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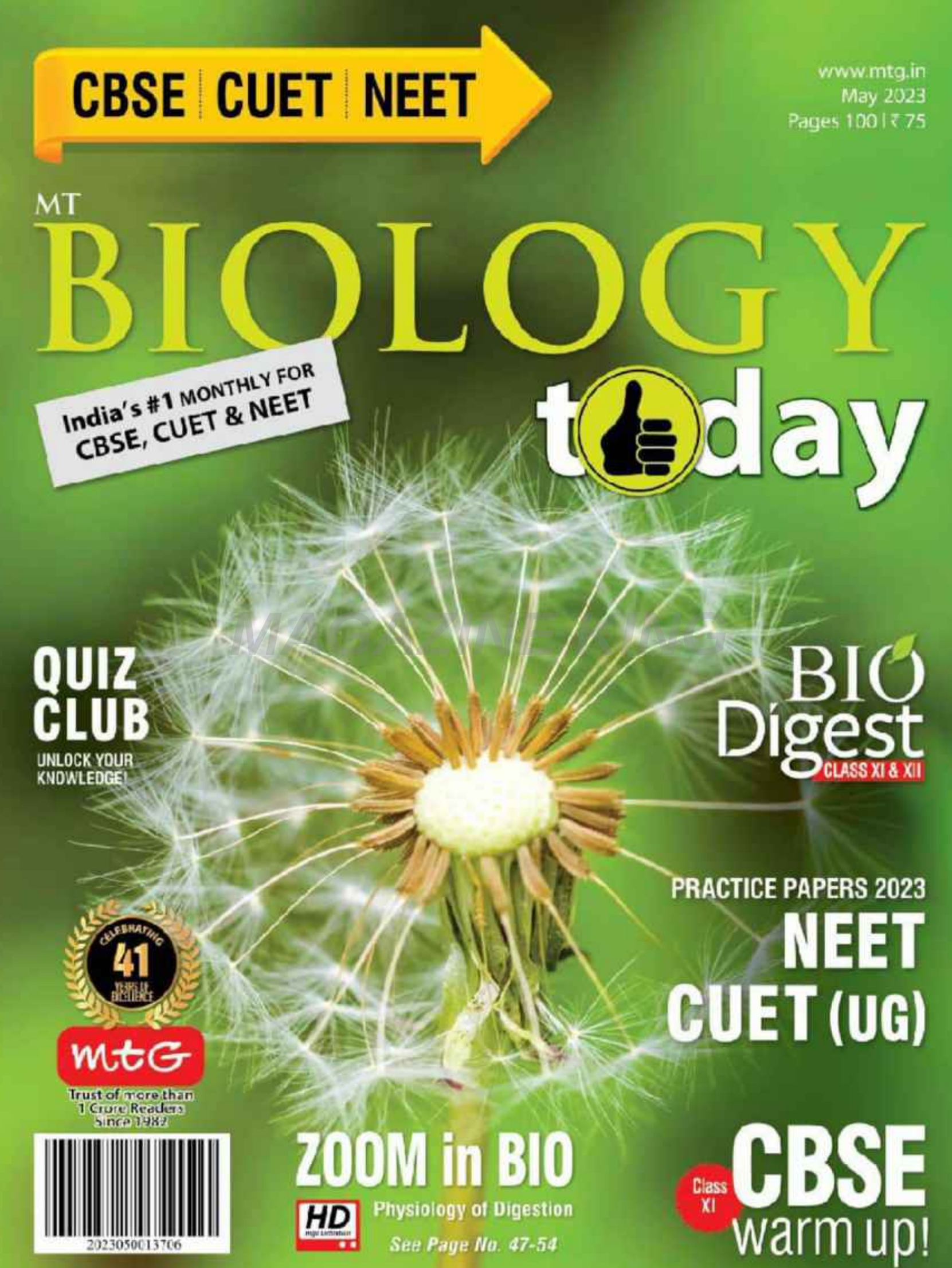

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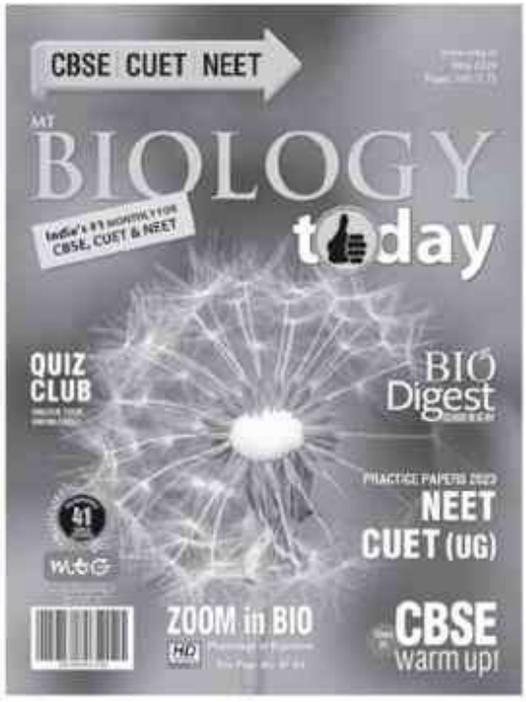

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PRACTICE PAPER
NEET 2023

(BOTANY)
SECTION - A

1. Water hyacinth was introduced in India due to its
   (a) beautiful flowers and shape of leaves
   (b) ability to reproduce sexually
   (c) ability to drain oxygen from water
   (d) antibacterial and antifungal properties.

2. Which of the following is/are seen in monocotyledonous stem?
   (a) Sclerenchymatous hypodermis
   (b) Parenchymatous ground tissue
   (c) Conjoint and closed vascular bundles
   (d) All of these

3. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).
   Assertion (A) : Some species of *Asteraceae* and grasses show apomixis.
   Reason (R) : Apomixis is a special mechanism for production of seedless fruits.
   In the light of the above statements, choose the correct answer from the options given below.
   (a) Both (A) and (R) are true and (R) is the correct explanation of (A).
   (b) Both (A) and (R) are true but (R) is not the correct explanation of (A).
   (c) (A) is true but (R) is false.
   (d) (A) is false but (R) is true.

4. The oldest known viable seed is of _____ plant.
   (a) lupine (b) apple (c) orange (d) mango

5. Read the given statements and select the correct option.
   Statement I : Characters are controlled by discrete units called factors.
   Statement II : Factors represent the genetic basis of inheritance.
   (a) Both statement I and statement II are correct.
   (b) Both statement I and statement II are incorrect.
   (c) Statement I is correct but statement II is incorrect.
   (d) Statement I is incorrect but statement II is correct.

6. The margins of sepal or petals overlap one another but not in any particular direction in
   (a) *Cassia* and China rose (b) *Cassia* and gulmohur
   (c) Cotton and pea (d) *Calotropis* and lady's finger.

7. Select the incorrect statement regarding Gregor Mendel.
   (a) He conducted hybridisation experiments on sweet pea.
   (b) He conducted cross pollination experiments by using several true-breeding pea lines.
   (c) His work got delayed as communication was difficult during his time.
   (d) He could not provide any physical proof for the existence of factors.

8. What would be the number of recombinant progenies in snapdragon when F_1 progenies of true breeding red flower and white flower are self crossed?
   (a) 1 (b) 2 (c) 3 (d) 4

9. The correct equation for water potential is
   (a) $\Psi_w = \Psi_s + \Psi_p$ (b) $\Psi_w = \Psi_s - \Psi_p$
   (c) $\Psi_w = \Psi_s$ (d) $\Psi_w = \Psi_p$

10. *Erythroxylum coca* plant is native to
    (a) South Africa (b) South America
    (c) North America (d) East America.

11. Select the correct statement(s) regarding chemiosmotic hypothesis.
    (a) Splitting of water molecule takes place on the outer side of chloroplast.
    (b) Protons released by splitting of water accumulate within the lumen of thylakoid.
    (c) NADP reductase enzyme is located on the stroma side of the membrane.
    (d) Both (b) and (c)

12. Identify the enzyme A which catalyses the given reaction. α–ketoglutaric acid + NH_4^+ +NADPH $\xrightarrow{A}$ glutamate +H_2O +NADP
    (a) Glutamate dehydrogenase
    (b) Nitrogenase
    (c) Dinitrogenase
    (d) Transaminase

13. Read the given statements and select the correct option.

Statement I: *Agrobacterium tumefaciens* is a pathogen of several monocot plants.

Statement II: A tumor inducing (Ti) plasmid found in *Agrobacterium tumefaciens* is modified to be used as a cloning vector.

(a) Both statement I and statement II are correct.
(b) Both statement I and statement II are incorrect.
(c) Statement I is correct but statement II is incorrect.
(d) Statement I is incorrect but statement II is correct.

14. Which of the following statements are incorrect about bryophytes?

A. They are dependent on water for sexual reproduction.
B. Their main plant body is diploid.
C. They lack true roots, stem or leaves.
D. They produce a unicellular body called a sporophyte.

(a) A and D (b) C and D
(c) B and D (d) B and C

15. A small DNA sequence that shows very high degree of polymorphism is called

(a) Variable Number of Tandem Repeats
(b) Variation in Number of Tandem Repeats
(c) Variable Number of Tandem Resources
(d) Various Number of Tandem Repeats.

16. Which of the following phenomenon causes heterophylly in leaves of coriander?

(a) Plasticity
(b) Re-differentiation
(c) Photoperiodism
(d) Vernalisation

17. Who is known as the father of ecology in India?

(a) Ramdeo Misra (b) E.P Odum
(c) Ernst Haeckel (d) Morgan

18. Which of the following component forms maximum percentage of the total cellular mass?

(a) Proteins (b) Carbohydrates
(c) Water (d) Nucleic acids

19. Which of the following biomes shows maximum mean annual precipitation in India?

(a) Coniferous forest (b) Tropical forest
(c) Temperate forest (d) Desert

20. Which of the following represent a correct stratification from top to bottom of a forest?

(a) Trees, shrubs and grasses
(b) Shrubs, trees and grasses
(c) Trees, grasses and shrubs
(d) Herbs, shrubs and grasses

21. Match the column-I with column-II.

	Column I (Organism)		Column II (Size)
A.	Typical bacteria	(i)	About 0.1 µm
B.	Viruses	(ii)	0.02-0.2 µm
C.	PPLO	(iii)	10-20 µm
D.	Eukaryotic cell	(iv)	1-2 µm

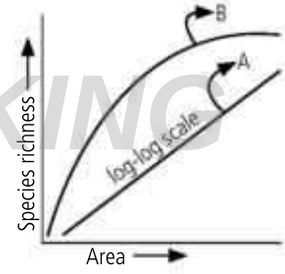
Choose the correct answer from the options given below.

(a) A-(ii), B-(iii), C-(iv), D-(i)
(b) A-(iv), B-(ii), C-(i), D-(iii)
(c) A-(iii), B-(i), C-(ii), D-(iv)
(d) A-(i), B-(iv), C-(iii),D-(ii)

22. The detritus is degraded by the bacterial and fungal enzymes into simple inorganic substances. This process is called

(a) catabolism (b) fragmentation
(c) leaching (d) humification.

23. Refer to the given graph and identify the equation A and B *w.r.t* the species/area relationship.



	(A)	(B)
(a)	Log S = Log C +Z log A	$S=CA^Z$
(b)	$S=CA^Z$	Log S = Log C +Z log A
(c)	$C= AS^z$	Log C = Log S +Z log A
(d)	Log C = Log S +Z log A	$S=CA^Z$

24. The bakane disease of rice seedlings is caused by

(a) Tobacco Mosaic Virus (b) *Gibberella fujikuroi*
(c) baculovirus (d) rhinoviruses.

25. A species found naturally in only one geographic area but not found anywhere else is known as

(a) alien species (b) endemic species
(c) invasive species (d) native species.

26. Who studied the small ringlets of DNA floating freely in the cytoplasm of certain bacterial cells and capable of replicating independently?

(a) Stanley Cohen (b) James Watson
(c) Francis Crick (d) Gregor Mendel

27. In which year was the concept of Joint Forest Management (JFM) introduced by the Government of India?

(a) 1980 (b) 1967 (c) 1957 (d) 1978

28. Read the given statements and select the correct option.
Statement I: Biomagnification is the natural aging of a lake by nutrient enrichment of its water.
Statement II: Eutrophication involves increase in concentration of toxicant at successive trophic levels.
(a) Both statement I and statement II are correct.
(b) Both statement I and statement II are incorrect.
(c) Statement I is correct but statement II is incorrect.
(d) Statement I is incorrect but statement II is correct.

29. Select the correct arrangement of taxonomic categories in ascending order.
(a) *aestivum* → *Triticum* → Poales → Poaceae → Monocotyledonae → Angiospermae
(b) *aestivum* → *Triticum* → Poaceae → Poales → Monocotyledonae → Angiospermae
(c) *indica* → *Mangifera* → Anacardiaceae → Dicotyledonae → Sapindales → Angiospermae
(d) *Mangifera* → *indica* → Sapindales → Angiospermae → Anacardiaceae → Dicotyledonae

30. How many genetically different rice varieties are found in India?
(a) More than 50,000
(b) Less than 50,000
(c) More than 5,000 but less than 20,000
(d) 2,000

31. The given table shows the characteristics of the three kingdoms-Monera, Fungi and Plantae.

S. No.	Characters	Monera	Fungi	Plantae
(i)	Cell type	Eukaryotic	Prokaryotic	Prokaryotic
(ii)	Cell wall	Non-cellulosic	Absent	Absent
(iii)	Nuclear Membrane	Present	Absent	Absent
(iv)	Body organisation	Cellular	Multicellular	Tissue / Organ system

Select the correct option which shows the correct characteristics of the kingdom.
(a) (i), (ii) and (iii) (b) (ii), (iii) and (iv)
(c) (iii) and (iv) (d) Only (iv)

32. Read the given statements and select the correct option.
Statement I: The ovules are not enclosed by an ovary wall in gymnosperms.
Statement II: The leaves of gymnosperms are well adapted to withstand extremes of temperature.
(a) Both statement I and statement II are correct.
(b) Both statement I and statement II are incorrect.
(c) Statement I is correct but statement II is incorrect.
(d) Statement I is incorrect but statement II is correct.

33. In plants, cells are bombarded with high velocity micro-particles of gold or tungsten coated with DNA in a method known as
(a) biolistics (b) micro-injection
(c) gene therapy (d) insertional inactivation.

34. Match the column-I with column-II.

Column I (Modifications)		Column II (Plants)	
A.	Stem thorns	(i)	Maize
B.	Stem tendrils	(ii)	*Bougainvillea*
C.	Leaf spine	(iii)	Pumpkin
D.	Stilt roots	(iv)	Cacti

Choose the correct answer from the options given below .
(a) A-(ii), B-(iii), C-(iv), D-(i)
(b) A-(iv), B-(i), C-(ii), D-(iii)
(c) A-(iii), B-(i), C-(ii), D-(iv)
(d) A-(i), B-(iv), C-(iii),D-(ii)

35. Given below are statements regarding the Inheritance of gene.
(i) Alleles do not show blending as per law of segregation.
(ii) Segregation of one pair of character is independent of the other when two pairs of traits are combined in a hybrid.
(iii) A phenotypic ratio of monohybrid cross is 9:3:3:1.
(iv) A genotypic ratio of monohybrid cross is 3:1.
(v) A genotypic ratio of dihybrid cross is 9:3:3:1.
Identify the correct statements.
(a) (ii), (iii) and (v) (b) (i) and (ii)
(c) (iii) and (v) (d) (i), (iii) and (iv)

SECTION - B

Attempt any 10 questions out of 15.

36. Read the given statements and select the correct option.
Statement I : Intine wall of the pollen grain is pecto-cellulosic in composition.
Statement II : The intine wall can withstand high temperatures.
(a) Both statement I and statement II are correct.
(b) Both statement I and statement II are incorrect.
(c) Statement I is correct but statement II is incorrect.
(d) Statement I is incorrect but statement II is correct.

37. Bast fibres are made up of
(a) sclerenchymatous cells (b) companion cells
(c) subsidiary cells (d) collenchymatous cells.

38. Match List-I with List-II.

	List-I		List-II
A.	The rate of biomass production.	(i)	Gross Primary Productivity
B.	The rate of production of organic matter during photosynthesis.	(ii)	Productivity
C.	The available biomass for the consumption to heterotrophs.	(iii)	Net Primary Productivity

Select the correct answer from the options given below.

	A	B	C
(a)	(i)	(iii)	(ii)
(b)	(ii)	(i)	(iii)
(c)	(ii)	(iii)	(i)
(d)	(iii)	(i)	(ii)

39. The cytoskeleton in an eukaryote is involved in
(a) mechanical support and maintenance of the shape of the cell.
(b) motility and storage of food material.
(c) mechanical support and packaging of food material.
(d) synthesis of proteins and maintenance of the shape of the cell.

40. In which stage of meiosis-I, dyad of cells are visible?
(a) Prophase I (b) Metaphase I
(c) Anaphase I (d) Telophase I

41. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A) : Meiosis involves pairing of homologous chromosomes.
Reason (R) : Meiosis involves recombination between non-sister chromatids of homologous chromosomes.
In the light of the above statements, choose the correct answer from the options given below.
(a) Both (A) and (R) are true and (R) is the correct explanation of (A).
(b) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(c) (A) is true but (R) is false.
(d) (A) is false but (R) true.

42. Read the given statements and select the correct option.
Statement I: Plasmolysis occurs when water moves out of the cell and the cell membrane of a plant cell shrinks away from its cell wall.
Statement II: The process of plasmolysis is usually irreversible.
(a) Both statement I and statement II are correct.
(b) Both statement I and statement II are incorrect.
(c) Statement I is correct but statement II is incorrect.
(d) Statement I is incorrect but statement II is correct.

43. Who coined a term related to describe the physical association of genes on a chromosome?
(a) T.H Morgan (b) Sutton and Boveri
(c) Gregor Mendel (d) Von Tschermak

44. Which of the following bacterial species are involved in denitrification?
(a) *Pseudomonas* and *Thiobacillus*
(b) *Nitrosomonas* and *Nitrococcus*
(c) *Nitrobacter* and *Thiobacillus*
(d) *Nitrobacter* and *Pseudomonas*

45. Match List-I with List-II.

	List-I		List-II
A.	Methionine	(i)	UGG
B.	Tryptophan	(ii)	AUG
C.	Phenylalanine	(iii)	AAA
D.	Lysine	(iv)	UUU

Select the correct option.

	A	B	C	D
(a)	(ii)	(i)	(iv)	(iii)
(b)	(iv)	(iii)	(ii)	(i)
(c)	(iii)	(ii)	(i)	(iv)
(d)	(i)	(ii)	(iv)	(iii)

46. Which of the following is the most crucial step of C_3 cycle?
(a) Regeneration of RUBP
(b) Reduction of 3-Phosphoglycerate
(c) Fixation of CO_2 into a stable organic intermediate
(d) Utilisation of ATP and NADPH

47. Which one of the following is the key product of partial oxidation of glucose in anaerobic organisms?
(a) Oxaloacetate (b) Pyruvic acid
(c) Glucose (d) Fructose -6-phosphate

48. Choose the correct genus which shows the following characteristics as biocontrol agents.
I. They attack insects and arthropods.
II. They are species-specific insecticides.
III. They have no negative impacts on non-target insects.
IV. They are used when an ecologically sensitive area is being treated.
(a) *Nucleopolyhedrovirus* (b) *Glomus*
(c) *Bacillus* (d) None of these

MONTHLY TEST DRIVE CLASS XII ANSWER KEY

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

49. Which of the following is not an example of invasive weed species?
(a) *Parthenium* (b) *Eichhornia*
(c) *Rauwolfia vomitoria* (d) Both (a) and (b)

50. The exponential growth can be expressed as
(a) $W_1 = W_0 e^{rt}$ (b) $L_t = L_0 + rt$
(c) $W_1 = W_0$ (d) $L_t = L_0$

(ZOOLOGY)

SECTION - A

51. Identify the correct statements with respect to the parts of male reproductive system.
(A) Ejaculatory duct store and transport sperms from testis to outside through urethra.
(B) The scrotum helps in maintaining the high temperature of the testes.
(C) Secretion of bulbourethral glands helps in lubrication of penis.
(D) The germ cells provide nutrition to the Sertoli cells.
(E) Leydig cells secrete testicular hormone androgens.
(a) (A), (D) and (E) (b) (A), (C) and (E)
(c) (B), (D) and (E) (d) (A), (B) and (C)

52. Partial pressure of oxygen and carbon dioxide is 40mm Hg and 45 mmHg respectively in
(a) systemic arteries (b) alveoli
(c) systemic veins (d) atmospheric air.

53. The female external genitalia include
(a) clitoris (b) labia minora
(c) labia majora (d) all of these.

54. Read the given statements and select the correct option.
Statement I: Spermatogenesis is initiated due to decrease in gonadotropin-releasing hormone(GnRH).
Statement II: GnRH acts at the anterior lobe of pituitary gland to secrete LH and FSH.
(a) Both statement I and statement II are correct.
(b) Both statement I and statement II are incorrect.
(c) Statement I is correct but statement II is incorrect.
(d) Statement I is incorrect but statement II is correct.

55. All of the following digestive reactions occur in small intestine, except
(a) Maltose ⟶ Glucose + Glucose
(b) Monoglycerides ⟶ Fatty acids + Glycerol
(c) Peptones ⟶ Dipeptides
(d) Dipeptides ⟶ Amino acids

56. Which of the following pair of contraceptive devices make the uterus unsuitable for implantation and the cervix hostile to the sperms?
(a) Progestasert and LNG-20
(b) Multiload 375 and Cu7
(c) Foams and LNG-20
(d) LNG-20 and Lippes' loop

57. Number of bones in humerus, carpals, ulna, phalanges, radius and metacarpals in each forelimb respectively are
(a) 1, 14, 1, 8, 1, 5 (b) 1, 16, 1, 5, 1, 6
(c) 1, 5, 1, 14, 1, 8 (d) 1, 8, 1, 14, 1, 5.

58. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A) : According to the Hardy-Weinberg principle, allele frequencies in a population remain stable and constant from generation to generation.
Reason (R) : Sum total of all the allelic frequencies as per Hardy – Weinberg principle is 0.
In the light of the above statements, choose the correct answer from the options given below.
(a) Both (A) and (R) are true and (R) is the correct explanation of (A).
(b) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(c) (A) is true but (R) is false.
(d) (A) is false but (R) true.

59. Which of the following set of animals belong to the Class Osteichthyes?
(a) *Bufo, Hippocampus, Labeo, Betta*
(b) *Exocoetus, Catla, Betta, Hippocampus*
(c) *Clarias, Icthyophis, Pristis, Trygon*
(d) *Exocoetus, Betta, Scoliodon, Carcharodon*

60. Which one of the following antibody is produced in response to the allergens ?
(a) IgA (b) IgG (c) IgE (d) IgM

61. Which of the following is present on the 4th, 5th and 6th segments of earthworm?
(a) Oesophagus (b) Gizzard
(c) Blood glands (d) Typhlosole

62. Which one of the following genetic disorder is characterised by an additional copy of the chromosome number 21?
(a) Klinefelter's syndrome (b) Turner's syndrome
(c) Down's syndrome (d) Haemophilia

63. Read the given statements and select the correct option .
Statement I: Intervening sequences do not appear in a processed RNA.
Statement II : Exon sequences appear in a processed RNA.
(a) Both statement I and statement II are correct.
(b) Both statement I and statement II are incorrect.
(c) Statement I is correct but statement II is incorrect.
(d) Statement I is incorrect but statement II is correct.

64. Which of the following animals have common excretory structures?
(a) *Planaria* and prawns
(b) Earthworm and cockroach
(c) *Planaria* and *Fasciola*
(d) Prawns and *Amphioxus*

65. Match column I with column II and select the correct option.

	Column I		Column II
A.	*Aspergillus niger*	(i)	Lactic acid
B.	*Acetobacter aceti*	(ii)	Butyric acid
C.	*Clostridium butylicum*	(iii)	Acetic acid
D.	*Lactobacillus*	(iv)	Citric acid

(a) A-(ii), B-(iii), C-(i), D-(iv)
(b) A-(iv), B-(iii), C-(ii), D-(i)
(c) A-(iii), B-(i), C-(ii), D-(iv)
(d) A-(i), B-(iv), C-(iii),D-(ii)

66. Identify the organism on the basis of the following characteristics.
I. It shows bilaterally symmetry.
II. It is triploblastic and coelomate animal.
III. Its body is covered by calcareous shell and is unsegmented.
IV. Its mouth contains radula for feeding.
(a) *Aedes* (b) *Ascaris* (c) *Nereis* (d) *Loligo*

67. Which one of the following statements is correct?
(a) In tailing, a methyl guanosine triphosphate is added to the 5'-end of hnRNA.
(b) In capping, adenylate residues are added at 3'-end in a template independent manner.
(c) Splicing involves removal of introns and joining of exon in a defined order.
(d) None of these

68. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A) : In heart failure, heart does not pump blood effectively enough to meet the needs of the body.
Reason (R) : Heart failure occurs due to deposition of calcium, fat and cholesterol.
In the light of the above statements, choose the correct answer from the options given below.
(a) Both (A) and (R) are true and (R) is the correct explanation of (A).
(b) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(c) (A) is true but (R) is false.
(d) (A) is false but (R) true.

69. Human excreta are handled using dry composting toilets in
(a) West Bengal and Europe
(b) Kerala and Sri Lanka
(c) Haryana and Odisha
(d) India and Canada.

70. Which of the following has the ability to transform normal cells into cancerous cell in animals?
(a) $\phi \times 174$ (b) Retroviruses
(c) *Agrobacterium* (d) *Meloidogyne*

71. Select the incorrect statements among the following.
(i) Both anterior and posterior pituitary are under the direct neural regulation of hypothalamus.
(ii) Excess secretion of growth hormone in childhood leads to acromegaly.
(iii) Parathyroid hormone stimulates the demineralisation of bones.
(iv) Aldosterone causes excretion of K^+ and phosphate ions in renal tubules.
(a) (ii) and (iii) (b) (i) and (ii)
(c) (iii) and (iv) (d) (i) and (iv)

72. Which of the following are examples of Phylum Hemichordata?
(a) *Balanoglossus* and *Saccoglossus*
(b) *Cucumaria* and *Ophiura*
(c) *Asterias* and *Echinus*
(d) *Antedon* and *Asterias*

73. Which one of the following statements is/are incorrect regarding downstream processing?
(a) It is a quantity control testing which vary from product to product.
(b) It includes separation of the product from the reactor.
(c) It includes purification of the product.
(d) Both (a) and (b)

74. Select the correct pair of difference between *Hemidactylus* and *Aptenodytes*.

	Hemidactylus	*Aptenodytes*
(a)	Fertilisation is internal.	Fertilisation is external.
(b)	They are poikilotherms.	They are homoiothermous.
(c)	They are oviparous.	They are viviparous.
(d)	Their development is direct.	Their development is indirect.

75. Which of the following is an example of convergent evolution?
(a) Australian marsupials and placental mammals
(b) Thorn and tendrils of *Bougainvillea* and *Cucurbita*
(c) Vertebrate heart or brain
(d) Forelimbs of whale, bats, cheetah and humans

76. Read the following statements and select the correct option.
Statement I : Cells of connective tissues secrete modified polysaccharides.
Statement II : Cells of connective tissues provide protection against chemical and mechanical stresses.
(a) Both statement I and statement II are correct.
(b) Both statement I and statement II are incorrect.
(c) Statement I is correct but statement II is incorrect.
(d) Statement I is incorrect but statement II is correct.

77. Which of the following is correct regarding animal tissue found in inner surface of fallopian tubes?
(a) They help in movement of particles in specific direction over the epithelium.
(b) They support other tissues of the body.
(c) They provide protection against chemical and mechanical stresses.
(d) They play role in movement of the body.

78. A phenomenon in which cancer cells spread to distant sites through body fluids to start a tumor is known as
(a) metastasis (b) contact inhibition
(c) active immunisation (d) anaphylaxis.

79. Which of the following cover the hindwings when cockroach is at rest?
(a) Tergites (b) Sternites
(c) Tegmina (d) Hypopharynx

80. The organisms that can tolerate a wide range of salinity are known as
(a) stenothermal (b) eurythermal
(c) stenohaline (d) euryhaline.

81. Match column I with column II and select the correct option.

	Column I		Column II
A.	Ligase	(i)	Hydrolysis of C—C bond
B.	Isomerase	(ii)	Oxidoreduction between two substrates
C.	Hydrolase	(iii)	Interconversion of optical isomers
D.	Dehydrogenase	(iv)	Linking of C—O bonds

(a) A-(i), B-(ii), C-(iii), D-(iv)
(b) A-(iv), B-(iii), C-(i), D-(ii)
(c) A-(ii), B-(i), C-(iii), D-(iv)
(d) A-(iv), B-(i), C-(ii),D-(iii)

82. Which of the following is a structure formed from a combination of nitrogen base, sugar and phosphate group?
(a) Adenine (b) Uridylic acid
(c) Guanosine (d) Thymidine

83. Identify the incorrect statement regarding venereal infections.
(a) Incidence of these infections are high among age group of 15-24 years.
(b) Hepatitis B, genital herpes and HIV infections are incurable.
(c) Some infections can be transmitted by sharing of injection needles .
(d) These infections are not a major threat to a healthy society.

84. What will be the total volume of air a person can inspire after a normal expiration, if 500mL of air is inspired during a normal respiration and 1100ml of additional air is inspired after a forcible inspiration?
(a) 600mL (b) 1100mL (c) 1600mL (d) 500mL

85. Which of the following conditions are favourable for dissociation of oxygen from oxyhaemoglobin?
(a) Low pO_2 (b) High pCO_2
(c) Less H^+ (d) Both (a) and (b)

SECTION - B

Attempt any 10 questions out of 15.

86. In the female reproductive system, the fimbriae is involved in
(a) maintaining the temperature of the ovary
(b) collection of the ovum after ovulation
(c) production of ovarian hormone
(d) uterine contraction during parturition.

87. Select the correct sequence of the cardiac cycle from the following events.
1. Contraction of atria
2. Closure of tricuspid and bicuspid valves
3. Relaxation of ventricles
4. Closure of semilunar valves
5. Opening of semilunar valves
6. Opening of bicuspid and tricuspid valves
7. Contraction of ventricles

(a) $1 \rightarrow 6 \rightarrow 7 \rightarrow 2 \rightarrow 5 \rightarrow 3 \rightarrow 4$
(b) $1 \rightarrow 2 \rightarrow 7 \rightarrow 6 \rightarrow 5 \rightarrow 4 \rightarrow 3$
(c) $4 \rightarrow 6 \rightarrow 2 \rightarrow 7 \rightarrow 5 \rightarrow 3 \rightarrow 1$
(d) $1 \rightarrow 5 \rightarrow 3 \rightarrow 2 \rightarrow 6 \rightarrow 7 \rightarrow 4$

88. In Meselson and Stahl's experiment, DNA is separated by
(a) paper chromatography
(b) agarose gel electrophoresis
(c) flow cytometry
(d) density gradient centrifugation.

89. Which blood group(s) can be transferred to the person with no antigens on RBCs?
(a) A only (b) Both B and O
(c) O only (d) A, B and O

90. Read the given statements and select the correct option .
Statement I: *Monascus purpureus* is used for commercial production of cyclosporin.

WHO AM I ...

1.	Gymnosperms	Pg. 28
2.	Bryophytes	Pg. 36
3.	Gonad	Pg. 71
4.	Test tube baby	Pg. 74

Statement II: The large holes in Swiss cheese are due to the production of CO_2 by *Propionibacterium shermanii*.

(a) Both statement I and statement II are correct.
(b) Both statement I and statement II are incorrect.
(c) Statement I is correct but statement II is incorrect.
(d) Statement I is incorrect but statement II is correct.

91. Select the incorrect statement about tubular functions of nephron.
(a) Reabsorption is minimum in descending limb of loop of Henle.
(b) PCT is lined by simple cuboidal brush border epithelium.
(c) DCT is involved in selective secretion of H^+, K^+ and NH_3.
(d) Large amount of water is reabsorbed from collecting duct to produce concentrated urine.

92. Match column I with column II and select the correct option from the given codes.

	Column I		Column II
A.	*Ichthyosaurs*	(i)	350mya
B.	*Homo erectus*	(ii)	200mya
C.	Jawless fish	(iii)	1.5mya
D.	*Australopithecines*	(iv)	2 mya

(a) A-(ii), B-(iii), C-(i), D-(iv)
(b) A-(iv), B-(ii), C-(i), D-(iii)
(c) A-(iii), B-(i), C-(ii), D-(iv)
(d) A-(i), B-(iv), C-(iii),D-(ii)

93. What happens immediately after binding of calcium with a subunit of troponin on actin filaments?
(a) Removal of masking of active sites for myosin
(b) Release of neurotransmitter acetylcholine
(c) Formation of cross bridge
(d) Formation of ATP

94. Which structure along with hypothalamus is involved in expression of pleasure, rage and fear?
(a) Corpus callosum
(b) Limbic lobe
(c) Cerebral aqueduct
(d) Corpora quadrigemina

95. Which of the following contains neurons with one axon and one dendrite?
(a) Cerebral cortex (b) Embryo
(c) Retina of eye (d) Both (a) and (b)

96. Which of the following is correct regarding RNA interference?
(a) It takes place in all prokaryotic organisms.
(b) It involves silencing of a specific mRNA due to complementary dsRNA molecule preventing translation of the mRNA.
(c) It involves silencing of a specific tRNA due to complementary dsRNA molecule preventing translation of the mRNA.
(d) It involves silencing of a specific rRNA due to complementary dsDNA molecule preventing translation of the mRNA.

97. Hormones secreted by adrenal cortex play role in
(a) pupillary dilation
(b) utilisation of amino acids
(c) uptake of glucose
(d) growth of body.

98. Select the incorrectly matched pair.
(a) Insulin – Peptide
(b) Cortisol – Steroid
(c) Thyroxine – Iodothyronine
(d) Epinephrine – Protein

99. Read the following statements and select the correct option.
Statement I : Rennin helps in digestion of milk proteins.
Statement II : Rennin is found in gastric juice of infants only.
(a) Both statement I and statement II are correct.
(b) Both statement I and statement II are incorrect.
(c) Statement I is correct but statement II is incorrect.
(d) Statement I is incorrect but statement II is correct.

100. Which enzyme secreted by intestinal mucosa is involved in activation of enzymes present in pancreatic juice?
(a) Pepsinogen (b) Enterokinase
(c) Lipase (d) Carboxypeptidase

ANSWER KEY

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

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PRACTICE PAPER 2023

CUET (UG)

Exam on 21st to 31st May 2023

Section II of CUET (UG) is domain specific. In this section of Biology 40 questions to be attempted out of 50.

Time Allowed : 45 Minutes **Maximum Marks :** 200

Section A

(All questions are compulsory)

1. Identify a hormone releasing IUD from the following options.
(a) Cu7 (b) Lippes loop
(c) Multiload 375 (d) LNG-20

2. Tightly linked genes show **(A)** while loosely linked genes on same chromosome show **(B)** .
(a) (A)-high recombination; (B)-low recombination
(b) (A)-low recombination; (B)-high recombination
(c) (A)-co-dominance; (B)-independent assortment
(d) (A)-dominance; (B)-co-dominance

3. Which of the following explains the disadvantage of external fertilisation?
(a) Large number of offsprings are produced.
(b) Fertilisation does not take place effectively.
(c) Offsprings are not protected from their predators.
(d) Less number of offsprings are produced.

4. Match the genetic disorder in column I with its cause in column II.

Column I	Column II
A. Down's syndrome	(i) Trisomy of 21st chromosome
B Klinefelter's syndrome	(ii) Additional copy of X-chromosome
C. Turner's syndrome	(iii) Monosomy of X-chromosome

(a) A-(i); B-(ii); C-(iii) (b) A-(iii); B-(i); C-(ii)
(c) A-(iii); B-(ii); C-(i) (d) A-(ii); B-(i); C-(iii)

5. Select the incorrectly matched pair from the following options.
(a) Sertoli cells - Provide nutrition to the germ cells
(b) Interstitial cells - Secrete androgens
(c) Bulbourethral glands - Lubrication of penis
(d) Seminiferous tubules - Store and transport the sperms

6. Taylor and his colleagues (1958) performed an experiment using radioactive thymidine to prove semi-conservative replication of the chromosomes of
(a) *Vicia faba* (b) *Drosophila*
(c) *E. coli* (d) *Caenorhabditis elegans.*

7. Read the following statements and select the option with all incorrect statements.
(I) In young anther, sporogenous tissue occupies the centre of each microsporangium.
(II) Tapetal cells are uninucleate cells with dense cytoplasm.
(III) Sporogenous tissue undergo meiotic divisions to form microspore tetrads.
(IV) Middle layer and tapetum provide nourishment to the developing pollen grains.
(a) I and II (b) II and IV
(c) I and III (d) III and IV

8. Cholesterol lowering molecule is obtained from which of the following species?
(a) *Trichoderma polysporum*
(b) *Penicillium notatum*
(c) *Monascus purpureus*
(d) *Saccharomyces cerevisiae*

9. Which of the following is not an adaptation of non-migratory organisms in order to avoid unfavourable conditions?
(a) Aestivation (b) Hibernation
(c) Diapause (d) Camouflage

10. Match the items in column I with those in column II.

Column I	Column II
A. Heroin	(i) Hallucinogen
B. *Datura*	(ii) Depressant
C. Morphine	(iii) Sedative

(a) A-(i); B-(ii); C-(iii) (b) A-(ii); B-(i); C-(iii)
(c) A-(iii); B-(ii); C-(i) (d) A-(iii); B-(i); C-(ii)

11. Rivet popper hypothesis was developed by which of the following ecologist?
(a) Paul Ehrlich
(b) David Tilman
(c) Alexander von Humboldt
(d) Edward Wilson

12. Which of the following conditions is required for the conversion of inactive Bt protoxins to active toxin in armyworm?
(a) Acidic pH of the gut
(b) Neutral pH of the gut
(c) Alkaline pH of the gut
(d) High temperature of the gut

13. Read the given statements and select the correct option.
Statement I : Saprophytes are not given any place in the ecological pyramids.
Statement II : Ecological pyramids can accommodate single species occupying two or more trophic levels.
(a) Both statements I and II are correct.
(b) Both statements I and II are incorrect.
(c) Statement I is correct but II is incorrect.
(d) Statement I is incorrect but II is correct.

14. *Agrobacterium tumefaciens* causes tumor in which of the following group of plants?
(a) Liverworts (b) Mosses
(c) Dicotyledons (d) Monocotyledons

15. The cross between individuals of same breed with no common ancestors for 4-6 generations is known as_____.
(a) interspecific hybridisation
(b) cross-breeding
(c) inbreeding
(d) out-crossing

Section B

(Attempt any 25 questions)

16. Read the given statements and select the correct option.
Statement I : Darwinian variations are small and directional.
Statement II : Hugo de Vries believed that speciation is caused due to mutation.
(a) Both statements I and II are correct.
(b) Both statements I and II are incorrect.
(c) Statement I is correct but II is incorrect.
(d) Statement I is incorrect but II is correct.

17. Identify the correct pair of extinct species with their geographical location from the following.
(a) Dodo - Russia (b) Steller's sea cow - Africa
(c) Thylacine - Australia (d) Quagga - Mauritius

18. Select the correct statements from the following.
(I) Pusa swarnim is resistant to white rust.
(II) Jaya and Ratna are dwarf varieties of wheat developed in India.
(III) *Saccharum officinarum* had poor sugar content and grow in South India.
(IV) Pusa Gaurav is resistant to aphids.
(a) Only I and II (b) Only II and IV
(c) Only I and IV (d) Only III and IV

19. Which of the following wastes are used for making polyblend?
(a) e-waste (b) Biodegradable waste
(c) Nuclear waste (d) Plastic waste

20. Which of the following insects are destroyed by the toxic proteins of *Bacillus thuringiensis*?
(A) Armyworm (B) Beetles
(C) Tobacco budworm (D) Monarch butterfly
(a) A and B only (b) B and C only
(c) C and D only (d) A, B and C only

21. How much per cent of the Earth's land area is covered by all the biodiversity hotspots?
(a) > 3 (b) < 2 (c) > 5 (d) > 10

22. Match the organisms in column I with their evolution time period in column II.

Column I	Column II
A. Invertebrates	(i) 200 mya
B. Jawless fish	(ii) 350 mya
C. Reptiles	(iii) 500 mya
D. Sea weeds	(iv) 320 mya

(a) A-(i); B-(ii); C-(iii); D-(iv) (b) A-(iii); B-(iv); C-(ii); D-(i)
(c) A-(iii); B-(iv); C-(i); D-(ii) (d) A-(iii); B-(ii); C-(i); D-(iv)

23. Amrita Devi Bishnoi Wildlife Protection Award is awarded to the
(a) the local farmers who performed Jhum cultivation
(b) local communities for protecting and managing forests
(c) local women who were involved in protecting various forest products
(d) individuals or communities from rural areas who showed dedication in protecting wildlife.

24. Read the given statements and select the correct option.
Statement I : Semi-conservative DNA replication was experimentally proved by Watson and Crick.
Statement II : Meischer identified that DNA is an acidic substance found in the nucleus of cell.
(a) Both statements I and II are correct.
(b) Both statements I and II are incorrect.
(c) Statement I is correct but II is incorrect.
(d) Statement I is incorrect but II is correct.

25. Which of the following vegetative propagules can produce new banana plants?
(a) Bulbil (b) Rhizome
(c) Offset (d) Sucker

26. In embryo of monocotyledons, _____ is present towards the lateral side of the embryonal axis.
(a) plumule (b) radicle
(c) root cap (d) scutellum

27. Select the correct method for disposal of nuclear waste.
(a) Burn the nuclear waste in order to reduce the volume of waste.
(b) Bury the waste at depth of 500 m below the earth's surface in shielded containers.
(c) Releasing the waste into water bodies.
(d) Recycling is the only solution for the disposal of nuclear waste.

28. Match items in column I with those in column II.

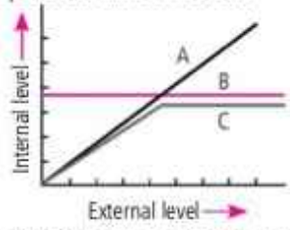
Column I		Column II	
A.	Primary follicle	(i)	Releases ovum on rupture
B.	Tertiary follicle	(ii)	23 chromosomes
C.	Graafian follicle	(iii)	Primary oocyte surrounded by a layer of granulosa cells
D.	Secondary oocyte	(iv)	A fluid filled cavity *i.e.*, antrum is present

(a) A-(i); B-(ii); C-(iii); D-(iv)
(b) A-(iii); B-(iv); C-(i); D-(ii)
(c) A-(iii); B-(iv); C-(ii); D-(i)
(d) A-(iv); B-(ii); C-(i); D-(iii)

29. Which of the following is responsible for graft rejection?
(a) Cell mediated immunity
(b) Innate immunity
(c) Autoimmunity
(d) Humoral immunity

30. Identify the correct sequence of primary succession in water.
(a) Phytoplanktons → rooted-floating angiosperms → rooted-submerged plants → scrub → free-floating plants → marsh-meadow → trees.
(b) Phytoplanktons → free-floating plants → rooted-floating angiosperms → scrub → rooted-submerged plants → marsh-meadow → trees.
(c) Phytoplanktons → rooted-submerged plants → rooted-floating angiosperms → free-floating plants → reed swamp → marsh-meadow → scrub → trees.
(d) Phytoplanktons → rooted-submerged plants → free-floating plants → scrub → rooted-floating angiosperms → marsh-meadow → trees.

31. Identify A, B and C from the given diagrammatic representation of organism response to abiotic factors.



(a) A-Conformers; B-Regulators; C-Partial Regulators
(b) A-Conformers; B-Partial Regulators; C-Regulators

UNSCRAMBLE ME

Unscramble the words given in column I and match them with their explanations in column II.

Column I	Column II
1. OICLBNOROT	(a) The unisexual male flower bearing only stamens.
2. AUHRTERYEML	(b) The biological term for surgical method of contraception.
3. LAEPHHLOI	(c) The outermost layer of the wall of alimentary canal.
4. TNERIEFRNOS	(d) The complex formed by a pair of synapsed homologous chromosomes.
5. SETSRIITLAINO	(e) A biological method which is used to control harmful plant diseases and pests.
6. REOSSA	(f) A organism that can tolerate a wide range of temperatures.
7. DAPEISO	(g) The proteins that are secreted by virus-infected cells.
8. ATMSNEITA	(h) Bacteria that live in extremely salty areas.
9. VINABELT	(i) The periodic exposure to light to induce flowering in some plants.
10. MOPTHPOOERIDIS	(j) A type of loose connective tissue that is specialised to store fats.

Readers can send their responses at editor@mtg.in or post us with complete address by 10th of every month. Winners' names and answers will be published in next issue.

(c) A-Regulators; B-Partial Regulators; C-Conformers
(d) A-Regulators; B-Conformers; C-Partial Regulators

32. Sea anemone and clown fish show which of the following type of interaction?
(a) Amensalism (b) Commensalism
(c) Competition (d) Parasitism

33. Which hormone is administered for induction of super-ovulation in cow in MOET?
(a) Oxytocin (b) LH
(c) FSH (d) Relaxin

34. The amount of nutrients present in soil at any given time is called as
(a) biomass (b) standing crop
(c) sere (d) standing state.

35. The rock shelter of Bhimbetka are found in which of the following states?
(a) Rajasthan (b) Madhya Pradesh
(c) Bihar (d) Gujarat

36. Read the following statements and select the correct option regarding 'competition'.
(A) In interference competition, the feeding efficiency of one species might be reduced due to the inhibitory presence of the other species
(B) When resources are limited, the competitively superior species will eventually eliminate the inferior species.
(C) In Galapagos Island, goats and Abingdon tortoise co-existed by escaping competition.
(D) Closely related species of warblers co-existed due to physiological differences.
(a) A and D are incorrect. (b) C and D are incorrect.
(c) A and C are correct. (d) B and C are correct.

37. Identify the correctly matched pair.
(a) Bacteriophage lambda- 4850 bp
(b) $\phi \times 174$ - 5338 nucleotides
(c) Human DNA- 3.3 x 10^9 bp
(d) *E.coli* - 4.6 x 10^3 bp

38. Which of the following options represent elution step of gel electrophoresis technique?
(a) Loading of DNA sample into wells
(b) Migration of DNA sample on gel
(c) Separation and extraction of DNA bands from agarose gel
(d) Cutting the DNA by restriction endonuclease

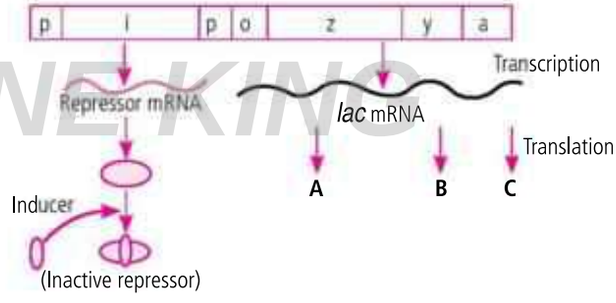
39. Which of the following bacterium is responsible for large holes in the Swiss cheese?
(a) *Propionibacterium shermanii*
(b) *Acetobacter aceti*
(c) *Lactobacillus*
(d) *Clostridium butylicum*

40. Which of the following statements is/are incorrect?
(A) Stigma receptivity and pollen release are not synchronised in some species.
(B) Inhibition of pollen germination or pollen tube growth in the pistil prevents self pollination.
(C) Presence of male and female flowers on different plants prevent autogamy only.
(D) Production of unisexual flowers prevent both autogamy and geitonogamy.
(a) A and D (b) A, B and C
(c) B only (d) C and D

Case Based MCQs

Case I : Read the passage and refer to the given representation of *lac* operon in the presence of inducer and answer the questions from 41 to 45.

From a number of studies on the metabolism of bacterium *Escherichia coli*, two French scientists, Jacob (geneticist) and Monod (biochemist) in 1961 proposed a model of gene regulation, known as operon model. Operon is a co-ordinated group of genes such as structural gene, operator gene, promoter gene, regulator gene which function together and regulate a metabolic pathway as a unit.



41. Identify A, B and C.

	A	B	C
(a)	β-galactosidase	Transacetylase	Permease
(b)	β-galactosidase	Permease	Transacetylase
(c)	Permease	β-galactosidase	Transacetylase
(d)	Transacetylase	Permease	β-galactosidase

42. Which enzyme is responsible for increasing the permeability of the cell to β-galactosides?
(a) A (b) B
(c) C (d) Both (a) and (c)

43. Lactose act as a substrate for which of the following enzyme(s)?
(a) C (b) A
(c) B (d) Both (b) and (c)

44. Which of the following correctly explains the role of 'A'?
(a) It codes for regulatory gene (*i* gene).
(b) It prevents RNA polymerase from transcribing the operon.

(c) It inactivates the interaction of repressor *m*RNA with the inducer.
(d) It is responsible for the hydrolysis of the lactose into its monomeric units.

45. Binding of 'o' with repressor protein results in the
(a) binding RNA polymerase to the promoter and continuation of transcription
(b) transportation of lactose into the cells
(c) prevention of RNA polymerase from transcribing the operon
(d) formation of a polypeptide.

Case II : Read the passage given below and answer the questions from 46 to 50.

The municipal waste-water is known as sewage, which is treated in sewage treatment plants (STPs) to make it less polluting. The water samples were collected from the different tanks of treatment plants to measure Biochemical oxygen demand (BOD). The BOD measured in tank A, B and C are 400 mg/L, 50 mg/L and 48 mg/L respectively. It has been observed that tank A has floating debris but tank B was devoid of it. Tank B was open, fitted with a mechanical agitator and contained highest amount of sludge. However, there was another additional tank D with solid sludge only which remained closed, connected to tank C and is a source of energy. Tank C allows the sludge to sediment. The water can be released from both the tank B and tank C in the natural water bodies.

46. Identify the tank in which sewage water is filtered by physical methods.
(a) Tank A (b) Tank B
(c) Tank C (d) Tank D

47. What could be the reason for releasing water from tank B and tank C directly into water streams?
(a) BOD in both tanks has reduced significantly.
(b) Other bacteria and fungi has been digested anaerobically is the sludge
(c) Useful aerobic microbes has increased significantly.
(d) Mixture of methane, hydrogen sulfide and carbon dioxide has produced.

48. Sludge from which of the following tanks can be used as inoculum for biological treatment?
(a) A (b) B (c) C (d) D

49. Which of the following explains the function of 'tank D'?
(a) It is involved in flocs formation.
(b) It provides oxygen for growth of microbes.
(c) It helps in production of biogas.
(d) It measures the amount of organic matter.

50. The reason behind the sudden decrease in BOD from Tank A to Tank B is due to the
(a) sequential filtration in tank B
(b) flocs formation in tank B
(c) presence of low amount of organic matter in tank B
(d) less polluting potential of tank B.

SOLUTIONS

1. (d) : LNG-20 is the hormone releasing IUDs. Lippes loop is a non-medicated IUD, Cu7 and Multiload 375 are copper releasing IUDs.

2. (b) : Thomas Hunt Morgan from his experiments deduced that the tightly linked genes on same chromosomes shows less recombination whereas loosely linked genes show high rate of recombination.

3. (c) : In external fertilisation, large number of offsprings are produced but they are extremely vulnerable to predators.

4. (a) **5. (d)**

6. (a) : Taylor and colleagues (1958) experiment involved use of radioactive thymidine to detect distribution of newly synthesised DNA in the chromosomes of *Vicia faba* (faba beans). It proved that the DNA in chromosomes replicate semiconservatively.

7. (b) : Tapetal cells generally have more than one nucleus. The inner most wall layer *i.e.*, tapetum provides nourishment to the developing pollen grains.

8. (c) : Statins are blood cholesterol lowering agents produced from yeast *Monascus purpureus*. *Trichoderma polysporum* produces cyclosporin A, *Penicillium notatum* produces penicillin and *Saccharomyces cerevisiae* produces ethanol.

9. (d) **10. (b)**

11. (a) : Rivet popper hypothesis was used by stanford ecologist Paul Ehrlich.

12. (c) : Bt toxins remain as inactive protoxins in the *Bacillus* but when ingested by an insect, the inactive protoxins gets converted to active form due to the alkaline pH of the gut.

The same THREE LETTERS will complete these four words.

Can you find the three-letter sequence?

V A – – – R E S S I N

B A – – – H I L

D R O – – – H I L A

M E – – – H Y L L

Readers can send their responses at editor@mtg.in or post us with complete address by 10th of every month.
Winners' names will be published in next issue.

13. (c)

14. (c) : *Agrobacterium tumefaciens* causes tumor in dicot plants where tumor cells produce the chemicals required by the pathogen.

15. (d) : Out-crossing refers to the crossing between individuals of same breed with no common ancestors for 4-6 generations. Interspecific hybridisation refers to the crossing between two different related species and cross-breeding is a cross between two superior males of one breed and superior females of another breed.

16. (a)

17. (c) : The geographical location of extinct species is as follows - Dodo (Mauritius), Quagga (Africa), Thylacine (Australia), Steller's Sea Cow (Russia).

18. (c) : Jaya and Ratna are dwarf varieties of rice developed in India. *Saccharum barberi* is grown in North India, had poor sugar content and yield whereas *Saccharum officinarum* had high sugar content and grown in South India.

19. (d) : Polyblend is a mixture formed from the plastic waste which is recycled and modified to a powder form. The mixture was prepared by Ahmed Khan in his company in Bangalore.

20. (d) : Some strains of *Bacillus thuringiensis* produce proteins that kill certain insects such as lepidopterans (tobacco budworm, armyworm), coleopterans (beetles) and dipterans (flies, mosquitoes).

21. (b) : All the biodiversity hotspots cover less than 2 percent of the total land area of the Earth.

22. (d) **23. (d)**

24. (d) : Watson and Crick proposed the double helical model of DNA but the experimental proof of DNA replication came from the experiments of Meselson and Stahl in 1958.

25. (b) : In banana, the new plantlets arise from the buds present at the nodes of the rhizome (modified stem). These buds when come in contact with soil produce roots and new plants.

26. (d) : In grass family, the cotyledon also known as the scutellum is situated towards lateral side of the embryonal axis.

27. (b) : It has been recommended that the correct method for disposal of nuclear waste is to bury the waste at depth of 500 m below the earth's surface in shielded containers.

28. (b)

29. (a) : Graft rejection occurs due to the ability of immune response to recognise self and non-self, and cell mediated immunity.

30. (c) **31. (a)**

32. (b) : Commensalism is an interaction in which one species is benefitted while another species is neither harmed nor benefited. The interaction between sea anemone and clown is an example of commensalism where sea anemone does not derive any benefit but clown fish gets protection from predators due to the stinging tentacles of the anemone.

33. (c) : In Multiple Ovulation Embryo transfer (MOET), the cow is administered with FSH hormone to induce follicular maturation and super-ovulation (6-8 eggs per cycle).

34. (d)

35. (b) : Pre-historic humans saw the cave paintings at Bhimbetka rock shelter in Raisen district of Madhya Pradesh.

36. (b) : In Galapagos Island, Abingdon tortoise became extinct when goats were introduced because of the high grazing efficiency of the goats. MacArthur showed that, the five closely related species of warblers living on the same tree were able to avoid competition and co-existed due to behavioural differences in their foraging activities.

37. (c)

38. (c) : The separation of DNA bands from the gel and extraction of DNA from the gel piece is known as elution.

39. (a) : The large holes in 'Swiss cheese' are due to production of a large amount of CO_2 by a bacterium named *Propionibacterium shermanii*.

40. (d)

41. (b) : The *lac* operon consists of three structural genes (*z*, *y*, and *a*). The *z* gene codes for beta-galactosidase (A). The *y* gene codes for permease (B). The *a* gene codes for transacetylase (C).

42. (b) : The y gene codes for permease (B), which increases permeability of the cell to β-galactosides.

43. (b) : Lactose is the substrate for the enzyme beta-galactosidase (A) and it regulates switching on and off of the operon. Hence, it is termed as inducer.

44. (d) : The *z* gene codes for enzyme beta-galactosidase (*A*) enzyme, which is primarily responsible for the hydrolysis of the disaccharide, lactose into its monomeric units, galactose and glucose.

45. (c)

46. (a) : The physical separation of debris takes place in tank A where debris is removed by filtration followed by sedimentation.

47. (a) : The BOD in tank B and C is very less therefore, water can be discharged directly into water streams.

48. (c) : Sludge from tank C is known as activated sludge and therefore, some of it can be pumped back into aeration tank to serve as inoculum.

49. (c) : The sludge from tank C gets collected in the tank D *i.e.*, anaerobic sludge digestor where anaerobic bacteria produce gases like methane, hydrogen sulfide, etc. These gases form biogas which acts as a source of energy.

50. (b) : In Tank B, water is agitated mechanically and air is pumped into it which allows vigorous growth of useful aerobic microbes into flocs. While growing, these microbes consume the major part of the organic matter in the effluent. It significantly reduces the BOD (biochemical oxygen demand) of the effluent (Tank B).

Quiz CLUB

Unlock Your Knowledge!

1. Which of the following virus causes Chickenpox?
(a) Rhinovirus (b) Varicella-Zoster virus
(c) Variola virus (d) Influenza virus

2. Which of the following combination destroys stratospheric ozone?
(a) Fluorine + Bromine and UV-rays
(b) Chlorine + Bromine and infrared-rays
(c) Fluorine + Chlorine and gamma-rays
(d) Chlorine + Bromine and UV-rays

3. Who is known as father of modern genetics?
(a) Gregor Mendel (b) William Bateson
(c) Lamarck (d) Hugo de Vries

4. What is the name of world's first vaccine developed for any parasitic disease in 2021?
(a) Sputnik (b) Mosquirix
(c) Prevnar (d) Novavax

5. Which of the following branch of science deals with the study of interaction between the physical Earth and the biosphere?
(a) Paleobiology (b) Systems biology
(c) Geobiology (d) Entomology

6. Choose the bird that can fly backwards too.
(a) Humming bird (b) Vulture
(c) Bar-headed goose (d) White stork

7. Which of the following is the most diverse type of tissue found in an animal?
(a) Muscular tissue (b) Connective tissue
(c) Nervous tissue (d) Epithelial tissue

8. Which of the following is the heaviest tree dwelling animal?
(a) Orangutan (b) Tarsier
(c) Flying lemur (d) Three-toed sloth

9. The swollen trunk of which tree can store upto 1,20,000 litres of water?
(a) Maple tree (b) Baobab tree
(c) Sal tree (d) Peepal tree

10. When do we celebrate world Biodiversity day?
(a) 4th March (b) 1st June
(c) 11th July (d) 22nd May

11. How many biosphere reserves are present in United States of America?
(a) 18 (b) 72 (c) 47 (d) 22

12. Which of the following disease is a result of continuous practice of cannibalism in humans?
(a) Alzheimer (b) Kuru
(c) Filariasis (d) Scrape

13 Which of the following organ stimulated directly by the anabolic steroids?
(b) Heart (b) Lungs
(c) Brain (d) Muscles

14. Choose the disease that cannot be prevented by vaccination.
(a) Rabies (b) Beri beri
(c) Typhoid (d) Measles

15. What is photophobia?
(a) The adjustment of the eye for light.
(b) The ability to perceive light.
(c) The abnormal intolerance of light.
(d) A disease caused by too much sunlight.

☺☺

Readers can send their responses at editor@mtg.in or post us with complete address by 10th of every month. Winners' names and answers will be published in next issue.

UNSCRAMBLED WORDS

APRIL 2023

1-b-NEPHRON	2-e-SETAE
3-g-AUXIN	4-a-CIRRHOSIS
5-c-NITROGENASE	6-h-MINERALISATION
7-d-EXINE	8-i-EPINEPHRINE
9-j-EUTROPHICATION	10-f-AUTOSOME

Winner: *Yash Kapoor (Delhi)*

UCD Unique Career in Demand

Explore the available Unique Career Options!

Bachelor of Food Technology

(B.Sc Food Technology)

Bachelor of Science or B.Sc in Food Technology is a full-time 3-year undergraduate course. This course involves an advanced study of techniques and activities which are involved in preserving, processing, and manufacturing of food. This program provides students knowledge of the scientific and technical approaches to understand the nature of raw food materials.

This course basically involves a combination of food science, home science, engineering and hotel management.

Job Perspectives

- Students can opt out for a wide range of profession after completing their B.Sc in Food Technology. A graduate student can easily get a job in production management firms, quality assurance firms, hotels, restaurants, etc. There are large number of career options and job opportunities like technical brewer, organic chemist, production manager, biochemist, research analyst, nutritional therapist, food technologist and product development science.
- After completing the bachelor's degree, students can also go for further studies like M.Sc in Food Technology and M.Tech in Food Technology.
- Top recruiters are Nestle, Dabur, PepsiCO, Agrotech Foods, Amul, Godrej, Cadbury, etc.

Eligibility

- For getting admission in a B.Sc Food Technology course, candidates must have passed class 12 or equivalent from a recognised board with Physics, Chemistry and Biology/Home Science as compulsory subjects with an aggregate of atleast 50% marks (45% for candidates belonging to SC/ST/OBC category). Admission is based on candidates performance in the entrance exam asked by the university. However, some universities take admission on the merit basis.

Selection Criteria

A student is required to fill the application form for the respective university in order to be considered for the admission to a specific university apart from meeting the eligibility criteria. Most of the colleges conduct online mode of exam for the convenience of the students. The admission to B.Tech Food Technology is done through National level entrance examinations so not many colleges prefer having an entrance test specifically for B.Sc Food Technology course. Some of the exams with their respective dates are given as follows:

B.Sc Food Technology Entrance Exams

Name of the Exams	Registration Dates	Exam Dates
NPAT	December 1st, 2022 – May 21st, 2023	January 4th, 2023 – May 31st, 2023
CUET	April 2023	May 21st – 31st, 2023
CUCET	November 28th - May 29th, 2023	November 28th - May 30th, 2023
SET	December 10th – April 12th, 2023	May 6th, 2023 (Test 1) May 14th, 2023 (Test 2)
CFTRI	Between March & April	Has not announced yet.
IIFPT (Through JEE Main)	Between February & March	April 6th - 15th, 2023

Top Colleges offering B.Sc Food Technology

(i) Shaheed Rajguru College for Applied Sciences for Women, New Delhi

(ii) Lady Irwin college, New Delhi

(iii) NIMS, Jaipur

(iv) Uttaranchal University, Dehradun, Uttarakhand

(v) Bilaspur University, Chhattisgarh

(vi) Birla Institute of Technology, Ranchi, Jharkhand

(vii) Andhra University, Vishakhapatnam, Andhra Pradesh

(viii) Lovely Professional University, Jalandhar

(ix) Govind Ballabh Pant University of Agriculture and Technology, Pantnagar

College Info

LADY IRWIN COLLEGE

Lady Irwin College is one of the most prestigious College of the University of Delhi located in the North Campus. Established in 1932, it is a women's college located in New Delhi, India, and offers graduate courses in Food Technology as well as graduate and post-graduate courses in Home Science. The department of food and nutrition is first post-graduate program of this college.

Selection criteria - Candidates must appear in CUET in any of the following subject combinations:

Combination I : Physics + Chemistry + Biology/Biological Studies/ Biotechnology/Biochemistry OR **Combination II:** Physics + Chemistry + Mathematics.

Merit will be based on the best CUET score obtained from any of the above mentioned combinations of subjects.

Yes, organs can be repaired

The Department of Regenerative and Restorative Medicine at Jaslok Hospital, Mumbai, tests effects of magnetic stimulation in the brain.

We know that the human body has an in-built ability to heal itself but it is only now, thanks to technology, that doctors have been able to capture this bio mechanism. This has helped researchers develop restorative and regenerative medicines with which doctors can heal the long-lasting and scarring impact of chronic conditions resulting from stroke, diabetes and osteoarthritis among others. In short, your organs and tissues could be revived, repaired and be as functional as they were before. Examples, according to the Association for the Advancement of Blood and Biotherapies, "include cell therapies (which involve injection of stem cells or progenitor cells); immunomodulation therapy (regeneration by biologically active molecules administered alone or as secretions by infused cells); and tissue engineering (transplantation of laboratory grown organs and tissues)."

Regenerative medicine is a relatively new area of multi-disciplinary research but has already found its way into India. Mumbai's Jaslok Hospital has just launched its Department of Regenerative and Restorative Medicine. Says Dr. Paresh Doshi, its new director, Restorative Medicine deals with restoring body functions. This can be done through several methods. We can use modern cutting edge technology to restore body functions among patients with cognitive decline. This could be a result of diseases like Alzheimer's, a post-stroke syndrome, slurry speech or paraplegia following spinal trauma and many such triggers. At the moment, these patients have to live with whatever deficits they might have. However, bio-prosthetic limbs, visual aids and even comparative brain interfaces could help restore the functionality among them."

For example, the deep Transcranial Magnetic Stimulation (TMS) — a non-invasive procedure that uses magnetic fields to stimulate nerve cells in the brain — has been known to be very effective in controlling symptoms of Obsessive Compulsive Disorder (OCD). "Studies have shown that if deep TMS therapy is applied during an ongoing depressive episode, when the patient is partially responsive to medical treatment, it has the best chance of success. One study showed how deep TMS had significantly better outcomes in controlling depression. Similar benefits have been found in stroke and Alzheimer's disease," he adds. "Also, ortho biologics, which use biological tissues found in the human body, such as blood, fat or bone marrow, can be used to treat bone disorders," he says.

The new therapies have been administered to two patients suffering from severe chronic pain. At the moment, the hospital offers cell-based therapies in the form of platelet-rich plasma and ortho biologics treatment for avascular necrosis of the femoral head (death of bone tissue due to lack of blood supply).

"We are also using upper deep transcranial magnetic stimulation. We have a state-of-the-art TMS machine that can offer repetitive transcranial magnetic stimulation (rTMS) therapy to patients. This is probably the only and the most comprehensive set-up in the country. It is a drug-free, non-invasive approach which uses magnetic stimulation in the scalp to stimulate areas of the brain that are responsible for pain, psychiatric disorders and neurological disorders," explains Dr Doshi.

These therapies, he feels, will define the future of medicine where several disciplines will interact with each other to improve the quality of life of patients.

Courtesy : The Indian Express

Class XI

BIO Digest

This article covers high yield facts of the given topic.

Plant Kingdom

- The Kingdom Plantae includes eukaryotic, photosynthetic organisms. According to traditional system of classification, the Kingdom Plantae is divided into two subkingdoms.

Kingdom Plantae

Cryptogamae

- Plants called cryptogams do not bear conspicuous reproductive structures like seeds *i.e.*, seedless plants.
- Plant body is not well organised and do not bear flowers, fruits and seeds.
- The reproductive structures or sex organs are invisible.

Thallophyta

- Plant body is undifferentiated and is known as thallus.
- It may range from microscopic unicellular to macroscopic multicellular forms.
- The plants are non-vascular and chlorophyllous. It includes only algae.

Bryophyta

- Represent group of plants growing in amphibious habitat.
- They are simpler and smaller embryophytes.

Pteridophyta

- Referred as first land plants or vascular cryptogams as they possess xylem and phloem.

Phanerogamae

- Phanerogams are flowering or seed plants.
- The plant body is differentiated into root, stem and leaves.
- They bear visible reproductive structures like cones and flowers.
- These are vascular plants.

Gymnospermae

- Naked seed bearing plants.

Angiospermae

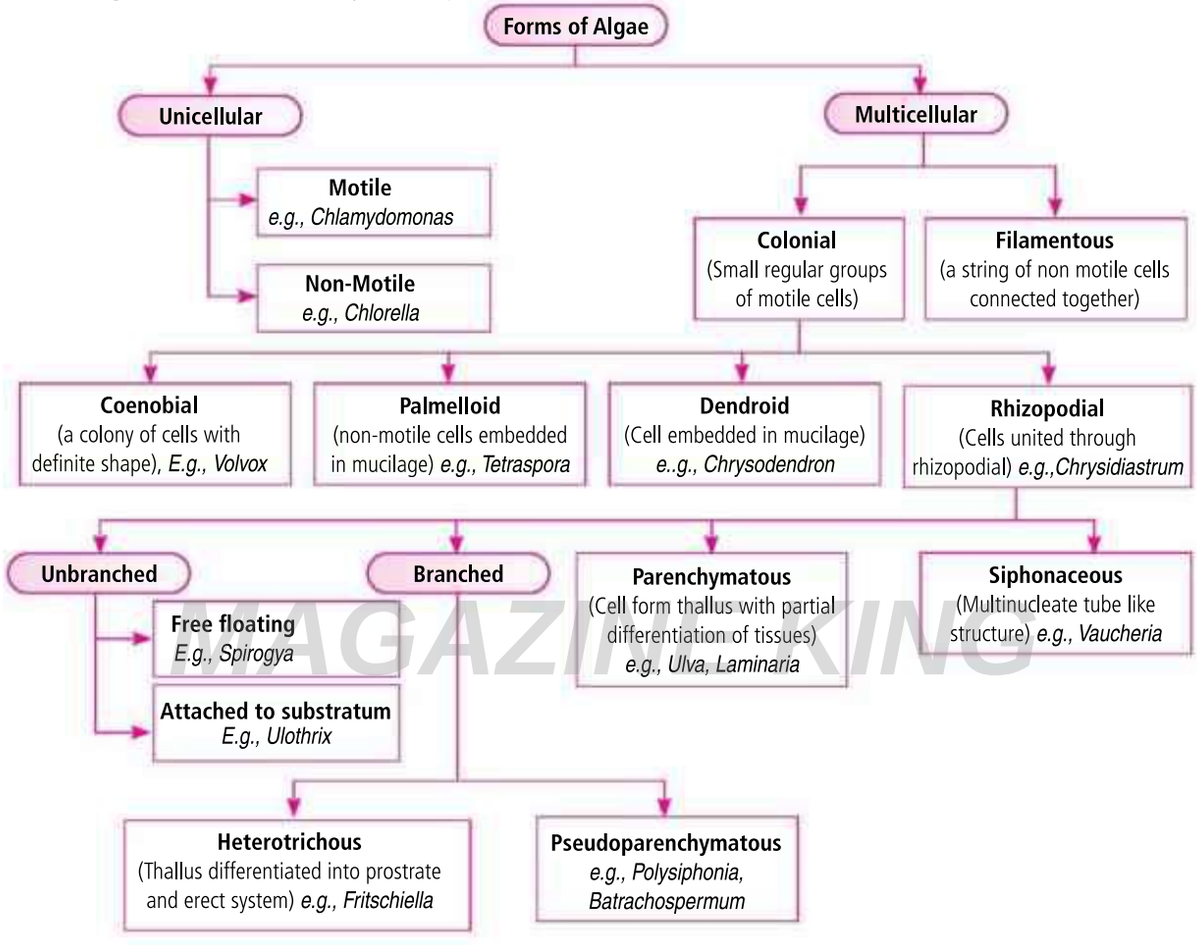
- Plants bear covered seeds and fruits. Most evolved group of plant kingdom.

ALGAE

- Alage includes all chlorophyllous thallophytes. They include autotrophic avascular plants with thallose plant body that fail to show any cellular differentiation.

General Characteristics

- **Habitat :** Algae are distributed widely from depth of oceans to highest peak of mountains. But they are usually aquatic *i.e.*, either marine or freshwater, while only few algae occur in moist terrestrial habitats *e.g.*, tree trunks, wet rocks, moist soil.
- **Forms :** Algae may be unicellular or multicellular, ranging from small colonial (*Volvox*) to several hundred feet long (*Macrocystis)*. Filamentous forms may be branched or unbranched.



- The plant body is covered by mucilage which protects the algae from epiphytic growth and decaying effect of water.
- Vascular and mechanical tissues are absent, therefore the body is flexible and easily gets swayed without being torn.
- Nutrition is photosynthetic. Grana are absent in chloroplast. The chloroplast varies in appearance among different algal forms, *e.g.*, cup shaped, girdle shaped, reticulate or ribbon shaped.
- Algae contain chlorophyll *a*, *b*, *c*, *d*, carotenes and xanthophylls. Additional pigments like phycobilins, fucoxanthin occur in specific groups.

- Pyrenoids are associated with chloroplast for storage of starch. The reserve food may be starch, laminarin, mannitol, oil, fats etc. which differs among different algal members.
- Vegetative and asexual modes of reproduction are present.
- Vegetative reproduction may take place by fragmentation (*e.g., Ulothrix, Oedogonium*), fission (*e.g., Chalmydomonas*), hormogonia (*e.g., Oscillatoria*), tubers (*e.g., Chara*), budding (*e.g., Protosiphionia*), etc.
- Asexual reproduction takes place by flagellated **zoospores** (*e.g., Ulothrix, Oedogonium*); non-motile, thin walled **aplanospore**

(*e.g., Chlorella, Microspora*) and non-motile, thick walled hypnospores (*e.g., Vaucheria, Chlamydomonas nivalis*, thick walled akinetes (*e.g., Cladophora*), palmella stage (*e.g., Chlamydomonas*).

- Under favourable conditions, algae show sexual reproduction which may be isogamous or heterogamous (*i.e.*, anisogamous and oogamous). Sex organs are non-jacketed and one celled called gametangia.
- Life cycle may be haplontic, diplontic or diplohaplontic.

Classification

- Dr. F.E. Fritsch, known as father of algae, classified algae into various classes depending upon the phylogeny, affinities and inter-relationship.
- However, according to Whittaker's system of classification, algae are mainly of three types : Green, brown and red.

Table: Characteristics of different classes of algae

Classes	Structure	Occurrence	Major pigments	Reserve food material	Reproduction		
					Vegetative	Asexual	Sexual
Chlorophyceae, (Green algae) *e.g., Spirogyra, Ulothrix*	Unicellular to heterotrichous filaments. Cellulosic cell wall. Starch sheathed pyrenoids. Motile cells with 2-4 equal flagella.	Mostly fresh water a few marine. A marked tendency towards terrestrial habitat.	Chl. *a* and *b*, carotenes and xanthophyll	True starch and sugar	Fragmentation or fission	Zoospores	Isogamous to advanced oogamous
Phaeophyceae (Brown algae) *e.g., Fucus, Sargassum*	Simple filamentous to bulky parenchymatous with giant size, external and internal differentiation, motile cells with 2 lateral flagella.	Mostly marine	Fucoxanthin, flavoxanthin, β-carotenes, Chl. *a* and *c*.	Laminarin, mannitol	Fragmentation is most common.	Zoospores, tetraspores etc.	Isogamous to oogamous
Rhodophyceae (Red algae) *e.g., Polysiphonia, Porphyra*	Simple filamentous to complex forms. Motile cells not known.	Few freshwater, others are marine.	Phycoerythrins, phycocyanin, allophycocyanin, carotenoids, Chl. *a* and *d*.	Floridean starch	Uncommon, except unicellular ones	Monospores, carpospores, polyspores etc.	Advanced oogamous type producing special carpospores.

Economic Importance

Food
Sea weeds and certain marine algae are used as food *e.g., Porphyra, Laminaria, Sargassum* etc., *Chlorella* and *Spirulina* are rich sources of proteins, hence used as food supplements.

Photosynthesis
Nearly 50% of total photosynthesis on earth is carried out by algae. It is essential for respiration of aquatic life.

Alginic acid
Obtained from Phaeophyceae such as *Laminaria, Macrocystis, Fucus*, etc. It is used in stabilising emulsions, flameproof plastics, security glass and artificial fibres.

Agar-agar
A phycocolloid extracted from species of red algae as *Gelidium, Gracilaria* and *Gigartina* is used as a solidifying agent in culture medium, canning of fish and meat, sizing of textiles and paper etc.

Carrageenan
Obtained from red algae *Chondrus crispus* and issued as pharmaceutical emulsifier, cleaning agent and in textile, leather and brewing industries.

Medicines
Owing to high iodine content, brown algae are used in various goitre medicines.

Sewage disposal
Green algae like *Chlamydomonas, Chlorella, Scendesmus* are components of sewage oxidation tanks which provide aerobic conditions for disposal of sewage by decomposers.

- **Algal pollution :** Algae is also known to cause pollution, called as algal bloom. It affect water supply and purification and become obnoxious in water reservoirs, rivers and oceans.

Intext Practice Questions

1. Name the group of algae in which plant body is differentiated into holdfast, stipe and frond.
2. Which pigment is responsible for brown colour of phaeophyceae?

BRYOPHYTES

- Bryophytes are simplest and most primitive non vascular terrestrial plants of moist habitats in which a multicellular diploid sporophyte lives as parasite on an independent multicellular haploid gametophyte.
- They are able to live on land as well as in water, therefore are called as "amphibians of plant kingdom."

General Characteristics

- **Habitat :** Bryophytes live in damp and shady habitats, usually found in rainy season forming green carpets or mats on damp soil, rocks, walls, tree trunks etc.
- The dominant phase of the plant is a free living gametophyte.
- Rhizoids (instead of roots) are present. They may be unicellular or multicellular.

Bryophytes seldom attain great heights and thus remains small in size. It may be due to
- absence of roots and vascular tissues
- absence of cuticle on plant body
- absence of mechanical tissues
- requirement of external sheet of water for capillary conduction.

- **Reproduction :** Vegetative reproduction is quite common. It may take place by fragmentation, tubers, gemmae *e.g.*, *Marchantia*, buds, adventitious branches *e.g.*, *Riccia*.
- Accessory spores are not formed.
- Sexual reproduction is oogamous *i.e.*, fusion of a non-motile passive egg cell and biflagellated active male gamete.
- Sex organs are multicellular and jacketed and are of two types : **antheridium** (male), and **archegonium** (female).
- Antheridium produces a number of flagellated male gametes called sperms or antherozoids.
- Archegonium is flask shaped with tubular single layered neck (having 5-6 rows of cells) and a swollen venter (1-2 layered wall) enclosing a sterile ventral canal cell and a fertile egg.
- The sterile neck canal cells and venter canal cells of archegonium degenerate, gelatinise, absorbs water and swells up into mucilage. It opens the lid of neck and leads a passage upto oosphere.
- An external layer of water is essential for the swimming of male gametes to archegonia.
- Fertilisation leads to formation of embryo inside archegonium. The embryo grows into a sporophyte, which is parasitic on gametophyte. Since it is dependent on gametophyte, it is called **sporogonium**.
- Sporophyte consists of foot, seta and capsule. In some members, however, the sporophyte is represented either only by capsule (*e.g., Riccia*) or by foot and capsule (*e.g., Corrinia*).
- Sporogonium produces haploid meiospores inside its capsule. On germination, each spore produces a gametophyte either directly or through a juvenile stage called **protonema**.
- Bryophytes show heteromorphic or heterologous alternation of generations.

Classification

Table: Classification of bryophytes

Features	Hepaticopsida	Anthocerotopsida	Bryopsida
Common name	Liverworts	Hornworts	Mosses
Gametophytic plant body	May be thallose or foliose. Aseptate rhizoids.	Thallose Aseptate rhizoids	Gametophyte has two growth stages: thalloid protonema stage and leafy gametophore stage. Obliquely septate rhizoids.
Sex organs	Present on dorsal surface of thallus.	Present on dorsal surface of thallus.	Develop from the superficial cells at the apex of leafy gametophore.
Sporophyte or sporogonium	Simple, represented by capsule only *e.g., Riccia* or differentiated into foot, seta and capsule (*e.g., Marchantia*).	Differentiated into a bulbous foot, small meristematic seta and long cylindrical capsule.	Differentiated into foot, seta and capsule.

Elaters	Generally present, absent in some like *Riccia*.	Pseudoelaters are present in the capsule.	Absent
Sporogenous cells	Develops from endothecium.	Develops from amphithecium and endothecium, forms sterile columella.	Develops from outer layer of endothecium. Inner layer forms sterile columella.
Dehiscence of capsule	Irregular and indefinite	Irregular	Regular
Examples	*Riccia, Marchantia, Sphaerocarpos,* etc.	*Anthoceros, Notothylas, Megaceros,* etc.	*Sphagnum, Polytrichum, Funaria,* etc.

Economic Importance

Prevention of soil erosion

Mosses form dense mats over the soil and prevent soil erosion by running water.

Soil formation

They make an important link in ecological succession on rocky areas by taking part in soil formation in rocky crevices, formed by lichens. For example, growth of *Sphagnum* fills ponds and lakes with soil.

Water retention

Some bryophytes or mosses as *Sphagnum* can retain or absorb 18-26 times its weight of water. This water retention capability is employed by gardeners to keep seedlings and cut plants moist during transportation and propagation.

Peat

Sphagnum often grows in acidic marshes where there is little decay. The dead parts of moss and other marshy plants slowly get carbonised, compressed and fossilised over thousands of years to produce a dark spongy mass called peat. It is dried, compressed and cut to form blocks. Peat is used as good manure to overcome soil alkalinity and it increases water retention as well as aeration.

Affinities of Bryophytes with Algae

I. Resemblances of bryophytes with algae

(i) Presence of thalloid and gametophytic plant body.
(ii) Autotrophic nature of plants.
(iii) In both groups, chloroplasts contain chlorophyll-*a*, *b*, α-and β-carotene, lutein, violaxanthin and xeoxanthin.
(iv) Starch as reserve food material.
(v) Dominance of gametophyte.
(vi) Absence of vascular tissues.
(vii) Absence of true roots, stem and leaves.
(viii) Dependence on water for fertilisation.

II

Table: Differences between algae and bryophytes

	Algae	Bryophytes
(i)	Most of the algae are aquatic.	These are terrestrial plants occurring mostly in shady and moist habitats.
(ii)	Plant body is unicellular, multicellular, filamentous or pseudoparenchymatous.	Plant body is multicellular, parenchymatous and thalloid or differentiated into rhizoids, axis and lateral appendages.
(iii)	Filaments are unbranched or show regular or irregular branching.	Thallus is usually dichotomously branched.
(iv)	Plant body does not show division of labour.	Although plant body does not show distinct division of labour, cells in different parts have specific functions.
(v)	Structures like pores and stomata are absent.	Pores and stomata are present.
(vi)	Asexual reproduction is common and it takes place by zoospores, aplanospores or akinetes.	Asexual reproduction is absent but some species multiply by vegetative means.
(vii)	Sexual reproduction is isogamous, anisogamous or oogamous.	Sexual reproduction is oogamous.
(viii)	Sex organs are usually unicellular and do not have a covering of sterile cells.	Sex organs are multicellular and have a protective covering (jacket) of sterile cells.
(ix)	Zygote usually undergoes a period of rest after liberation from the parent plant.	Zygote divides immediately after fertilisation to form sporophytes.
(x)	Zygote does not form embryo, instead haploid spores are formed.	Zygote forms embryo.

Intext Practice Questions

3. Mention the name of male and females sex organs of bryophytes.
4. State the economic importance of *Sphagnum.*

PTERIDOPHYTES

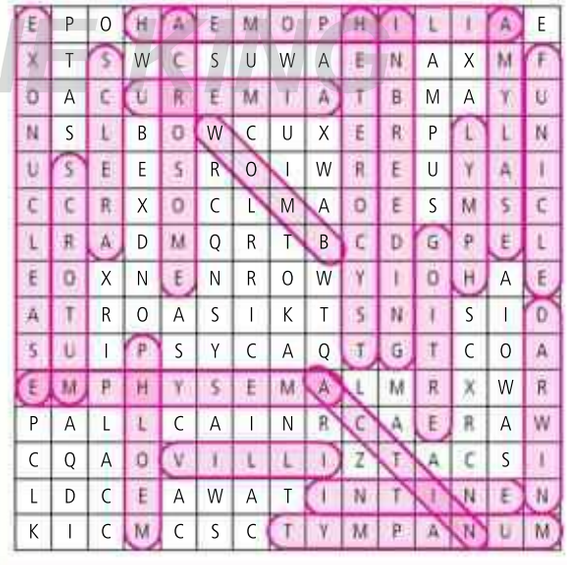
- Pteridophytes are seedless vascular plants *i.e.*, cryptogams having sporophyte plant body and inconspicuous gametopyte. They are called as "Botanical snakes" evolved after amphibians (bryophytes).

General Characteristics

- **Habitat :** They grow in a variety of habitats but mostly they are terrestrial plants that thrive well in abundant moisture and shade while some flourish well in xeric conditions.
- The sporophytic plant body is differentiated into true roots, stem and leaves, though some of the primitive members may lack true roots and well developed leaves.
- Leaves can be **microphyllous** *i.e.*, small without forming leaf gaps in vascular supply or **macrophyllous** *i.e.*, large forming leaf gaps *e.g.*, ferns.
- The branching of the stem may be dichotomous type or monopodial.
- Pteridophytes show presence of vascular tissues; xylem and phloem. In xylem, true vessels are absent while, in phloem, companion cells and sieve tubes are absent.
- The vascular system of pteridophytes varies in different groups showing stelar system ranging from simple protostele, siphonostele or a dictyostele.
- The sporophytes reproduces asexually by means of spores, produced in small capsules called sporangia. Leaves bearing sporangia are called **sporophylls** which may be widely scattered or clustered in definite areas and structures called cones or **strobili**.
- The diploid spore mother cells or **sporocytes** within the sporangia undergo meiosis or reduction division to form spores. These spores may be similar as in majority of pteridophytes called **homosporous** *e.g.*, *Lycopodium* and *Dryopteris* or different with two types of spores (microspores and megaspores) called **heterosporous** *e.g.*, *Selaginella*, *Salvinia*.
- Spores upon germination give rise to haploid gametophytes or prothallus bearing multicellular, jacketed sex organs.
- Gametophytes formed from homospores are monoecious (both antheridia and archegonia are borne on same prothallus) while those formed from heterospores are dioecious (antheridia and archegonia develop on separate male and female prothallus).
- Antheridia are small and sessile comprising of androcytes, each of which produces a motile antherozoid. Archegonia are partially embedded and consists of 4-rowed neck.
- Water is essential for fertilisation, as it assists in carrying bi-or multiflagellate sperms to archegonia.
- The young sporophyte is dependent on gametophyte during its early years.
- Pteridophytes exhibit alternate succession of sporophytic and gametophytic generation.

Contributed by : Niladri Bandhyopadhyay, (Kolkata)

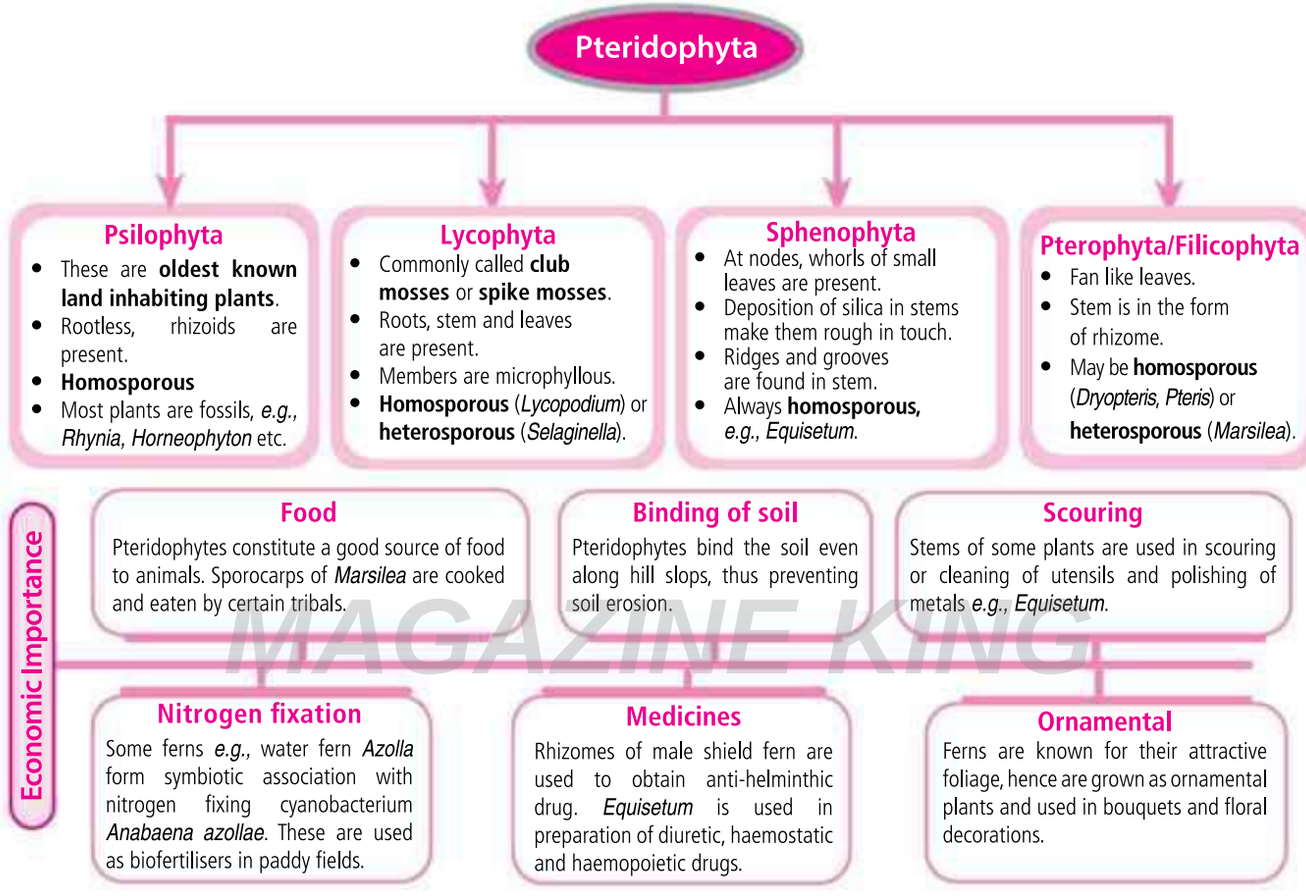
SOLUTIONS TO APRIL 2023 WORD GRID



1. Haemophilia
2. Heterocyst
3. Emphysema
4. Scrotum
5. Tympanum
6. Inbreeding
7. Villi
8. Darwin
9. Actin
10. Exonuclease
11. Uremia
12. Acrosome
13. Phloem
14. Intine
15. Goitre
16. Amylase
17. Womb
18. Lymph
19. Funicle
20. Sclera

- Evolution of Seed Habit. The ability of plant to form seed is called seed habit. It is considered to have originated in pteridosperms during Devonian-carboniferous periods. The development of zygote into young embryo within female gametophyte in heterosporous plants *e.g.*, *Selaginella* is a precursor to the evolution of seed habit.
- The differentiation of spores into microspores and megaspores and their dependence on the parent sporophyte for the nutrition are certain features considered as pre-requisites for the formation of seeds.

Classification of Pteridophytes



Affinities of Pteridophytes with Bryophytes

I. Resemblances of pteridophytes with bryophytes

(i) Identical jacketed sex organs.
(ii) Flagellated male gametes.
(iii) Fertilisation in film of water.
(iv) Fundamentally similar structure of archegonium.
(v) Both show heteromorphic alternation of generation.
(vi) The sexual reproduction in both groups is oogamous; the male and female reproductive structures are known as antheridia and archegonia respectively.
(vii) Zygote forms embryo.
(viii) The terminal sporangia with columella of Psilophytales are similar to moss capsules.
(ix) Many pteridophytes are homosporous (*e.g.*, *Lycopodium*, *Equisetum*, *Psilotum*, *Polypodium*, etc.) like bryophytes.

II. Differences between pteridophytes and bryophytes

(i) The most striking characteristic which distinguishes pteridophytes from bryophytes is that the plant body in the former is sporophytic and in the latter gametophytic.
(ii) The plant body of pteridophytes is differentiated into root, stem and leaves, whereas in bryophytes it is thalloid or foliose.
(iii) The vascular system of pteridophytes is well developed and composed of xylem and phloem, whereas there is no vascular tissue in bryophytes.
(iv) Vegetative reproduction is more common in bryophytes than in pteridophytes.
(v) Bryophytes are always homosporous, whereas many pteridophytes show heterospory.
(vi) In pteridophytes, the sporophyte is large, long lived and independent of the gametophyte but in bryophytes, it is completely or partly dependent on the gametophyte.
(vii) The sporophyte of some bryophytes has elaters along with spores but elaters are altogether absent in pteridophytes.

Intext Practice Questions

5. Briefly comment on significance of heterospory.
6. Write down the general characteristics of seedless vascular plants.

GYMNOSPERMS

- Gymnosperms are plants with naked seeds, having freely exposed ovules on megasporophylls. They are referred to as phanerogams without ovary and act as connecting link between pteridophytes and angiosperms.

General Characteristics

- Though the gymnosperms are widely distributed but they are more abundant in temperate regions.
- Sporophyte is dominant and differentiated into root, stem and leaves. Usually tap roots are present but in some cases **coralloid** roots (*e.g.*, *Cycas*) or mycorrhiza (*e.g.*, *Pinus*) is present. Stem is erect, aerial and woody. It may be branched or unbranched *e.g.*, *Cycas*.
- Leaves are dimorphic *i.e.*, foliage and scale leaves. Flowers are absent, instead sporophylls *i.e.*, microsporophylls and megasporophylls are aggregated to form distinct cones or strobili.
- Plants may be dioecious (*e.g.*, *Cycas*) or monoecious (*e.g.*, *Pinus*) and are heterosporous producing microspores and megaspores.
- Gametophytic generation is much reduced. The pollen grain forms the first male gametophyte while the female gametophytic cells is represented by functional megaspore that produces nuclear and later cellular female gametophyte (archegonia).
- Pollination takes place by wind and pollen grains directly reach the ovules. The male gametes reaches the female gamete by forming a tube *i.e.*, **Siphonogamy**, to effect fertilisation.
- Endosperm is gametophytic and derived from female gametophyte. Polyembryony is common in *Pinus*. The number of cotyledons may be one or two or a whorl of many.
- Fruits are not formed due to absence of ovary.
- Xylem do not possess vessels (except in Gnetales) and phloem do not possess companion cells and sieve tubes.
- Vascular bundles are open in stem, thus show secondary growth.

Classification of Gymnosperms

Gymnosperms

Cycadopsida
- Primitive group, represented by small plants.
- Wood is manoxylic.
- Male cones are large with compactly arranged microsporophylls.
- Megasporophylls are loosely arranged and does not form a cone.
- Seeds are radially symmetrical.
- Examples : *Cycas*, *Zamia*, etc.

Coniferopsida
- Includes larger dominant gymnosperms.
- Wood is pycnoxylic.
- Sporophylls form cones.
- Seeds are bilaterally symmetrical.
- Examples : *Pinus*, *Ginkgo*, *Taxus*.

Gnetopsida
- Includes advanced gymnosperms.
- Secondary xylem shows vessels.
- Ovules are orthotropous with long tubular micropyle.
- Examples : Order Gnetales (*Gnetum*, *Ephedra*, *Welwitschia*)

Economic Importance

Food
Seeds of *Pinus gerardiana* are edible and are eaten after roasting.

Timber
The softwood of gymnosperms is used in preparation of light furniture, plywood, packing cases etc.

Paper
A wide range of gymnosperms are utilised in manufacture of paper *e.g.*, *Picea*, *Pinus*, *Abies* etc.

Resin
It is a semifluid secretion containing terpenes, resin, acids and esters which solidifies on exposure to air. It helps in sealing, is antiseptic and toxic to pests, thus, prevents microbial and insect attack. Resin is commercially extracted to obtain turpentine and resin.

Ephedrine
It is a drug obtained from *Ephedra* and used in curing respiratory ailment, including asthma.

Prior infections driving dengue virus evolution in India

Several lines of evidence point to interlinked dengue evolution driven by the underlying population-level natural immunity

Based on an analysis of 184 whole-genome dengue sequences and 408 E gene sequences from India spanning more than 60 years, a team led by Dr. Rahul Roy from the Department of Chemical Engineering at the IISc have carried out a detailed investigation of the virus diversity and evolutionary dynamics of the virus in India. They have analysed how the virus evolves from its ancestors in the presence of serotypes.

Dengue virus evolution and vaccine efficacy

The analysis was based on 184 whole-genome dengue sequences and 408 E gene sequences from India spanning more than 60 years.

1 People with prior infection are protected from reinfection by the same serotype. But a different serotype can cause a second infection.

2 The second infection generally causes more severe disease.

3 Protection against the virus that is identical to the one that caused the first infection lasts for a long time. But viruses that are a bit look-alike of the serotye that caused the first infection have greater ability to cause severe disease.

4 The dominant immune selection pressure has led to the emergence of a unique Indian dengue lineage (DENV-4-Id) belonging to serotype 4.

5 The DENV-4-Id lineage is dominant in South India and is responsible for about 50% of infections.

Vector : *Aedes aegypti* mosquitoes can carry any of the four dengue virus serotypes.

6 Most of dengue virus evolution happens in the E gene and evolution is driven primarily due to interaction with the host immune system.

7 As the current Indian lineages are highly divergent from those used in all major vaccines, there can be significant reduction in vaccine efficacy.

Cross-protection

While the first infection with any of the four dengue serotypes can prevent reinfection by the same serotype for a long period, the second infection by a different serotype can have a very high viral load and cause severe disease. This is because the cross-protection offered by the first infection acts as a shield against other serotypes only for two-three years and then begins to drop.

Around one-three years after the cross-protection begins to wane is the time when antibody-dependent enhancement is most likely. This is because while the antibodies are not able to neutralise the virus belonging to different serotypes, the virus is better able to bind to the antibodies leading to higher cell infection and thus enhanced severity and viral load. This is called the antibody-dependent enhancement mediated by cross-reactive antibodies.

While the virus that is identical to the one that caused the first infection will be neutralised for a long time, viruses that are a bit look-alike of the serotype that caused the first infection have greater ability to take advantage of the weakened immune responses and bind to pre-existing antibodies and cause severe disease than the three other serotypes that did not cause the first infection, according to Suraj Jagtap from the Department of Chemical Engineering, IISc and the first author of a paper published in *PLOS Pathogens*.

"Several lines of evidence point to this interlinked dengue evolution driven by the underlying population-level natural immunity in India. The cross-reactive antibodies and cellular immunity from prior dengue infections can drive such co-evolution in endemic regions," Dr. Roy elaborates.

The dominant immune selection pressure has led to the emergence of a unique Indian dengue lineage (DENV-4-Id) belonging to serotype 4 (DENV-4). "The DENV-4-Id lineage has diverged away from global sequences," says Dr. Roy.

South India

"The DENV-4-Id lineage is dominant in South India, and about 50% of infections in South India are due to this India-unique lineage," says Dr. Roy. "We strongly feel that the DENV-4-Id lineage will become dominant in North India too."

The E gene, which is seen across the dengue virus exterior, plays an important role in binding to the cell receptors. The substitution rate for the E gene was highest at 44% in genotype I of DENV-4 compared with the whole genome, suggesting high immunological pressure driving the divergence of the DENV-4 E gene. "Most of dengue virus evolution happens in the E gene. This suggests that evolution is driven primarily due to interaction with host immune system," says Dr. Roy.

Taking a cue from the divergence of DENV-4-Id, the researchers examined whether the high seroprevalence can play a role in the evolution of dengue in India. "We identified recurring fluctuations in the divergence of envelope gene sequences of circulating dengue viruses in South India, indicating that all four serotypes are co-evolving," says Dr. Roy.

"In South India, we find that, in general, the E gene diverges from the ancestral sequence for all serotypes, but this divergence fluctuates over time. Overall, in our dataset, the E gene sequences within a serotype and between serotypes bring the viruses closer or similar to the ancestors or drift away from the ancestors. And this happens in a coordinated fashion across all four serotypes," says Dr. Roy. "This behaviour is pronounced in DENV-2 and DENV-4 with an estimated time period (peak-to-peak) of about three years."

The evolution of the viruses across serotypes has implications for vaccine efficacy. The majority of strains used for developing dengue vaccines are based on strains isolated between 1964 and 1988.

"As the current Indian lineages are highly divergent from those used in all major vaccines (the genotypes used in the vaccine strains are not observed in India), there is a potentially significant reduction in vaccine efficacy," says Dr. Roy. "Overall, about 6% of all known epitopic regions are different in Indian dengue sequences compared to the vaccine strains. Further, almost half of all the E protein variations lie either in known epitopic regions where the antibodies bind to or have a positive antigenic effect."

Indian variants of DENV-1 and DENV-4 are distinct from all the vaccines compared to DENV-2 and DENV-3.

Courtesy : The Hindu

Affinities of Gymnosperms with Pteridophytes

I. Resemblances of gymnosperms with pteridophytes

(i) Both these groups show distinct alternation of generations with dominant sporophytic phase.

(ii) Sporophytic plant body is differentiated into root, stem and leaves.

(iii) The leaves of gymnosperms show circinate vernation like those of ferns. They are pinnately composed in the groups.

(iv) Xylem in pteridophytes as well as gymnosperms lacks vessels except for Gnetales. Phloem is devoid of companion cells.

(v) Several fossils and living pteridophytes show secondary growth like gymnosperms.

(vi) In some gymnosperms like *Cycas*, sporangia occur in groups or in sori as in ferns.

(vii) Sporangia are formed on specialised leaves, known as sporophylls. As in most pteridophytes, mega- and microsporophylls also form compact strobili in gymnosperms.

(viii) In some pteridophytes, suspensor is also formed during embryo development as in gymnosperms.

II. Differences between gymnosperms and pteridophytes

(i) Gymnosperms are mostly trees, whereas pteridophytes are usually perennial herbs or shrubs.

(ii) Pteridophytes usually grow in moist, shady and terrestrial places, while gymnosperms occur in xerophytic habitats.

(iii) Pteridophytes possess adventitious roots, whereas gymnosperms have tap roots.

(iv) Pteridophytes lack vascular cambium (hence do not show secondary growth), while cambium is present in gymnosperms (hence they show secondary growth).

(v) Gymnosperms have ovule and seeds but these structures are absent in pteridophytes.

(vi) The gametophytes of gymnosperms are fully dependent on sporophyte, whereas those of pteridophytes are green, autotrophic and independent of sporophyte.

(vii) In gymnosperms, partial development of the male gametophyte occurs within the sporangium, but in pteridophytes spores germinate only after their liberation from the sporangium.

(viii) Pollen tube is the sperm carrier in gymnosperms, whereas no such structure is formed in pteridophytes.

(ix) Neck canal cells are absent in gymnosperms but are present in pteridophytes.

INTEXT PRACTICE QUESTIONS

7. "Gymnosperms are referred as naked seeded plants." Justify the statement.
8. Give some medicinal uses of Gymnosperms.

ANGIOSPERMS

- Angiosperms are seed plants in which sporophylls are organised into flowers and seeds are produced inside fruits. They are the most highly evolved plants and form the dominant vegetation of present day earth.

General Characteristics

- Angiosperms or flowering plants occur in most environments on the earth.
- Plant body is sporophytic and represented by herbs, shrubs, trees, twiners, trailers, climbers, etc.
- Sporophyte is differentiated into roots, stem and leaves.
- Xylem possess vessels while phloem possess sieve tubes and companion cells. Vascular bundles are conjoint and collateral and open in dicots, hence show secondary growth.
- Sporophylls are aggregated to form flowers. Both microsporophylls and megasporophylls are specialised to form stamen and carpel producing male and female gametes respectively.
- Archegonia is absent and female gametophyte is represented by embryo sac.
- Pollination takes place by several agencies.
- Double fertilisation is characteristic feature of angiosperms, wherein of two male gametes, one fuses with egg to form zygote while other fused with central cell to form PEN (Primary endosperm nucleus).
- Endosperm is triploid, formed after fertilisation and represents a new structure.
- The ovary develops into fruit and ovules ripen into seeds, after fertilisation. This is another peculiar feature of angiosperms.

Angiosperms have developed **xylem vessels** that are absent in all other vascular plants. Vessels are efficient conductors. Besides, flower ensure pollination and fruits ensure seed dispersal more effectively. That is why they make the dominant vegetation on earth.

Classification of Angiosperms

- Angiosperms are divided into two classes:

Table: Comparison between dicots and monocots

Features	Dicots	Monocots
Cotyledons	Usually two	One cotyledon
Flowers	Penta or tetramerous	Trimerous
Pollen grains	Three germ pores	Single germinal furrow
Venation	Reticulate	Parallel except a few
Primary root	Often long lived forming tap root system. Adventitious roots occur in some.	Short-lived, Tap roots absent, instead adventitious roots are found.
Vascular bundles of stem	In a ring, cambium (open), thus secondary growth present.	Scattered, cambium is absent (closed).
Root	Pith absent or small. Vascular bundles 8 or less.	Pith present. Vascular bundles more than 8.
Xylem vessels	Polygonal	Rounded

Affinities of Gymnosperms with Angiosperms

I. Resemblances of gymnosperms and angiosperms

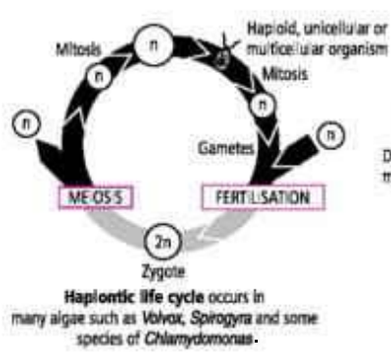
(i) Sporophyte is differentiated into root, stem and leaves.
(ii) The vascular system of stem consists of conjoint, collateral and open vascular bundles.
(iii) The stem increases in girth by secondary growth.
(iv) Vessels and companion cells also occur in some gymnosperms (Gnetales) like angiosperms.
(v) Like gymnosperms, many angiosperms are also wind pollinated.
(vi) Fertilisation occurs with the help of pollen tube in both groups.
(vii) Development of megaspore into female gametophyte takes place inside the megasporangium (ovule).
(viii) In both groups, ovules develop into seeds.
(ix) The seed germination is epigeal or hypogeal in both groups.
(x) The gametophytic phase is reduced in both groups.

II. Differences between gymnosperms and angiosperms

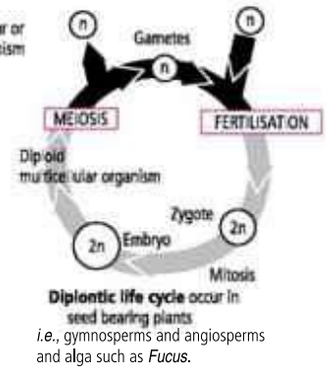
(i) Gymnosperms are mostly woody trees, but angiosperms have a variety of trees, shrubs or herbs.
(ii) Xylem vessels and companion cells are of universal occurrence in angiosperms (except for some vessel-less genera) but they are only confined to Gnetales amongst gymnosperms.
(iii) The strobili of gymnosperms are usually unisexual, whereas the flowers of angiosperms are mostly bisexual.
(iv) The ovules of gymnosperms are naked, whereas those of angiosperms remain enclosed within the ovary wall.
(v) The structures like ovary, style and stigma are not found in gymnosperms.
(vi) In the female gametophyte of gymnosperms, archegonia are present but they are not found in angiosperms.
(vii) Double fertilisation and triple fusion found in angiosperms, do not occur in gymnosperms.
(viii) Free nuclear divisions occur in the zygote of gymnosperms but they do not occur in angiosperms.

ALTERNATION OF GENERATION

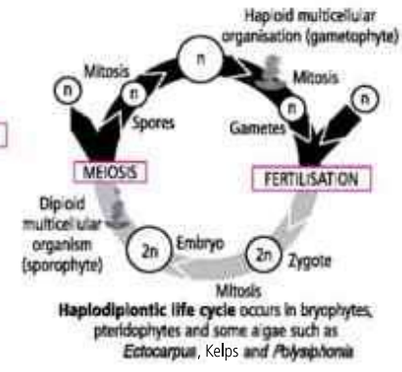
- Different plant groups complete their life cycles in different patterns. The phases in which the life cycle is completed is called alternation of generations.
- It may be of three types in plants.



Haplontic life cycle occurs in many algae such as *Volvox*, *Spirogyra* and some species of *Chlamydomonas*.



Diplontic life cycle occur in seed bearing plants *i.e.*, gymnosperms and angiosperms and alga such as *Fucus*.



Haplodiplontic life cycle occurs in bryophytes, pteridophytes and some algae such as *Ectocarpus*, Kelps and *Polysiphonia*

INTEXT PRACTICE QUESTIONS

9. Mention the adaptations of angiosperms to land.
10. How many types of life cycle does green algae exhibit?

☺☺

CBSE warm-up!

CLASS-XI

Chapterwise practice questions for CBSE Exams as per the latest pattern and reduced syllabus by CBSE for the academic session 2023-24.

Series-1

• Living World • Biological Classification • Plant Kingdom • Animal Kingdom

GENERAL INSTRUCTIONS

(i) All questions are compulsory.
(ii) The question paper has five sections and 33 questions. All questions are compulsory.
(iii) Section–A has 16 questions of 1 mark each; Section–B has 5 questions of 2 marks each; Section– C has 7 questions of 3 marks each; Section– D has 2 case-based questions of 4 marks each; and Section–E has 3 questions of 5 marks each.
(iv) There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
(v) Wherever necessary, neat and properly labelled diagrams should be drawn.

Time Allowed : 3 hours **Maximum Marks : 70**

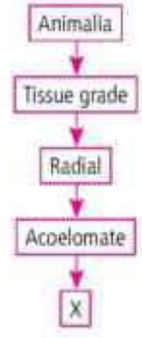
SECTION-A

1. Which of the following characters belongs to the Kingdom Monera?
(a) Eukaryotic
(b) Heterotrophic
(c) Multicellular
(d) Presence of cell wall made of cellulose

2. Which one of the following shows the hierarchical arrangement of taxonomic categories of plants in descending order?
(a) Kingdom ← Division ← Class ← Order ← Family ← Species ← Genus
(b) Kingdom ← Division ← Order ← Class ← Family ← Genus ← Species
(c) Kingdom → Division → Order → Class → Family → Genus → Species
(d) Kingdom → Division → Class → Order → Family → Genus → Species

3. Which of the following groups of algae produces algin?
(a) Phaeophyceae and Chlorophyceae
(b) Rhodophyceae and Phaeophyceae
(c) Chlorophyceae and Rhodophyceae
(d) Phaeophyceae only

4. Identify the Phylum X.



(a) Hemichordata (b) Aschelminthes
(c) Platyhelminthes (d) Coelentrata

5. Select the wrong statement.
(a) The walls of diatoms are easily destructible.
(b) 'Diatomaceous earth' is formed by the cell walls of diatoms.
(c) Diatoms are chief producers in the oceans.
(d) Diatoms are microscopic and float passively in water.

6. Class is the category of taxonomy which includes related
(a) families (b) orders
(c) genus (d) species.

7. Match column I with column II and choose the correct options.

Column I		Column II
I.	Incomplete digestive system	A. Porifers
II.	Cellular level of organisation	B. Coelenterates
III.	Radial symmetry	C. Annelids
IV.	Pseudocoelomate	D. Platyhelminthes
V.	Metamerism	E. Aschelminthes

(a) I-C, II-D, III-A, IV-B, V-E
(b) I-D, II-E, III-B, IV-C, V-A
(c) I-D, II-A, III-B, IV-E, V-C
(d) I-A, II-B, III-C, IV-D, V-E

8. Morels and truffles groups of fungi are classified under
(a) Phycomycetes (b) Deuteromycetes
(c) Basidiomycetes (d) Ascomycetes.

9. Match column I with column II for housefly classification and select the correct option using the codes given below.

Column I		Column II
A.	Family	(i) Diptera
B.	Order	(ii) Arthropoda
C.	Class	(iii) Muscidae
D.	Phylum	(iv) Insecta

(a) A-(iii), B-(i), C-(iv), D-(ii)
(b) A-(iii), B-(ii), C-(iv), D-(i)
(c) A-(iv), B-(iii), C-(ii), D-(i)
(d) A-(iv), B-(ii), C-(i), D-(iii)

10. Which of the following does not belong to Class Basidiomycetes?
(i) *Agaricus* (ii) *Aspergillus*
(iii) *Puccinia* (iv) *Saccharomyces*
(v) *Ustilago*
(a) (i) and (ii) only (b) (ii) and (iii) only
(c) (iii), (iv) and (v) only (d) (ii) and (iv) only

11. Conifers are adapted to tolerate extreme environmental conditions because of
(a) broad hardy leaves (b) superficial stomata
(c) thick cuticle (d) presence of vessels.

12. Which group of animals belong to the same phylum?
(a) Prawn, Scorpion, *Locusta*
(b) Scypha, Sea anemone, Starfish
(c) Leech, *Amoeba*, Octopus
(d) Earthworm, Roundworm, Tapeworm

Question No. 13 to 16 consist of two statements – Assertion (A) and Reason (R).

Answer these questions selecting the appropriate option given below:

(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true and R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

13. **Assertion (A) :** Cats and dogs have some similarities.
Reason (R) : Cats and dogs belong to the same Family Canidae.

14. **Assertion (A) :** Pasteur coined *Contagium Vivum Fluidum*.
Reason (R) : M.W. Beijerinck found that virus infected plant of tobacco can cause infection in healthy plant.

15. **Assertion (A) :** In Chlorophyceae, plant body is usually grass green.
Reason (R) : Members of Chlorophyceae, possess chlorophyll *a*, *c*, carotenoids and xanthophyll.

16. **Assertion (A) :** Cnidarians which exist in both forms, polyp and medusa, exhibit metagenesis.
Reason (R) : Polyp produces medusae sexually and medusae form the polyp asexually.

SECTION-B

17. Brinjal and potato belong to the same Genus *Solanum*, but to two different species. What defines them as separate species?

18. Who proposed the five kingdom classification? Name the five kingdoms.

19. Differentiate between a virus and a viroid.

20. Why artificial system of classification not accepted? Give reason.

21. Which animal exhibits the phenomenon of bioluminescence? Mention its phylum.

OR

To which class of vertebrates do *Petromyzon* belong? Write its characters.

SECTION-C

22. Give complete hierarchial classification of
(a) Mango (b) Wheat.

23. Discuss the economic importance of algae in brief.

24. **(a)** What makes species a basic taxonomic category?

(b) What is a monotypic genus?

25. **(a)** Give a brief account of the type of body plan found in sponges. How is it different than the body plan of flatworms?

(b) Name the animal groups which have four chambered heart.

26. What are the different phases in the process of sexual reproduction in fungi? Explain.

OR

How will you differentiate fungi from plants?

27. Write four similarities and four differences between gymnosperms and pteridophytes.

28. Identify the phylum that exhibit each of the following features:

(a) Jointed appendages

(b) Comb plates

(c) Water vascular system

(d) Pseudocoelom

(e) Metagenesis

(f) Notochord

SECTION-D

Question No. 29 and 30 are case based questions. Each question has subparts with internal choice in one subpart.

29. There are fundamental features common to various individuals inspite of differences in structure and form of different animals. These includes arrangement of cells, body symmetry, nature of coelom, patterns of digestive, circulatory or reproductive systems. Refer to the given figures of animals, identify them and answer the following questions.

A B C D

(a) Name the phylum under which animal A is categorised.

(b) Mention the role of the most distinctive feature of animal 'B'.

(c) Mention four characteristic features of animal 'C'.

OR

(c) Mention four characteristic features of animal 'D'.

30. Algae are chlorophyll-bearing, simple thalloid, autotrophic and largely aquatic organisms. They occur in variety of other habitats: moist stone, soils and wood. Refer to the given table showing various classes of algae with their few characteristic features, identify them and answer the following questions.

Classes	Stored food	Cell wall
A	Starch	Cellulose
B	Mannitol, laminarin	Cellulose and algin
C	Floridean starch	Cellulose, pectin and polysulphate esters

(a) Identify the above mentioned algae and give two examples of each classes.

(b) Name the algae which is used for commercial production of agar. In which of the classes mentioned in table these algae belong?

(c) Discuss briefly about reproduction occurs in class 'A'.

OR

(c) Name the major pigments present in classes A, B and C.

SECTION-E

31. Make a comparison table for characteristics of five kingdom classification.

OR

List the salient features of Kingdom Protista.

32. Describe the general characteristics of seedless vascular plants.

OR

"Gametophyte is the dominant phase in the life cycle of a bryophyte". Explain.

33. (a) Compare the characters of chordates and non-chordates.

(b) Why is *Pila* asymmetrical?

OR

"Mammals are most adapted among the vertebrates". Elaborate.

SOLUTIONS

1. **(b) :** Kingdom Monera comprises of unicellular, prokaryotic organisms. Some of the bacteria are autotrophic but vast majority are heterotrophs, *i.e.*, they depend on other organisms or on dead organic matter for food. They have peptidoglycan cell wall and genetic material lies freely in the cytoplasm, known as nucleoid.

2. **(d)**

3. **(d) :** Alginic acid (or algin or alginate) is an anionic polysaccharide distributed widely in the cell walls of many brown algae (Phaeophyceae). It is a phycocolloid which is obtained commercially from *Laminaria, Macrocystis, Nereocystis, Fucus, Sargassum*, etc.

4. **(d)**

5. **(a) :** Diatoms are marine or freshwater unicellular organisms which have cell walls (frustules) composed of pectin impregnated with silica and consisting of two halves, one overlapping the other. The siliceous frustules of diatoms do not decay easily.

6. **(b) :** The seven obligate categories used in taxonomy are: Kingdom, Phylum/Division, Class, Order, Family, Genus, Species. Class includes a group of related orders *e.g.*, Class-

Mammalia includes different orders such as Rodentia (of rats), Lagomorpha (of rabbits) and Carnivora (of cats and dogs).

7. **(c)**

8. **(d) :** Morels and truffles are classified under Class Ascomycetes. They are edible and are considered delicacies.

9. **(a)**

10. **(d) :** *Aspergillus* and *Saccharomyces* are classified under Ascomycetes.

11. **(c) :** Needle like leaves with thick cuticle and sunken stomata are xerophytic adaptations of conifers for tolerating extreme environmental conditions.

12. **(a) :** Prawn, Scorpion and *Locusta* belong to the Phylum Arthropoda. All other animals categories are given below:

Sponge	→	Porifera
Sea anemone	→	Coelenterata
Starfish	→	Echinodermata
Leech	→	Annelida
Amoeba	→	Protozoa
Octopus	→	Mollusca
Earthworm	→	Annelida
Roundworm	→	Aschelminthes
Tapeworm	→	Platyhelminthes

13. **(d)**

14. **(d) :** M. W. Beijerinck demonstrated that the extract of the infected plant of tobacco could cause infection in healthy plants and called the fluid *Contagium Vivum Fluidum* (infectious healthy fluid).

15. **(c) :** Members of Chlorophyceae are commonly called green algae. The plant body is usually grass green due to the dominance of pigments, chlorophyll *a* and *b*.

16. **(c) :** Polyp produces medusae asexually and medusae form the polyp sexually.

17. Genus is a group or assemblage of related species which resemble one another in certain correlated characters. Brinjal and potato belong to same Genus *Solanum* but they are different species *Solanum melongena* and *Solanum tuberosum*, respectively. The basic criterion for defining two different species is that they cannot interbreed and produce fertile offspring. Potato and brinjal neither actually nor potentially interbreed, thus they are defined as separate species.

18. Five kingdom classification was proposed by R.H. Whittaker in 1969. The five kingdoms are :

(i) Kingdom Monera (ii) Kingdom Protista
(iii) Kingdom Fungi (iv) Kingdom Plantae
(v) Kingdom Animalia

19. The differences between virus and viroid are as follows :

	Virus	Viroid
(i)	Virus is a nucleoprotein particle.	Viroid is a RNA particle.
(ii)	Nucleic acid can be DNA or RNA.	Viroid is formed of only RNA.
(iii)	A protein covering or coat is present.	A protein coat is absent.
(iv)	Virus has a larger size.	Viroid has a smaller size.
(v)	Virus is known to infect all types of organisms.	Viroid is known to infect only plants.

20. Artificial system of classification were based upon morphological characters (such as habit, habitat, colour, number and shape of leaves, etc.) for grouping of organisms. Such systems often separated the closely related species since they were based only on a few characteristics. Hence, it was not accepted because morphological characters often tend to be easily affected by environment.

21. *Pleurobrachia* exhibits the phenomenon of bioluminescence *i.e.*, phenomenon of emission of light by living organisms. It belongs to the Phylum Ctenophora.

OR

Petromyzon belongs to Class Cyclostomata of Subphylum Vertebrata. Some characteristic features are:

(i) It has both parasitic and non-parasitic species, as it sucks out blood of host fish.
(ii) 7 pairs of external gill slits.
(iii) Brain better developed as compared to other cyclostomes and 10 pairs of cranial nerves.
(iv) Sexes are separate, external fertilisation and indirect development with ammocoete larva.

22. **(a) :** Classification of mango is as follows:

Phylum	-	Angiospermae
Class	-	Dicotyledonae
Order	-	Sapindales
Family	-	Anarcardiaceae
Genus	-	*Mangifera*
Species	-	*indica*

(b) Classification of wheat is as follows:

Division	-	Angiospermae
Class	-	Monocotyledonae
Order	-	Poales
Family	-	Poaceae
Genus	-	*Triticum*
Species	-	*aestivum*

23. Economic importance of algae can be discussed under following headings :

(i) Food - Sea weeds and certain marine algae are used as food *e.g.*, *Porphyra*, *Laminaria*, *Sargassum* etc. *Chlorella* and *Spirulina* are rich sources of proteins, hence used as food supplements by space travellers.

(ii) Photosynthesis - Nearly 50% of total photosynthesis on earth is carried out by algae. It is essential for respiration of aquatic life.

(iii) Alginic acid - Obtained from members of Phaeophyceae such as *Laminaria*, *Macrocystis*, *Fucus* etc. It is used in stabilising emulsions, flameproof plastics, security glass and artificial fibres.

(iv) Agar-agar - A phycocolloid extracted from species of red algae *viz*. *Gelidium* and *Gracilaria* is used as a solidifying agent in culture medium, canning of fish and meat, sizing of textiles and paper etc.

(v) Carrageenan - Obtained from red algae *Chondrus crispus* and is used as pharmaceutical emulsifier, cleaning agent and in textile, leather and brewing industries.

(vi) Sewage disposal - Green algae like *Chlamydomonas*, *Chlorella*, *Scendesmus* are components of sewage oxidation tanks which provide aerobic conditions for disposal of sewage by decomposers.

24. **(a)** Species is the lowest or basic taxonomic category which consists of one or more individuals that resemble one another more closely than individuals of other species. The members of a species interbreed freely and are reproductively isolated from other species. These characters make species a basic taxonomic category.

(b) Monotypic genus is a genus containing only one species.

25. **(a)** Sponges have cell aggregate type of body plan. The body consists of a cluster or aggregation of cells which have rudimentary differentiation but are not organised into tissues or organs, while the flatworms have blind sac body plan. The body has a single cavity with one opening to the outside. The single opening functions as both mouth for ingestion and anus for egestion.

(b) Birds and mammals have complete four-chambered heart.

26. There are three distinct phases in the process of sexual reproduction which occur in sequence of plasmogamy, karyogamy and meiosis.

Plasmogamy involves union between two protoplasts resulting in bringing the fusing nuclei of different parents close to each other.

Karyogamy – By fusion of two haploid nuclei, a diploid zygote is produced called synkaryon.

Meiosis – The diploid nucleus divides by meiosis resulting in the formation of haploid nuclei. Usually meiosis occurs immediately after fusion of two nuclei. In most of the lower fungi, plasmogamy is immediately followed by karyogamy and meiosis. In higher forms, the karyogamy is delayed so that the fungus remains dikaryotic. This phase of the fungus is called dikaryophase.

OR

Differences between fungi and plants are as follows:

(i) Fungi differ fundamentally from plants in their lack of chlorophyll, which means they are unable to synthesise their own organic food.

(ii) Like plants, they have walled cells but their walls do not contain cellulose (with one exception, *i.e.*, oomycetes)

(iii) They obtain their nutrients from the surrounding media by absorbing soluble inorganic and organic molecules.

(iv) They store the food in the form of glycogen rather than starch, as most plants do.

(v) Fungal bodies are filamentous, not parenchymatous.

(vi) Their many biochemical pathways differ significantly from plants.

27. Similarities between gymnosperms and pteridophytes are as follows:

(i) Both these groups show distinct alternation of generations with dominant sporophytic phase.

(ii) Sporophytic plant body is differentiated into root, stem and leaves.

MIRROR GRAM

Use a mirror to read each word *and* record it on answer sheet

HEART	TAXON
REPLICATION	GENETICS
PHOTOSYNTHESIS	

ANSWERS

1. TAXON 2. HEART
3. GENETICS 4. REPLICATION
5. PHOTOSYNTHESIS

(iii) The leaves of gymnosperms show circinate vernation like those of ferns.

(iv) Xylem in pteridophytes as well as gymnosperms lacks vessels except for Gnetales. Phloem is devoid of companion cells.

Differences between gymnosperms and pteridophytes are as follows:

(i) Gymnosperms are mostly trees, whereas pteridophytes are usually perennial herbs or shrubs.

(ii) Pteridophytes usually grow in moist, shady and terrestrial places, while gymnosperms occur in xerophytic habitats.

(iii) Pteridophytes possess adventitious roots, whereas gymnosperms have tap roots.

(iv) Gymnosperms have ovule and seeds but these structures are absent in pteridophytes.

28. (a) Arthropoda

(b) Ctenophora

(c) Echinodermata

(d) Achelminthes

(e) Coelenterata

(f) Chordata

29. (a) Animal A is prawn which belongs to Phylum Arthropoda.

(b) Animal B is *Asterias* which are echinoderms. The most distinctive feature of echinoderms is the presence of water vascular system which helps in locomotion, capture and transport of food and respiration.

(c) Animal C is *Hippocampus* which belongs to Class Osteichthyes. Characteristic features of *Hippocampus* are as follows:

(i) Their body is streamlined.

(ii) They have four pairs of gills covered by an operculum on each side.

(iii) They have air bladder which regulates buoyancy.

(iv) They are cold-blooded animals. *i.e.*, poikilothermous.

OR

(c) Animal D is *Ornithorhynchus* which are mammals. Characteristic features of *Ornithorhynchus* are as follows:

(i) They have milk producing mammary glands for nourishing their young ones.

(ii) They have two pairs of limbs, adapted for walking, running, climbing, burrowing, swimming or flying.

(iii) They are warm-blooded animals, *i.e.*, homoiothermous.

(iv) External ears or pinnae are present.

30. (a) A, B, and C represents chlorophyceae, phaeophyceae and rhodophyceae respectively. Examples of each classes are as follows:

Chlorophyceae (A) – *Volvox, Ulothrix*

Phaeophyceae (B) – *Ectocarpus, Dictyota*

Rhodophyceae (C) – *Polysiphonia, Porphyra*

(b) *Gelidium* and *Gracilaria* are used for commercial production of agar. These algae belongs to rhodophyceae (C) or red algae.

(c) In chlorophyceae, vegetative reproduction usually takes place by fragmentation or by formation of different types of spores. Asexual reproduction is by flagellated zoospores produced in zoosporangia. The sexual reproduction shows considerable variation in the type and formation of sex cells and it may be isogamous, anisogamous or oogamous.

OR

(c) The major pigments in chlorophyceae are chlorophyll *a* and *b*.
The major pigments in phaeophyceae are chlorophyll *a*, *c* and fucoxanthin
The major pigments in rhodophyceae are chlorophyll *a*, *d* and phycoerythrin.

31. The characteristics of five kingdom of classification are as follows:

	Characters	Monera	Protista	Fungi	Plantae	Animalia
(i)	Cell type	Prokaryotic	Eukaryotic	Eukaryotic	Eukaryotic	Eukaryotic
(ii)	Mitochondria	Absent	Present	Present	Present	Present
(iii)	Plastids (chloroplasts)	Absent	Present in some cases	Absent	Present	Absent
(iv)	Cell wall and its chemical nature	Non-cellulosic (polysaccharide + amino acid)	Present in some (various types)	Present (Non-cellulosic)	Present (cellulose)	Absent
(v)	Nuclear membrane	Absent	Present	Present	Present	Present

(vi)	Multicellularity	Absent	Absent	Present	Present	Present
(vii)	Motility	By flagella, gliding or non-motile	By cilia, flagella, amoeboid, contractile fibrils	By cilia, flagella in some or mostly non-motile	By cilia and flagella in lower forms, absent in most forms	By cilia and flagella, contractile fibrils
(viii)	Nutrition	Autotrophic (chemosynthetic and photosynthetic), heterotrophic (saprophyte or parasitic)	Photosynthetic or heterotrophic	Heterotrophic saprophytic or parasitic absorption	Autotrophic by photosynthesis	Heterotrophic (holozoic/ saprophytic)
(ix)	Sexual reproduction	Conjugation, transduction, transformation or none	Syngamy followed by meiosis, conjugation or none	Fertilisation followed by meiosis or none, dikaryons may be formed	Fertilisation, meiosis	Fertilisation, meiosis
(x)	Nervous system	Absent	Primitive for conduction of stimuli	Absent	Absent	Present, usually complex

OR

Salient features of Kingdom Protista are :

(i) They are unicellular and colonial eukaryotes.

(ii) They are mostly aquatic organisms.

(iii) The cellular organisation is of two-envelope type with an outer cell membrane around the cytoplasm and number of membrane bound organelles inside the cytoplasm.

(iv) The cells may be naked or covered by cell wall, pellicle, shell or cuticle.

(v) A well defined nucleus is present. Protists can be uninucleate, binucleate or multinucleate. The genetic material is linear DNA, enclosed by nuclear envelope.

(vi) Cell wall, if present, contains cellulose.

(vii) Locomotion can occur through flagella, cilia, pseudopodia, contractions and mucilage extrusion.

(viii) Flagella and cilia, when present, have 9 + 2 pattern of microtubular strands.

(ix) The nutritive modes are variable *i.e.*, photosynthetic (= holophytic), ingestive (= holozoic, phagotrophic) and absorptive (saprobic, parasitic).

(x) The photosynthetic protists act as chief producers of food in the oceans and in fresh water.

(xi) Food reserve is starch, glycogen, paramylon, chrysolaminarin and fat.

(xii) Some protists are parasitic. Some live symbiotically in the gut of animals while a few act as decomposers.

(xiii) Asexual reproduction is quite common and occurs through budding, binary fission, multiple fission, plasmotomy, sporulation, cyst formation, etc.

(xiv) Sexual reproduction occurs with the help of nonjacketed gametangia. It involves meiosis and karyogamy.

32. General characteristics of pteridophytes or seedless vascular plants can be described as follows:

(i) They grow in a variety of habitats but mostly they are terrestrial plants that thrive well in abundant moisture and shade while some flourish well in xeric conditions.

(ii) The sporophytic plant body is differentiated into true roots, stem and leaves, though some of the primitive members may lack true roots and well developed leaves.

(iii) Leaves can be microphyllous, *i.e.*, small without forming leaf gaps in vascular supply or macrophyllous, *i.e.*, large forming leaf gaps.

EXAM ALERT 2023

Exam	Date
NEET	7th May
CUET	21st to 31st May
MHT CET (PCB)	15th to 20th May
KCET (BM)	20th May

(iv) The branching of the stem may be dichotomous type or monopodial.

(v) Pteridophytes show presence of vascular tissues; xylem and phloem. In xylem, true vessels are absent while, in phloem, companion cells and sieve tubes are absent.

(vi) The vascular system of pteridophytes varies in different groups showing stelar system ranging from simple protostele, siphonostele or a dictyostele.

(vii) The sporophyte reproduces asexually by means of spores, produced in small capsules called sporangia. Leaves bearing sporangia are called sporophylls.

(viii) The diploid spore mother cells or sporocytes within the sporangia undergo meiosis or reduction division to form spores. These spores may be similar as in majority of pteridophytes called homosporous, *e.g.*, *Lycopodium* and *Dryopteris* or different with two types of spores (microspores and megaspores) called heterosporous, *e.g.*, *Selaginella*, *Salvinia*.

(ix) Spores upon germination give rise to haploid gametophytes or prothallus bearing multicellular, jacketed sex organs.

(x) Gametophytes formed from homospores are monoecious (both antheridium and archegonium are borne on same prothallus) while those formed from heterospores are dioecious (antheridium and archegonium develop on separate male and female prothallus).

(xi) Antheridia are small and sessile comprising of androcytes, each of which produces a motile antherozoid. Archegonia are partially embedded and consist of 4-rowed neck.

(xii) Water is essential for fertilisation, as it assists in carrying bi-or multiflagellate sperms to archegonia.

(xiii) The young sporophyte is dependent on gametophyte during its early years.

(xiv) Pteridophytes exhibit alternate succession of sporophytic and gametophytic generations.

OR

Bryophytes are a group of the simplest and primitive plants belonging to embryophyta. Gametophytic and sporophytic phases are present in the life cycle of bryophytes and both these phases are morphologically distinct (heteromorphic). Gametophytic phase in bryophytes is more conspicuous, long lived, independent, green and freely branched whereas, the sporophytic phase is short lived and dependent upon the gametophyte. The main plant body of the bryophyte is haploid and bears sex organs *i.e.*, antheridium and archegonium.

Antheridium produces a number of flagellate male gametes called sperms or antherozoids and archegonium is flask shaped with tubular neck and swollen venter. The gametophytic plant body of bryophytes is thalloid in liverworts whereas foliose in mosses. In liverworts, the thallus is differentiated into a dorsal photosynthetic and ventral storage region. Sex organs antheridia and archegonia are either distributed on the dorsal surface of the thallus or are on distinct receptacles. In mosses, the gametophyte has two growth stages (i) Protonema stage; it is the juvenile stage represented by prostrate, creeping, green and branched filamentous structure; it develops from the spore and is only a transitory vegetative stage and (ii) leafy stage or gametophore - an erect cylindrical shoot with persistent leaves and sex organs.

33. (a) Comparison between the chordates and non-chordates are as follows:

	Chordates	Non-chordates
(i)	A notochord is present at some stage in the life of chordates.	Notochord is not present at any stage in the life.
(ii)	Central nervous system is dorsal and hollow.	Central nervous system is ventral and solid.
(iii)	Gill slits are present in the pharynx either in the embryo or adult.	Gill slits are absent.
(iv)	Tail is present at some stage in the life of the chordates.	Tail is absent.
(v)	Heart is ventral.	Heart is dorsal.
(vi)	If present, RBCs contain respiratory pigment (haemoglobin).	If haemoglobin is present, it is found in the blood plasma. RBCs are absent.

(b) The early embryo of gastropods (*e.g.*, *Pila*) is bilaterally symmetrical, but during development, the body twists showing torsion and the body becomes asymmetrical.

OR

Mammals are most adapted among the vertebrates. This can be elaborated by the following characteristics of mammals :

(i) They are found in a variety of habitats like polar ice caps, mountains, deserts, forests and oceans.
(ii) Most of them are terrestrial but some of them are adapted to fly (bat) or live in water (whale).
(iii) They have 2 pairs of limbs, adapted for walking, running, climbing, burrowing, swimming or flying.
(iv) They have mammary glands and are the only animals which nourish their young ones with milk.
(v) They are capable of learning due to presence of developed brain and thus, are dominant animals.
(vi) Presence of muscular diaphragm is a characteristic feature of mammals which help in breathing.
(vii) Four-chambered heart with completely divided atrium and ventricles pump only oxygenated blood.
(viii) A well developed placenta is present except in egg laying mammals.
(ix) They are warm blooded, capable of maintaining constant body temperature. ***E.g.***, ***Macropus*** (Kangaroo), ***Equus*** (Horse), ***Macaca*** (Monkey), etc.

☺☺

MAY 22

International Day for BIOLOGICAL DIVERSITY

The United Nations has proclaimed May 22 as The International Day for Biological Diversity. Here's a quiz on Biodiversity

Q. Why is International Biodiversity Day celebrated?

Ans. The International Day for Biological Diversity aims to increase understanding and awareness of biodiversity issues.

Q. 'Biodiversity hotspots' are the regions with very high levels of species richness and high degree of endemism *i.e.*, species confined to that region and not found anywhere else. Which areas in India are known as 'biodiversity hotspots'?

Ans. The Himalayas, the Western Ghats, the Indo-Burma region and the Sundaland.

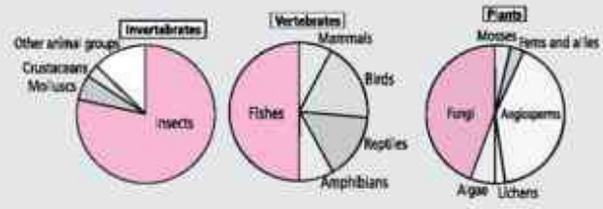
Q. There is a growing recognition that biological diversity is a global asset of tremendous value to future generations, the number of species is being significantly reduced by certain human activities. Given the importance of public education and awareness about this issue, the UN decided to celebrate the International Day for Biological Diversity annually.What was the theme of biodiversity day 2022?

Ans. Building a shared future for all life.

Q. A group of researchers from Saveetha Institute of Medical and Technical Sciences, Chennai, have discovered a new species of jumping spider. The spider was discovered during an expedition to Kulathupuzha in the Shendurney Wildlife Sanctuary in December 2021. Mention the scientific name and the family of the spider identified.

Ans. The scientific name of jumping spider is *Thiania indica* which belongs to Family Salticidae.

Q. Make the connection between the following images.



Ans. Robert May was a theoretical ecologist, who placed the global species diversity about 7 millions.

ZOOM IN BI

Physiology of Digestion

The digestive system helps the body to digest food. Human digestive system is made up of gastrointestinal (GI) tract and the digestive glands. The GI tract is a series of hollow organs joined together in a long, twisting manner from the mouth to the anus. The organs that make up the GI tract are mouth, oesophagus, stomach, small intestine and large intestine (including the rectum and anus). Food enters the mouth and passes out through the anus. The salivary glands, gastric glands, liver, pancreas and gall bladder are the digestive glands of the digestive system.

Mouth performs mastication which refers to the mechanical breakdown of food by chewing and chopping actions of the teeth. Mastication breaks up the food into small particles, which provides a greater surface area for digestion and enables the food to pass through the oesophagus.

Teeth are hard structures which are meant for holding, cutting, grinding and crushing the food.

Tongue is a strong muscular organ that helps in chewing of food. It also aids in swallowing and is an organ of taste. Upper surface of tongue bears four types of papillae :

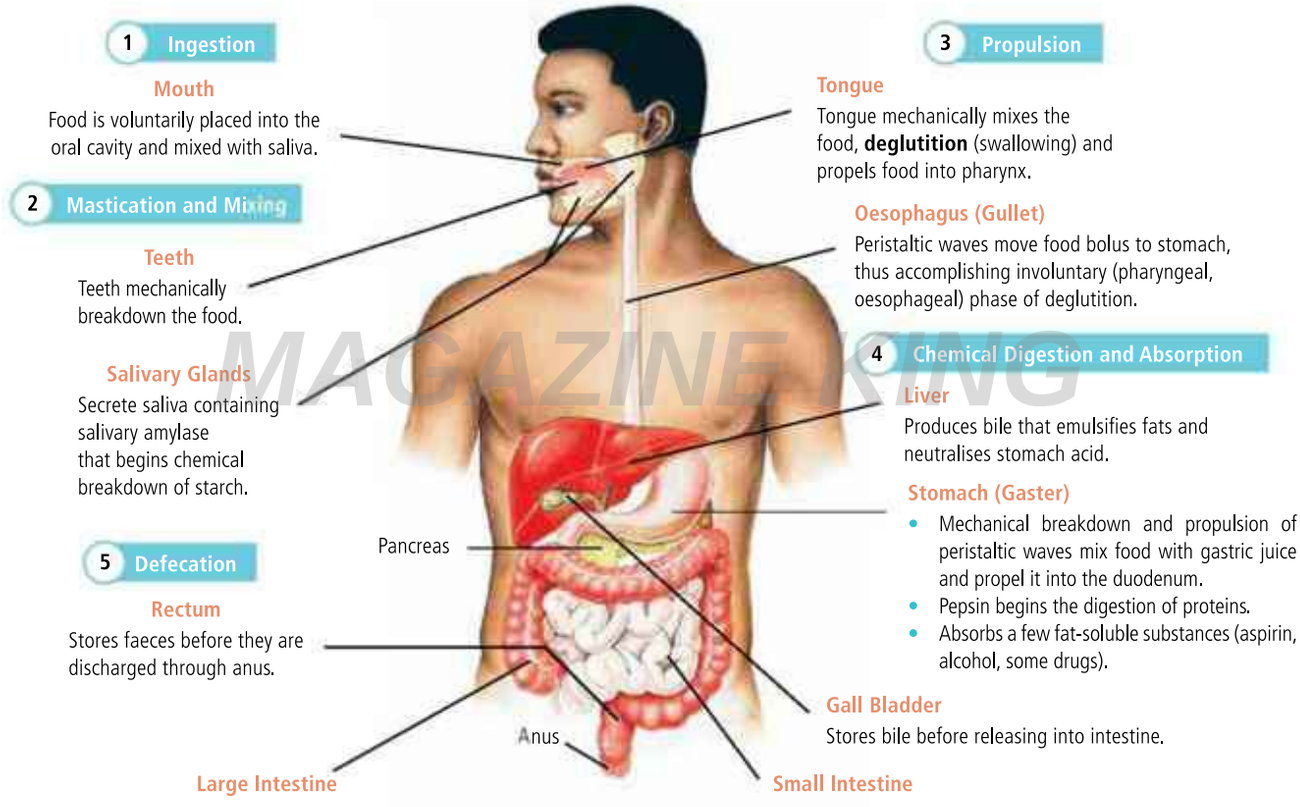
Vallate Papillae	Fungiform Papillae	Filiform Papillae	Foliate Papillae
Usually 8-12 in number. They are largest of all four types.	Most numerous near the tip. Each papilla contains five taste buds.	Smallest and most numerous. They contain tactile receptors, not taste buds.	Not developed in humans. Their taste buds degenerate in early childhood.

Bacteria in the GI tract, also called gut flora or microbiome, helps in digestion. Parts of the nervous and circulatory system also play role in the digestive process. Together, a combination of nerves, hormones, bacteria, blood and the organs of the digestive system completes the complex task of digesting the food and liquid a person consumes each day.

Digestion is important for breaking down food into nutrients, which the body uses for providing energy, growth and cell repair. Food must be converted into smaller molecules of nutrients (*i.e.*, carbohydrates, proteins, fats and vitamins) before the blood absorbs them and carries them to cells throughout the body.

Organs of the GI tract contain a muscular layer that enables their walls to move. The involuntary movement of muscular walls of alimentary canal is called **peristalsis**. It propels food and liquid through the GI tract and mixes the contents within each organ. Peristalsis looks like an ocean wave travelling through the muscle as it contracts and relaxes. Peristalsis initiates in oesophagus as soon as the food enters into it through mouth. This movement is completely involuntary.

Digestion works by moving food through the GI tract. Digestion begins in the mouth with chewing and ends in the small intestine. As the food passes through the GI tract, it mixes with digestive juices, causing large molecules of food to break down into smaller molecules. The body then absorbs these smaller molecules through the walls of the small intestine into the bloodstream, which delivers them to rest of the body. Waste products of digestion pass through the large intestine and out of the body as a solid matter called **stool**.



- Some remaining food residues are digested by enteric bacteria (which also produce vitamin K and some B vitamins).
- Absorbs most remaining water, electrolytes (largely NaCl) and vitamins produced by bacteria.
- Propels faeces toward rectum by haustral churning and mass movements.
- Reflex triggered by rectal distension; eliminates faeces from body.

- Segmentation by smooth muscle of the small intestine continually mixes contents with digestive juices and along with short-distance peristaltic waves, moves food along tract, allowing sufficient time for digestion and absorption.
- Digestive enzymes delivered from pancreas and brush border enzymes attached to microvilli membranes complete digestion of all classes of foods.
- Breakdown products of carbohydrates, proteins, fats and nucleic acids plus vitamins, electrolyte and water are absorbed by active and passive mechanisms.

Fig.: Steps in Human Digestion

Snap Shots

Bolus is a ball of chewed food bound together with saliva that is formed in the mouth by the action of tongue. The bolus is shaped to a size that allows it to pass into the oesophagus after swallowing *i.e.*, deglutition which is a reflex response to presence of food in pharynx.

Histology of Alimentary Canal

Four basic layers of alimentary canal from inner lumen to outer surface are : mucosa, submucosa, muscularis externa and serosa.

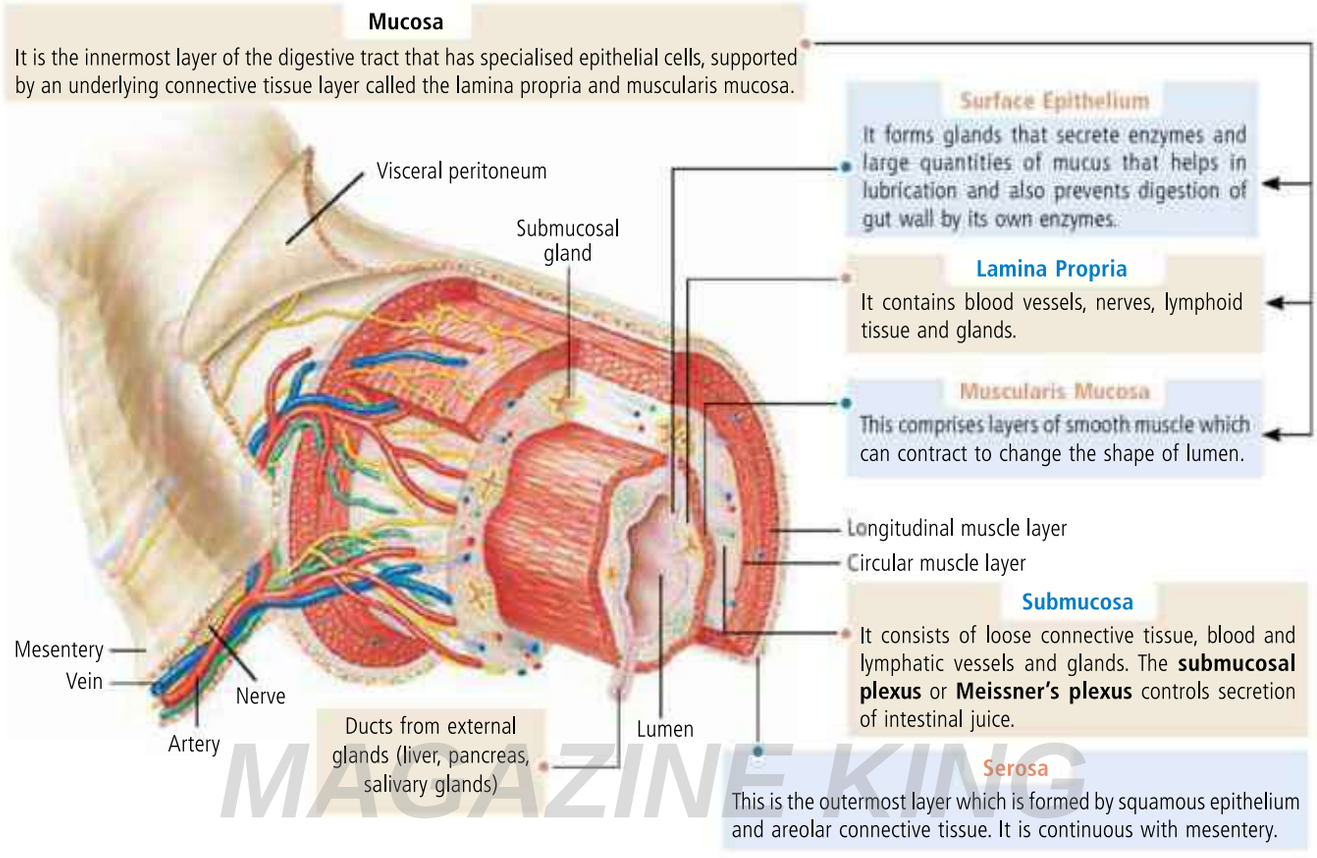


Fig.: Layers of Alimentary Canal

Digestion of Food

Digestion of Carbohydrates

Polysaccharides and disaccharides are broken down into monosaccharides by action of **carbohydrases**.

1. Action of Saliva in Oral Cavity

In the oral cavity, food is mixed with saliva. Saliva contains an enzyme **salivary amylase** (ptyalin) which acts on starch.

$$\text{Starch} \xrightarrow[\text{pH 6.8}]{\text{Salivary amylase}} \text{Maltose} + \text{Isomaltose} + \alpha\text{-Dextrins}$$

About 30 percent starch is hydrolysed in oral cavity.

Role of Different Substances Present in Saliva :

1. Lysozyme acts as an antibacterial enzyme.
2. Thiocyanate ions act as an antimicrobial agent.
3. Bicarbonate ions neutralise the acid in food.
4. Mucus moistens and dissolves food. It also lubricates the oesophagus.

2. In Small Intestine

- Brunner's gland of duodenum, secrete viscous, enzyme-free, alkaline and watery mucoid fluid in response to stimuli from vagus nerve (10^{th} cranial nerve) and secretin (gastrointestinal hormone).
- This secretion enables duodenum to withstand acidic chymes entering from the stomach, until it is neutralised by alkaline pancreatic juice and bile.
- Mucus protects duodenal wall from getting digested.

Lactose Intolerance

It is an impaired ability to digest lactose, a sugar found in milk and other dairy products. It is due to deficiency of enzyme lactase, that is required to breakdown lactose into glucose and galactose, which can then be absorbed into bloodstream and used for energy. It causes gas, nausea, diarrhoea, abdominal cramps.

Action of Various Carbohydrases in Duodenum

1. Action of Pancreatic Juice

- Pancreatic α-amylase converts starch into simple sugars.
- Bicarbonate neutralises HCl of the chyme that enters the duodenum.

Starch $\xrightarrow{\text{Pancreatic α-amylase}}$ Maltose + Isomaltose + α-Dextrins

2. Action of Intestinal Juice

Various enzymes of intestinal juice act as follows:

Maltose $\xrightarrow{\text{Maltase}}$ Glucose + Glucose

Isomaltose $\xrightarrow{\text{Isomaltase}}$ Glucose + Glucose

Sucrose $\xrightarrow{\text{Sucrase}}$ Glucose + Fructose

Lactose $\xrightarrow{\text{Lactase}}$ Glucose + Galactose

α-Dextrins $\xrightarrow{\text{α-Dextrinase}}$ Glucose

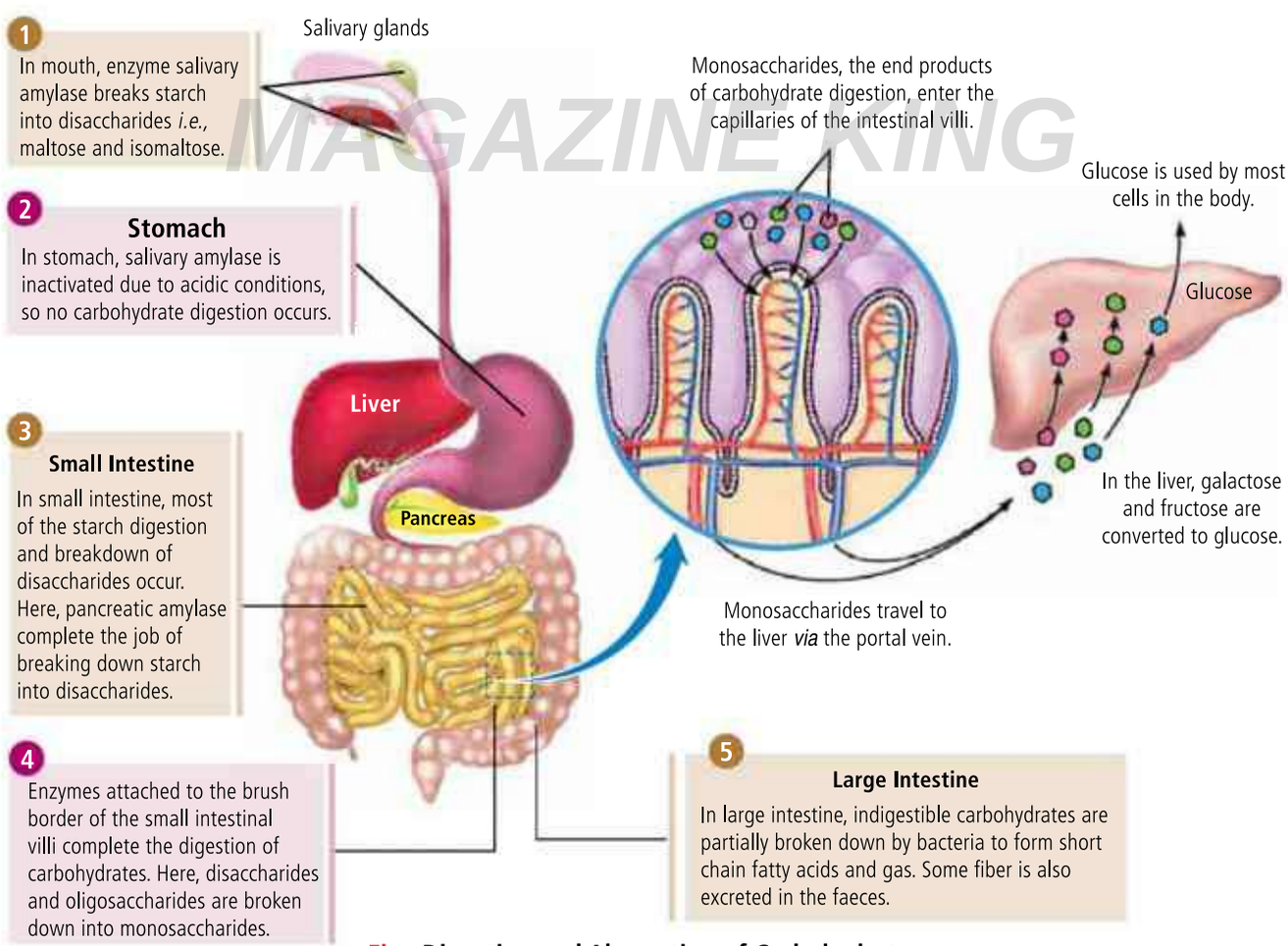


Fig.: Digestion and Absorption of Carbohydrates

Digestion of Proteins

- **Proteases or peptidases** are protein hydrolysing enzymes, that are mostly secreted in inactive forms as **proenzymes**. Proenzymes are converted into their active forms at their sites of action.
- Protein digestion does not occur in oral cavity as saliva does not contain any protein digesting enzymes.

Snap Shots

Chyle is a white or pale yellow fluid taken up by the lacteals (lymph capillaries) from the intestine during digestion. It mainly consists of absorbed fat.

In stomach

- Stomach stores food for 4-5 hours. Gastric juice secreted by gastric gland of stomach contains HCl, proenzymes (pepsinogen and prorennin).
- HCl maintains strongly acidic pH of 1.5 – 2.5 in stomach.
- **Chyme** - Thick acidic mixture of gastric juice and semi-digested food formed in the stomach.

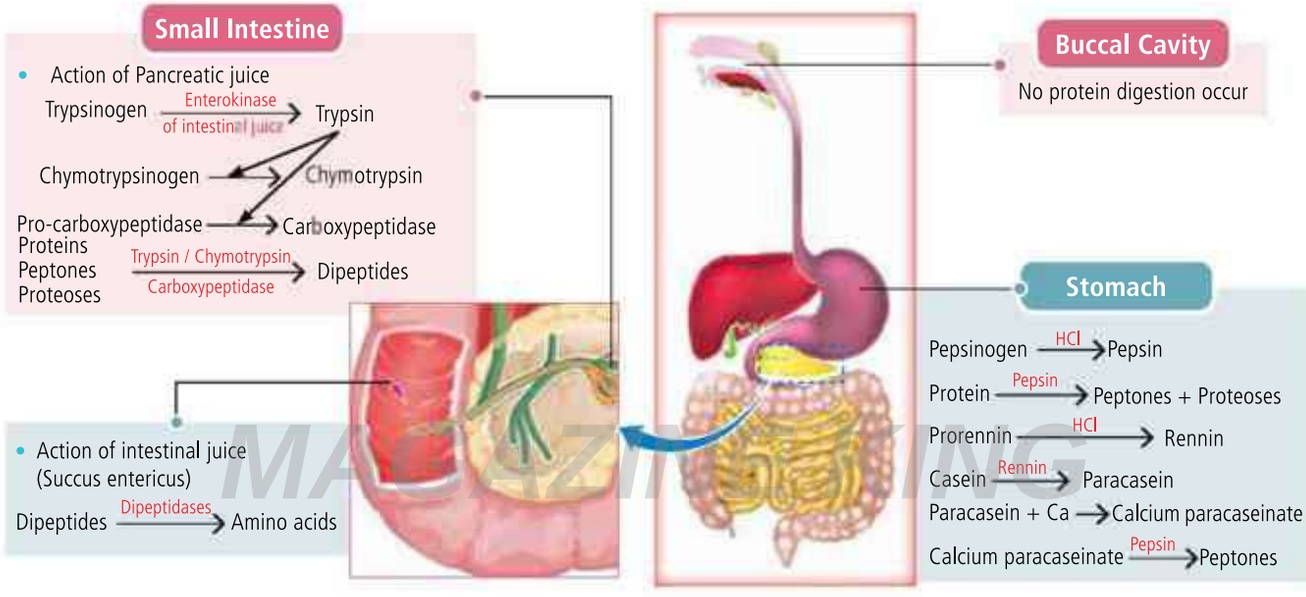


Fig.:Digestion of Proteins

Digestion of Fats

Almost the entire fat portion of the diet consists of triglycerides (neutral fats) which are made up of three fatty acid molecules and a single glycerol molecule.

In Mouth

Lipases are not present in saliva hence, fats are not digested in buccal cavity.

In Stomach

Gastric juice contains small amount of gastric lipase which converts some fats into monoglycerides and fatty acids.

In Small Intestine

Bile salts of the bile break down fat droplets into many small ones by reducing the surface tension of fat droplets. This process is called **emulsification**. This increases lipase action on fat. Lipase is present in the pancreatic juice and intestinal juice. Pancreatic lipase is the principle enzyme for digestion of fat.

Fat —Bile→ Emulsified fat ; Emulsified fat —Pancreatic lipase→ Fatty acid + Diglyceride; Diglyceride —Pancreatic lipase→ Fatty acid + Monoglyceride

Monoglyceride —Pancreatic lipase→ Fatty acid + Glycerol; Emulsified fat —Intestinal lipase→ Monoglycerides + Fatty acids

Digestion of Nucleic Acids

Nucleic acids are digested in small intestine.

Action of pancreatic juice ← DNA/RNA —DNase/RNase→ Nucleotides —Nucleotidases→ Nucleosides + Inorganic phosphate —Nucleosidases→ Nitrogenous bases + Pentose sugar → Action of intestinal juice

Regulation of Digestion

Activities of GI tract are under both neural and hormonal control and some local factors for proper co-ordination among different parts.

1 Neural Control Mechanisms

Short reflexes are triggered by chemoreceptors or stretch receptors in the walls of the digestive tract; the controlling neurons are located in the myenteric plexus. These reflexes are often called **myenteric reflexes**. Long reflexes involving interneurons and motor neurons in the CNS provide a higher level of control over digestive and glandular activities, generally controlling large-scale peristaltic waves that move materials from one region of the digestive tract to another. Long reflexes may involve parasympathetic motor fibers in the glossopharyngeal, vagus, or pelvic nerves that synapse in the myenteric plexus.

2 Hormonal Control Mechanisms

The digestive tract produces various hormones that affect almost every aspect of digestive function and some of them also affect the activities of other systems. These hormones are peptides produced by the enteroendocrine cells in the epithelium of the digestive tract.

3 Local Factors

Local factors are the primary stimulus for digestive activities and include changes in the pH of the contents of the lumen, entrance of chyme, physical and chemical stimulations.

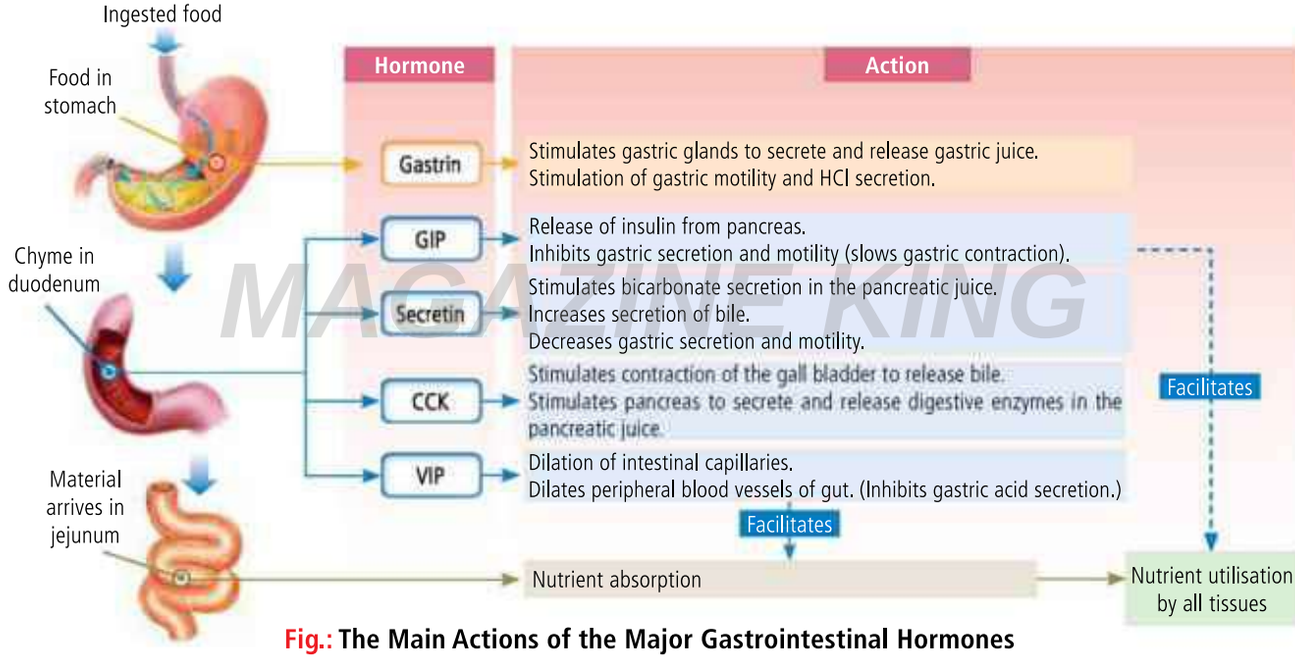


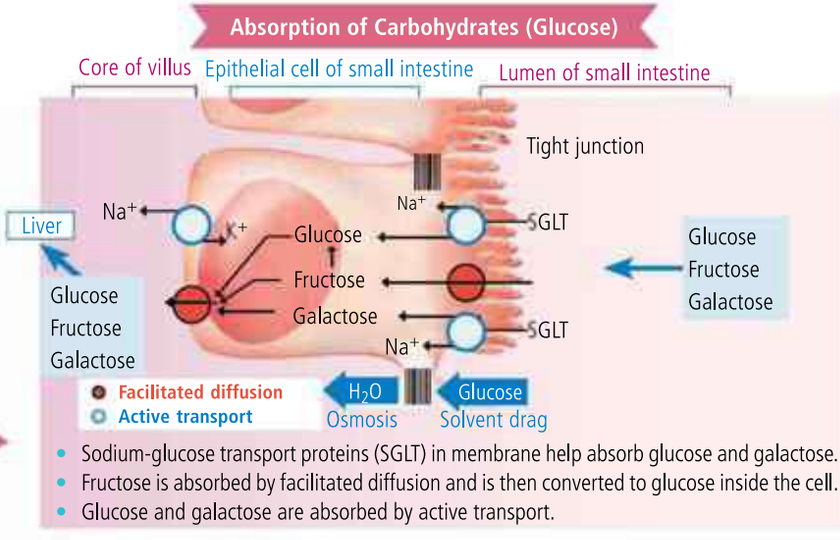
Fig.: The Main Actions of the Major Gastrointestinal Hormones

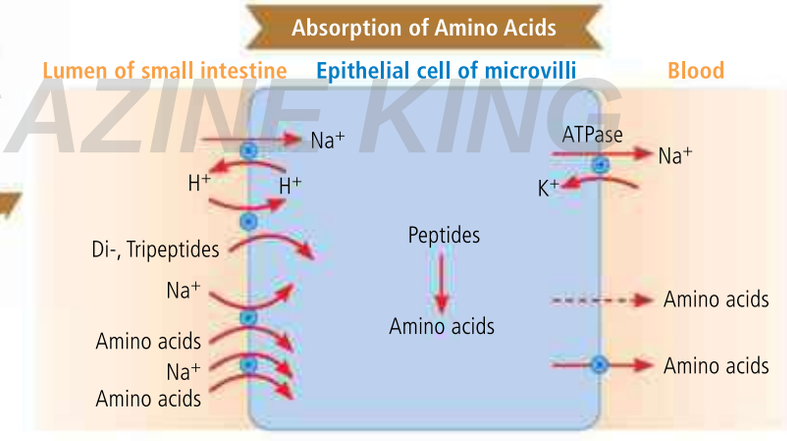
Summary of Action of Some Other Gastrointestinal Hormones

Hormone	Source	Target Organ	Action
Duocrinin	Duodenum	Duodenum	Stimulates the Brunner's glands to release mucus and enzymes into the intestinal juice.
Enterocrinin	Small intestine	Small intestine	Stimulates the Crypts of Lieberkuhn to release enzymes into the intestinal juice.
Villikinin	Small intestine	Small intestine	Accelerates movements of villi.
Somatostatin (SS)	Delta cells of islets of Langerhans of pancreas.	Pancreas, Gastrointestinal tract	Inhibits the secretion of glucagon by alpha cells and insulin by beta cells. It also inhibits absorption of nutrients from the gastrointestinal tract.
	Argentaffin cells of gastric and intestinal glands.	Gastrointestinal tract	Suppresses the release of hormones from the digestive tract.
Pancreatic Polypeptide (PP)	Pancreatic Polypeptide cells	Pancreas	Inhibits the release of pancreatic juice from the pancreas.

Absorption of Nutrients

Absorption is the process by which nutrients pass from the alimentary canal into the blood and lymph through its mucous membrane. About 90% of nutrients are absorbed in small intestine while the rest 10% absorption occurs in stomach and large intestine.





Absorption of Fats

Fatty acids and glycerol are absorbed via simple diffusion. Fatty acids and glycerol are insoluble in water, therefore, they cannot reach the blood stream directly. They are first incorporated into small, spherical, water soluble droplets called **micelles** with the help of the bile salts and phospholipids in the intestinal lumen. A micelle is an aggregate of many molecules. From the micelles fatty acids, glycerides, sterols and fat soluble vitamins are absorbed into the intestinal cells by diffusion where they are resynthesised in the ER and converted into very small fat molecules (droplets) called chylomicrons. The latter are released from the intestinal cells into the lymph present in the lymphatic capillaries, the **lacteals**.

Absorption of Water

Water is the most abundant substance in chyme. Approx. 8000 mL of ingested and secreted water enters the small intestine each day but only 1500 mL passes on to the large intestine because 80% of fluid is absorbed in small intestine. The absorption of water from the small intestine is associated with the absorption of electrolytes. If the chyme remains in the large intestine for a very long time, a lot of water is absorbed causing the faecal matter to become very hard. That is why regular bowel habits need to be generated since childhood. Certain bacteria inhabiting the large intestine synthesises vitamin K, which is also absorbed by the cells of the large intestine.

Absorption of Salts

Sodium is absorbed from small intestine by active transport. Other ions like calcium, potassium, iron, magnesium and phosphate are absorbed by active transport. Most of the absorption of ions takes place through small intestine. Bile salts are absorbed in ileum.

Absorption of Water Soluble Vitamins

Most of the water soluble vitamins such as **vitamin B complex**, **C** etc., are absorbed by **simple diffusion** into the blood capillaries. But reabsorption of **vitamin B_{12}** requires combination with **Castle's intrinsic factor** produced by the stomach for its absorption.

Assimilation of Nutrients

Assimilation is the absorption of nutrients into the body cells after digestion in the intestine and their transformation in biological tissues and fluids.

Fats

- Fat is stored as fat deposits of the body, such as subcutaneous layers, mesenteries, etc.
- Fat has insulating properties, as it helps in heat conservation and maintenance of body temperature.
- Fat acts as packaging material between organs.
- In liver cells, fats are converted into amino acids and carbohydrates.

Proteins

- Proteins are used for growth, repair, etc.
- Excess amino acids are converted into glucose and then to fats and are thus, stored.
- Amino acids are deaminated and are converted to glucose.
- Liver is the chief site of deamination.
- Ammonia produced from deamination of amino acids is converted into urea and is filtered from blood in the kidney.

Carbohydrates

- Excess of monosaccharides are stored in the liver and muscle cells in the form of glycogen.
- During glucose deficiency in blood, glycogen is converted into glucose.
- Muscle glycogen is utilised during muscle contraction.

Egestion

- The elimination of faeces from alimentary canal is called egestion or defecation.
- **Faeces** comprises of about three-fourth water and one-fourth solid matter. Brown colour of faeces is due to brown pigments, stercobilinogen and stercobilin, which are derivatives of bilirubin.

Mechanism of Egestion

1. Indigestible materials are pushed from small intestine to large intestine by peristalsis.
2. Water and electrolytes are absorbed from the chyme.
3. *E.coli* present in colon, feeds on undigested matter and produces vitamin K, B_{12}, B_1 and B_2 absorbed by the wall of colon.
4. Chyme gets converted into semi-solid faeces.
5. Pellets of faeces entering rectum induces 'defecation reflex'.
6. Reflex initiates peristalsis in the last part of colon and rectum, forcing faeces towards anus.
7. As the faeces reaches anus, involuntary relaxation of internal anal sphincter and voluntary relaxation of external anal sphincter cause defecation. Voluntary contraction of diaphragm and abdominal muscles forces the sphincters to open and the faeces is expelled through the anus.

Medical Education in India

Neetu, a 19-year-old, medical aspirant, daughter of a government employee and the eldest of her three siblings. In order to achieve her goal of securing a seat in a prestigious medical college, she joined a renowned coaching institute right after her 10th Boards. She appeared for her NEET first attempt in 2021 after completing her 12th Boards and managed to score 410 out of 720. However, with this score she could not get a seat in a government college and her father was not in a position to pay the hefty fees of private institutions. Putting in all of her best efforts, she again appeared for NEET 2022 and this time she managed to score 465 out of 720, which again cannot result in admission in any government college. Like Neetu, there are millions of students who dream to be doctors but because of tough competition, feel helpless.

In 1826, to offer Indians an opportunity to learn and practice Western medicine, an Indian medical school was started in Southern Bombay with surgeon John McLennan as the superintendent.

MBBS is one of the most prestigious courses one can think of after completing class 12 with science stream, with Biology. When we talk about MBBS, the first name that comes to the mind of the candidates is AIIMS, which is a dream college of every MBBS aspirant. The admissions to AIIMS and government medical colleges take place through NEET scores.

MBBS is a 5.5 year long UG degree. Candidates are taught pre-clinical and clinical subjects during MBBS course, and candidates are employed as doctors. Candidates who have studied PCB can pursue the MBBS course. The tuition fee in government medical colleges cost between 80,000 rupees and 2.5 lakh rupees for the entire programme. Whereas it can cost anywhere up to 1.5 crore rupees in private colleges. About 18.70 lakh candidates appeared for the national level medical entrance exam NEET last year and around 18-20 lakh students applied for NEET 2023. Indian states with the most medical colleges include Delhi, NCR, Punjab, Karnataka, Maharashtra, Tamil Nadu, and with the fewest include Tripura, Chandigarh, Goa & Sikkim.

As per government data, 670 medical colleges offer an MBBS/BDS degree with an annual student take of 102558. Out of these 670 medical colleges, 355 are Govt. medical colleges, 46 are deemed medical colleges and 299 are private medical colleges. About 16 lakh students take the NEET exam every year. NEET - UG 2023 offers 91,415 MBBS seats; 26,946 BDS; 50,720 AYUSH seats and 525 B.VSc & AH seats, from the data provided by MCI and the Ministry of Health and Family Welfare. A total of 52143 MBBS seats are offered at 355 government medical colleges and 48315 MBBS seats at 299 private medical colleges.

There are millions of students who aspire to become doctors. In my opinion, they should not be disheartened. Rather, they can explore admission opportunities abroad where the total fee, including tuition and hostel fee ranges from 20 lakh to 50 lakh per course. Every year, thousands of students go abroad to turn their dream of becoming a doctor a reality.

MBBS abroad is rapidly becoming a top choice for Indian students aspiring to become successful doctors of the highest international repute. The remaining candidates have to explore medical education options in affordable countries, such as Russia, America, Ukraine, Georgia, Kyrgyzstan, Kazakhstan, Armenia, Nepal, Bangladesh, etc. The guidance and counselling plays an important role. The candidate in need of counselling and guidance, can contact Dr. Suman Chahar, Director, Contiwide Education, *Ph. 8773045002, E-mail- conwidedu@gmail.com*

GK CORNER

Enhance Your General Knowledge with Current Updates!

LATEST APPOINTMENTS

- Gianni Infantino will serve a second term as **FIFA President** after being re-elected unopposed to lead global football's governing body for another four years, during the 73rd FIFA Congress in Kigali, Rwanda.
- Craig Fulton appointed as new chief coach of **Indian men's hockey team** on 3rd March, 2023, succeeding Graham Reid who resigned after India's poor outing at the 2023 World Cup in January.
- Kalikesh Narayan Singh Deo, who held the position of Senior Vice-President, took over as the President of the **National Rifle Association of India** (NRAI) on April 2023. The NRAI is responsible for promoting and governing the sport of shooting in India and organizes various national-level competitions and selection trials for international events. The association also selects and trains shooters for major international competitions such as the Olympic Games, Commonwealth Games, and Asian Games.
- Former Supreme Court Judge, Justice Abdul Nazeer took oath as the new governor of Andhra pradesh on 24th February, 2023. **Justice S Abdul Nazeer was part of many landmark judgments, including the Triple Talaq case, the Ayodhya-Babri Masjid dispute case and demonetisation case**.
- Ramesh Bais has been appointed as the new **Maharashtra governor**, on 18th February, 2023. He took oath as the 22nd Governor of Maharashtra, replacing Bhagat Singh Koshyari.
- Shri S.S. Dubey took charge as the **28th Controller General of Accounts (CGA), Ministry of Finance, Government of India** on 6th March, 2023. Besides, serving Government of India, Shri Dubey also has international experience of five years in United Nations, where he worked as Head of Procurement and Logistics, United Nations World Food Programme, New Delhi.
- **SpiceJet chief Ajay Singh** has taken over as President of the Associated Chambers of Commerce and Industry of India (ASSOCHAM) on 29th March, 2023. Singh replaces Sumant Sinha, the Managing Director of Renew Power, who has completed his tenure at the chamber.
- Rohit Jawa has been appointed as the new **CEO of Hindustan Unilever LTD (HUL)** and will take over from the current CEO Sanjiv Mehta on June 27, 2023. Rohit Jawa will be appointed for a five-year period that will come into effect from June 27, 2023.
- Bollywood star Ayushmann Khurrana has been appointed as **UNICEF India National Ambassador** on 18th February, 2023. In this new role with UNICEF, he will continue to be a strong voice for children's rights.
- Honeywell on 14th march has announced that **Vimal Kapur, President and Chief Operating Officer,** will succeed Darius Adamczyk as Chief Executive Officer of the company on June 1, 2023. It's yet another Indian-origin business executive who has occupied the corner office of a top American MNC.
- Cholayil, the parent company of household brands such as **Medimix and Cuticura** makers has appointed new CEO **Anupam Katheriya** to spearhead the company's expansion plans into new markets and more personal care products.
- Climate entrepreneur Shreya Ghodawat has been appointed as India's ambassador for '**She Changes Climate**' which global campaign aimed at driving awareness of the crucial role of women in accelerating just climate action.
- Bharat Petroleum Corporation Limited (BPCL) has appointed **G. Krishnakumar as the Chairman and Managing Director** of the company on March 2023.
- Rajeev Raghuvanshi appointed as new Drug Controller General of India on 22nd February, 2023. The DCGI heads the Central Drugs Standard Control Organisation (CDSCO) which is responsible for ensuring quality drugs supply

across the country. It has authority to give approval to new drugs and regulating clinical trials.

- The BJP's Anand district unit president Vipul Patel was elected 14th February, 2023 as the new chairman of the Kaira District Cooperative Milk Producers' Union Limited– the oldest milk cooperative of Gujarat, popularly known as Amul Dairy.
- Praveen Sharma, a 2005 batch officer from Indian Defence Service of Engineers has been selected for appointment as Director in the National Health Authority (Ayushman Bharat Digital Mission) under the Ministry of Health & Family Welfare on 19th January, 2023.
- Nutrition multinational Herbalife Nutrition India on 9th January signed up woman cricketer **Smriti Mandhana to be its brand ambassador**. She is the fifth Indian athlete and the second cricketer to be the company's nutrition sponsor joining the team of Virat Kohli, Mary Kom, Lakshya Sen, and Manika Batra.
- Drugmaker **Pfizer Limited** has announced appointment of **Meenakshi Nevatia** as an Additional Director and the Managing Director for a period of five years from 3rd April, 2023.
- Associate Fellow Professor **Meghana Pandit** has been appointed as permanent Chief Executive Officer of Oxford University Hospitals NHS Foundation Trust starting in March 2023. More recently, Meghana served as Chief Medical Officer at Oxford University Hospitals, with responsibility for Clinical Safety and Outcomes, Medical Education, and Research and Development.
- Indian-origin **Manpreet Monica Singh** was sworn in as a judge of the Harris County Civil Court at Law No. 4 in Texas on 6th January, 2023. Singh's father immigrated to the US in the early 1970s.
- New Zealand's former Covid-19 response minister, Chris Hipkins will replace Jacinda Ardern as Prime Minister after receiving the only nomination from fellow MPs.
- The Board of Governors of the **International Atomic Energy Agency (IAEA)** on 10th March 2023, reappointed Mr. Rafael Mariano Grossi for a second four-year term in office beginning in early December 2023.
- Janata Samajbadi Party leader Ram Sahaya Prasad Yadav has won the election to become Nepal's third Vice President. He received support from the Nepali Congress, CPN (Maoist Centre), and the CPN (Unified Socialist) including the ruling alliance.

Test Yourself!

1. Who has been appointed as the new head coach of the Indian men's hockey team?
   (a) Mike Greenlay (b) Krishnamurthy Gobinathan
   (c) Craig Fulton (d) Herve Renard
2. Who has appointed as Oxford University Hospitals CEO in March, 2023?
   (a) Meghana Pandit (b) Sir Jonathan
   (c) Claire Flint (d) Dr. Teniola Adesanya
3. Who has been appointed as 40th President of FICCI Ladies Organisation?
   (a) Sudha Shivkumar (b) Indu Jain
   (c) Leena Nair (d) Ms. Jahnabi Phookan
4. Who has recently elected as a chairman of Amul Dairy?
   (a) Vipul Patel (b) Shamal Patel
   (c) Tribhuvandas Patel (d) Ramsingh Parmar
5. Who has appointed as New Zealand's current Prime Minister?
   (a) Michael Wood (b) Nanaia Mahuta
   (c) Jacinda Ardern (d) Chris Hipkins
6. Who has been appointed as managing director of drug maker Pfizer limited?
   (a) Sameer Khetarpal (b) Dilip S Shanghvi
   (c) Dr Radha Rangarajan (d) Meenakshi Nevatia
7. Vietnam parliament has elected whom as the new President?
   (a) Vo Van Thuong (b) Hun Sen
   (c) Ranil Sriyan Wickremesinghe
   (d) Joko Widodo
8. Who has been appointed as the CEO of Honeywell on 14th March, 2023?
   (a) Mohit Malhotra
   (b) Darius Adamczyk
   (c) Vimal Kapur
   (d) Tedros Adhanom Ghebreyesus
9. Who won the election to become Nepal's 3rd Vice President?
   (a) Ram baran Yadav (b) Ram Sahaya Prasad Yadav
   (c) Bidhya Devi Bhandari (d) Ram Chandra Poudel
10. Who has been appointed as new CEO of the Medimix and Cuticura makers?
    (a) Anupam Katheriya (b) Pradeep Cholayil
    (c) V Narayanan (d) Joy Gupta

Answer Key

1.	(c)	2.	(a)	3.	(a)	4.	(a)	5.	(d)
6.	(d)	7.	(a)	8.	(c)	9.	(b)	10.	(a)

WORD GRID

Readers are requested to send their responses of word grid to be the winner.

Find and encircle the words in the given grid, running in one of the possible directions; horizontal, vertical or diagonal by reading the clues given below.

Clues

1. An abnormally folded proteins which functions as infectious agents.
2. A series of communities that successively changes in an area in an ecological succession.
3. The organ that helps in grinding the food particles in cockroach.
4. An enzyme produced by bacteria and genetically modified to be used as a clot buster.
5. A molecule that starch can hold in their helical portions.
6. A secondary lymphoid organ having a large reservoir of erythrocytes.
7. It is the unit for measuring water potential.
8. The inability to conceive even after two years of unprotected sexual co-habitation.
9. A bone formed by the fusion of Ilium, ischium and pubis.
10. A group of compactly arranged homogenous cells that occupies the centre of each microsporangia.

S	T	R	E	P	T	O	K	I	N	A	S	E	F	C
U	A	C	R	O	M	E	G	A	L	Y	Z	R	P	I
P	H	A	E	O	P	H	Y	C	E	A	E	A	I	N
M	S	E	R	E	P	R	I	O	N	S	E	A	R	F
A	S	P	L	E	E	N	D	C	A	P	S	U	L	E
G	I	Z	Z	A	R	D	I	F	L	O	W	E	R	R
N	C	M	L	N	M	L	P	O	L	R	O	S	I	T
E	I	U	I	E	E	C	L	I	T	O	R	I	S	I
S	S	T	V	U	A	M	O	R	T	G	L	X	Y	L
I	I	A	E	P	S	I	T	O	U	E	A	Y	N	I
U	O	T	R	L	E	T	E	S	C	N	V	G	A	T
M	D	I	G	O	E	O	N	I	I	O	E	O	P	Y
T	I	O	U	I	A	S	E	E	S	U	X	T	S	Z
S	N	N	T	D	R	I	O	P	K	S	F	A	E	O
R	E	S	Y	Y	S	P	M	P	A	S	C	A	L	S

11. A chronic condition that occurs due to excess secretion of growth hormone in adults.
12. The tiny finger-like structure which lies at the upper junction of two labia minora above the urethral opening in females.
13. A macronutrient that is a constituent of the ring structure of chlorophyll.
14. A condition where chromatids fail to segregate during cell division cycle leading to the gain or loss of chromosomes.
15. An enzyme that increases the permeability of the cell to β-galactosides in *lac* operon.
16. A stage of prophase-I that may last for months or years in oocytes of some vertebrates.
17. The process through which variations are created by altering the genetic material.
18. A thick rigid mucilage layer that covers the cell wall of bacteria.
19. The first transgenic cow which produced human protein α-lactalbumin enriched milk.
20. A group of algae with major pigments as chlorophyll *a*, *c* and fucoxanthin.

☺☺

*Please send entries of solutions both with words and scanned copy of the grid within 10th of every month.

MONTHLY TEST DRIVE

XI

This specially designed column enables students to self analyse their extent of understanding of specified chapter. Give yourself four marks for correct answer and deduct one mark for wrong answer. Self check table given at the end will help you to check your readiness.

Series 2 : Plant Kingdom Animal Kingdom

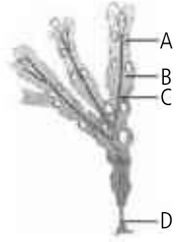
Total Marks : 160 Time : 40 Min.

1. Read the given statements and select the correct option.
Statement I: Linnaeus system of classification is a natural system of classification.
Statement II: Natural system of classification is based on external features only.
(a) Both statements I and II are correct.
(b) Both statements I and II are incorrect.
(c) Statement I is correct but statement II is incorrect.
(d) Statement I is incorrect but statement II is correct.

2. Identify the correct match for structure of animals (Column I) with their functions (Column II) and phylum (Column III).

	Column I	Column II	Column III
(a)	Comb plates	Feeding	Ctenophora
(b)	Radula	Locomotion	Annelida
(c)	Statocyst	Balancing organ	Arthropoda
(d)	Ostia	Water transport	Coelenterata

3. Refer to the given figure of brown algae and identify A, B, C and D.



	A	B	C	D
(a)	Holdfast	Stipe	Midrib	Frond
(b)	Midrib	Holdfast	Air bladder	Frond
(c)	Air bladder	Frond	Midrib	Holdfast
(d)	Frond	Air bladder	Midrib	Holdfast

4. Match the column I and column II and choose the correct option.

	Column I		Column II
A.	Isogamy	(i)	*Spirogyra*
B.	Anisogamy	(ii)	*Eudorina*
C.	Oogamy	(iii)	*Ulothrix*
		(iv)	*Volvox*
		(v)	*Fucus*

(a) A-(i), (iii); B-(ii); C-(iv), (v)
(b) A-(iv), (v); B-(iii); C-(i), (ii)
(c) A-(ii), (v); B-(iii); (iv); C-(i)
(d) A-(i); B-(ii); (iii); C-(iv), (v)

5. Select the incorrectly matched pair.
(a) *Physalia*-Portuguese man-of-war
(b) *Limulus*-King crab
(c) *Ichthyophis*-Limbless amphibian
(d) *Pterophyllum* -Flying fish

6. Which of the following statements are correct?
(I) Metagenesis is present in cnidarians.
(II) *Nereis* is a dioecious species.
(III) An excretory system is absent in *Ophiura*.
(IV) Proboscis gland is an excretory organ of *Sepia*.
(a) (I), (III) and (IV) (b) (II), (III) and (IV)
(c) (I), (II) and (IV) (d) (I), (II) and (III)

7. Select the correct statement(s) regarding '*Sphagnum*'.
(a) It can be used as packing material for shipment of living material.
(b) It can be used as a fuel.
(c) It can be used to produce antibiotics.
(d) Both (a) and (b)

8. Which one of the following is correctly matched pair?
(a) Sphenopsida – *Selaginella*
(b) Psilopsida – *Equisetum*
(c) Pteropsida – *Adiantum*
(d) Lycopsida – *Pteris*

9. Identify A, B, C and D in the given table and select the correct option.

Class	Stored food	Cell wall
Rhodophyceae	**(A)**	Cellulose, Pectin and **(B)**
(C)	Starch	Cellulose
Phaeophyceae	Laminarin and **(D)**	Algin and **(E)**

(a) A - Mannitol; B - Algin; C- Chlorophyceae; D - starch; E - pectin
(b) A - Starch; B - Polysulphate esters; C - Chlorophyceae; D - mannitol; E-pectin
(c) A - Floridean starch; B - Algin; C - Chlorophyceae; D - starch; E-cellulose
(d) A - Floridean starch; B - Polysulphate esters; C - Chlorophyceae; D - mannitol; E - cellulose

10. Which of the following pair of marine animals have to swim constantly to avoid sinking?
(a) *Catla* and *Trygon*
(b) *Carcharodon* and *Scoliodon*
(c) *Petromyzon* and *Myxine*
(d) *Clarias and Hippocampus*

11. Study the given features carefully and identify the organism.
(i) Presence of ctenoid scales on skin.
(ii) External fertilisation with direct development.
(iii) Unable to maintain constant body temperature.
(a) *Hippocampus* (b) *Trygon*
(c) *Myxine* (d) *Doliolum*

12. Which one of the following pair of algae have pyriform and flagellated gametes?
(a) *Ulothrix* and *Spirogyra*
(b) *Dictyota* and *Fucus*
(c) *Sargassum* and *Ulothrix*
(d) *Fucus* and *Gracilaria*

13. Read the given statements and select the correct option.
Statement I : Roots of *Cycas* are associated N_2 - fixing cyanobacteria.
Statement II : Roots of *Pinus* possess fungal associations.
(a) Both statements I and II are correct.
(b) Both statements I and II are incorrect.
(c) Statement I is correct but statement II is incorrect.
(d) Statement I is incorrect but statement II is correct.

14. Gizzard and crop are additional structures of **(i)** in the members of Class **(ii)**.
(a) (i)-circulatory system,(ii)-cyclostomata
(b) (i)-digestive system, (ii)-reptilia
(c) (i)- digestive system, (ii)-aves
(d) (i)-excretory system,(ii)-amphibia

15. Vegetative reproduction in mosses takes place by budding and fragmentation in
(a) prothallus (b) secondary protonema
(c) rhizoids (d) gemmae.

16. Match column I and column II and select the correct option.

Column I	Column II
A. Haplontic algae	(i) *Fucus*
B. Haplo-diplontic algae	(ii) *Volvox*
C. Diplontic algae	(iii) *Ectocarpus*
	(iv) *Polysiphonia*
	(v) *Spirogyra*

(a) A-(ii), (iii); B-(iv), (v); C-(i)
(b) A-(i), (iv); B-(iii); C-(ii), (v)
(c) A-(ii), (v) ; B-(iii),(iv); C-(i)
(d) A-(i); B-(ii), (iii); C-(iv), (v)

17. Which of the following features distinguish *Ornithorhynchus* from other mammals?
(a) It is a viviparous mammal.
(b) The fertilisation is external.
(c) It is a warm-blooded mammal.
(d) It is an oviparous mammal.

18. Fill in the given blanks and select the correct option.
A. (i) alga is used by space travellers as a source of food.
B. (ii) hydrocolloid is obtained from red algae.
C. Agar is obtained from (iii) and (iv) algae.
D. Marine algal species used as food are (v) and (vi).
(a) (i)- *Sargassum*, (ii)-Algin, (iii) -*Spirogyra*, (iv) - *Fucus*, (v)- *Ectocarpus*, (vi)- *Laminaria*
(b) (i)- *Laminaria*, (ii) - Carrageenan, (iii) - *Gelidium*, (iv)- *Ectocarpus*, (v) - *Sargassum*, (vi) - *Volvox*
(c) (i) - *Chlorella*, (ii)- Carrageenan, (iii) - *Gelidium*, (iv) - *Gracilaria*, (v) - *Sargassum*, (vi) - *Laminaria*
(d) (i) - *Ectocarpus*, (ii) - Algin, (iii) - *Gracilaria*, (iv) - *Sargassum*, (v) - *Spirogyra*, (vi) - *Laminaria*

19. Flame cells are a characteristic features of the Phylum **(i)** which helps in **(ii)**.
(a) (i) - Platyhelminthes, (ii) - excretion and osmoregulation
(b) (i) - Aschelminthes, (ii) - respiration and digestion
(c) (i) - Annelida, (ii) - digestion and excretion
(d) (i) - Hemichordata,(ii) - locomotion and osmoregulation

20. Members from how many given Phylum possess external fertilisation?

Arthropoda, Hemichordata, Ctenophora, Echinodermata, Porifera, Aschelminthes

(a) 2 (b) 3 (c) 4 (d) 6

21. Read the following statements and select the option that correctly identifies true (T) and false (F) ones.
A. Protonema is a green, branched and filamentous stage of liverworts.
B. Gametophyte is haploid, dominant and independent in bryophytes.

C. Prothallus is a thalloid gametophyte of mosses.
D. Sporophyte is diploid, dominant and independent in pteridophytes.

	A	B	C	D
(a)	F	F	T	T
(b)	T	T	F	F
(c)	F	T	F	T
(d)	T	F	T	F

22. Chemotaxonomy of plants is based on
(a) chromosome number
(b) evolutionary relationship
(c) chemical constituents
(d) observable characters.

23. Match the column I with column II and select the correct option.

Column I	Column II
A. Hooks and suckers	(i) *Salpa*
B. Water vascular system	(ii) *Pristis*
C. Presence of notochord in larval tail only	(iii) *Fasciola*
D. Placoid scales	(iv) *Ophiura*

(a) A-(iii), B- (iv), C-(i), D-(ii)
(b) A-(iii), B-(iv), C-(ii), D-(i)
(c) A-(i), B- (ii), C-(iii), D-(iv)
(d) A-(iv), B- (ii), C -(i), D-(iii)

24. Which of the following organisms is devoid of scales?
(a) *Clarias* (b) *Pristis*
(c) *Betta* (d) *Myxine*

25. Identify the respective number of acoelomate, pseudocoelomate and coelomate animals from the following phylum.

Annelida, Ctenophora, Hemichordata, Platyhelminthes, Aschelminthes, Coelenterata, Porifera, Mollusca

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

26. Which of the following statements is incorrect about gymnosperms?
(a) *Eucalyptus* is the tallest species of gymnosperms.
(b) The needle like leaves of conifers reduce the surface area.
(c) Sunken stomata present in gymnosperms help to reduce water loss.
(d) The pollen grains are carried by air.

27. Select the correct statements regarding 'Heterospory as an evolutionary step' in pteridophytes.
(I) The male gametophytes retain on the parent sporophytes for variable periods.
(II) The development of the zygotes take place within female gametophytes.
(III) They produce two types of spores-micro and megaspores.
(IV) Germination of microspores and megaspores leads to formation of male and female gametophytes respectively.
(a) I and II (b) II and IV
(c) I and III (d) III and IV

28. Identify A, B, C and D and select the correct option.

Phylum	Fertilisation	Development	Symmetry
Echinodermata	**(A)**	Indirect	Radial
(B)	External	Indirect	Bilateral
Reptilia	Internal	**(C)**	Bilateral
Ctenophora	External	Indirect	**(D)**

(a) A- External; B-Aves; C-Indirect; D-Bilateral
(b) A-External; B-Amphibia; C-Direct; D- Radial
(c) A-Internal; B- Mammalia; C-Direct; D-Radial
(d) A-Internal; B-Osteichthyes; C-Indirect; D-Bilateral

29. Identify the correctly matched pair.
(a) Polyp- Umbrella shape
(b) Medusa- Cylindrical shape
(c) Bioluminescence- Property of living organisms to emit light.
(d) Parapodia-Help in osmoregulation

30. Which of the following phyla has bilaterally symmetrical and coelomate animals?
(a) Platyhelminthes (b) Annelida
(c) Arthropoda (d) Ctenophora

31. Select the correct identifiable characters with respect to dicot plants.
(a) Two cotyledons, reticulate venation, pentamerous flowers.
(b) Single cotyledon, parallel venation, trimerous flowers.
(c) Two cotyledons, parallel venation, pentamerous flowers.

FIRE BOLT

How fast you can answer?

1. Can bacteria reproduce sexually?
2. Do jellyfish have heart?
3. Do earthworm have eyes?
4. Which DNA can change their shape in absence of water?
5. 13-chambered heart is found in which animal?

ANSWERS

1. Yes 2. No 3. No
4. C-DNA 5. Cockroach

(d) Single cotyledon, reticulate venation, tetramerous flowers.

32. Read the given statements and select the correct option.
Statement I : Medusae are produced asexually from polyps.
Statement II : Medusa is cylindrical and sessile form of cnidarians.
(a) Both statements I and II are correct.
(b) Both statements I and II are incorrect.
(c) Statement I is correct but statement II is incorrect.
(d) Statement I is incorrect but statement II is correct.

33. Pyrenoids located in the **(A)** are made up of **(B)** .
(a) (A)-mitochondria; (B)-fat and proteins
(b) (A)-chloroplast; (B)-proteins and starch
(c) (A)-peroxisomes ; (B)-starch and calcium
(d) (A)-vacuole; (B)-proteins and sucrose

34. Read the following statements and select the option that correctly identifies true (T) and false (F) ones.
A. Vertebrates possess notochord during the embryonic period.
B. In adults vertebrates, notochord is replaced by a vertebral column.
C. In cephalochordata, notochord remain persistent throughout their life.
D. Protochordates comprises of subphyla cephalochordata and urochordata.

	A	B	C	D
(a)	F	F	T	T
(b)	T	T	F	F
(c)	F	T	T	F
(d)	T	T	T	T

35. Choose the incorrect statement regarding kelps.
(a) They are filamentous forms of brown algae.
(b) They can reach height of 100 meters.
(c) They are profusely branched forms of brown algae.
(d) They have photosynthetic organ called fronds.

36. Match the column I to column II and select the correct option.

Column I	Column II
A. *Naja*	(i) Cobra
B. *Delphinus*	(ii) Common dolphin
C. *Labeo*	(iii) Roundworm
D. *Echinus*	(iv) Rohu
E. *Ascaris*	(v) Sea urchin

(a) A-(i), B-(ii),C-(iv), D-(v), E-(iii)
(b) A-(i), B-(ii), C-(v), D-(iv), E-(iii)
(c) A-(ii), B-(iii), C-(iv), D-(v), E-(i)
(d) A-(iv), B-(v), C-(i), D-(iii), E-(ii)

37. Read the following statements and select the incorrect statement(s).
(i) In *Cycas*, male cones and megasporophylls are borne on same tree.
(ii) In *Pinus*, male or female strobili are borne on same tree.
(iii) In *Pinus*, stems are unbranched.
(iv) In *Cycas*, stems are branched.
(a) (ii) only (b) (ii), (iii) and (iv)
(c) (i), (iii) and (iv) (d) (i), (ii) and (iv)

38. Read the following statements.
(A) In haplontic life cycle of *Chlamydomonas*, the gametophyte is dependent and sporophyte is independent.
(B) In diplontic life cycle of *Fucus*, the gametophyte is independent and sporophyte is dependent.
(C) In haplontic life cycle of *Volvox*, the gametophyte is independent and sporophyte is dependent.
(D) In haplo-diplontic life cycle of *Polytrichum*, the gametophyte is independent and sporophyte is partially or totally dependent.
Choose the correct option.
(a) A and B are correct. (b) B and C are correct.
(c) A and C are correct. (d) C and D are correct.

39. Which of the following is unique feature of mammal?
(a) Pneumatic cavity (b) Poikilothermous
(c) Mammary glands (d) Viviparity

40. Read the given statements and select the correct option.
Statement I : The body is covered by calcareous shell in molluscs.
Statement II : The body is covered by chitinous exoskeleton in arthropods.
(a) Both statements I and II are correct.
(b) Both statements I and II are incorrect.
(c) Statement I is correct but statement II is incorrect.
(d) Statement I is incorrect but statement II is correct.

☺☺

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SELF CHECK

No. of questions attempted .....
No. of questions correct .....
Marks scored in percentage .....

Check your score! If your score is

> 90%	EXCELLENT WORK !	You are well prepared to take the challenge of final exam.
90-75%	GOOD WORK !	You can score good in the final exam.
74-60%	SATISFACTORY !	You need to score more next time.
< 60%	NOT SATISFACTORY!	Revise thoroughly and strengthen your concepts.

Class XII

BIO Digest

This article covers high yield facts of the given topic.

Human Reproduction

- Sexual reproduction is the process by which new organisms are created, by combining genetic information from two individuals of different sexes.
- Sexual dimorphism is evident in human beings, *i.e.*, male and female individuals are separately distinguishable. Reproductive system, whether in male or female is a collection of internal and external organs that work together to produce a new generation of living organisms similar to their parents.
- The external features which provide distinctiveness to the two sexes but have no role in sexual reproduction, are collectively called **secondary sex characters**.
- The specialised cells for reproduction or reproductive units are called gametes. Gametes are of two types : male gametes are **spermatozoa** and female gametes are **ova**. Gametes are formed in separate, paired organs of mesodermal origin, called **gonads**.
- Sperm producing gonads are called **testes** and ova producing gonads are called **ovaries**. Testes and ovaries are known as **primary sex organs**.
- **Puberty** is the process of physical development from the first signs of adolescence to full adult maturity. It is brought about by a series of chemical signals (hormones).
- Onset of puberty varies across individuals and is slightly earlier for girls (about age of 12) than it is for boys (about age of 14).

Acronyms

- ABP – Androgen Binding Protein
- FSH – Follicle Stimulating Hormone
- GnRH – Gonadotropin Releasing Hormone
- hPL – Human Placental Lactogen
- hCG – Human Chorionic Gonadotropin
- hCS – Human Chorionic Somatomammotropin
- ICSH – Interstitial Cell Stimulating Hormone
- LH – Luteinising Hormone
- PRL – Prolactin

MAJOR REPRODUCTIVE EVENTS

- **Gametogenesis** is the formation of gametes. It includes spermatogenesis (formation of sperms) and oogenesis (formation of ova or eggs).
- **Insemination** is the process of transfer of sperms into the genital tract of female.
- **Fertilisation** is the event of fusion of male and female gametes to form zygote within oviduct.

- **Cleavage** is the rapid mitotic divisions of single celled zygote to develop multicellular blastocyst or blastula.
- **Implantation** is the process of attachment of blastocyst stage of embryo, to the uterine wall.
- **Placentation** is the formation of placenta between fetus and uterine wall of the mother to exchange essential materials.
- **Gastrulation** is the event of development of blastocyst into gastrula with three primary germ layers.
- **Organogenesis** is the formation of specific tissues, organs and organ-systems from three primary germ layers.
- **Parturition** is the process of expelling of baby from mother's womb (uterus) *i.e.*, childbirth.

MALE REPRODUCTIVE SYSTEM

- Male reproductive system is located in pelvic region. It comprises of scrotum, a pair of testis, vasa efferentia, epididymis, vasa deferentia, ejaculatory ducts, urethra, penis and certain accessory glands.

Scrotum

- It is a pouch or pigmented sac consisting of loose skin, muscles and connective tissue that hangs from the root, *i.e.*, attached portion of the penis. A **septum** divides the scrotum into two sacs. Each of these sacs contain one testis.
- The scrotum remains connected with the abdomen or pelvic cavity by two **inguinal canals** on each side of the scrotal septum.
- Scrotum acts as a thermoregulator and maintains testes at a temperature 2°C lower than the normal body temperature which is optimal for sperm production.

Testes

- There is a pair of testes that are suspended in the scrotum by the spermatic cords. The testes develop in the abdominal cavity just below the kidneys during early fetal life and then they descend into the scrotum.

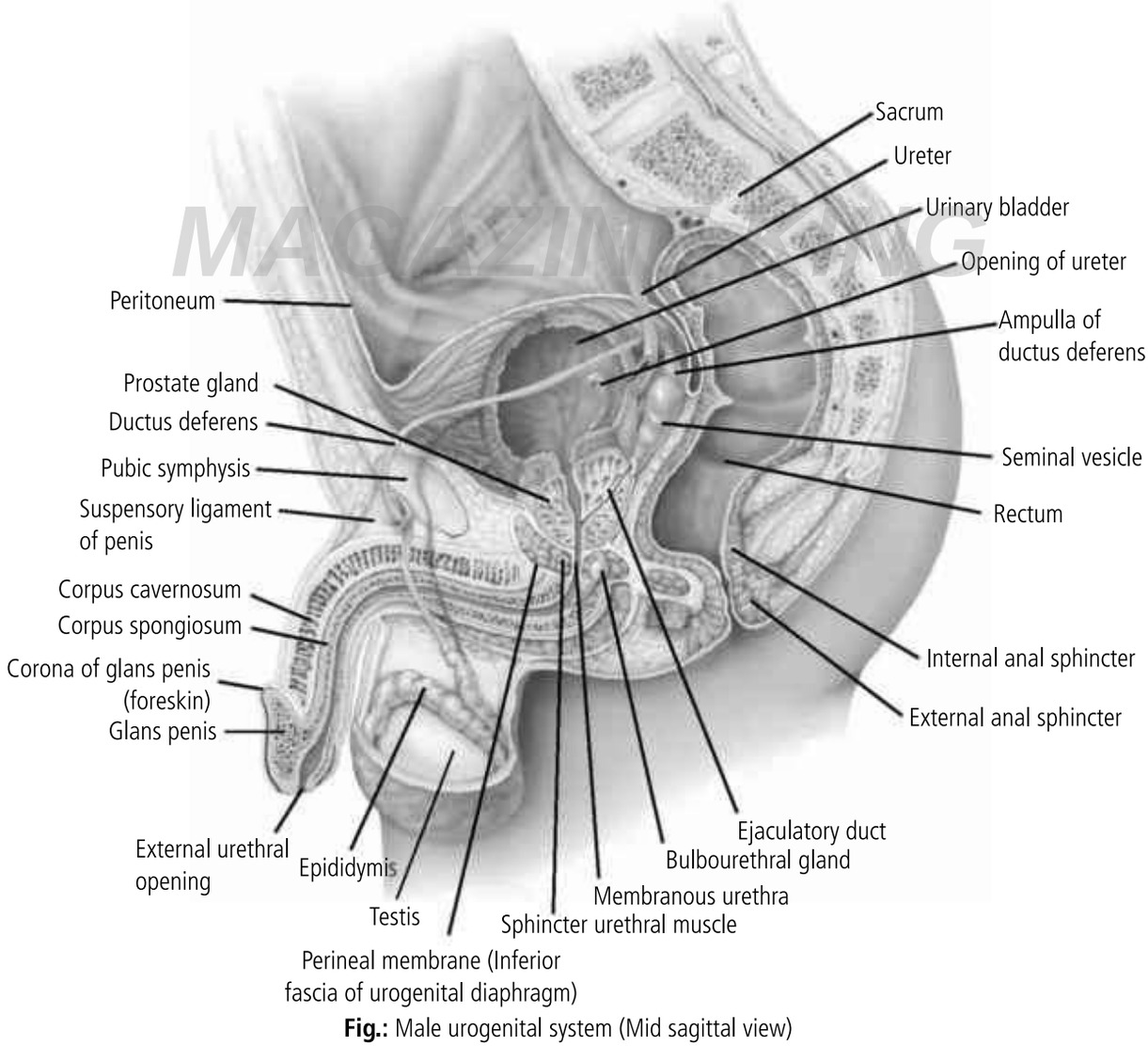


Fig.: Male urogenital system (Mid sagittal view)

- A fibrous cord that extends from the caudal end of the testis to the scrotal wall is called **gubernaculum**.
- Testis is surrounded by three layers : (i) **Tunica vaginalis-** Serous covering of testis, (ii) **Tunica albuginea -** A layer made of fibrous or collagenous connective tissue. (iii) **Tunica vasculosa -** Delicate, loose connective tissues lining testicular lobules, has rich supply of blood capillaries.
- Each testis has around 250 compartments called **testicular lobules** each of which contains several sperm producing coiled tubules called **seminiferous tubules**.
- The lining of seminiferous tubules called germinal epithelium has two types of cells, **spermatogenic cells** and **supporting cells** or **Sertoli cells**.
- In between the seminiferous tubules, in the connective tissue, there are present small groups of rounded endocrine cells, called **interstitial** or **Leydig's cells.**
- Under the influence of luteinising hormone (LH) or interstitial cell stimulating hormone (ICSH), Leydig's cells produce androgens *e.g.*, **testosterone**.
- Testes perform two functions : (a) production of sperms and (b) secretion of male sex hormones.

Male Duct System

- **Rete testis**, **vasa efferentia**, **epididymis** and **vasa deferentia**, **(**or **vas deferens)** are ducts of male reproductive system. These ducts store and transport the sperms from the testis to the outside through urethra.
- The seminiferous tubules join at one end to form a network or **rete testis** from where vasa efferentia arise.
- Vasa efferentia carries spermatozoa from the rete testis to the epididymis.

Epididymis

- It is a mass of long narrow closely coiled tubule which lies along the inner side of each testis.
- At the anterior end of the testis, epididymis is called **caput epididymis**, in which the vasa efferentia opens. The middle part of the epididymis is known as **corpus epididymis**. The posterior end of the epididymis is called as **cauda epididymis**.

Vas Deferens

- It is a continuation of the cauda epididymis. It leaves the scrotal sac and enters the abdominal cavity through the inguinal canal.
- The vas deferens curves over the urinary bladder where it is joined by duct from the seminal vesicle to form the ejaculatory duct. Vasa deferentia carry sperms.

Ejaculatory Ducts

- They are formed by union of ducts from seminal vesicle and vas deferens. They pass through the prostate gland and join the prostatic part of urethra.
- They carry sperms mixed up with secretion of seminal vesicle.

Urethra

- It is the urinary duct which originates from neck of urinary bladder and opens out at the tip of penis. It also receives secretions of prostate and Cowper's glands.
- It carries both urine and semen.
- It consists of three regions - **prostatic urethra** where prostate gland opens, **membranous urethra** at the urinogenital diaphragm and the spongy **penile urethra** that passes through penis.
- The urethra has two sphincters-internal sphincter of smooth muscle fibres at its beginning and external sphincter of striated muscles fibres around its membranous part.

Penis

- The penis is a male copulatory organ.
- The penis contains three cylindrical masses of erectile tissue — two dorsal **corpora cavernosa** and one ventral **corpus spongiosum**. These bodies are surrounded by fibrous tissue.
- The corpus spongiosum, through which the urethra extends, enlarges at its distal end to form a sensitive cone-shaped **glans penis**, covered by loose fold of skin called **prepuce** or **foreskin.**
- During sexual arousal, the three bundles of tissue in the penis become engorged with blood.

Male Accessory Glands

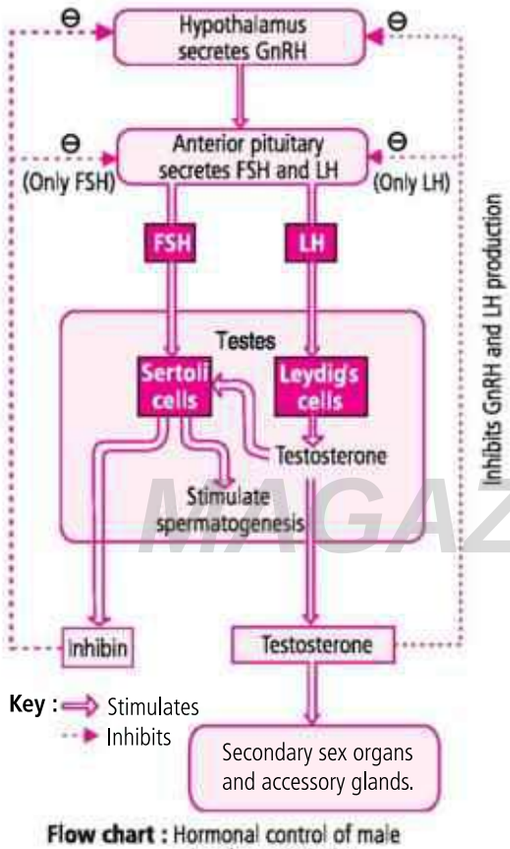
- **Seminal vesicles :** These are paired, glandular, sac-like structures near the base of the bladder, secreting fluids which constitute approximately 60% of the volume of semen. Its secretion contains **fructose** and **prostaglandins**.
- Fructose is the source of energy and prostaglandins stimulate uterine contractions and thus help the sperm to move towards female's oviduct.
- Fructose, which is present in seminal fluid is not produced anywhere else in the body and is used for confirmation of sexual intercourse/rape during forensic test.
- **Prostate gland :** It is a single large gland surrounding urethra. It produces a milky secretion which forms 25% of the volume of semen.
- The secretions of prostate gland also contain glycoprotein **prostate specific antigen (PSA)** which liquefies the clotted semen.
- **Bulbourethral (Cowper's) gland :** These are a pair of glands present on either side of membranous urethra. They

secrete an alkaline fluid that neutralises acids from urine in the urethra.

Semen is the collection of secretions from the seminal vesicles, prostate gland, Cowper's glands, sperms from testes. It is ejected from the penis during ejaculation.

Hormonal Control of Male Reproductive System

- The growth, maintenance and functions of the male reproductive organs are under the hormonal control.



Flow chart : Hormonal control of male reproductive system

SPERMATOGENESIS

- The process of formation of male gametes *i.e.*, sperms is called spermatogenesis. It occurs in the seminiferous tubules of the testes.

Formation of Spermatids

- **Multiplication phase:** The undifferentiated germ cells divide mitotically to form large number of spermatogonia.
- **Growth phase :** Each spermatogonium accumulates large amount of nutrients and chromatin material, grows to a larger primary spermatocyte by the process called spermatocytogenesis.
- **Maturation phase :** Each primary spermatocyte undergoes first meiotic division to form two secondary haploid spermatocytes which in turn produce four spermatids *via* second meiotic division. The first meiotic division is a homotypic division, whereas the second meiotic division is heterotypic.

Formation of Spermatozoa

- The transformation of spermatids into spermatozoa (sperm) is called **spermiogenesis** or **spermateliosis** or **differentiation phase**.

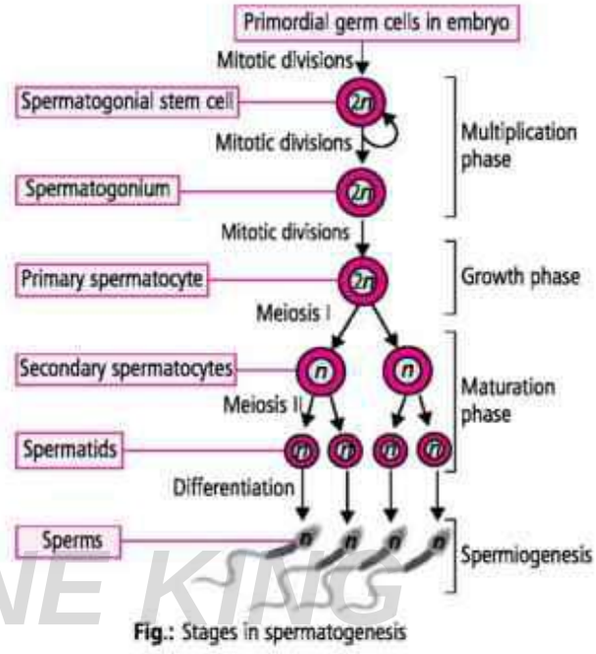


Fig.: Stages in spermatogenesis

- The different changes occurring during spermiogenesis are:
  (i) Formation of acrosome by Golgi apparatus. The latter then degenerates.
  (ii) Elongation and condensation of nucleus.
  (iii) Separation of centrioles into anterior proximal centriole and posterior distal centriole.
  (iv) Formation of axial filament from distal centriole.
  (v) Development of mitochondrial spiral around upper parts of axial filament.
  (vi) Formation of flagellum.
- After their maturation, spermatozoa detach from Sertoli cells, the process is called **spermiation**.

Four sperms are differentiated from a spermatogonium cell. The released sperms are stored in epididymis and first portion of vasa deferentia where they complete their maturation and become capable of fertilising an ovum. Nutrition is provided by epithelium of epididymis.

Sperm or Spermatozoon

- Sperm is a microscopic structure composed of a head, neck, a middle piece and a tail. A plasma membrane envelops the whole body of sperm.

- The sperm head contains an elongated haploid nucleus. The anterior portion of head forms **acrosome** containing proteolytic and lysosomal enzyme.
- The middle piece possesses numerous mitochondria which provide energy for sperm motility.
- The tail helps the sperm to swim in fluid medium.

Disorders of Male Reproductive System

- **Prostatitis** - It is inflammation of prostate generally caused by infection. Prostatitis results in perineal or testicular discomfort, mild dysuria and symptoms of urinary obstruction.
- **Prostate carcinoma** - It is cancer of prostate. Some symptoms are dysuria, difficulty in voiding, increased frequency of urination or urinary retention.
- **Impotence** - It is the inability of the adult male to achieve penile erection. It can be due to physiological, psychological or neuromuscular defects.
- **Sterility** - Sperms are unable to fertilise the ovum due to low count or less motility.
- **Cryptorchidism** - It is a failure of one or both of the testicles to descend into the scrotum. Cryptorchidism is caused by deficient secretion of testosterone by fetal testes. If spontaneous descent does not occur by the age of one year, hormonal injection is given. Retention of testes in the abdomen results in sterility.

INTEXT PRACTICE QUESTIONS

1. Name the layer of testis which is made up of fibrous or collagenous connective tissues.
2. How Sertoli cells are stimulated by Leydig's cells during spermatogenesis?

FEMALE REPRODUCTIVE SYSTEM

- The female reproductive system consists of a pair of ovaries, a pair of fallopian tubes or oviducts, uterus, vagina, external genitalia or vulva. A pair of mammary glands or breasts are also considered as part of reproductive system due to their role in child care.

Ovaries

- Ovaries are the **primary sex organs** in human female. They are paired structures located in the upper pelvic cavity.
- Each ovary is held in place within peritoneal cavity by several ligaments.

Structure of ovaries

- Anatomically, it is differentiated into following parts — **germinal epithelia**, the outermost layer of the ovary which forms oogonia in the fetus; is made up of squamous or cuboidal epithelium, **tunica albuginea**, sheath of dense connective tissue that lies below germinal epithelium and **ovarian stroma**, differentiated into dense outer **cortex** and less dense inner **medulla**.

At birth, the ovaries contain an estimated total of 2 to 4 million oogonia (egg mother cells). No more oogonia are formed and added after birth.

Follicular development

- During fetal life, all the oogonia develop into primary oocytes, which then begin a first meiotic division by replicating their DNA. They do not complete the division in the fetus.
- Accordingly, all the eggs present at birth are primary oocytes which contain 46 chromosomes each with two sister chromatids. The cells are said to be in a state of **meiotic arrest**.
- This state continues until puberty and the onset of renewed activity in the ovaries.
- The dormant primary oocyte surrounded by follicuwlar cells in the ovary of a newborn female is called **primordial follicle**.
- At puberty, oogenesis is resumed and primordial follicle enlarges to form **primary follicle**.
- In the primary follicle, development proceeds, the follicular cells keep dividing to form several layers around the primary oocyte and at cells this stage are known as the **granulosa cells.**
- The primary oocyte secretes an acellular glycoprotein layer around itself, called the **zona pellucida.**
- As the granulosa cells keep on dividing, a small cavity appears between these cells called the **antrum** which is filled with a fluid, liquor folliculi, secreted by the granulosa cells. At this stage the follicle is known as **secondary follicle.**

MONTHLY TEST DRIVE CLASS XI ANSWER KEY

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

- Around the granulosa cells, connective tissue of ovarian stroma get differentiated into two layers: a **vascular theca interna** and a **fibrous theca externa.**
- The innermost layer of granulosa cells around the zona pellucida consists of columnar cells and is known as the **corona radiata.**

Ovulation

- The fully formed mature dominant follicle with a large antrum is called **Graafian follicle**. It has a **primary oocyte,** which is still in meiotic arrest. Just before ovulation this primary oocyte completes its first meiotic division to form a haploid **secondary oocyte** and a **polar body.**
- This secondary oocyte is released in the peritoneal cavity during ovulation from where it is picked up by the fimbriae of the oviduct.
- The ovulated secondary oocyte is carried into the fallopian tube where fertilisation occurs.

Fallopian Tube

- The function of the fallopian tube is to convey the ovum from the ovary to the uterus by peristalsis.
- Fertilisation of the ovum generally takes place in the upper portion of the fallopian tube *i.e.*, (ampullary-isthmic junction).
- Each fallopian tube (10 - 20 cm) consists of four parts: (i) **Infundibulum :** Funnel shaped free end of the oviduct bearing finger-like processes called fimbriae which help in collection of liberated ovum after ovulation; (ii) **Ampulla:** The widest and longest part of the fallopian tube; (iii) **Isthmus :** Short, narrow, thick-walled portion following ampulla; and (iv) **Uterine part :** Passes through the uterine wall and communicates with the uterine cavity.

Uterus

- It is an inverted pear-shaped highly elastic large part of female reproductive system where development of fetus takes place.
- Uterine wall have three layers : **Perimetrium**, an outer thin covering of peritoneum; **myometrium**, middle thick layer of smooth muscle fibres that shows strong contraction during delivery of the baby and **endometrium**, inner glandular layer lining the uterine cavity.
- Uterus is differentiated into three regions — The upper dome-shaped region called **fundus**, the broad main part called **body** and a small, narrow, cylindrical inferior extremity called **cervix**. Cervix connect to the vagina through external os.

Vagina

- The vagina is a tube, about 10 cm long, that extends from the cervix to the outside of the body. It provides a passage for the menstrual flow, serves as the receptacle for sperm during intercourse and forms part of the birth canal during labour.

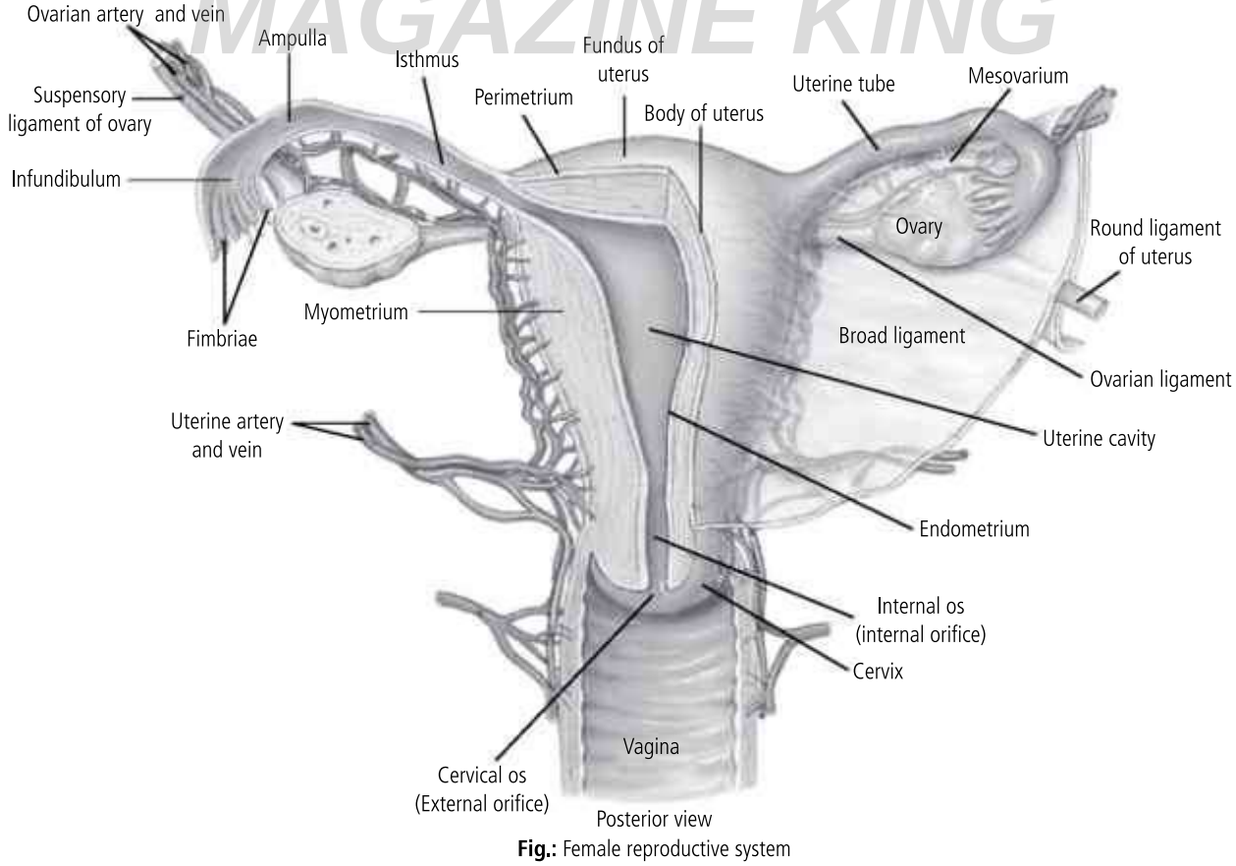


Fig.: Female reproductive system

- The opening of the vagina is called the **vaginal orifice**. It is partially covered by a perforate membrane called **hymen**.

External Genitalia (Vulva)

- The female external genitalia include the **mons pubis**, **labia majora, labia minora, clitoris, vestibule of the vagina,** and **vestibular glands**. External genitalia are collectively called vulva.
- Clitoris contains erectile tissue, it is homologous to glans penis of male.

Female Accessory Glands

- The lesser vestibular glands **(Paraurethral glands or glands of Skene**) are numerous minute glands that are present on either side of the urethral orifice, secreting mucus.
- The greater vestibular glands **(Bartholin's glands)** are a pair of small glands occurring one on each side of vaginal opening, secreting thick, viscous, alkaline fluid. These are homologous to Bulbourethral glands of male.

Mammary Glands

- Mammary glands are modified sweat glands that lie over the pectoralis major muscle.
- Its **glandular tissue** comprises about 15-20 mammary lobes. Each lobe consists of a number of **lobules**, which contain glandular alveoli that produce milk in lactating woman.

Hormonal Control of Female Reproductive System

- GnRH secreted by the hypothalamus stimulates the anterior lobe of pituitary gland to secrete LH and FSH. FSH stimulates the growth of Graafian follicles and also the development of egg/oocyte. LH stimulates the formation of estrogens and progesterone. LH causes ovulation. The rising level of progesterone inhibits the release of GnRH, which in turn, inhibits production of FSH and LH.

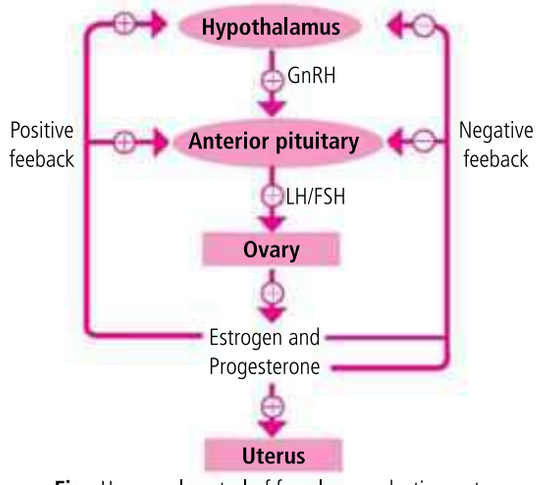


Fig.: Hormonal control of female reproductive system

Oogenesis

- Gametogenesis in female, *i.e.*, the process of development and maturation of ovum is known as oogenesis.
- It is consists of three phases— multiplication, growth and maturation phase.

Multiplication phase

- During multiplication phase, the germinal epithelium cells divide and detach to produce oogonia, which multiply mitotically and project into the stroma as a cord, **the egg tube of Pfluger**, which later becomes a round mass, the **egg nest**.
- One cell in the egg nest grows to form diploid primary oocyte having the same number of chromosomes as in parent somatic cells, which cease to divide and enter the growth phase.

Growth phase

- This phase of the primary oocyte is very long extending over many years.
- There is accumulation of food materials and other, resources for nourishment of the oocyte.
- Meiosis begins in the primary oocytes soon after their formation. However, the oocytes are arrested in the early part of meiotic prophase I (diplotene stage), the **first resting stage**. They undergo a round of DNA synthesis and chromosome pairing takes place, but meiosis does not proceed further until years later.

SOLUTIONS TO APRIL 2023 QUIZ CLUB

1. *Rauwolfia vomitoria*
2. 2018
3. Gardasil 9
4. Vitamin B
5. Beaver
6. Cancer
7. Late blight of tomato
8. Pituitary
9. Russia
10. *Fusarium oxysporum*
11. 2-3 pm
12. Kimchi
13. Willem Einthoven
14. Kerala
15. Amari rabbit
16. Sarcomere
17. Deletion
18. IgM
19. Female Mayfly (*Dolania Americana*)
20. 5 litres
21. Fructose
22. Leptin
23. Erythritol
24. Leprosy
25. *Thevetia peruviana*

Winner: Priya Verma (Mumbai)

Maturation phase

- After primary oocyte has finished its growth, there are two specialised nuclear divisions, first one is the **reductional division**.
- At the beginning of puberty, a small number of primary oocytes are activated each month. However, only one continues meiosis I, producing two haploid cells of dissimilar size, smaller cell is called **first polar body** and larger cell is called **secondary oocyte**.
- The secondary oocyte proceeds with meiosis II but the division gets arrested in metaphase II stage, the **second resting stage**. This is due to an activity called **cytostatic factor** which maintains arrest through preventing loss of **Maturation Promoting Factor (MPF).**
- MPF is a protein in cell cycle which stimulates M-phase of cell cycle.
- It is in this stage of oocyte that the ovum is shed during ovulation. It passes into oviduct, where in the ampulla part, cell cycle will resume only after the entry of sperm.
- Ca^{2+} rise initiated by fertilising sperm results in degradation of regulatory unit of MPF (M-phase Promoting Factor) and activation of **Anaphase Promoting Complex (APC)** thus, promoting completion of cell cycle.
- The first polar body may divide to form two-second polar bodies. Thus from **one oogonium, one ovum** and **three polar bodies** are formed.
- The ovum, is the actual female gamete. The polar bodies take no part in reproduction and soon degenerate due to lack of cytoplasm and food. The formation of non-functional polar bodies enables the egg to get rid of excess chromosomes.

MENSTRUAL CYCLE

- The first menstruation begins at puberty and is called **menarche**. In human females, menstruation is repeated at an average interval of about **28/29 days** and the cycle of events starting from one menstruation till the next, is called **menstrual cycle**.
- The menstrual cycle can be functionally divided into following four phases:

Table : Phases of menstrual cycle

Phases	Days	Events
Menstrual phase (Bleeding phase)	1^{st}-5^{th}	Endometrium breaks down, menstruation begins. The cells of endometrium, secretions, blood and the unfertilised ovum constitute the menstrual flow. Progesterone and estrogen production is reduced.
Follicular phase (Proliferative phase)	6^{th}-13^{th}	Endometrium rebuilds, secretion of FSH and estrogen increases.
Ovulatory phase	14^{th}	Both LH and FSH attain a peak level. Concentration of estrogen in the blood is also high and reaches its peak. Ovulation occurs.
Luteal phase (Secretory phase)	15^{th}-28^{th}	Corpus luteum secretes progesterone. Endometrium thickens and uterine glands become secretory.

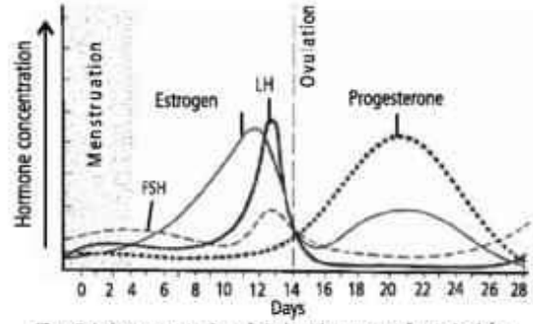


Fig.: Relative concentration of pituitary hormones of anterior lobe (FSH and LH) and ovarian hormones (estrogen and progesterone) during a normal menstrual cycle.

Menopause

- It is the phase in the life of a woman when ovulation and menstruation stop. During this condition, ovaries fail to respond or may be resistant to FSH. In this case, FSH levels are very high and the estrogen level is very low. It occurs between age of 45 to 55 years.

Disorders of Female Reproductive System

- **Breast cancer :** Breast cancer is rarely seen before the age of thirty. Its incidence increases after menopause.
- **Infertility :** Infertility in women is the inability to get pregnant. It may be due to failure to ovulate or some anatomical factor that prevents the union of egg and sperm.
- **Endometriosis :** It is the growth of endometrial tissue outside the uterus. Symptoms include premenstrual pain or unusual menstrual pain.
- **Cervical cancer :** It is relatively slow-growing cancer. Its main risk is that it is unnoticed until it has invaded other tissues.
- **Oophorocystosis (Ovarian cysts) :** Ovarian cysts are fluid filled tumors of the ovary. Such cysts sometimes rupture and regress (get smaller) during pregnancy.
- **Ectopic pregnancy :** It is implantation of embryo at a place other than uterus, generally in the oviduct.

- **Oophoritis :** It is inflammation of ovary, usually caused by an infection.

FERTILISATION

- Fertilisation is the process of fusion of two types of gametes (spermatozoon and ovum) so as to form a **diploid zygote.**
- In human beings, fertilisation is internal and takes place mostly in the **ampullary-isthmic junction** of the oviduct (fallopian tube).
- The secretions of the female genital tract remove coating substances, deposited on the surface of the sperms particularly those on the acrosome exposing the receptor sites and activating the sperm to penetrate the ovum. This phenomenon of sperm activation is called **capacitation**.
- The **capacitated sperm** undergoes acrosomal reaction and releases various chemicals contained in the acrosome. These chemicals are collectively called **sperm lysins.**
- Due to **acrosomal reaction** plasma membrane of the sperm fuses with the plasma membrane of the secondary oocyte so that the sperm contents enter the oocyte.
- **Cortical reaction,** after the fusion of the plasma membrane of oocyte with sperm, the cortical granules fuse with the plasma membrane releasing their contents along with cortical enzymes which hardens the zona pellucida preventing entry of additional sperms, *i.e.*, polyspermy.
- Entry of the sperm induces the completion of the meiotic division of the secondary oocyte. The second meiotic division is also unequal and results in the formation of **second polar body** and a haploid ovum (ootid). Haploid nucleus of the sperm and that of the ovum fuse together to form a diploid **zygote.**

EMBRYONIC DEVELOPMENT

- **Embryonic development** or **embryogenesis** is the development of embryo from fertilised ovum and its subsequent development into a young organism.

Table: Principal events during embryonic development

	Stage	Time period	Principal events
(i)	Zygote	12-14 hours after ovulation	Haploid sperm unites with haploid egg, making the latter a diploid zygote with unique genotype.
(ii)	Cleavage	30 hours to 3 days	Mitotic divisions increase number of cells without increasing total cytoplasmic mass.
(iii)	Morula	Third to fourth day	Solid ball formed, comprising outer layer of small cells around an inner mass of large cells.
(iv)	Blastocyst	Fifth day to end of second week	Hollow ball formed, comprising trophoblast, embryonic knob and blastcyst cavity, implantation occurs, embryonic disc forms, primary germ layers established.

- Blastocyst then gets attached to the endometrium (trophoblast) and the inner cell mass gets differentiated as the embryo.
- After attachment, the uterine cells divide rapidly and covers the blastocyst. As a result, blastocyst become embedded in the endometrium. This is called **implantation**. It begins about seventh day after fertilisation of ovum.
- Implantation leads to **pregnancy**. In human beings it is approximately 9 months ±7days. If hCG (Human Chorionic Gonadotropin) is present in a woman's urine it indicates her pregnancy. After implantation, finger-like projections appear on the trophoblast called **chorionic villi**. Chorionic villi and uterine tissue becomes interconnected with each other and jointly form **placenta** between mother and developing fetus.
- Placenta connects with fetus by a rope-like structure called **umbilical cord**.

- Transformation of blastocyst into gastrula by formation of primary germ layers by rearrangement of cells is called **gastrulation**.
- In all triploblastic animals, three germ layers — ectoderm, mesoderm and endoderm are formed.

Table : Structures derived from the three embryonic germ layers during organogenesis

Ectoderm	Mesoderm	Endoderm
• Epidermis of skin and its derivatives (including sweat glands, hair follicles) • Epithelial lining of mouth and rectum • Sensory receptors in epidermis • Cornea and lens of eye, nervous system • Adrenal medulla, epithelium of pineal and pituitary glands	• Notochord, skeletal and muscular systems • Muscular layer of stomach, intestine, etc. • Sclera, choroid, ciliary body • Excretory, circulatory and lymphatic systems • Dermis of skin and lining of body cavity • Adrenal cortex	• Epithelial lining of digestive tract • Epithelial lining of respiratory system • Lining of urethra, urinary bladder and reproductive system • Epithelium of liver, pancreas, thymus, thyroid and parathyroid glands

- The growing embryo/fetus develops four membranes called the **extra-embryonic** or **fetal membranes.** These include
  (i) **Chorion** completely surrounds the embryo and protects it, takes part in the formation of placenta.
  (ii) **Amnion** is the membrane that closely covers the embryo when first formed. The space between amnion and embryo is filled with amniotic fluid. Amniotic fluid absorbs shock, regulates temperature of fetus and prevents desiccation of the embryo.
  (iii) **Allantois** is small and non-functional except for furnishing blood vessels to the placenta.
  (iv) **Yolk sac** is non-functional in human beings except that it functions as the site of early blood cell formation.

PARTURITION

- Parturition is the act of expelling the full-term young one from the mother's uterus at the end of gestation.
- **Gestation** (pregnancy) is completed in about **266 days** from conception.
- Process of parturition is induced by both nervous system and hormones secreted by the endocrine glands of the mother.
- The signals for childbirth (parturition) originate from the fully matured **fetus** and **placenta** which induce mild uterine contractions called **fetal ejection reflex.**
- This causes quick release of oxytocin which promotes contraction of uterine muscles from the maternal posterior lobe of pituitary gland. The amount of oxytocin is increased just before and during **"labour pains"** (pains of childbirth).
- **Relaxin** secreted by the placenta increases the flexibility of the pubic symphysis and ligaments of the sacroiliac and sacrococcygeal joints and helps to dilate the uterine cervix during labour pains.
- The hormone most recently found to be produced by the placenta is **corticotropin-releasing hormone (CRH),** which in non-pregnant women is secreted only by neurosecretory cells in the hypothalamus.

LACTATION

- The mammary glands of the female undergo differentiation during pregnancy and start producing milk towards the end of pregnancy by the process called **lactation**.
- Secretion of milk is influenced by **prolactin**, secreted by anterior lobe of the pituitary gland and ejection of milk is stimulated by **oxytocin**, secreted by posterior lobe of the pituitary gland. This helps the mother in feeding the newborn.
- The first milk which comes from the mammary glands of mother produced during initial 2 or 3 days after childbirth is called **colostrum**. Colostrum contains antibodies **(IgA)** that provide natural passive immunity to the newborn.

INTEXT PRACTICE QUESTIONS

3. Which embryonic germ layer produces dermis of skin?
4. In which phase of menstrual cycle, endometrium rebuilds and secretion of FSH and estrogen increases?

Reproductive Health

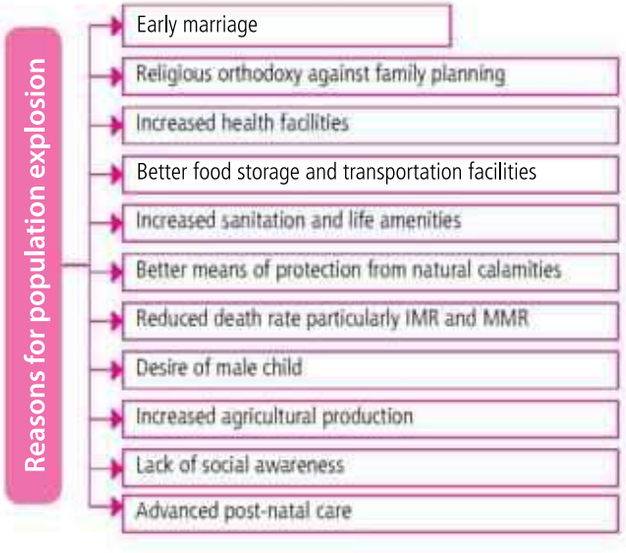
- Reproductive health refers to the healthy reproductive organs with their normal functions.
- According to the World Health Organisation (WHO), the reproductive health means a total well being in physical, emotional, behavioural and social aspects in reproduction.
- Reproductive health problems include population explosion, low birth weight, preterm birth, reduced fertility, impotency, menstrual disorder and sexually transmitted diseases.

STRATEGIES FOR REPRODUCTIVE HEALTH PROBLEMS

- Government of India undertook a number of programmes to attain total well being of reproductive health as a social goal.
- '**Family Planning programmes**' were initiated in 1951 and were periodically assessed over the past decades.
- Improved programmes covering wider reproduction-related areas are currently in operation under the popular name '**Reproductive and Child Health Care (RCH) Programmes**'.
- **Sex education** should be introduced in schools to provide right information about myths and misconceptions about sex-related aspects.
- Statutory ban on **amniocentesis** for sex-determination to legally check increasing female feticides, massive immunisation of children etc., are some appreciable steps.

POPULATION EXPLOSION

- Human population is increasing at a very fast rate over a relatively short period of time. Such a rapid or exponential increase in population is termed as **population explosion**.
- Increased health facilities along with better living conditions has an explosive impact on the growth of population.



- In 2016, the population of India was reported as 1.32 billion (May 15, 2016), second to China with 1.37 billion people. According to most recent UN data, population of India is 1.35 billion (2018).
- Over population leads to a number of problems which exert adverse impact on a nation.
- It increases poverty, unemployment, scarcity of food, water, natural resources, home, etc. It also causes eco-degradation, energy crisis, etc. So, **over population must be checked to maintain continuity of human race**.

BIRTH CONTROL METHODS

- The regulation of conception by various preventive methods or devices to limit the number of offspring is called **birth control** or **contraception**.
- Birth control methods act by one of the three processes– preventing sperm transport to ovum, preventing ovulation or preventing implantation of early embryo in uterus.
- Contraceptive methods can be broadly categorised into two groups: temporary and permanent methods.

Temporary Methods

- Temporary methods include natural methods, barrier methods, chemical methods, IUDs, oral contraceptive pills, subcutaneous implants and hormone injections.

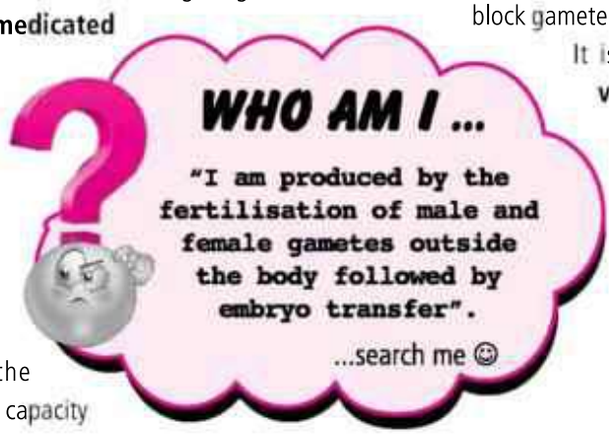
- **Natural methods** avoid meeting of sperm and ovum by following ways:
  (i) **Periodic abstinence or rhythm method :** The couples avoid or abstain from coitus from day 10^{th} to 17^{th} of the menstrual cycle because ovulation can occur during this period. The effectiveness of this method is limited.
  (ii) **Coitus interruptus** or **withdrawal method :** It involves withdrawal of penis from vagina by the male just before ejaculation. Effectiveness is moderate.
  (iii) **Lactational amenorrhea method :** This method is based on the fact that ovulation and therefore the menstrual cycle does not occur during the period of intense lactation following parturition. It can be effective only upto a maximum period of six months after child birth.
- **Barrier methods** prevent the meeting of sperm and ovum by use of following barriers:
  (i) **Condoms** are made of thin rubber/latex sheath used to cover penis in male or vagina and cervix in female just before coitus. Condom is also a safeguard against AIDS and other sexually transmitted diseases (STDs). Female condoms are called **femidoms**.
  (ii) **Diaphragms**, **Cervical caps** and **Vaults** are also made of rubber and are inserted into the female reproductive tract to cover the cervix before coitus.
- **Chemical methods** include foam tablets, creams, jellies and pastes that are inserted in the vagina before intercourse to prevent sperms from entering the uterus. These contain spermicides such as lactic acid, citric acid, boric acid, zinc sulphate and potassium permanganate which kill sperms.
- **Intrauterine devices (IUDs)** are plastic or metal objects which are inserted by doctors in the uterus through vagina. These are available as **non-medicated IUDs** (*e.g.*, Lippes' loop), **copper releasing IUDs** (CuT, Cu7, Multiload 375) and **hormone releasing IUDs** (Progestasert, LNG-20). IUDs increase phagocytosis of sperms within the uterus and the Cu^{2+} ions released by these IUDs suppress the sperm motility and fertilising capacity of sperms. The hormone releasing IUDs make the uterus unsuitable for implantation and the cervix hostile to the sperms.
- **Oral contraceptives** are physiological contraceptives used in the form of pills. These are of two types:
  (i) **Combined pills** are most commonly used oral contraceptive pills which contain synthetic progesterone and estrogen to check ovulation.
  (ii) **Mini pills** contain progestin (progesterone like synthetic hormone) only.

Saheli, a new oral contraceptive pill for female contains a **non-steroidal** preparation called **centchroman** which is taken once in a week after an initial intake of twice a week dose for three months.

- **Morning after pills** are also known as **emergency contraceptives**. These pills can prevent pregnancy when taken within 72 hours after unprotected intercourse. It is not a regular contraceptive method.
- Hormonal pills act in four ways: (i) Inhibition of ovulation. (ii) Inhibition of motility and secretory action of oviducts. (iii) Impairing cervix's ability to allow sperm passage and transport. (iv) Alteration in uterine endometrium making it unsuitable for implantation.
- **Subcutaneous implants** or **norplant** is a six matchstick-sized capsule containing steroid which is inserted under the skin of the inner arm, above the elbow. The capsules slowly release the synthetic progesterone for about five years. It is very safe, convenient, effective and long-lasting.
- **Hormone injections** are progesterone derivative injections which are given once every three months.

Permanent Methods

- These include sterilisation by surgery. Surgical methods block gamete transport and prevent fertilisation. It is effective but **reversibility is very poor**. It includes:
  (i) **Vasectomy** is the sterilisation procedure in males. In this method, a small part of vas deferens is removed or tied up through a small cut on the scrotum.
  (ii) **Tubectomy** is the sterilisation procedure in females. In this method, a small



part of the fallopian tube is removed or tied up through a small cut in the abdomen or through vagina.

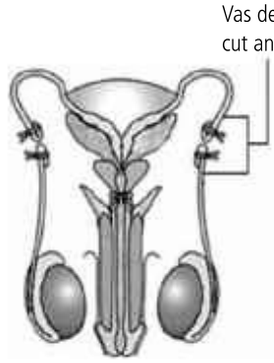


Fig.: Vasectomy

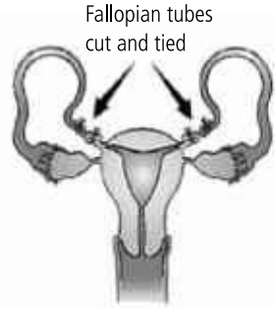


Fig.: Tubectomy

MEDICAL TERMINATION OF PREGNANCY (MTP)

- **Medical termination of pregnancy (MTP)** or **induced abortion** is **intentional** or **voluntary termination** of pregnancy before the fetus becomes viable. Nearly 45 to 50 million MTPs are performed in a year all over the world which accounts to 1/5th of the total number of conceived pregnancies in a year.
- MTP is comparatively safe **upto 12 weeks** (the first trimester) of pregnancy.
- **Government of India legalised MTP in 1971.**
- At present, termination is legally allowed upto 28th weeks of pregnancy, if the gynaecologist consider the need for abortion.

SEXUALLY TRANSMITTED DISEASES

- Infections and diseases which are transmitted through sexual contact with infected persons are collectively called **sexually transmitted diseases (STDs)** or **venereal diseases (VD)** or **reproductive tract infections (RTI).**
- Except HIV infection, Hepatitis-B and genital herpes, all other STDs are completely curable if detected early and treated properly. (*Some common STDs are tabulated as follows*):

INFERTILITY

- Inability to conceive or produce children inspite of unprotected sexual intercourse is called **infertility.**
- Infertility occurs due to defects in the male or in the female or in both.

Table : **Some common STDs**

Disease	Pathogen	Transmission	Incubation period	Symptoms	Diagnosis	Treatment
I. STDs caused by Bacteria						
Syphilis	*Treponema pallidum*	Through sexual contact and from mother to child.	10-90 days	Symptoms of the **first stage** are painless ulcer on the genitals and swelling of local lymph glands. In the **second stage,** chancre is healed and there are skin lesions, rashes, hair loss, swollen joints and flu-like illness occasionally. In the **tertiary stage,** chronic ulcers appear on palate, nose and lower leg. There can be paralysis, brain damage, blindness, heart trouble and aortic impairment.	(a) Antibody detection, *e.g.*, VDRL (b) ELISA test	Antibiotics, *e.g.*, penicillin, tetracycline
Gonorrhea	*Neisseria gonorrheae*	Sexual contact, common toilets and under clothes	2-5 days	The bacterium lives in genital tubes, produces pus containing discharge, pain around genitalia and burning sensation during urination. **It may lead to arthritis and eye infection in children of gonorrhoea afflicted mothers.**	Gram staining of discharge and culture	Antibiotics *e.g.*, penicillin, ampicillin
II. STDs caused by Viruses						
AIDS	Human Immuno-deficiency virus (HIV)	Through semen and blood.	6 months - 10 years	Fever, lethargy, pharyngitis, weight loss, nausea, head-ache, rashes, etc. **HIV** attacks **helper T-lymphocytes,** the patient gets immune deficient.	ELISA, PCR	Anti-retroviral drugs such as zidovudine and didanosine
Hepatitis B	Hepatitis B virus (HBV)	Blood transfusion, sexual contact, saliva, tears, intravenous drug abuse, tatooing, ear and nose piercing, sharing of razors, etc.	30-80 days	Fatigue, jaundice, persistent low grade fever, rash and abdominal pain. It can cause cirrhosis and possibly liver cancer.	Hepatitis B surface antigen (HBSAg), ELISA	Adefovir or Entecavir
Genital herpes	Herpes simplex virus	Genital secretions (through contact with genitalia).	–	Vesiculopustular lesions followed by clusters of painful erythematous ulcers over external genitalia and peri-anal regions, vaginal and urethral discharge and swelling of lymph nodes.	Antigen detection, PCR, nucleic acid hybridisation	Acyclovir, valacyclovir or famciclovir
Genital warts	Human papilloma virus	Sexual intercourse	–	Benign, hard outgrowths with horny surface (warts) over the skin and mucosal surface of external genitalia and peri-anal area.	Antibody detection, culture and DNA hybridisation	Cryosurgery is used in removal of warts. *Podophyllum* preparations and podofilox are useful in treatment. Imiquimod, an interferon inducer, is also useful.
III. STDs caused by Chlamydia						
Chlamydiasis	*Chlamydia trachomatis*	Sexual contact	1 week	Urethritis, epididymitis, mucopurulent, cervicitis, inflammation of fallopian tubes, proctitis (rectal pain with mucus and occasional bleeding), etc.	Gram staining of discharge, antigen detection, nucleic acid hybridisation	Antibiotics like tetracycline, erythromycin and rifampacin
IV. STDs caused by Protozoans						
Trichomoniasis	*Trichomonas vaginalis*	Sexual intercourse	–	In females, it causes vaginitis with foul smelling, yellow vaginal discharge and burning sensation. In males, it causes urethritis, epididymitis and prostatitis resulting in pain and burning sensation.	Gram staining of discharge, antigen detection, nucleic acid hybridisation	Metronidazole
Amoebiasis	*Entamoeba histolytica*	Contaminated food and water, sometimes through sexual contact	–	The patient passes blood along with faeces and feels pain in abdomen.	–	Antiamoebic tablets

- In case the treatment of cause of infertility is not possible, the couple can be assisted to have children through certain special techniques called **assisted reproductive technologies (ART)**. Some important techniques of ART are:

Test Tube Baby

- This method involves *in vitro* fertilisation (IVF), *i.e.*, fertilisation of male and female gametes outside the body in almost similar conditions as that *in vivo* followed by **embryo transfer (ET).**
- In this method, ova from wife/donor female and sperms from husband/donor male are induced to form zygote in laboratory.
- Embryo upto 8 blastomeres is transferred into the fallopian tube (**ZIFT - Zygote Intra Fallopian Transfer**) to complete its further development.
- If the embryo is with more than 8 blastomeres, then it is transferred into uterus (**IUT - Intra Uterine Transfer**) to complete its further development.

Artificial Insemination (AI) Technique

- AI technique is used in case of infertility of male partner, where the husband is either unable to inseminate the female or has very low sperm count in the ejaculation.
- In this technique, the semen collected either from the husband or a healthy donor is artificially introduced into the vagina or uterus (**IUI - Intra-Uterine Insemination**) of the female.

Gamete Intra Fallopian Transfer (GIFT)

- This method is used in females who cannot produce ova but can provide suitable environment for fertilisation and further development of embryo in the oviducts.
- In this technique, both sperms and unfertilised oocytes are transferred into fallopian tubes of female and fertilisation takes place inside the body of female.

Intracytoplasmic Sperm Injection (ICSI)

- In this technique, one single spermatozoon or even a spermatid is injected directly into the cytoplasm of an oocyte by micropuncture of the zona pellucida.
- The embryo is later transferred by **ZIFT** or **IUT** in woman.

DETECTION OF FETAL DISORDERS

- The fetal disorders during early pregnancy can be detected by following techniques:

Amniocentesis

- Amniocentesis is a fetal sex determination and disorder test based on the chromosomal pattern in the amniotic fluid surrounding the developing embryo.
- At the early stage of pregnancy (14^{th} or 15^{th} week), the location of the fetus and placenta is determined by sonography.
- Then a small amount of amniotic fluid is drawn by passing a special surgical syringe needle into the abdominal wall and uterine wall into the amniotic sac containing amniotic fluid.
- The amniotic fluid contains cells from fetus skin and respiratory tract. These cells are cultured and are used to determine chromosomal abnormalities (Down's syndrome, Klinefelter's syndrome, etc.) and metabolic disorders (phenylketonuria, sickle cell anaemia, etc.) of the fetus.
- Unfortunately, this useful technique, is being misused to kill the normal female fetuses. It has been **legally banned for the determination of sex** to avoid female feticide.

Non-invasive techniques

- One of the widely used non-invasive technique to determine fetal condition is **ultrasound imaging.**
- Another non-invasive technique is based on the fact that a few fetal blood cells leak across the placenta into the mother's blood stream. A blood sample from the mother provides enough fetal cells that can be tested for genetic disorders.

Fetoscopy

- Fetoscopy is another technique in which a needle-thin tube containing a viewing scope is inserted into the uterus, giving the physician a direct view of the fetus.

INTEXT PRACTICE QUESTIONS

5. What is the non-steroidal chemical preparation of the contraception pill 'Saheli'?
6. By which method both sperm and unfertilised oocytes are transferred into fallopian tube of female?

☺☺

Check Your Vitals for NEET

Maximise your chance of success in medical entrance exams by reading this article. This section is specially designed to optimise your preparation by practising more and more. It is a unitwise series having chapterwise question bank, allowing you to prepare systematically and become more competent.

- Recall question or single concept question – indicated by a single finger.
- Application question or question which requires 2 or 3 concepts - indicated by 2 fingers.
- Application question or question which requires 3 or more concepts - indicated by 3 fingers.

UNIT-VI : REPRODUCTION

CHAPTER-1 : REPRODUCTION IN ORGANISMS

Multiple Choice Questions

1. Arrange the following animals in an ascending order of their life span.

Butterfly, Crow, Crocodile, Parrot

(a) Crow, butterfly, parrot, crocodile
(b) Butterfly, crow, crocodile, parrot
(c) Butterfly, crocodile, crow, parrot
(d) Parrot, crow, crocodile, butterfly

2. Choose the odd one out on the basis of their mode of reproduction.

(a) Rhizome (b) Sucker
(c) Bulb (d) Conidia

3. Vegetative propagules of water hyacinth, *Bryophyllum*, *Agave*, ginger respectively are

(a) offset, bulbil, leaf buds, rhizome
(b) rhizome, offset, bulbil, leaf buds
(c) offset, leaf buds, bulbil, rhizome
(d) offset, leaf buds, rhizome, bulbil.

4. Which of the following is not a vegetative propagule?

(a) Bulb (b) Gemmule
(c) Sucker (d) Offset

5. In potato, banana and ginger, new plant arise from which part of the modified stem?

(a) Axil (b) Internodes
(c) Nodes (d) Both (b) and (c)

6. A rice plant have 6 pairs of chromosomes in their nucleus. What would be the respective chromosome number of the female gamete, zygote and seeds?

(a) 6, 6, 12 (b) 12, 6, 6
(c) 12, 12, 12 (d) 6, 12, 12

7. Find the correct sequence with respect to events of sexual reproduction.

(a) Zygote formation, gamete transfer, embryogenesis, syngamy
(b) Gamete transfer, syngamy, zygote formation, embryogenesis
(c) Syngamy, embryogenesis, zygote formation, gamete transfer
(d) Gamete transfer, zygote formation, embryogenesis, syngamy

8. Which of the following statements is incorrect regarding syngamy?

(a) In most aquatic organisms, it occurs in water only.
(b) It results in formation of diploid zygote.
(c) It is seen in amphibians.
(d) In majority of plants, syngamy occurs outside the body of organisms.

9. Which one is incorrectly matched?

(a) *Cucurbita* _ Monoecious
(b) Date palm _ Dioecious
(c) Earthworm _ Hermaphrodite
(d) Cockroach _ Bisexual

10. The hard shell covering found in eggs of various reptiles and birds are made up of salts of

(a) calcium (b) magnesium
(c) phosphorus (d) chitin.

11. If a turkey bird has 40 pairs of chromosomes then what will be the number of chromosomes in its progeny?

(a) 80 (b) 30 (c) 160 (d) 20

12. Identify the incorrect statement(s) about *Amoeba*.
(i) Under unfavourable condition it withdraws its pseudopodia.
(ii) It can secrete a four layered wall around itself.
(iii) *Amoeba* can reproduce by binary fission dividing the cell into two halves.
(iv) When favourable condition returns the *Amoeba* divides by budding.
(a) (i), (iii) and (iv) are incorrect
(b) (ii), (iv) are incorrect
(c) (i), (iv) are incorrect
(d) Only (i) incorrect

13. Which division is responsible for production of gametes in haploid organism?
(a) Meiosis
(b) Mitosis
(c) Both mitosis and meiosis
(d) Amitosis

14. Which of the following is a post-fertilisation event in flowering plants?
(a) Transfer of pollen grains
(b) Formation of egg
(c) Embryo development
(d) Parthenogenesis

15. Which of the following correctly describe the similarity between an angiospermic egg and a human egg?
(a) Both are formed once in a lifetime.
(b) Both are stationary.
(c) Both are motile.
(d) Both are haploid.

Match The Columns

16. Match the column I with column II.

Column I		Column II
A. Unisexual animal	(i)	Staminate
B. Monoecious plants	(ii)	Cockroach
C. Unisexual male flower	(iii)	Coconut
D. Unisexual female flower	(iv)	Pistillate

17. Match the column I with column II. (There can be more than one match for items in column I).

Column I	Column II
A. Seed	(i) Thick wall of fruit
B. Pericarp	(ii) Meiocyte
C. Parthenogenesis	(iii) Leech
D. Diploid	(iv) Zygote
E. Bisexual	(v) Turkey
	(vi) Rotifers
	(vii) Tapeworm
	(viii) Fertilised ovule

Passage Based Questions

18.(A) Complete the given passage with appropriate words.
Gametes are (i) in nature and usually a direct product of (ii) division except in haploid organisms where gametes are formed by (iii). (iv) transfer is an essential event in sexual reproduction. In majority of organisms, male gamete is (v), while female gamete is (vi) except fungi and algae. In seed plants, pollen grains produced in (vii) are the carriers of male gametes while egg is present in (viii). Successful transfer and coming together of gametes is essential for the fertilisation to occur.

(B) Read the given passage and correct the errors, wherever present.
In several fungi and plants, homothallic and monoecious terms are used to denote the unisexual condition and heterothallic and dioecious are the terms used to denote the bisexual condition, whereas in flowering plants, the unisexual male flower is pistillate while the female flower is staminate. Coconut is a dioecious plant in which both male and female flowers are present on the same individual whereas date palm is a monoecious plant in which both male and female flowers are present on the separate individual. Cockroach is typical example of bisexual animal that possess both male and female reproductive organs. Leech is an example of unisexual species.

Assertion & Reason

In each of the following questions, a statement of Assertion (A) is given and a corresponding statement of Reason (R) is given just below it. Of the statements, mark the correct answer as :
(a) If both A and R are true and R is the correct explanation of A.
(b) If both A and R are true but R is not the correct explanation of A.
(c) If A is true but R is false. (d) If A is false but R is true.

19. **Assertion :** Reproduction is a biological process in which an organism gives rise to young ones.
Reason : Reproduction enables the continuity of species generation after generation.

20. **Assertion :** When offspring is produced by a single parent without the involvement of gamete formation, the reproduction is asexual.
Reason : Asexual reproduction results in formation of genetically dissimilar species.

21. **Assertion :** *Amoeba* withdraws its pseudopodia under unfavourable conditions and secrete a three layered hard covering or cyst.
Reason : Bursting of cyst wall releases spores to grow up into many *Amoeba*.

22. **Assertion :** Cell divisions increases the number of cells in a developing embryo.
Reason : Cell differentiation helps group of cells to undergo modifications to form specialised tissues and organ.

23. **Assertion :** It is very difficult to clearly define the vegetative, reproductive and senescent phase in perennial species.
Reason : Perennial plants have very short life span.

24. **Assertion :** Females of placental mammals exhibit cyclical changes in activities of ovaries, accessory duct and hormones during reproductive phase.
Reason : Oestrus cycle is seen in non-primates mammals only.

25. **Assertion :** Gametogenesis is the process of formation of gametes.
Reason : Formation of two similar gametes are called heterogametes.

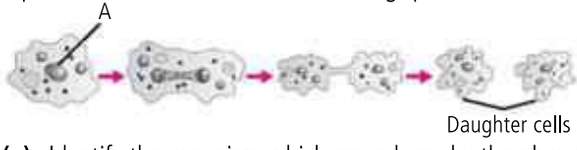
26. **Assertion :** The most vital event of sexual reproduction is zygote formation.
Reason : Zygote ensures continuity of species between organisms of one generation to next.

27. **Assertion :** The wall of zygote in fungi is resistant to dessication and damage.
Reason : Zygote develops a thick wall around itself during development.

28. **Assertion :** Chances of survival of young ones is greater in oviparous organisms.
Reason : Majority of mammals including humans are viviparous.

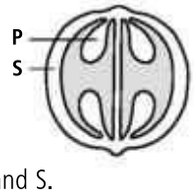
Figure Based Questions

29. Refer to the given figure showing process of asexual reproduction and answer the following questions.



(a) Identify the organism which reproduces by the above method in the figure and label 'A'.
(b) What type of reproduction is shown in figure?
(c) Name the process by which the organism cover itself during unfavourable condition.

30. Refer to the given figure and answer the following questions.



(a) Identify P and S.
(b) What is the function of P and S?
(c) Between S and P, which one is formed as the result of fertilised ovule?
(d) Name the progenitor of next generation present inside a seed.

CHAPTER-2 : SEXUAL REPRODUCTION IN FLOWERING PLANTS

Multiple Choice Questions

1. The stamen represents a
(a) microsporangia (b) male gametophyte
(c) male gamete (d) microsporophyll.

2. Which of the following statements is correct?
(a) Sporogenous tissue is haploid.
(b) Endothecium produces microspores.
(c) Tapetum nourishes the developing pollen grains.
(d) Hard outer layer of pollen is called intine.

3. The arrangement of nuclei in a typical female gametophyte in an angiosperm is
(a) 3 + 3 + 3 (b) 3 + 1 + 3
(c) 3 + 2 + 3 (d) 3 + 2 + 2.

4. The science of cultivation, breeding, marketing and arrangement of flowers is called
(a) pisciculture (b) arboriculture
(c) horticulture (d) floriculture.

5. A typical angiosperm anther is bilobed. How many theca cells are there in one lobe?
(a) 4 (b) 2 (c) 8 (d) 10

6. What will be the ploidy of the cells of the nucellus, MMC, the functional megaspore and female gametophyte respectively?
(a) n, n, 2n, n (b) 2n, 2n, 2n, n
(c) n, n, 2n, 2n (d) 2n, 2n, n, n

7. In angiosperms, how many embryo sac are found in an ovule and how many egg(s) are present in an embryo sac respectively?
(a) 2, 1 (b) 1, 1 (c) 2, 2 (d) 1, 2

8. Arrange the following terms in correct developmental sequence.

Pollen grain (P), Sporogenous tissue (S), Microspore tetrad (T), Pollen mother cell (PM), Male gamete (MG)

(a) S, T, PM, MG, P (b) S, PM, T, P, MG
(c) P, PM, T, MG, S (d) S, T, P, MG, PM

9. How many microspore mother cells would be required to produce 100 pollen grains in a pollen sac?
(a) 25 (b) 50 (c) 100 (d) 75

10. A bilobed dithecous anther has 100 microspore mother cell per microsporangium. How many male gametophytes can this anther produce?
(a) 200 (b) 400 (c) 1600 (d) 800

11. Fill in the blanks A and B and select the correct option.
Zygote → **A** → Globular embryo → **B** → Mature embryo
(a) A-Proembryo, B-Heart shaped embryo
(b) A-Heart shaped embryo, B-Proembryo

(c) A-Blastula, B-Embryo
(d) A-Gastrula, B-Egg

12. A typical angiospermic ovule is attached to the placenta by means of a stalk called **A**. Body of the ovule fuses with A in the region called **B**. Identify A and B.

	A	B
(a)	hilum	funicle
(b)	micropyle	hilum
(c)	funicle	hilum
(d)	funicle	chalaza

13. Which of the following is a haploid, diploid and triploid structure respectively?
(a) Egg, zygote, endosperm
(b) Nucellus, pollen grain, endosperm
(c) Endosperm, nucellus, pollen grain
(d) Zygote, egg, endosperm

14. Which of the following is not a water pollinated plant?
(a) *Zostera* (b) *Vallisneria*
(c) Water hyacinth (d) *Hydrilla*

15. Identify the examples on the basis of following features.
A. Remnants of nucellus are persistent.
B. Endosperm is completely consumed during embryogenesis.
C. Endosperm is not completely used up during embryogenesis.

	A	B	C
(a)	Barley	Pea	Wheat
(b)	Black pepper	Wheat	Pea
(c)	Beet	Pea	Barley
(d)	Castor	Groundnut	Maize

Match The Columns

16. Match the column I with column II.

	Column I		Column II
A.	Funicle	(i)	Stalk attaching ovule to placenta
B.	Hilum	(ii)	Central part of ovule containing embryo sac
C.	Integument	(iii)	Junction between an ovule and funicle
D.	Chalaza	(iv)	Protective layer of ovule
E.	Nucellus	(v)	Basal part of ovule

17. Match the column I with column II. (There can be more than one match for items in column I.

	Column I		Column II
A.	Anther	(i)	Endothecium
B.	Wall layer of microsporangium	(ii)	Exine
C.	Layers of pollen grain	(iii)	Xenogamy
D.	Cross pollination	(iv)	*Hydrilla*
E.	Hydrophily	(v)	Bilobed
		(vi)	Dithecous
		(vii)	Geitonogamy
		(viii)	Intine
		(ix)	Tapetum
		(x)	*Zostera*

Passage Based Questions

18.(A) Complete the given passage with appropriate words.
In angiosperms, the (i) is the final product of sexual reproduction thus, it is often described as a fertilised (ii). Seeds are formed inside (iii). A seed typically consists of a seed coat, (iv), and an (v) axis. Mango fruit develops only from (vi) thus, are called (vii) fruits. Although, fruits are the results of fertilisation in most of the species, there are few species in which fruit develops without fertilisation. Such fruits are called (viii) fruits.

(B) Read the given passage and correct the errors, wherever present.
Flowers are the site of asexual reproduction in bryophytes. In the flower, androecium consists of pistils and represent the female reproductive organs and gynoecium consists of stamens which represent the male reproductive organ. A typical anther is bilobed and monothecous. Pollen grains develops inside the microsporangia. Five layers of wall surround the microsporangium. The cells of sporogenous tissue lying in the centre of the microsporangium undergoes mitosis to form microspore dyads of megaspore. Individual microspores on maturation of anther develops into egg.

Assertion & Reason

In each of the following questions, a statement of Assertion (A) is given and a corresponding statement of Reason (R) is given just below it. Of the statements, mark the correct answer as :
(a) If both A and R are true and R is the correct explanation of A.
(b) If both A and R are true but R is not the correct explanation of A.
(c) If A is true but R is false. (d) If A is false but R is true.

19. **Assertion :** Parthenocarpy involves formation of seedless fruits.
Reason : Parthenocarpy occurs without fertilisation.

20. **Assertion :** The coconut water in tender coconut is free nuclear endosperm.
Reason : The white kernel of coconut is cellular endosperm.

21. **Assertion :** A typical angiospermic embryo sac is 8 nucleated and 7 celled structure.
Reason : Embryo sac is formed from four mitotic division of functional megaspore.

22. **Assertion :** Cleistogamous flower undergoes only self pollination.

Reason : Cleistogamous flower remains closed during pollination.

23. **Assertion :** The vegetative cell is small and floats in cytoplasm of the generative cell.
Reason : The generative cell is spindle-shaped with little cytoplasm.

24. **Assertion :** Artificial hybridisation is one of the major approaches of crop improvement programme.
Reason : Artificial hybridisation is achieved by emasculation and bagging.

25. **Assertion :** Flowers pollinated by flies and beetles secrete foul odours to attract animals.
Reason : Insect pollinated flower have light, sticky and wettable stigma.

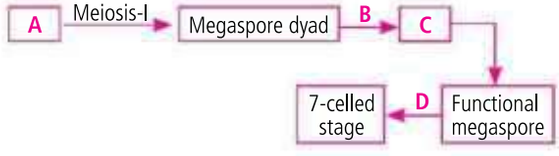
26. **Assertion :** Flowers are modified condensed root.
Reason : Flowers are the sites of sexual reproduction.

27. **Assertion :** Pollen grains can be preserved as fossils.
Reason : Sporopollenin is absent in the region of germ pores.

28. **Assertion :** Double fertilisation is a unique event in flowering plants.
Reason : Double fertilisation includes both syngamy and triple fusion.

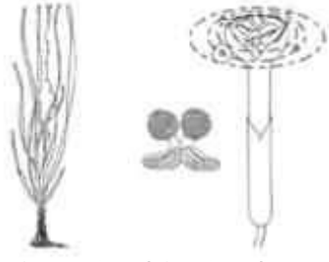
Figure Based Questions

29. Refer to the given figure and answer the following questions.



(a) Identify A, B, C, D.
(b) How many functional megaspore will be formed from C?
(c) Name all the cells of 7 celled embryo sac with their numbers.

30. Consider the given figure showing male and female flower of a species, identify it and answer the following questions.



(a) Name the species of the given figure.
(b) What type of pollination occurs in the species shown?
(c) What are the characteristics of the male gametophytes?

CHAPTER-3 : HUMAN REPRODUCTION

Multiple Choice Questions

1. Seminal plasma, the fluid part of semen is contributed by
(i) seminal vesicle (ii) prostate
(iii) urethra (iv) bulbourethral gland
(a) (i), (ii) (b) (i), (ii), (iv)
(c) (i), (ii), (iii) (d) Only (i)

2. Read the following sequences and identify A and B.
Gametogenesis → A → Fertilisation → B → Parturition
Identify A and B.

	A	B
(a)	Gestation	Insemination
(b)	Artificial insemination	Gestation
(c)	Insemination	Embryogenesis
(d)	Insemination	Gestation

3. Select the number of testicular lobules present in a pair of testes of male reproductive organ?
(a) 250 (b) 500
(c) 350 (d) 100

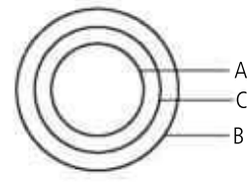
4. Spermatogonia gets its nutrition from
(a) germ cells (b) Sertoli cell
(c) Leydig cells (d) rete testis.

5. An inverted pea resembles the shape of _____ reproductive organ.
(a) uterus (b) clitoris
(c) fimbriae (d) infundibulum

6. Read the following statement(s) and select the incorrect statement about hymen.
(a) Hymen often gets torn during first period.
(b) Hymen can break by a sudden fall.
(c) In some women, the hymen persists even after intercourse.
(d) The presence or absence of hymen is not a reliable indicator of virginity.

7. The ovaries remain attached to the pelvic wall and uterus by _____.
(a) muscles (b) tendons
(c) bone (d) ligaments.

8. The given figure represents the wall of a uterus. Identify labels A, B, C respectively.



	A	B	C
(a)	Endometrium	Perimetrium	Myometrium
(b)	Myometrium	Endometrium	Perimetrium
(c)	Endometrium	Myometrium	Perimetrium
(d)	Perimetrium	Endometrium	Myometrium

9. Select the ploidy of spermatogonium, secondary spermatocyte, spermatids and spermatozoa respectively.
(a) 2n, 2n, n, n (b) n, n, 2n, 2n
(c) 2n, n, n, n (d) n, n, 2n, n

10. In humans, at the end of the first meiotic division, the male germ cell differentiates into the
(a) spermatids
(b) spermatogonia
(c) primary spermatocyte
(d) secondary spermatocyte.

11. Identify the day of the menstrual cycle in which both LH and FSH attain a peak level.
(a) 10 (b) 14 (c) 7 (d) 20

12. Which hormones are produced by a women during pregnancy only?
(a) hCG, hPL, relaxin
(b) hCG, estrogen, relaxin
(c) hPL, hCG, progesterone
(d) hPL, relaxin, estrogen

13. Which among the following posses 23 chromosomes?
(a) Spermatogonia (b) Zygote
(c) Secondary oocyte (d) Oogonia

14. Morula is a developmental stage
(a) between the zygote and blastocyst
(b) between blastocyst and gastrula
(c) before fertilisation
(d) between implantation and parturition.

15. How many sperms are formed from one secondary spermatocyte?
(a) 8 (b) 4 (c) 2 (d) 16

Match The Columns

16. Match the column I with column II.

	Column I		Column II
A.	Gametogenesis	(i)	Embryonic development
B.	Gestation	(ii)	Delivery of baby
C.	Spermiation	(iii)	Attachment of blastocyst to the uterine wall
D.	Parturition	(iv)	Formation of gamete
E.	Implantation	(v)	Release of sperm

17. Match the column I with column II. (There can be more than one match for items in column I).

	Column I		Column II
A.	Male reproductive organ	(i)	Secondary spermatocyte
B.	23 chromosomes	(ii)	Trophoblast
C.	Hormones released during pregnancy	(iii)	Spermatids
D.	Placenta	(iv)	Inner cell mass
E.	Blastomere	(v)	Testes
		(vi)	Endocrine tissue
		(vii)	hCG
		(viii)	Secrete hCG
		(ix)	Accessory glands
		(x)	hPL

Passage Based Questions

18.(A) Complete the given passage with appropriate words.
The male reproductive system is located in the (i) region. It includes a pair of testes along with accessory ducts, (ii) and external genitalia. Testes are (iii) structures which lie outside the (iv) cavity in a pouch called (v). Each testis has about 250 compartments of (vi) lobules with each testicular lobule containing 1-3 highly coiled (vii). These tubules are surrounded by the blood vessels and (viii) cells on outerside.

(B) Read the given passage and correct the errors, wherever present.
The reproductive cycle in the female non-primates is called menstrual cycle. The first menstruation begins at puberty and is called menopause. In human females, menstruation is repeated at an average interval of about 15/18 days, and the cycle of events starting from one menstruation till the next one is called the menstrual cycle. Two ova are released (ovulation) during the middle of each menstrual cycle. The cycle starts with the menstrual phase, when menstrual flow occurs and it lasts for 3-5 days. The menstrual flow results due to breakdown of myometrial lining of the uterus and its blood vessels which forms liquid that comes out through vagina. Menstruation only occurs if the released ovum has not fertilised.

Assertion & Reason

In each of the following questions, a statement of Assertion (A) is given and a corresponding statement of Reason (R) is given just below it. Of the statements, mark the correct answer as :
(a) If both A and R are true and R is the correct explanation of A.
(b) If both A and R are true but R is not the correct explanation of A.
(c) If A is true but R is false. (d) If A is false but R is true.

19. **Assertion :** Testes are situated outside the abdominal cavity within a pouch called scrotum.
Reason : Scrotum helps in maintaining the low temperature of testes.

20. **Assertion :** Each testicular lobule has 1-3 seminiferous tubule.
Reason : Each testis has about 500 testicular lobules.

21. **Assertion :** A penis is the male external genitalia.
Reason : The enlarged end of penis is called rete testis.

22. **Assertion :** Each spermatogonium is diploid and contains 46 chromosomes.
Reason : A primary spermatocyte form 2 haploid secondary spermatocytes after first meiotic division.

23. **Assertion :** The spermatids are transformed into spermatozoa by the process called spermiation.
Reason : After spermiogenesis, sperm heads become embedded in Sertoli cells.

24. **Assertion :** The first menstruation begins at puberty and is called menarche.
Reason : In human females menstruation is repeated at an average interval of 28/29 days.

25. **Assertion :** The mitotic division in a zygote, when it moves through an oviduct is called blastocyst.
Reason : The embryo with 8-16 blastomeres is called a morula.

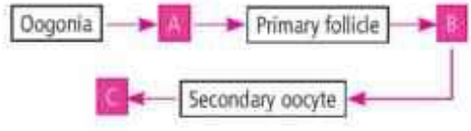
26. **Assertion :** The sex of the baby is determined by the chromosome released by the male.
Reason : Sex chromosomes in human female is XX and that of male is XY.

27. **Assertion :** The mammary gland in females start producing milk towards the end of pregnancy.
Reason : Milk help the mother in feeding the new borns.

28. **Assertion :** The signals of delivery of fetus originate from fully developed fetus through fetal ejection reflex.
Reason : The process of delivery of fetus is called parturition.

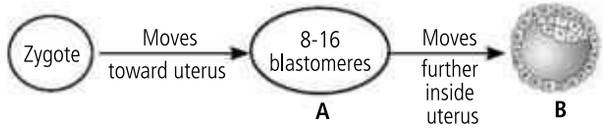
Figure Based Questions

29. Refer to the given figure of oogenesis and answer the following questions.



(a) Identify A, B, C.
(b) What will be the ploidy of A?
(c) If oogonia has 46 chromosomes, what will be the chromosome number in secondary oocyte?
(d) Which cellular division lead to formation of A from oogonia?

30. Consider the given figure and answer the following questions.



(a) Identify A and B.
(b) The blastomeres in B are arranged into how many layer? Name them.
(c) When B gets embedded in the endometrium of the uterus, what is that process called? Will it lead to pregnancy?

CHAPTER-4 : REPRODUCTIVE HEALTH

Multiple Choice Questions

1. Which of the following cannot be considered as an advantage of amniocentesis?
(a) Detection of sex-linked or genetic disorder.
(b) Determination of survivability of fetus.
(c) Determination of sex of developing fetus.
(d) Both (a) and (b)

2. Which among the following IUDs makes the uterus unsuitable for implantation?
(a) LNG-20 (b) CuT
(c) Multiload 375 (d) Lippes loop

3. Which among the following symptoms is not seen in a patient suffering from STIs in the early stage?
(a) Itching (b) Fluid discharge
(c) Swelling (d) Night blindness

4. Which of the following is not a side effect of using contraceptive methods?
(a) Nausea (b) Itching
(c) Abdominal pain (d) Breast cancer

5. Progestogen-estrogen combination contraceptive pills are advised to females to be taken for
(a) 5 days (b) 21 days
(c) 7 days (d) 25 days.

6. Read the following statements and select the options stating which ones are True (T) and which ones are False (F).
(i) Amniocentesis is done to determine the presence of certain genetic disorders.
(ii) Saheli is an oral contraceptive pill discovered by CDRI, Punjab.
(iii) Cervical caps, vaults are barriers made up of rubber.
(iv) Pills inhibit ovulation and implantation.

	A	B	C	D
(a)	T	T	T	T
(b)	T	F	T	T
(c)	T	F	F	T
(d)	F	T	F	T

7. In periodic abstinence, the couple avoids intercourse
(a) one day before and after ovulation
(b) two days before and after ovulation

(c) three days before and after ovulation
(d) one week before and after ovulation.

8. Which among the following methods of contraception has maximum chances of failure?
(a) Lactational amenorrhea
(b) Vasectomy
(c) Condoms
(d) IUDs

9. Use of spermicidal creams, jellies and foam along with diaphragm, cervical cap and vault
(a) increase contraceptive efficiency
(b) prevent implantation
(c) prevent ovulation
(d) increase sexual desire and drive.

10. _____ is inserted by the doctor or trained nurse in the uterus through vagina.
(a) Diaphragm (b) Progestasert
(c) Vaults (d) Saheli

11. The sterilisation method of females which blocks gamete transport to prevent conception is
(a) tubectomy (b) vasectomy
(c) hysterectomy (d) foetoscopy

12. Which of the following is an incorrect match between the type of contraception and its function?

	Contraceptive devices	Functions
(a)	Contraceptive pills	Inhibit ovulation and implantation
(b)	Sterilisation method	Inhibit gamete formation
(c)	IUDs	Phagocytosis of sperms
(d)	Natural methods	Prevent ovum and sperm meeting

13. Which of the following is incorrect about oral contraceptive pills?
(a) They have to be taken daily for a period of 21 days starting preferably within the first five days of menstrual cycle.
(b) They contain small doses of progestogen-estrogen combinations.
(c) They inhibit both ovulation and implantation.
(d) They inhibit physical meeting of ovum and sperms inside females.

14. If a person is suffering from male infertility due to low sperm count in the ejaculate, it could be corrected by
(a) ZIFT (b) IVF
(c) AI (d) ET.

15. In a test tube baby programme, a zygote upto 8 blastomere is transferred into (A) and the process is called (B).

	A	B
(a)	fallopian tube	ZIFT
(b)	uterus	IUT
(c)	fallopian tube	IUT
(d)	uterus	ZIFT

Match The Columns

16. Match the column I with column II.

	Column I		Column II
A.	Vaults	(i)	Removal of fallopian tube
B.	IUDs	(ii)	Blocks entry of sperms through cervix.
C.	Tubectomy	(iii)	Removal of vas deferens
D.	Vasectomy	(iv)	Phagocytosis of sperms within the uterus
E.	Lactational amenorrhea	(v)	Absence of menstruation

17. Match the column I with column II. (There can be more than one match for items in column I).

	Column I		Column II
A.	Amniocentesis	(i)	Coitus interruptus
B.	Natural methods	(ii)	Multiload 375
C.	Copper releasing IUDs	(iii)	Detect down syndrome
D.	Sterilisation	(iv)	Lactational amenorrhea
E.	Venereal diseases	(v)	Cu7
		(vi)	Vasectomy
		(vii)	Detect haemophilia
		(viii)	Gonorrhoea
		(ix)	Syphilis
		(x)	Tubectomy

Passage Based Questions

18.(A) Complete the given passage with appropriate words.
Natural methods of contraception works on the principle of preventing chances of (i) and sperm meeting. Periodic abstinence is one such method in which the couple (ii) from coitus from 10 to (iii) days of menstrual cycle. (iv) interruptus is another method in which the male partner withdraws his penis from (v) before ejaculation. In (vi) methods, ovum and sperm are prevented from physically meeting with the help of barriers. (vii) are barrier made up of thin rubber or latex sheath that is used to cover penis in male or vagina and (viii) in female just before coitus.

(B) Read the given passage and correct the errors, wherever present.
Oral administration of high doses of either estrogen or progestogen-estrogen combinations is another barrier

method used by the females. They are used in the form of syrups and are popularly called as implants. It has to be taken daily for a period of 25 days starting preferably within the first six days of menstrual cycle. They stimulate ovulation and implantation as well as alter the quality of cervical mucus to prevent entry of ova.

Assertion & Reason

In each of the following questions, a statement of Assertion (A) is given and a corresponding statement of Reason (R) is given just below it. Of the statements, mark the correct answer as :

(a) If both A and R are true and R is the correct explanation of A.
(b) If both A and R are true but R is not the correct explanation of A.
(c) If A is true but R is false. (d) If A is false but R is true.

19. **Assertion :** Population of India crossed 1.2 billion in May 2011.
Reason : Population explosion was the result of rapid decline in MMR, IMR as well as an increase in number of people in reproducible age.

20. **Assertion :** IUDs are widely accepted method of contraception in India.
Reason : IUDs suppress sperm motility, fertilising capacity of sperms making the uterus unsuitable for implantation.

21. **Assertion :** In periodic abstinence, the couple avoid coitus from day 10-17 of the menstrual cycle.
Reason : Periodic abstinence works on the principle of avoiding chances of sperm and ovum meeting.

22. **Assertion :** Surgical method used in male is called vasectomy.
Reason : Surgical method block gamete transport to prevent conception.

23. **Assertion :** Saheli is new oral contraceptive for female containing a steroidal preparation.
Reason : Saheli is once a week pill with very few side effects and high contraceptive value.

24. **Assertion :** In test tube baby programme, ova from female and sperm from the male are collected and induced to form zygote under laboratory.
Reason : In test tube baby programme, embryo with more than 8 blastomeres are transferred to fallopian tube (ZIFT) to complete its further development.

25. **Assertion :** Infertility occurs when couples are unable to produce children inspite of unprotected sexual co-habitation.
Reason : Physical, congenital, diseases, drugs, immunological or even psychological factors are responsible for infertility.

26. **Assertion :** MTP has been legalised in India since 1971 with some strict conditions.
Reason : MTP is performed to get rid of unwanted pregnancy due to rapes.

27. **Assertion :** GIFT is advised to a couple when female cannot produce ovum, but can provide suitable environment for fertilisation.
Reason : GIFT involves transfer of ovum from a donor into the fallopian tube.

28. **Assertion :** People in age group 25-50 are vulnerable to STIs.
Reason : Hepatitis-B, genital herpes and HIV are incurable STDs.

Bio CAPSULES

Pets help kids fight food allergies (0-13 years)

Living with pet cat or dogs is associated with fewer food allergies in children, according to a study that analysed over 65,000 infants from Japan. Children exposed to pet cats or indoor dogs during fetal development or early infancy tended to have fewer food allergies compared to sheltered ones. Those exposed to indoor dogs were significantly less likely to experience egg, milk and specifically, nut allergies; children exposed to cats were significantly less likely to have egg, wheat and soybean allergies. Across some high-income countries, more than one in 10 children are diagnosed with food allergies.

Melatonin curbs self-harm in girls (13-18 years)

Melatonin use is associated with a reduced risk of intentional self-harm among female adolescents with psychiatric disorders, according to a study published in the Journal of Child Psychology and Psychiatry. It was conducted by Johnson & Johnson and the Karolinska Institute. The researchers found that the rates of body injuries, falls and transport accidents were comparable in the year prior to and after medication initiation, but the risk for self-harm was highest in the months immediately preceding initiation of melatonin and decreased thereafter. This was particularly prominent with greater absolute risks for girls versus boys.

Type of obesity determines CVD risk (18-50 years)

The risk of developing cardiovascular disease (CVD) is lower in people with obesity who have a genetic predisposition for high BMI than people with obesity influenced mainly by environmental factors such as lifestyle, say researchers from Karolinska Institute. Almost one third of the world's population now lives with being overweight or obesity. "The figure is alarming since it is well-established that a high BMI in middle-age increases the risk of developing cardiovascular disease and other conditions," says Ida Karlsson, assistant professor at the Department of Medical Epidemiology and Biostatistics.

Crosswords can improve memory (50 + years)

Older people with mild memory problems improved their cognition abilities and experienced less brain shrinkage when they did web-based crossword puzzles regularly for three months compared to those who played web-based cognitive games. People assigned to do crosswords scored better on cognitive test at 12 and 78 weeks than their counterparts who did the brain-training games, according to study results published in the The New England Journal of Medicine. Researchers found that only crosswords were beneficial for people with more advanced symptoms. Those with milder symptoms appeared to benefit from both crosswords and games.

Figure Based Questions

29. Refer to the given figures and answer the following questions.

A

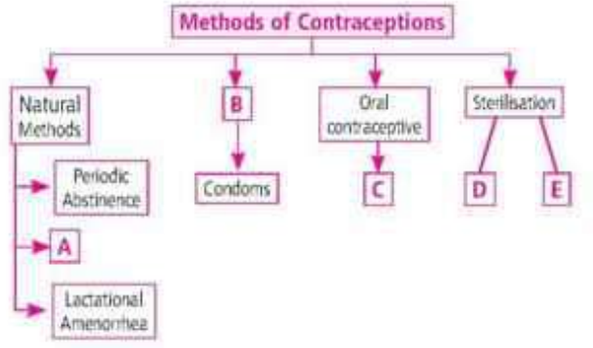
B

(a) Which contraceptive method is seen in the above figure?

(b) Which part of the reproductive system is cut and tied in both the figures?

(c) What is the mechanism of action of the contraceptive method shown?

30. Consider the given figure and answer the following questions.



(a) Identify A, B, C, D, E.

(b) Name any two examples of method B used by females.

(c) What is the composition of oral contraceptive?

SOLUTIONS

CHAPTER-1 : REPRODUCTION IN ORGANISMS

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

16. A-(ii); B-(iii); C-(i); D-(iv)

17. A-(viii); B-(i); C-(v, vi); D-(ii, iv); E-(iii, vii)

18.(A) (i) haploid (ii) meiotic
(iii) mitosis (iv) Gamete
(v) motile (vi) stationary
(vii) anther (viii) ovule

(B) In several fungi and plants, homothallic and monoecious terms are used to denote the ~~unisexual~~ bisexual condition and heterothallic and dioecious are the terms used to denote the ~~bisexual~~ unisexual condition, whereas in flowering plants, the unisexual male flower is ~~pistillate~~ staminate white the female is ~~staminate~~ pistillate. Coconut is a ~~dioecious~~ monoecious plant in which both male and female flowers are present on the same individual whereas date palm is a ~~monoecious~~ dioecious plant in which both male and female flowers are present on the separate individuals. ~~Cockroach~~ Earthworm/Sponge/Leech/Tapeworm is a typical example of bisexual animal that possess both male and female reproductive organs. ~~Leech~~ Cockroach is an example of unisexual species.

19. (b) **20.** (c) **21.** (b) **22.** (b) **23.** (c)
24. (b) **25.** (c) **26.** (d) **27.** (a) **28.** (d)

29. **(a)** Given sequence of reproduction is of *Amoeba* and A is nucleus
(b) Binary fission
(c) Encystation

30. **(a)** P-Seed, S-Pericarp
(b) Pericarp (S), a thick wall developed by fruit is protective in function. After dispersal, seeds (P) germinate under favourable conditions to produce new plants.
(c) In angiosperms, seed (P) is the final product of sexual reproduction, thus, it is often described as a fertilised ovule.
(d) Embryo

CHAPTER-2 : SEXUAL REPRODUCTION IN FLOWERING PLANTS

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

16. A-(i); B-(iii); C-(iv); D-(v), E-(ii)

17. A-(v, vi); B-(i, ix); C-(ii, viii); D-(iii, vii); E-(iv, x)

18.(A) (i) seed (ii) ovule
(iii) fruits (iv) cotyledons
(v) embryonal (vi) ovary
(vii) true (viii) parthenocarpic

(B) Flowers are the site of ~~asexual~~ sexual reproduction in ~~bryophytes~~ angiosperms. In the flower, androecium consists of ~~pistils~~ stamens and represent the ~~female~~ male reproductive organs and gynoecium consists of ~~stamens~~ pistils which represent the ~~male~~ female reproductive organ. A typical anther is bilobed and ~~monothecous~~ dithecous. Pollen grains develops inside the microsporangia. ~~Five~~ Four layers of walls surround the microsporangium. The cells of sporogenous tissue lying in the centre of the

microsporangium undergoes ~~mitosis~~ meiosis to form microspore tetrads of megaspores. Individual microspores on maturation of anther develops into ~~egg~~ pollen grains.

19. (a) **20.** (b) **21.** (c) **22.** (a) **23.** (d)
24. (b) **25.** (c) **26.** (d) **27.** (b) **28.** (b)

29. (a) A-MMC, B-Meiosis-II, C-Megaspore tetrad, D-Mitosis
(b) In a majority of flowering plants, one of the megaspores out of three remains functional which develops into female gametophyte.
(c) Three cells (2 synergids and 1 egg cell) grouped together at the micropylar end constitute egg apparatus. Three cells at the chalazal end are called antipodals. The large central cell has two polar nuclei.

30. (a) *Vallisneria*
(b) Water pollination or hydrophily
(c) Pollen grains released from anther are covered by mucilage which helps them in sticking to stigma as well as protection from wetting by water.

CHAPTER-3 : HUMAN REPRODUCTION

1. (b) **2.** (d) **3.** (b) **4.** (b) **5.** (a)
6. (a) **7.** (d) **8.** (a) **9.** (c) **10.** (d)
11. (b) **12.** (a) **13.** (c) **14.** (a) **15.** (c)
16. A-(iv), B-(i), C-(v), D-(ii), E-(iii)
17. A-(v, ix); B-(i, iii); C-(vii, x); D-(vi, viii); E-(ii, iv)
18. (A) (i) pelvis (ii) glands
(iii) paired (iv) abdominal
(v) scrotum (vi) testicular
(vii) seminiferous tubules (viii) Leydig

(B) The reproductive cycle in the female ~~non-primates~~ primates is called menstrual cycle. The first menstruation begins at puberty and is called ~~menopause~~ menarche. In human females, menstruation is repeated at an average interval of about ~~15/18~~ 28/29 days, and the cycle of events starting from one menstruation till the next one is called the menstrual cycle. ~~Two~~ One ovum is released (ovulation) during the middle of each menstrual cycle. The cycle starts with the menstrual phase, when menstrual flow occurs and it lasts for 3-5 days. The menstrual flow results due to breakdown of ~~myometrial~~ endometrial lining of the uterus and its blood vessels which forms liquid that comes out through vagina. Menstruation only occurs if the released ovum has not fertilised.

19. (a) **20.** (c) **21.** (c) **22.** (b) **23.** (d)
24. (b) **25.** (d) **26.** (a) **27.** (a) **28.** (a)

29. (a) A-Primary oocyte; B-Secondary follicle; C-Mature or Graafian follicle.
(b) 2n, diploid
(c) 23 chromosomes.
(d) Mitosis or equational division.

30. (a) A-Morula; B-Blastocyst.
(b) 2 layers < Outer layer – trophoblast; Inner cell mass
(c) Implantation, yes it will lead to pregnancy.

CHAPTER-4 : REPRODUCTIVE HEALTH

1. (c) **2.** (a) **3.** (d) **4.** (d) **5.** (b)
6. (b) **7.** (c) **8.** (a) **9.** (a) **10.** (b)
11. (a) **12.** (b) **13.** (d) **14.** (c) **15.** (a)
16. A-(ii), B-(iv), C-(i), D-(iii), E-(v)
17. A-(iii, vii); B-(i, iv); C-(ii, v); D-(vi, x); E-(viii, ix)
18. (A) (i) ovum (ii) abstain
(iii) 17 (iv) Coitus
(v) vagina (vi) barrier
(vii) Condoms (viii) cervix

(B) Oral administration of ~~high~~ low doses of either ~~estrogen~~ progestogen or progestogen-estrogen combinations is another ~~barrier~~ contraceptive method used by the females. They are used in the form of ~~syrups~~ tablets and are popularly called as ~~implants~~ pills. It has to be taken daily for a period of ~~25~~ 21 days starting preferably within the first ~~six~~ five days of menstrual cycle. They ~~stimulate~~ inhibit ovulation and implantation as well as alter the quality of cervical mucus to prevent entry of ~~ova~~ sperm.

19. (a) **20.** (a) **21.** (b) **22.** (b) **23.** (d)
24. (c) **25.** (a) **26.** (b) **27.** (a) **28.** (d)
29. (a) Surgical method or sterilisation
(b) In the given figure A, Vas deferens and in figure B, Fallopian tubes are tied and cut.
(c) Surgical intervention blocks gamete transport and thereby prevent conception.
30. (a) A-Withdrawal or coitus interruptus, B-Barrier method, C-Pills, D-Tubectomy, E-Vasectomy.
(b) Cervical caps, Diaphragm, Vaults
(c) Progestogen and progestogen-estrogen combination. ☺☺

TRIO

ANSWERS APRIL 2023

The three letter word is **R U L**.

S P O **R U L** A T I O N
M O **R U L** A
S P I **R U L** I N A
G A S T **R U L** A T I O N

Winner : Evereen Tafannoom, Howrah (West Bengal)

MONTHLY TEST DRIVE

XII

This specially designed column enables students to self analyse their extent of understanding of complete syllabus. Give yourself four marks for correct answer and deduct one mark for wrong answer. Self check table given at the end will help you to check your readiness.

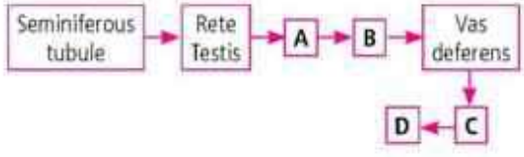
Total Marks : 160

Series 2 : Human Reproduction Reproductive Health

Time : 40 Min.

1. Identify the correct sequence of various reproductive events heading to parturition.
(a) Gametogenesis, insemination, fertilisation, implantation, gestation
(b) Gametogenesis, insemination, implantation, fertilisation, gestation
(c) Gametogenesis, gestation, insemination, implantation, fertilisation
(d) Gametogenesis, gestation, implantation, fertilisation, insemination

2. Given below is the path of sperm through the male reproductive system. Identify A, B, C and D.



	A	B	C	D
(a)	Vasa efferentia	Ejaculatory duct	Epididymis	Urethra
(b)	Urethra	Ejaculatory duct	Vasa efferentia	Epididymis
(c)	Vasa efferentia	Epididymis	Ejaculatory duct	Urethra
(d)	Epididymis	Vasa efferentia	Ejaculatory duct	Urethra

3. Pills usually contain small doses of _____ combinations.
(a) progesterone and estrogen
(b) progesterone and prolactin
(c) prolactin and estrogen
(d) progesterone and luteinising hormone

4. How many accessory glands are present in human males?
(a) Paired prostate, a seminal vesicle and paired bulbourethral glands.
(b) Testis, a prostate gland and paired bulbourethral glands.
(c) A prostate gland, paired seminal vesicles and paired bulbourethral glands.
(d) Paired prostate, paired seminal vesicles and a penis.

5. Emergency contraceptives are effective if used within
(a) 72 hour of coitus
(b) 72 hours of ovulation
(c) 72 hours of menstruation
(d) 72 hours of implantation.

6. Match the following column I with column II and select the correct option.

	Column I		Column II
1.	Cushion of fatty tissue covered by skin and pubic hair.	(A)	Labia minora
2.	Fleshy folds of tissue which surround the vaginal opening.	(B)	Labia majora
3.	Paired folds of tissue under labia majora.	(C)	Clitoris
4.	Tiny finger-like structure lying above urethral opening	(D)	Mons pubis

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

7. How many mammary lobes are there in glandular tissue of each breast in human female?
(a) 15-20 (b) 10-15 (c) 10-20 (d) 30-40

8. Which of the following methods of contraception has maximum chances of failure?
(a) Periodic abstinence (b) Vasectomy
(c) Tubectomy (d) IUDs

9. What does test tube baby mean?
(a) Fertilisation and development of embryo in a test tube.
(b) Development of zygote through tissue culture technique.
(c) Formation of zygote under simulated conditions in the laboratory.
(d) Formation of zygote from non-fertilised ovum.

10. How many sperms are formed from two primary spermatocytes?
(a) 4 (b) 8 (c) 12 (d) 16

11. Select the correct ploidy level for the given cells.

Cells	Ploidy level
Germ cells	A
Spermatids	B
1° spermatocytes	C
Spermatozoa	D

	A	B	C	D
(a)	2n	n	2n	n
(b)	n	n	2n	2n
(c)	2n	2n	n	n
(d)	2n	2n	2n	n

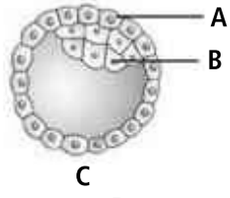
12. What measures should be followed by a person in order to present STIs?
(a) Avoid sex with multiple partners.
(b) Always try to use condoms during coitus.
(c) One should go to a qualified doctor for treatment in case of doubt.
(d) All of these

13. Read the following statements and select the correct option.
Statement I: The breakdown of endometrial lining of the uterus leads to menstruation.
Statement II: Lack of menstruation may be an indicative of pregnancy.
(a) Both statements I and II are correct.
(b) Statement I is correct but statement II is incorrect.
(c) Statement I is incorrect but statement II is correct.
(d) Both statements I and II are incorrect.

14. A women had her last period on 3rd April. In order to prevent pregnancy, when should the couple avoid coitus?
(a) 7th April - 15th April (b) 12th April - 19th April
(c) 3rd April - 9th April (d) 3rd April - 12th April

15. Which of the following is incorrectly matched?
(a) Copper releasing IUDs – Multiload 375
(b) Hormone releasing IUDs – Progestasert
(c) Non-medicated IUDs – LNG-20
(d) Saheli – Once a week pill

16. Given structure 'C' when gets embedded in the endometrium of the uterus leads to implantation and thus, pregnancy. Identify A, B and C.



	A	B	C
(a)	Inner cell mass	Trophoblast	Blastocyst
(b)	Trophoblast	Inner cell mass	Blastocyst
(c)	Inner cell mass	Trophoblast	Morula
(d)	Trophoblast	Inner cell mass	Morula

17. An embryo having 12 blastomeres is called
(a) morula (b) blastula
(c) gastrula (d) blastocyst.

18. Which of the following hormones are produced by a woman only during pregnancy?
(a) hPL and estrogen (b) hCG and hPL
(c) hCG and estrogen (d) progesterone and hPL

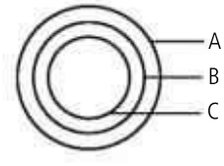
19. Which of the following contraceptive devices are inserted into female reproductive tract to cover the cervix during coitus?
(a) Cervical caps (b) Saheli
(c) Vaults (d) Both (a) and (c)

20. Which of the following produces energy for the movement of the tail of sperms?
(a) Ribosome (b) Plasma membrane
(c) Mitochondria (d) Nucleus

21. Choose the incorrect statement regarding an ideal contraceptive.
(a) It should be user friendly.
(b) It should be irreversible.
(c) It should not have any side effect.
(d) It should be easily available.

22. Which of the following is not a natural method of contraception?
(a) Periodic abstinence
(b) Coitus interruptus
(c) Lactational amenorrhea
(d) Diaphragms and vaults

23. Given below is a hypothetical representation of three walls of uterus. *i.e.*, A, B, C. Which of the layer(s) out of the three undergoes cyclical changes during menstrual cycle?



(a) A (b) C
(c) B (d) Both (a) and (c)

24. Rhea had 'Saheli' for 5 weeks in order to prevent conception. How many tablets she took during those 5 weeks?
(a) 10 (b) 5 (c) 35 (d) 25

25. Which of the following is present in testicular lobules?
(a) Seminiferous tubules (b) Seminal vesicles
(c) Lactiferous duct (d) Ampulla

26. Read the given statements and select the correct option.
Statement I : Pills are very effective contraceptives with few side effects.
Statement II : Pills inhibit ovulation and implantation as well as retard entry of sperms.
(a) Both statements I and II are correct.
(b) Statement I is correct but statement II is incorrect.
(c) Statement I is incorrect but statement II is correct.
(d) Both statements I and II are incorrect.

27. Select the incorrectly matched pair.
(a) Contraceptive pills – Inhibit ovulation
(b) Sterilisation – Inhibit gamete formation

(c) Hormonal IUDs – Inhibit implantation
(d) Barrier method – Block entry of sperms

28. Which of the following venereal diseases is/are completely incurable even if detected early and treated properly?
(a) Hepatitis-B (b) HIV
(c) Genital herpes (d) All of these.

29. Read the following and fill up the blanks with correct option. Each testis has about **A** compartments called testicular lobules with each containing **B** highly coiled seminiferous tubules where sperms are produced.

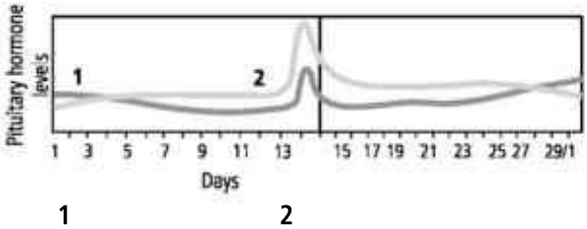
	A	B
(a)	50	1-3
(b)	100	1-2
(c)	250	1-3
(d)	250	3-4

30. Which of the following assisted reproductive technologies is advised when males are unable to inseminate the females?
(a) Artificial insemination (AI)
(b) Zygote intra fallopian transfer (ZIFT)
(c) Gamete intra fallopian transfer (GIFT)
(d) *In vivo* fertilisation (IVF)

31. Which of the following is an ideal contraceptive for the female who want to delay her pregnancy?
(a) Condoms (b) Vaults
(c) IUDs (d) Tubectomy

32. Which of the following is the role of copper ion in CuT?
(a) It inhibits ovulation.
(b) It inhibits gametogenesis.
(c) It suppresses fertilising capacity of sperms.
(d) It makes uterus unsuitable for implantation.

33. The following graph shows the levels of pituitary hormones during a menstrual cycle. What do 1 and 2 represent?



	1	2
(a)	LH	FSH
(b)	FSH	LH
(c)	LH	Estrogen
(d)	Progesterone	FSH

34. The phase of menstrual cycle that lasts for 3-5 days is
(a) follicular phase (b) luteal phase
(c) menstrual phase (d) secretory phase.

35. In test tube baby programme, the zygote with upto 8 blastomeres could be transferred into the _____ and the process is called _____.
(a) fallopian tube, IUT (b) fallopian tube, ZIFT
(c) uterus, IUT (d) uterus, ZIFT

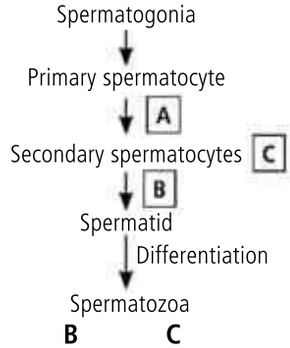
36. MTP has been legalised in India but with some strict conditions. Which of the following is the misuse of MTP?
(a) To avoid pregnancy during rapes
(b) To avoid pregnancy if it is dangerous for mother or child
(c) To abort the female fetus
(d) To get rid of unwanted pregnancy due to unprotected intercourse

37. The infundibulum leads to a wider part of the oviduct called
(a) isthmus (b) ampulla (c) fimbriae (d) hymen.

38. Ramesh undergoes a technique where his semen was collected and artificially introduced into the uterus of his wife Sipra. Identify the technique.
(a) IUI (b) GIFT (c) ZIFT (d) ICSI

39. Which of the following is not a barrier method of contraception?
(a) Diaphragm (b) Cervical caps
(c) Saheli (d) Vaults

40. The following flow chart shows a schematic representation of spermatogenesis. Identify A and B and how many secondary spermatocytes (C) are formed?



	A	B	C
(a)	Mitosis	Meiosis	2
(b)	Meiosis I	Meiosis II	8
(c)	Meiosis I	Meiosis II	2
(d)	Mitosis	Meiosis	4

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