Give an account of ecosystem services.

- Ans. Healthy ecosystems are the base of a wide range of economic environmental and aesthetic goods and sources. The products of ecosystem processes are called ecosystem services.
 - Example-Healthy forest ecosystems purify air and water, mitigate droughts and floods, cycle nutrients, generate fertile soils, provide wildlife habitat, maintain biodiversity, pollinate crops, provide storage site for carbon and also provide aesthetic, cultural and spiritual values.
CHAPTER - 15

BIODIVERSITY AND CONSERVATION

Multiple Choice Questions (MCQ)

- 1. Which of the following countries has the highest biodiversity ?
 - (a) Brazil (b) Sout Africa
 - (c) Russia (d) India
- 2. What percentage of the earth's land area do the biodiversity hotspots host their ecosystems ?
 - (a) 11.8 (b) 15.7
 - (c) 2.4 (d) 10.9
- 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 is reserve in India ?
 - (a) Similipal (b) Nilagiri
 - (c) Panna (d) Manas
- 9. How many biosphee 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 he 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

	Answer Keys												
	1.	(a)	4.	(c)	7.	(d)	10.	(c)	13.	(a)			
	ი	(\mathbf{c})	5	(b)	Q	(b)	11	(d)	11	(b)			
·	Ζ.	(C)	5.	(D)	0.	(0)	11.	(u)	14.	(u)			
:	3.	(d)	6.	(a)	9.	(d)	12.	(c)					

LONG ANSWER TYPE QUESTIONS

- 1. Name three important components of biodiversity.
- 2. How do scientists estimate the total number of species present in the World?
- Give three hypotheses for explaining why tropics show greater levels of species richness.
- 4. What is the significance of the slope of regression in a species area relationship.
- 5. What are the major causes of species losses in a geographical region ?
- 6. How is biodiversity important for ecosystem functioning?
- 7. What are sacred groves ? What is their role in conservation ?
- 8. Control of floods and soil erosion are among the ecosystem services. How is this achieved by the biotic components of ecosystem?
- 9. Species diversity of plants in much less than that of animals. What could be the explanation for animals achieving greater diversification ?

- 10. Can we justify a situation where we deliberately want to make a species extinct?
- 11. What are the causes of loss of biodiversity?
- 12. Write a note on importance of biodiversity?
- 13. What is a biodiversity hotspot?
- 14. What are the three types of species diversity recognized by IUCN?
- 15. What is the full form of IUCN? How it helps in conservation of biodiversity?
- 16. What is Red Data Book?
- 17. What are the important features of biosphere reserve?
- 18. How do we characterize a national park?
- 19. What is a Wildlife Sanctuary ? Give is three important features.
- 20. What is MBA programme ?

Answer Keys

1. Name three important components 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.
 - (a) **Genetic Diversity :** It arises through genetic recombination during sexual reproduction and mutation. It leads to origin of new species. Therefore, diversity within species is necessary to maintain diversity among spp.
 - (b) **Organizational 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 (number of individuals of different species).
 - (c) **Ecological Diversity :** It is about different types of ecosystems present in the biosphere.
- 2. How do scientists estimate the total number of species present in the World ?
- **Ans.** The diversity of living organisims present on the earth is vast. According to different estimates made by researchers it varies from 7 million to 8.7 million. The total number, however, is calculated by making statistical comparison between species richness of a well studied group like "insects" of temperate and tropical regions and extrapolating it with other groups of plants and animals.

3. Give three hypotheses for explaining why tropics show greater levels of species richness.

- **Ans.** (a) The tropical region has less seasonal variations. Constant temperature promote specialization and high species richness.
 - (b) Tropical region receives more solar energy than temperate regions. This leads to greater productivity and high species diversity.
 - (c) Temperate regions were subjected to glaciations during the ice age, whereas the tropical regions remained undisturbed, which led to increase in the species diversity in that region.

4. What is the significance of the slope of regression in a species - area relationship.

Ans. Regression is a statistical method used to determine the relationship between a dependent variable ('y' axis) and a series of other variables, known as independent variables ('x' axis).

The slope of regression in species - area relationship predicts species richness of an area. It also, indicates the dependency of species richness on the area as higher slope reflects higher dependency of the area. If the area is very large (example - a country), he slope is almost linear with the area.

In a smaller area, lower slope value indicates independence of species richness over the area.

The Z - value can be used to estimate the proportion of area required to represent a given proportion of species present in any land mass. Smaller areas tend to have smaller value of 'Z' in the range of 0.1 to 0.2 regardless of the taxonomic group or the region. But in a larger area, the slope of regression is steeper and has a value in the range of 0.6 to 1.2.

5. What are the major causes of species losses in a geographical region ?

Ans. The major causes of species loss are as follows :

- (a) **Loss of habitat -** Habitat loss due to natural calamities or human activities leading to loss of species diversity.
- (b) **Over-exploitation -** Due to over exploitation of various plants and animal spp. (example hunting) many spp. become endangered or extinct.
- (c) **Invasion of alien spp.** Accidental or intentional introduction of non-native species into a habitat lead to the decline or extinction of indigenous species.
- (d) **Co-extinction -** In a native habitat, one species in intricately connected with the other. Extinction of one species causes extinction of other species.

6. How is biodiversity important for ecosystem functioning ?

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.

Species richness and high diversity makes the ecosystem more resistant towards disturbances like alien species invasion etc. Ecosystem health ultimately supports survival of human race on earth.

7. What are sacred groves ? What is their role in conservation ?

Ans. Sacred groves are parts of forest that are left untouched by locals and have trees which are considered socially, culturally, medicinally and religiously important. Common examples are - *Ficus benghaleusis* 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. These are part of an ancient tradition of nature conservation. Examples like Aravalli hills of Rajasthan and Khasi & Jaintia Hills of Meghalaya still continue to make such conservation practices. Having religious content in their practices the local community helps in conservation of certain plant species.

8. Control of floods and soil erosion are among the ecosystem services. How is this achieved by the biotic components of ecosystem?

Ans. Biotic components of an ecosystem include living organisms such as plants animals and microorganisms. Plants play a very important role in controlling flood and soil erosion.

The roots of plants hold soil particles together, thereby preventing the top layer of the soil to get eroded by wind or running water. The roots also make the soil porous, so that flood water get infiltrated into the soil. That is how plants increase fertility of the soil and prevent natural calamities like flood and soil erosion.

9. Species diversity of plants in much less than that of animals. What could be the explanation for animals achieving greater diversification ?

- **Ans.** Out of the total living organisms, more than 70% are animals, whereas plants constitute only 22%. Animals have achieved greater diversification than plants because of the following reasons :
 - (i) Nervous system of the animals respond to outer stimuli, so as the nable them to adapt to changing environment.
 - (ii) They are mobile and to avoid competition, they show niche specialization.
 - (iii) Their mobility helps them to be subjected to less seasonal changes. On the other hand plants are fixed and require fewer evolutionary adaptations to meet their requirements of water, minerals & sunlight.
 - (iv) The animals have repeated body segments with paired appendages and external cullicles as in insects which make them versatile to develop ability of survive in various habitats as compared to other life forms.

10. Can we justify a situation where we deliberately want to make a species extinct?

Ans. There are various kinds of microbes that cause life threatening diseases like polio, small pox, hepatitis B etc. Since these are harmful to human beings, scientists are working hard to eliminate these micro organisms through vaccinations and other means. That is how small pox and polio virus have almost been eliminated, or we can say that we have succeeded in making them extinct. Therefore, under very special circumstances, we can justify extinction of these species.

11. What are the causes of loss of biodiversity?

Ans. As per IUCN estimates some 12259 species have become extinct since origin of life on earth. The factors that contribute to loss of biodiversity are :

- (i) Habitat loss and fragmentation -
- (ii) Overexploitation of resources
- (iii) Introduction of invasive species
- (iv) Pollution Air & Water pollution
- (v) Climate change Approx. 2^oC rise of temp by 2030.
- (vi) Population growth 25% consuming 75% of World resources.
- (vii) Unauthorised wildlife trade.

12. Write a note on importance of biodiversity?

Ans. A rich biodiversity provides a number of services. These are as follows :

(i) Ecosystem services :-

- (a) protection of soil and water resources
- (b) recycling of nutrients for healthy ecosystem functioning
- (c) breakdown and absorption of pollutants
- (d) contributing to maintenance of ecosystem and climate stability
- (ii) Biological resources :-
- (a) As food, medicine, clothing and products of timber
- (b) Raw material for industry
- (c) Bio-control of pests and diseases
- (iii) Social benefits :-
- (a) Ornamental value
- (b) Education and research
- (c) Recreation and ecotourism
- (d) Cultural values

Therefore, biodiversity and its maintenance are very important for sustaining life on earth. A diverse ecosystem is more productive and can withstand environmental stresses.

13. What is a 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.

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Norman Myers in the year 1988 identified 25 such biodiversity hotspots. After that 09 more have been added to this list making it 34. All these hotspots, cover less than 02% of the earth's land area. These sites support nearly 75% of the world's most threateneon threateneon and amphibians, 50% of all plants and 42% of land vertebrates. Four (two major and two in part) regions that are in India satisfy the above criteria. They are -

- (i) Western Ghats and Srilanka
- (ii) The Eastern Himalyas
- (iii) Indo-Burma-Northeast, Thailand, Cambodia, part of Yunan provinces of China.
- (iv) Sunda land South East Asian countries only Nicobar island of India.

14. What are the three types of species diversity recognized by IUCN?

Ans. Species diversity or organismal diversity is the diversity among species. It is measured by species richness (i.e. the number of species in a given area), species composition (i.e. the list of species) and their relative abundance (i.e. the number of individuals of different species). IUCN (International Union for Conservation of Nature) recognizes three types of species diversity i.e. alpha, beta and gamma.

Alpha diversity : It refers to the number or variety of species within a community - otherwise known as species richness.

Beta diversity : It is the diversity of species among communities.

Gamma diversity : It is the diversity of species across a wider geographical range.

15. What is the full form of IUCN? How it helps in conservation of biodiversity?

IUCN stands for International Union for Conservation of Nature and Natural Resources. 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.

16. What is 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 :

Extinct (EX)

Threatened

Critically endangered (CR) Endangered (EN) Vulnerable (VU)

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Lower Risk

Near threatened (NT) Conservation dependent (CD) Least concern (LC)

Extinct - The last individual has died. Example - Indian Cheetah.

Critically Endangered - Species facing extremely high rate of extinction in the wild in near future. Example - One horned Rhinoceros.

Endangered - Species facing high risk of extinction in the wild in near future. Example - Giant Panda, Polar Bear.

Vulnerable - Species facing high risk of extinction in the wild in the medium - term future. Example - Sparrow.

17. What are the important features of 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 and Odisha has one biosphere reserve in Similipal.

Biosphere reserves are established by individual countries and recognized under the UNESCO's MAN and Biosphere (MAB) programme. This programme aims to achieve integrated management of land, water and living resources over a contiguous patch of landscape. Conservation programmes are integrated into development through appropriate zoning of core, buffer and transition zones.

18. How do we characterize a national park?

- **Ans.** National Park is a category-II type IUCN protected area. It is a large area set aside 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. It has the following characteristics :
 - (a) The ecosystems are not much altered by humans. The plant and animal spp. and/or any important geological sites should be of scientific, educative and recreative interest. It should contain a natural landscape of great beauty.
 - (b) The country has taken steps to prevent / eliminate exploitation / occupation of the area, so as to enforce conservation measures.
 - (c) Visitors are allowed to enter for educative, cultural and recreative purposes.
 - (d) There is statutory protection with adequate budget and staff.

Corbett National Park (Hailey's) in Uttarakhand in the first national park established in India in 1935. There are 103 national parks in India Bhitarkanika is only national parks present in Odisha. However Similipal has been proposed to be a national park.

19. What is a Wildlife Sanctuary ? Give is three important features.

Ans. It comes under category-IV of the IUCN protected areas. A wildlife sanctuary is a protected area under which wildlife is protected from hunting, predation and poaching. Unlike national parks, wildlife sanctuaries do not have to properly marked boundaries.

It is an area where animals and birds can live protected and safe in their natural habitat. It is also a place of refuge, where abused, injured and abandoned captive wildlife may live in peace and dignity. They are primarily established for the protection of endangered speeds.

India has 553 wildlife sanctuaries which include 50 tiger reserves under the "Project Tiger" programme. Odisha has 10 wildlife sanctuaries. Rann of Kutch is the largest wildlife sanctuary in India. It is also known as Indian Wild Ass Sanctuary.

20. What is MBA 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 on research and development, capacity building and networking on three interlinked issues - biodiversity loss, climate change and sustainable development.

Biosphere Reserves are special sites that integrate human activities with conservation of biodiversity. The programme intends to establish a scientific basis for the improvement of relationship between people and their environments. It ensures that natural resources are efficiently utilized and are not destroyed. The biosphere reserves are divided into three zones like :

- (i) **Core zone -** This is strictly protected to maintain ecological diversity and integrity.
- (ii) **Buffer zone -** This zone concentrically surrounds the core zone. Recreational activities and sustainable utilization of natural resources are allowed here.
- (iii) **Transitional zone -** This zone is ecologically least sensitive. Therefore, research and other developmental activities are allowed here. Human settlements, crop lands, managed forests and other recreational and economic activities are found here.

On the basis of information collected, this programme predicts the consequences of today's actions on tomorrow's world and thereby increases people's ability to efficiently manage natural resources.

