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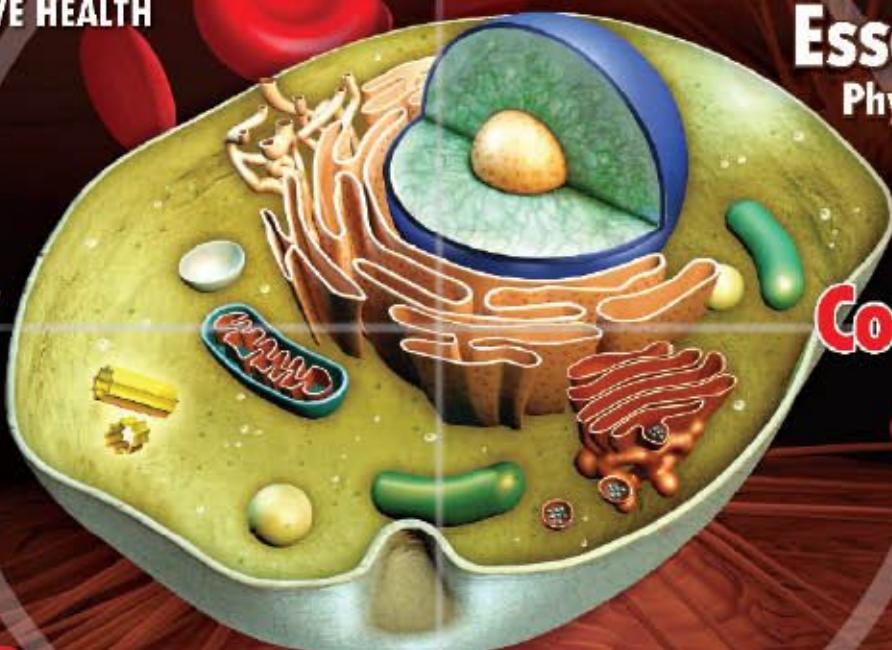
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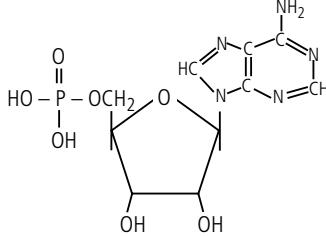


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Exam on
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1. The highly resistant nature of bacterial endospores is due to thick wall and presence of chemical called
 - (a) murein
 - (b) dipicolinic acid
 - (c) bacteriocin
 - (d) mycolic acid.
2. A are found at maximum depth of sea where no other photosynthetic organisms grow as they are able to absorb the short B wavelengths of light.

A	B
(a) Bryophytes	blue
(b) Chlorophytes	red
(c) Rhodophytes	blue green
(d) Phaeophytes	blue
3. Earthworm is structurally more advanced over roundworms. This can be explained by the presence of
 - (a) metamerism
 - (b) true coelom
 - (c) setae
 - (d) all of these.
4. Membrane bound crystalline structures called wortonin bodies
 - (a) completely plug the simple septal pores that allow movement of substances between cells
 - (b) are unicellular and are found in chitosomes
 - (c) are found in fungi belonging to classes Ascomycetes and Deuteromycetes
 - (d) are present in membranous vesicle lomasome, attached to plasma membrane.
5. In Mendelian dihybrid cross, when heterozygous round yellow are self crossed, round green offsprings are represented by the genotype
 - (a) RrYy, RrYY, RRYy
 - (b) Rryy, RRyy, rryy
 - (c) rrYy, RrYY
 - (d) Rryy, RRy.
6. Identify the given structure and select the correct option.
 - (a) Adenosine
 - (b) Guanosine
 - (c) Adenylic acid
 - (d) Cytidine
7. If a recombinant DNA carrying antibiotic resistance gene (e.g., tetracycline) is transferred into an *E.coli* cell, then the host cell is transformed into tetracycline resistant cell. The tetracycline resistant gene in this case is called a
 - (a) cloning site
 - (b) selectable marker
 - (c) vector
 - (d) recombinant protein.
8. What will happen to the population of *Yucca* plants if the population of moths in that area decreases?
 - (a) The population of *Yucca* plants will increase.
 - (b) The population of *Yucca* plants will decrease.
 - (c) The population of *Yucca* plants will remain same.
 - (d) The population of *Yucca* plants will first increase and then decrease.
9. The minute pores through which water enters in the body cavity of sponges is
 - (a) osculum
 - (b) spongocoel
 - (c) ostia
 - (d) choanocytes.
10. Cyclosporin A helps in the
 - (a) flavouring of soft drinks
 - (b) lowering blood cholesterol level
 - (c) inhibiting the activation of T-cells
 - (d) degumming of silk.
11. Arrange the given steps of respiration in correct sequence.
 - P. Transport of gases by the blood
 - Q. Utilisation of oxygen
 - R. Pulmonary ventilation
 - S. Diffusion of O₂ and CO₂ between blood and tissues
 - T. Diffusion of O₂ and CO₂ across alveolar membrane

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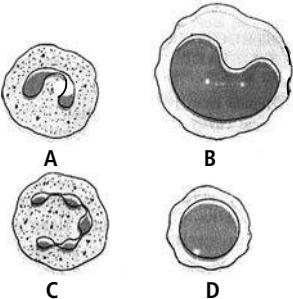
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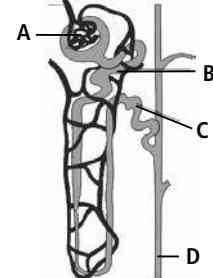
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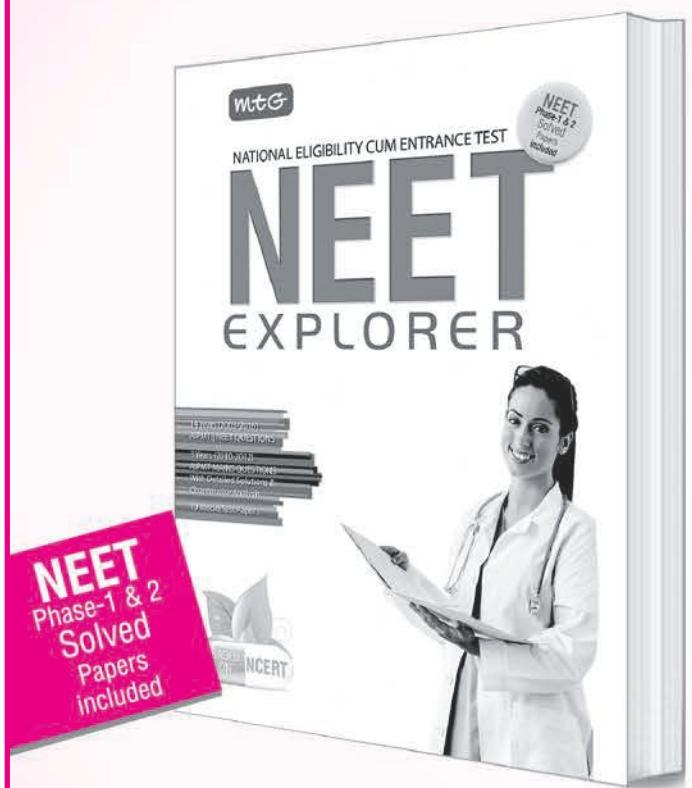
- (a) $P \rightarrow R \rightarrow Q \rightarrow S \rightarrow T$
(b) $T \rightarrow P \rightarrow S \rightarrow R \rightarrow Q$
(c) $R \rightarrow T \rightarrow P \rightarrow S \rightarrow Q$
(d) $S \rightarrow R \rightarrow P \rightarrow T \rightarrow Q$
- 12.** Consider the following statements and select the correct set of statements.
I. *Cycas* is a monoecious plant with both male and female cones borne on the same plant.
II. *Pinus* bears needle-like leaves that help them conserve water and remain evergreen.
III. *Pinus* bears coraloid roots having symbiotic association with blue green algae.
IV. *Cycas* bears two types of leaves - large green foliage and small brownish scale leaves.
(a) I and III only (b) II and IV only
(c) I, II and IV only (d) III and IV only
- 13.** What is the function of mucus and bicarbonates present in the gastric juice?
(a) They provide acidic pH optimal for action of pepsin.
(b) They help in thorough mixing up of the food in the intestine.
(c) They lubricate and protect the mucosal epithelium from excoriation by HCl.
(d) They activate enzymes of pancreatic juice.
- 14.** Which of the following statements is correct?
(a) During inspiration, external intercostal muscles and diaphragm contract.
(b) Volume of air remaining in the lungs even after a forcible expiration is called expiratory reserve volume.
(c) Partial pressure of oxygen in deoxygenated blood is 104 mm Hg.
(d) Emphysema is a difficulty in breathing due to inflammation of bronchi and bronchioles.
- 15.** Read the following statements and select the incorrect one.
(a) Rosie, a transgenic cow, produced milk containing α -1-antitrypsin.
(b) Human protein α -1-antitrypsin is used to treat emphysema.
(c) In children, ADA deficiency can be cured by bone marrow transplantation.
(d) Insulin, used for diabetes, was earlier extracted from the pancreas of cattle and pigs.
- 16.** *cryIAc* and *cryIAb* encode the protein which controls
(a) corn borers (b) cotton bollworms
(c) tobacco budworms (d) armyworms.
- 17.** Which of the following groups contain false fruits?
(a) Apple, strawberry and cashew
(b) Apple, strawberry and banana
- (c) Cashew, guava and orange
(d) Guava, orange and mango
- 18.** RQ (respiratory quotient) is
(a) $\frac{\text{Volume of } O_2 \text{ consumed}}{\text{Volume of } CO_2 \text{ evolved}}$
(b) $\frac{\text{Volume of } CO_2 \text{ evolved}}{\text{Volume of } O_2 \text{ consumed}}$
(c) $\frac{\text{Volume of } O_2 \text{ consumed}}{\text{Volume of } O_2 \text{ evolved}}$
(d) $\frac{\text{Volume of } O_2 \text{ evolved}}{\text{Volume of } CO_2 \text{ consumed}}$.
- 19.** The first vascular plants dominated the land because of the presence of
(a) mechanical tissues
(b) deep, penetrating and wide spreading roots
(c) vascular tissues for long distance transport system
(d) all of these.
- 20.** Identify the organism from the given characteristics.
(i) Presence of notochord in tail of larva
(ii) Dorsal tubular nerve cord is replaced by dorsal ganglion in adult stage
(iii) Shows retrogressive metamorphosis
(a) *Rhabdopleura* (b) *Doliolum*
(c) *Petromyzon* (d) *Branchiostoma*.
- 21.** Match the column I with column II.
- | Column I | Column II |
|------------------------------------|-------------------------|
| A. Filopodial locomotion | (i) <i>Actinophrys</i> |
| B. Axopodial locomotion | (ii) <i>Paramecium</i> |
| C. Reticulopodial locomotion | (iii) <i>Euglypha</i> |
| D. Ciliary locomotion | (iv) <i>Globigernia</i> |
| (a) A-(iii), B-(i), C-(iv), D-(ii) | |
| (b) A-(ii), B-(iii), C-(i), D-(iv) | |
| (c) A-(iii), B-(iv), C-(ii), D-(i) | |
| (d) A-(iv), B-(ii), C-(iii), D-(i) | |
-
- MPP CLASS XI & XII** **ANSWER KEY**
- | | | | | |
|---------|---------|---------|---------|---------|
| 1. (a) | 2. (a) | 3. (c) | 4. (d) | 5. (a) |
| 6. (d) | 7. (a) | 8. (c) | 9. (d) | 10. (c) |
| 11. (b) | 12. (c) | 13. (d) | 14. (b) | 15. (a) |
| 16. (b) | 17. (c) | 18. (c) | 19. (c) | 20. (b) |
| 21. (a) | 22. (c) | 23. (b) | 24. (c) | 25. (b) |
| 26. (a) | 27. (d) | 28. (d) | 29. (a) | 30. (b) |
| 31. (c) | 32. (d) | 33. (a) | 34. (a) | 35. (b) |
| 36. (a) | 37. (d) | 38. (a) | 39. (a) | 40. (a) |
| 41. (b) | 42. (a) | 43. (c) | 44. (b) | 45. (d) |
| 46. (d) | 47. (b) | 48. (c) | 49. (d) | 50. (a) |

- 22.** Select the correct statement regarding prions.
- These are infectious agents made up of highly resistant glycolipid particles.
 - These are formed by mutation in gene *PRNP*.
 - They accumulate in muscular tissue and cause its degeneration.
 - They get affected by enzymes, high temperature and UV radiations.
- 23.** Endosperm is formed during the double fertilisation by the fusion of
- two polar nuclei and one male gamete
 - one polar nucleus and one male gamete
 - ovum and male gamete
 - two polar nuclei and two male gametes.
- 24.** In a pond, *Daphnia* is preyed upon by prawn. Here, prawn and *Daphnia* are respectively
- tertiary consumer and secondary consumer
 - primary consumer and primary producer
 - secondary consumer and primary consumer
 - primary consumer and secondary consumer.
- 25.** Which of the following is not a key feature of telophase of mitosis?
- Attachment of spindle fibres to kinetochore of chromosomes
 - Clustering of chromosomes at opposite spindle poles resulting in loss of their identity as discrete elements
 - Nuclear envelope assembles around the chromosome clusters
 - Reformation of endoplasmic reticulum
- 26.** Which of the following statements is correct?
- Mitochondria contain circular DNA, but chloroplasts have linear DNA.
 - Chloroplasts contain circular DNA, but mitochondria lack it.
 - Neither mitochondria nor chloroplasts contain any DNA.
 - Both mitochondria and chloroplasts contain circular DNA.
- 27.** An angiospermic plant has 24 chromosomes in 'microspore mother cell'. The number of chromosomes in its endosperm will be
- 12
 - 36
 - 24
 - 48.
- 28.** In dihybrid crosses the F_1 heterozygous plants are self fertilised to produce F_2 generation and if offsprings are computed in Punnett square the phenotypic F_2 ratio as per Mendel's independent assortment will yield
- 9 : 7
 - 9 : 3 : 3 : 1
 - 9 : 6 : 1
 - 12 : 3 : 1.
- 29.** Gases used in Miller and Urey's experiment to produce complex organic compounds were
- oxygen, ammonia, methane and water
 - hydrogen, ammonia, methane and water vapour
 - hydrogen, ammonia, ethane and water vapour
 - hydrogen, oxygen, nitrogen and water.
- 30.** Identify A, B, C and D in the given table and select the correct option.
- | Crop | Variety | Resistance to disease |
|-----------------|--------------|-----------------------|
| A | Himgiri | Leaf and stripe rust |
| <i>Brassica</i> | B | White rust |
| C | Pusa Komal | Bacterial blight |
| Cauliflower | Pusa Shubhra | D |
- A B C D**
- Wheat Pusa Swarnim Cowpea Black rot
 - Chilli Pusa Sadabahar Cowpea Tobacco mosaic virus
 - Wheat Pusa Sadabahar Chilli Hill bunt
 - Cowpea Pusa Swarnim Chilli Leaf curl
- 31.** The movement of electrons in ETC in PS II is
- downhill in terms of redox potential scale
 - uphill in terms of redox potential scale
 - downhill in terms of oxidation reaction
 - uphill in terms of reduction reaction.
- 32.** Two adjacent cells A and B are being studied. Cell A has solute potential -10 bars and pressure potential 2 bars. Cell B has solute potential -20 bars and pressure potential 6 bars. What will be the direction of movement of water?
- Water will move from cell A to B.
 - Water will move from cell B to A.
 - Water will move in both directions.
 - There will be no movement of water.
- 33.** During which substage of prophase-I of meiosis, are bivalents formed?
- Pachytene
 - Leptotene
 - Diplotene
 - Zygotene
- 34.** Which of the following organelles is common in both plants and animals?
- Mitochondrion
 - Chloroplast
 - Lysosomes
 - Contractile vacuole
- 35.** The coding strand of DNA has the following sequence:
—A C G T A C —
What will be the sequence of mRNA?
- UGCAUG
 - ACGUAC
 - ACGTAC
 - TGCATG

- (d) On an average, a normal adult secretes about 1.5 litres of urine in 24 hours.
- 47.** At resting, the axonal membrane of a neuron is more permeable to
 (a) sodium ions
 (b) calcium ions
 (c) potassium ions
 (d) negatively charged proteins.
- 48.** Identify the cells labelled as A, B, C and D in the given diagram and select the correct option.
- 
- (a) A = Eosinophil, B = Erythrocyte, C = Neutrophil, D = Basophil
 (b) A = Eosinophil, B = Lymphocyte, C = Neutrophil, D = Monocyte
 (c) A = Erythrocyte, B = Basophil, C = Neutrophil, D = Lymphocyte
 (d) A = Eosinophil, B = Monocyte, C = Neutrophil, D = Lymphocyte
- 49.** Which of the following does not affect Hardy-Weinberg equilibrium?
 (a) Genetic drift (b) Natural selection
 (c) Gene migration (d) Selective mating
- 50.** Which of the following causes malignant malaria?
 (a) *Plasmodium vivax*
 (b) *Plasmodium malariae*
 (c) *Plasmodium falciparum*
 (d) *Plasmodium ovale*
- 51.** The steps in DNA fingerprinting are given below. Arrange them in the correct sequence.
 (i) Transfer of separated DNA fragments to nitrocellulose membrane
 (ii) Isolation of DNA
 (iii) Hybridisation using labelled VNTR probe
 (iv) Separation of DNA fragments by electrophoresis
 (v) Detection of hybridised DNA fragments by autoradiography
 (vi) Digestion of DNA by restriction endonucleases
 (a) (i), (iii), (ii), (v), (vi), (iv)
 (b) (ii), (vi), (iv), (i), (iii), (v)
 (c) (iii), (ii), (v), (i), (iv), (vi)
 (d) (iv), (iii), (ii), (v), (i), (vi)
- 52.** Verhulst-Pearl logistic growth is described by the equation
 (a) $dN/dt = rN \left(\frac{K - N}{N} \right)$
 (b) $dN/dt = rN \left(\frac{N - K}{N} \right)$
 (c) $dN/dt = rN \left(\frac{K - N}{K} \right)$
 (d) $dN/dt = rN \left(\frac{N - K}{K} \right)$.
- 53.** Which of the following statements regarding bioreactors is correct?
 (a) It is used in separation and purification of a product.
 (b) It is used as microinjection.
 (c) It is used in processing of large volumes of culture.
 (d) It is used in amplification of genes.
- 54.** Which stage of mitosis is characterised by splitting of centromeres and separation of chromatids?
 (a) Metaphase (b) Anaphase
 (c) Telophase (d) Prophase
- 55.** Which of the following plastids store oils and fats?
 (a) Aleuroplasts (b) Amyloplasts
 (c) Elaioplasts (d) Chromoplasts
- 56.** Which of the following antibodies is abundantly present in colostrum?
 (a) IgG (b) IgM
 (c) IgE (d) IgA
- 57.** Read the given statements about smoking.
 (i) Smoking increases carbon monoxide content in the blood.
 (ii) Smoking contains nicotine which helps in preventing gastric ulcers.
 (iii) It stimulates adrenal gland to release adrenaline into blood circulation.
 (iv) It increases the incidence of lung cancer and coronary heart disease.
- Which of the above given statements are correct?
 (a) (i), (ii) and (iii) only (b) (i), (iii) and (iv) only
 (c) (i) and (iv) only (d) (ii) and (iv) only
- 58.** The relative contribution of CH_4 , CFCs and N_2O to total global warming is respectively
 (a) 6%, 14% and 20%
 (b) 25%, 6% and 10%
 (c) 30%, 24% and 2%
 (d) 20%, 14% and 6%.
- 59.** In a grassland ecosystem, the largest population in a pyramid of numbers is that of
 (a) producers (b) primary consumers
 (c) secondary consumers (d) tertiary consumers.

- 60.** Tendons and ligaments are examples of
 (a) specialised connective tissue
 (b) loose connective tissue
 (c) dense irregular connective tissue
 (d) dense regular connective tissue.
- 61.** Initiation codon of protein synthesis (in eukaryotes) is
 (a) GUA (b) GCA
 (c) CCA (d) AUG.
- 62.** Which of the following pair is mismatched?
 (a) Interstitial cells – secrete testosterone
 (b) Seminiferous tubules – produce sperms
 (c) Vas deferens – produce seminal fluid
 (d) Penis – transfers semen
- 63.** A is the outermost layer of alimentary canal made up of a thin mesothelium with some B tissue. Select the correct option for A and B.
 (a) A-Mucosa, B-muscular
 (b) A-Serosa, B-connective
 (c) A-Muscularis, B-connective
 (d) A-Sub-mucosa, B-muscular
- 64.** Which of the following statements is correct?
 (a) Pure water has lowest water potential.
 (b) Water in a system moves from a region having higher water potential to the region of lower water potential.
 (c) Solute potential is always positive.
 (d) A positive pressure potential in xylem plays a major role in transporting water up a stem.
- 65.** In snapdragon, the phenotypic ratio of F_2 generation of a cross between pure white and pure red flower plant is
 (a) 3 (red) : 1 (white)
 (b) 1 (red) : 2 (pink) : 1 (white)
 (c) 1 (red) : 1 (pink)
 (d) 3 (pink) : 1 (white).
- 66.** During photorespiratory pathway,
 (a) only sugars are synthesised
 (b) both sugars and ATP are synthesised
 (c) only ATP is synthesised
 (d) neither sugars nor ATP are synthesised.
- 67.** Read the following statements and select the correct ones.
 (i) Conidia are the asexual propagules found in *Penicillium*.
 (ii) A piece of potato tuber having at least one eye (or node) is capable of giving rise to a new plant.
 (iii) Ginger propagates vegetatively by underground roots.
 (iv) Vegetative propagation in *Agave* takes place by bulbil.
 (a) (ii) and (iii) only (b) (i) and (iv) only
 (c) (i), (ii) and (iv) only (d) (i), (ii) and (iii) only
- 68.** Which of the following are membrane-less organelle?
 (a) Mitochondria (b) Lysosomes
 (c) Ribosomes (d) Vacuoles
- 69.** If the DNA content at G_1 phase is 1C, what will be the DNA content of the cells at S , G_2 and M phase respectively?
 (a) 2C, 2C and 2C (b) 2C, 2C and 1C
 (c) 1C, 1C and 2C (d) 2C, 1C and 1C
- 70.** Refer to the given figure of nephron.
- 
- Identify A, B, C and D and select the incorrect option regarding them.
- (a) A-Glomerulus - a tuft of capillaries formed by afferent arteriole
 (b) B-PCT-lined by simple cuboidal brush border epithelium
 (c) C-Loop of Henle reabsorption of glucose, amino acids, water, Na^+ , K^+ and uric acid
 (d) D-Collecting duct-extends from the cortex of the kidney to the inner parts of medulla
- 71.** Which of the following is not a type of succulent fruits?
 (a) Berries (b) Drupes
 (c) Syconus (d) Pome
- 72.** Big holes in Swiss cheese are made by a
 (a) a machine
 (b) a bacterium that produces methane gas
 (c) a bacterium producing a large amount of carbon dioxide
 (d) a fungus forming ethyl alcohol by fermentation.
- 73.** In which type of the following, do more individuals acquire peripheral character value at both ends of the distribution curve?
 (a) Stabilising selection (b) Directional selection
 (c) Disruptive selection (d) None of these
- 74.** In DNA, when AGCT occurs, their association is as per which of the following pair?
 (a) AT-GC (b) AG-CT
 (c) AC-GT (d) All of these
- 75.** Flattened petiole performing the function of photosynthesis is
 (a) phylloclade (b) pulvinus
 (c) phyllode (d) stipule.
- 76.** Levels of which hormone increases during secretory phase of menstrual cycle?
 (a) Follicle stimulating hormone
 (b) Estrogen

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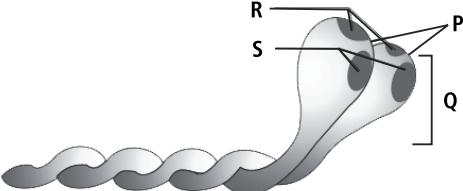
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- (c) Progesterone
(d) Luteinising hormone
- 77.** Read the following statements and select the correct ones.
 (i) Catecholamines stimulate the breakdown of glycogen.
 (ii) Adrenal cortex secretes hormones which are involved in carbohydrate metabolism.
 (iii) Parathyroid hormone decreases Ca^{2+} absorption from the digested food.
 (iv) Hyperthyroidism causes cretinism in young ones.
 (a) (i) and (ii) only (b) (ii), (iii) and (iv) only
 (c) (i), (iii) and (iv) only (d) (i) and (iv) only
- 78.** Which of the following statements is incorrect about sickle-cell anaemia?
 (a) It is an autosomal recessive trait.
 (b) The defect is caused by the substitution of glutamic acid by proline.
 (c) The disease is controlled by a single pair of allele.
 (d) A single base substitution at the sixth codon of the beta globin chain results in disease.
- 79.** Ozone degradation is caused by
 (a) methane (b) carbon monoxide
 (c) chlorofluorocarbons (d) carbon dioxide.
- 80.** Cattle and goats do not eat *Calotropis* because
 (a) it is distasteful to its predator
 (b) it produces highly poisonous glycosides
 (c) it possesses thorns
 (d) it is hard to chew.
- 81.** Study carefully the given diagram of myosin monomer and select the correct option regarding it.
- 
- (a) P is an active ATPase enzyme.
 (b) R are ATP binding sites.
 (c) S are actin binding sites.
 (d) P and Q together comprise light meromyosin.
- 82.** What would be the nature of offspring in F_2 progeny when a tall pea plant (TT) is crossed with dwarf plant (tt)?
 (a) All tall plants
 (b) All dwarf plants
 (c) Both tall and dwarf plants in 1 : 1 ratio
 (d) Both tall plants and dwarf plants in 3 : 1 ratio
- 83.** Common ancestor of man and ape is
 (a) *Australopithecus africanus*
 (b) *Dryopithecus africanus*
 (c) *Ramapithecus* (d) *Pithecanthropus erectus*.
- 84.** Tricarpellary, syncarpous, superior ovary with endospermous seeds is found in
 (a) *Belladonna* (b) *Sesbania*
 (c) *Gloriosa* (d) *Trifolium*.
- 85.** Select the incorrect pair.
- | Phyllotaxy | Example |
|-----------------------------|-------------------|
| (a) Alternate | Sunflower |
| (b) Opposite and decussate | <i>Calotropis</i> |
| (c) Whorled | <i>Alstonia</i> |
| (d) Opposite and superposed | China rose |
- 86.** The process of degradation of detritus into simpler inorganic substances by bacteria and fungi is known as
 (a) fragmentation (b) catabolism
 (c) humification (d) mineralisation.
- 87.** Which of the following is not used in catalytic converters?
 (a) Rhodium (b) Palladium
 (c) Lead (d) Platinum
- 88.** Hotspots are priority areas for *in situ* conservation. The key criteria for determining a hotspot is/are
 (a) location in developed/undeveloped country
 (b) vicinity to the sea
 (c) species richness and number of endemic species
 (d) number of species got extinct.
- 89.** Which of the following plants is not pollinated by water?
 (a) *Vallisneria* (b) Water lily
 (c) *Hydrilla* (d) *Zostera*
- 90.** The Chipko movement for conservation of forests was started in 1974 at
 (a) Rajasthan (b) Silent Valley
 (c) Sunderbans (d) Garhwal.

ANSWER KEY

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



PRACTICE PAPER

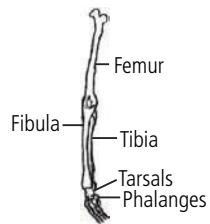
AIIMS

Exam on
28th May

1. When a bacteriophage, in its lytic phase, carries some of the bacterium partially digested chromosome with it to another host cell, the process is called
 - (a) generalised transduction
 - (b) conjugation
 - (c) transformation
 - (d) specialised transduction.
2. Which of the following reduces plant growth and induces dormancy?
 - (a) Cytokinin
 - (b) Auxin
 - (c) Xylene
 - (d) Abscisic acid
3. Restriction endonucleases are utilised in genetic engineering as
 - (a) molecular scalpers for cutting DNA at specific sites
 - (b) molecular builder of nucleotides
 - (c) molecular cement for combining DNA fragments into long chains
 - (d) none of these.
4. Select the mismatched pair from the following.
 - (a) Insulin – Gluconeogenesis
 - (b) Glucagon – Glycogenolysis
 - (c) Oxytocin – Contraction of uterine muscles
 - (d) Prolactin – Milk production and storage in mammary glands
5. Match the following and select the correct answer.

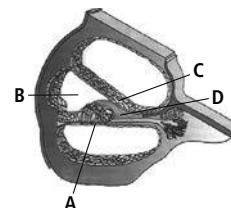
Column I	Column II
A. Choanocytes	1. Platyhelminthes
B. Cnidoblasts	2. Ctenophora
C. Flame cells	3. Porifera
D. Nephridia	4. Coelenterata
E. Comb plates	5. Annelida

 - (a) A – 2, B – 1, C – 4, D – 5, E – 3
 - (b) A – 2, B – 4, C – 1, D – 5, E – 3
 - (c) A – 5, B – 1, C – 3, D – 2, E – 4
 - (d) A – 3, B – 4, C – 1, D – 5, E – 2
6. An insect bite may result in inflammation of that spot. This is triggered by the alarm chemicals such as
 - (a) histamine and dopamine
 - (b) histamine and kinins
 - (c) interferons and opsonin
 - (d) interferons and histones.
7. Given diagram shows bone of the left human hindlimb as seen from front. It has certain mistakes in labelling. Two of the incorrectly labelled bones are
 - (a) tibia and tarsals
 - (b) femur and fibula
 - (c) fibula and phalanges
 - (d) tarsals and femur.
8. Which of the following statements is incorrect?
 - (a) Lichen, an association of fungus and algae is an example of mutualism.
 - (b) Those epiphytes which use other plants for support only and not for water or food supply are examples of commensalism.
 - (c) Sea-anemone on hermit-crab is an example of protocooperation.
 - (d) Mutualism, protocooperation, commensalism cannot be included under symbiosis.
9. Microtubule depolymerising drug such as colchicine is expected to
 - (a) inhibit spindle formation during mitosis
 - (b) inhibit cytokinesis
 - (c) allow mitosis beyond metaphase
 - (d) induce formation of multiple contractile rings.
10. Minamata disease was caused due to the consumption of
 - (a) sea food containing lots of cadmium
 - (b) fish contaminated with mercury
 - (c) oysters with lots of pesticide
 - (d) sea food contaminated with selenium.
11. Identify the type of chromosomal mutation shown in the given figure.
 - (a) Deletion
 - (b) Duplication
 - (c) Inversion
 - (d) Reciprocal translocation



- 12.** Which of the following is not correctly matched?
- Root knot disease—*Meloidogyne javanica*
 - Smut of bajra—*Tolypocladium longisporum*
 - Covered smut of barley—*Ustilago nuda*
 - Late blight of potato—*Phytophthora infestans*
- 13.** The correct sequence in cell cycle is
- S — M — G₁ — G₂
 - S — G₁ — G₂ — M
 - G₁ — S — G₂ — M
 - M — G₁ — G₂ — S.
- 14.** If a homozygous red-flowered plant is crossed with a homozygous white-flowered plant, the offsprings will be
- half-white flowered
 - half red-flowered
 - all white-flowered
 - all red-flowered.
- 15.** Features shown by crustaceans are :
- Cephalothorax, book lungs, chitinous exoskeleton
 - Head and thorax, biramous appendages, book lungs
 - Head and thorax, book lungs, chitinous exoskeleton
 - Cephalothorax, biramous appendages, gills
- 16.** Barr body is found during
- interphase in cell of female mammal
 - interphase in cell of male mammal
 - prophase in cell of female mammal
 - prophase in cell of male mammal.
- 17.** A frog has its brain crushed. But when pinched on the leg, the leg draws away. It is an example of
- neurotransmitter induced response
 - simple reflex
 - conditioned reflex
 - automated motor response.
- 18.** The technique called Gamete Intra Fallopian Transfer (GIFT) is recommended for those females
- who cannot produce an ovum
 - who cannot retain the foetus inside uterus
 - whose cervical canal is too narrow to allow passage for the sperms
 - who cannot provide suitable environment for fertilisation.
- 19.** Which of the following statements is true regarding light reaction of photosynthesis?
- In PSII the reaction centre chlorophyll *a* has an absorption peak at 700 nm, hence is called P₇₀₀.
 - In PSI the reaction centre chlorophyll *a* has an absorption maxima at 680 nm and is called P₆₈₀.
 - Lamellae of the grana have PSI and PSII and stroma lamellae membranes have PSII only.
 - Both photosystems I and II are involved in Z scheme.
- 20.** Which of the following statements is/are incorrect regarding connective tissues?
- Connective tissues are most abundant and widely distributed in the body of complex animals.
 - They connect and support other tissues.
- They include such diverse tissues as bone, cartilage, tendons, adipose and loose connective tissues.
 - They form the internal and external lining of many organs.
 - In all connective tissues except blood, the cells secrete fibres of structural proteins called collagen or elastin.
 - (iv) only (v) only
 - (i) and (ii) only (iii) and (v) only
- 21.** Appropriate measures to reduce overall greenhouse gas emissions are the commitments of the
- Montreal Protocol
 - Environment Act
 - Kyoto Protocol
 - Beijing Protocol.
- 22.** Which of the following is correct order of the evolutionary history of man?
- Peking man, *Homo sapiens*, Neanderthal man, Cromagnon man
 - Peking man, Neanderthal man, Heidelberg man, Cromagnon man
 - Peking man, Heidelberg man, Neanderthal man, Cromagnon man
 - Peking man, Neanderthal man, *Homo sapiens*, Heidelberg man
- 23.** Match column I with column II and select the correct option from the codes given below.
- | Column I
(Product) | Column II
(Part of <i>Cannabis</i> plant) |
|-------------------------------|---|
| A. Hashish | (i) Dried unfertilised female inflorescence |
| B. Ganja | (ii) Fresh/dried leaves and flowering shoots of both male and female plants |
| C. Marijuana | (iii) Dried/resinous extract from flowering top and leaves |
| D. Bhang | (iv) Dried flowers and top leaves of female plant |
- A - (i), B - (ii), C - (iii), D - (iv)
 - A - (ii), B - (i), C - (iv), D - (iii)
 - A - (iii), B - (i), C - (iv), D - (ii)
 - A - (iv), B - (iii), C - (ii), D - (i)
- 24.** The main function of the fimbriae of the Fallopian tube in females is to
- release ovum from the Graafian follicle
 - make necessary changes in the endometrium for implantation
 - help in the development of corpus luteum
 - help in the collection of the ovum after ovulation.
- 25.** Which part of the nephron makes the filtrate isotonic to blood plasma and how?
- Descending limb of loop of Henle because sodium and other solutes are not reabsorbed here.

- (b) Ascending limb of loop of Henle because sodium, potassium, calcium, magnesium and chloride ions are reabsorbed here.
- (c) Distal convoluted tubule because water, sodium and chloride ions are reabsorbed here under the influence of ADH and aldosterone.
- (d) Collecting tubule because sodium is reabsorbed here under the influence of aldosterone.
- 26.** What is true about tRNA?
- It binds with an amino acid at its 3' end.
 - It has five double stranded regions.
 - It has a codon at one end which recognises the anticodon on messenger RNA.
 - It looks like clover leaf in the three dimensional structure.
- 27.** In succulent plants, the stomata open in night and close in day. Which among the following would be best hypothesis to explain the mechanism of stomatal action in night only?
- CO_2 accumulates, reduces pH, stimulate enzymes resulting in accumulation of sugars.
 - Increase in CO_2 concentration, conversion of organic acids into starch resulting in the increased conversion into sugars resulting in K^+ transport.
 - Low CO_2 concentration accumulates organic acids resulting in the increased concentration of cell sap.
 - CO_2 used up, increase pH results in accumulation of sugars.
- 28.** Choose the correct statement.
- hPL plays a major role in parturition.
 - Fetus shows movements for first time in the 7th month of pregnancy.
 - Signal for parturition comes from fully developed fetus and placenta.
 - Embryo's heart is formed by the 2nd month of pregnancy.
- 29.** Cut surfaces of fruit and vegetables often become dark because
- dirty knife makes it dark
 - oxidation of phenolic compounds present in cells
 - reduction of iron present in cells
 - none of these.
- 30.** From the following groups, select the one which has only secondary metabolites?
- Abrin, cellulose, arginine, tyrosine
 - Glycine, gums, serine, diterpenes
 - Carotenoids, phenylalanine, curcumin, rubber
 - Concanavalin-A, morphine, codeine, vinblastin
- 31.** Which of the following conditions represents a case of co-dominant genes?
- A gene expresses itself, suppressing the phenotypic effect of its alleles.
 - Genes that are similar in phenotypic effect when present separately, but when together interact to produce a different trait.
- (c) Alleles, both of which interact to produce a trait, which may or may not resemble either of the parental types.
- (d) Alleles, each of which produces an independent effect in a heterozygous condition.
- 32.** The quiescent centre in root meristem serves as a
- site for storage of food which is utilised during maturation
 - reservoir of growth hormones
 - reserve for replenishment of damaged cells of the meristem
 - region for absorption of water.
- 33.** Which one of the following groups of structures/organs have similar function?
- Typhlosole in earthworm, intestinal villi in rat and contractile vacuole in *Amoeba*.
 - Nephridia in earthworm, Malpighian tubules in cockroach and urinary tubules in rat.
 - Antennae of cockroach, tympanum of frog and clitellum of earthworm.
 - Incisors of rat, gizzard (proventriculus) of cockroach and tube feet of starfish.
- 34.** Oxygen binding to haemoglobin in blood is
- directly proportional to the concentration of CO_2 in the medium
 - inversely proportional to the concentration of CO_2 in the medium
 - directly proportional to the concentration of CO in the medium
 - independent of the concentration of CO_2 in the medium.
- 35.** Which one is correct regarding electrocardiograph (ECG)?
- P-wave represents the electrical excitation of the ventricle.
 - QRS complex represents repolarisation of the ventricles.
 - T-wave represents repolarisation of the atria.
 - By counting the number of QRS complexes one can determine the pulse rate.
- 36.** Which of the following is correctly labelled?
- A - Reissner's membrane
 - B - Scala vestibuli
 - C - Basilar membrane
 - D - Tectorial membrane
- 37.** Photochemical smog formed in congested metropolitan cities mainly consists of
- ozone, peroxyacetyl nitrate and NO_x
 - smoke, peroxyacetyl nitrate and SO_2
 - hydrocarbons, SO_2 and CO_2
 - hydrocarbons, ozone and SO_x .



- 38.** The process of electroporation involves
(a) fast passage of food through sieve pores in phloem elements with the help of electric stimulation
(b) rapid bombardment of cells with high velocity microprojectiles coated with DNA
(c) making transient pores in the cell membrane to introduce gene constructs
(d) purification of saline water with the help of a membrane system.

- 39.** Grafting is successful in dicots but not in monocots because the dicots have
(a) vascular bundles arranged in a ring
(b) cambium for secondary growth
(c) vessels with elements arranged end to end
(d) cork cambium.

- 40.** Which one of the following is the correct statement regarding the particular drugs specified?
(a) Morphine leads to delusions and disturbed emotions.
(b) Barbiturates cause relaxation and temporary euphoria.
(c) Hashish causes alteration of thoughts, perceptions and hallucinations.
(d) Opium stimulates nervous system and causes hallucinations.

Directions : In the following questions (41-60), a statement of assertion is followed by a statement of reason. Mark the correct choice as :

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
(b) If both assertion and reason are true but reason is not the correct explanation of assertion.
(c) If assertion is true but reason is false.
(d) If both assertion and reason are false.

- 41. Assertion :** Mammalian ova produces hyaluronidase.
Reason : The eggs of mammal are microlecithal and telolecithal.

- 42. Assertion :** Connective tissue inside the brain is essential for conduction of nerve impulse.
Reason : Connective tissues hold together the nerve cells of brain.

- 43. Assertion :** Interferons are type of antibodies produced by body cells infected by bacteria.
Reason : Interferons stimulate inflammation at the site of injury.

- 44. Assertion :** Coacervates are believed to be the precursors of life.
Reason : Coacervates were self-duplicating aggregates of proteins surrounded by lipid molecules.

- 45. Assertion :** The duck-billed platypus and the spiny anteater, both are egg-laying animals yet they are grouped under mammals.
Reason : Both of them have seven cervical vertebrae and twelve pairs of cranial nerves.

- 46. Assertion:** Light is a very important external factor for transpiration.

Reason: Light induces stomatal opening and darkness induces stomatal closure.

- 47. Assertion:** Acetylcholine participates in the nerve impulse transmission across a synapse.

Reason: Acetylcholine is secreted by adrenergic fibres.

- 48. Assertion:** *Azolla pinnata* is used as a biofertiliser in rice cultivation.

Reason: *Azolla* performs nitrogen fixation with the help of symbiotic bacterium *Bacillus* sp.

- 49. Assertion :** Rheumatoid arthritis is a degenerative disease of joints.

Reason : In rheumatoid arthritis, the articular cartilage present at the synovial joints erodes.

- 50. Assertion :** 'Saheli' is an oral pill which contains progestin, with no estrogen and a non-steroidal preparation called centchroman.

Reason : Oral contraceptive pills cause changes in cervical mucus impairing its ability to allow passage and transport of sperms.

- 51. Assertion :** Persons suffering from haemophilia fail to produce blood clotting factor VIII.

Reason : Prothrombin producing platelets in such persons are found in very low concentration.

- 52. Assertion :** In woody stems, the amount of heartwood continues to increase year after year.

Reason : The activity of the cambial ring continues uninterrupted.

- 53. Assertion :** Movement of materials inside phloem is bidirectional, i.e., it can be both upwards or downwards.

Reason : Movement of molecules inside xylem is unidirectional, i.e., always upwards.

- 54. Assertion :** Small intestine is the principal organ for absorption of nutrients.

Reason : Absorption of water, simple sugars and alcohol, etc., takes place in small intestine.

- 55. Assertion:** In the descending limb of loop of Henle, the urine is hypertonic, while in ascending limb of loop of Henle, the urine is hypotonic.

Reason: Descending limb is impermeable to Na^+ , while ascending limb is impermeable to water.

- 56. Assertion :** Oxytocin is also known as anti-diuretic hormone (ADH).

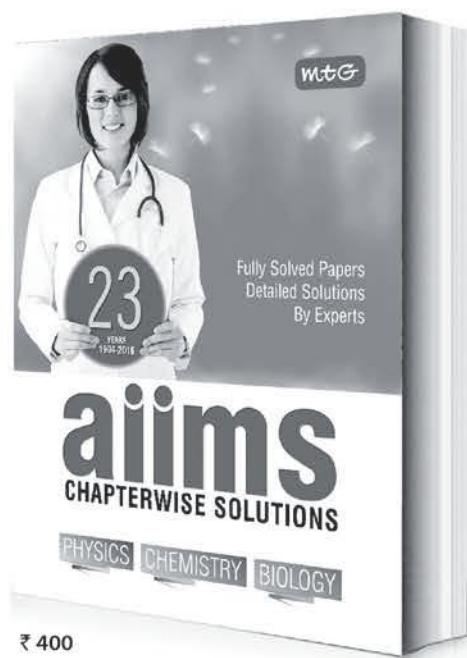
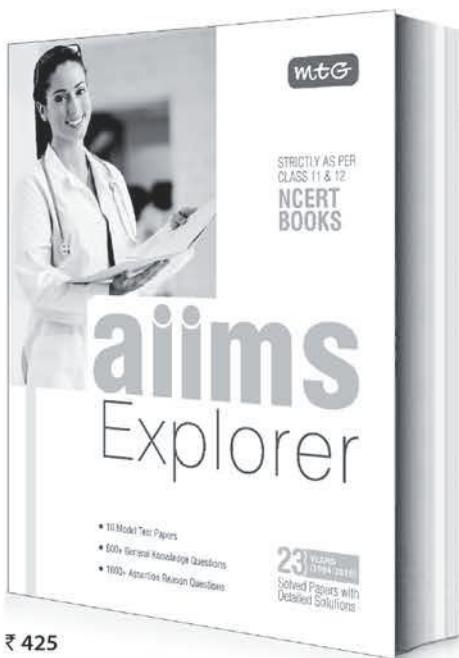
Reason : Oxytocin can cause an increase in the renal reabsorption of water.

- 57. Assertion :** There is no chance of transmission of malaria to man on the bite of a male *Anopheles* mosquito.

Reason : *Anopheles* carries a non-virulent strain of *Plasmodium*.



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58. Assertion : Atmospheric nitrogen gas is always fixed by nitrogen-fixing microorganisms.

Reason : Decomposers release nitrogen gas from dead remains of plants and animals.

59. Assertion : Gap junctions perform cementing function to keep the neighbouring cells together.

Reason : Tight junctions facilitate the cells to communicate with each other by connecting the cytoplasm of adjoining cells, for rapid transfer of ions, small and large molecules, etc.

60. Assertion : In apomixis, the plants with new genetic composition and variations are produced.

Reason: Apomixis is breeding of two genetically similar plants.

ANSWER KEY

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



PANCHANAN MAHESHWARI (FATHER OF INDIAN EMBRYOLOGY)



Prof. Panchanan Maheshwari was an eminent botanist who made India proud by placing it on the world botanical map. Panchanan was born on 09 Nov. 1904 in Jaipur, Rajasthan and completed his school there. He graduated from the Ewing Christian College affiliated to Allahabad University. Maheshwari did his M. Sc (1927) and

D. Sc (1931) under supervision of Dr. Winfield Scott Dudgeon, a reputed botanist from the University of Illinois, Chicago, who was a Professor at Allahabad University. Maheshwari began his teaching career in 1928 at Ewing Christian College, Allahabad, and subsequently served the Universities of Agra, Allahabad, Lucknow, and Dacca. In 1949, he was invited by Sir Maurice Gwyer, the then Vice-Chancellor of the University of Delhi, to head the Department of Botany at the University, which he did until his death in 1966. His chief interest was plant morphology, particularly the embryology of seed plants. Maheshwari studied the process of growth of embryo to become a full fledged plant in several species of angiosperms. He also classified them according to the differences he found in such embryological studies.

One of his books '*An Introduction to the Embryology of Angiosperms*', published in 1950 by McGraw-Hill is considered as a classic and standard reference in the whole world. This book has been reprinted several times and translated into several languages, including Russian.

Dr. Maheshwari discovered anomalous secondary growth in *Boerhaavia* and *Rumex* and traced their origin to protostellar tissues. He showed that sterility in the tree, *Albizia lebbek* was not in response to environmental factors as was earlier believed but due to the collapse of pollination mechanism and degeneration of male and female gametophyte due to internal (probably genetic) factors.

Panchanan and his students investigated more than one hundred families of angiosperms to study comparative embryology. About 10 taxa ranging from microbes to angiosperms were named after Dr. Maheshwari to commemorate his keen interest in several fields of botanical research e.g., *Panchanania jaipuriensis* (fungus), *Isoetes panchananii* (species of quillworts) *Maheshwariella bicornuta* (a Palaeozoic seed from the lower Gondwanas of Karaharbari coal field, India) and *Oldenlandia maheshwarii* (rubiaceous taxon).

Maheshwari invented the technique of test-tube fertilisation of angiosperms. This technique accelerated the rate of fertilisation by eliminating the dormancy period of a seed. Many more flowering plants could now be crossbred. This technique immensely helped plant breeders and opened up new avenues in economic and applied botany.

To promote interest and accommodate the increased contributions in morphology, he launched an International Society of Plant Morphologists with the journal *Phytomorphology* in 1951. To foster scientific writing of the undergraduates, he started a journal, *The Botanica*, published by the Delhi University Botanical Society. At the request of NCERT, he also undertook preparation of a textbook of biology for higher secondary schools.

Dr. Maheshwari was elected fellow of several academies and institutes like the Royal Society, London, Indian Academy of Sciences, Bangalore, Foreign Fellow of the American Academy of Arts and Sciences, Botanical Society of America, Royal Dutch Botanical Society, etc. He was decorated with the degree of D. Sc *honoris causa* of McGill University, Montreal. He was the President of the Indian Botanical Society and National Academy of Sciences, India. The Indian Botanical Society honoured him with the Birbal Sahni Medal in 1958. He was elected as the General President of Indian Science Congress Association for 1968, but he could not fulfil this role because of his untimely death on 18 May 1966.



Scanning Electron Microscope

Scanning electron microscope (SEM) permits direct study of biological ultrastructure owing to higher magnification and resolving power much greater than that of the light microscope. It is used when greatest resolution is required. In scanning electron microscope the image of specimen's surface is produced by secondary electrons reflected back from the specimen. SEM can be used in the field of material science, agriculture, medicine, forensic science, etc.



Electron Gun

It is equivalent to source of light as it thermionically emits beam of electrons. Tungsten filament is normally used for this process. Tungsten emits negatively charged electrons when a high accelerating voltage (40,000 – 100,000 V) is passed between cathode and anode, that pass through a hole in anode forming a beam.

Deflector Coils

These are the rolls of wire that face each other to make a magnetic field that pushes beam from side to side. This is the scanning part of SEM.

Sample Preparation

It is one of the most important step in SEM. The sample is fixed in glutaraldehyde, and dehydrated through a series of solvents and dried completely to avoid surface tension during the process. Biological samples are made conductive by covering them with a thin layer of a conductive material (usually gold) using a process called sputter coating. It is finally mounted onto a special metal holder or stub in the sample stage.

Sample Chamber

It refers to the container at the end of column. This evacuated chamber must be very sturdy and insulated. It may also include tilt and rotation devices, feed through to the outside, temperature stages, optical cameras and various other devices to assist in imaging the sample.

Working Mechanism

Cloud of electron is emitted from electron gun. Anode pulls them away from the wire and speeds them into a stream (electron beam). Magnetic lens bends the beam of electrons over the sample in the same way as glass lens bends beam of light. Beam of electrons hits the sample while some of the electrons bounce back. But since the sample too is made up of atoms, some new electrons are also emitted. Deflectors push the beam back and forth across the surface of sample. These emitted electrons are attracted by detectors that build up an image by mapping the detected signals with beam position and turns current into an image on a screen.

Anode

It is a metal plate which has a positive charge. It attracts the negatively charged electrons towards itself to form an electron beam.

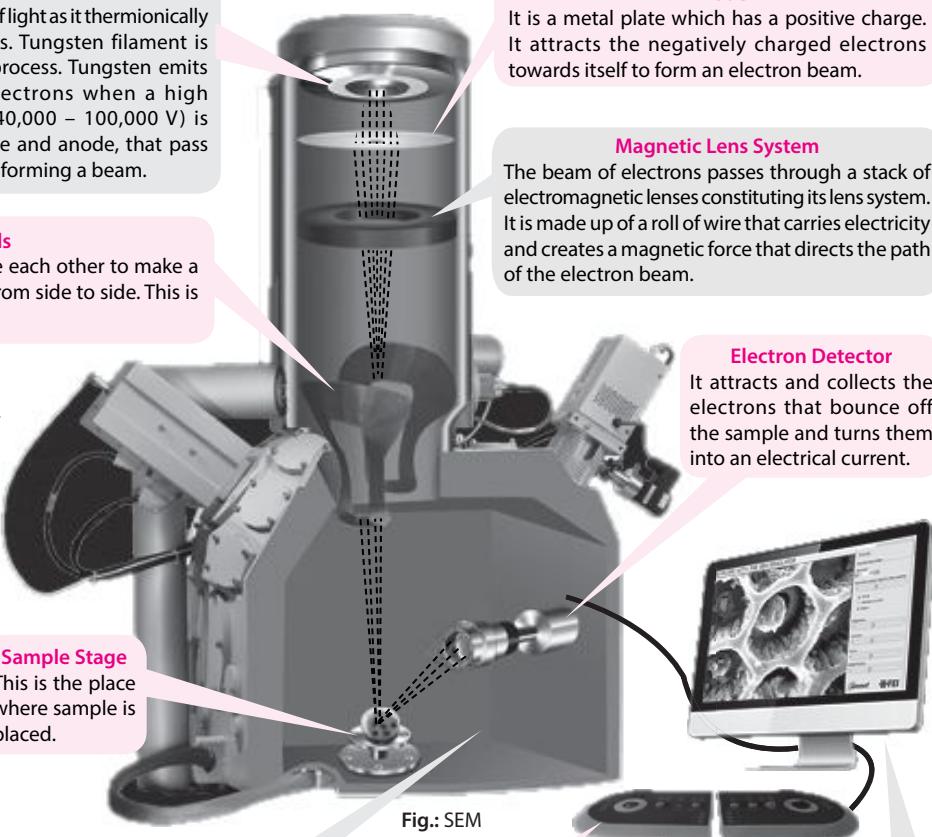
Magnetic Lens System

The beam of electrons passes through a stack of electromagnetic lenses constituting its lens system. It is made up of a roll of wire that carries electricity and creates a magnetic force that directs the path of the electron beam.

Electron Detector

It attracts and collects the electrons that bounce off the sample and turns them into an electrical current.

Fig.: SEM



Controller

Knobs, joysticks, tracker balls and keyboards are used to move the sample to achieve the best image.

Computer

Electron detector is attached to a computer that measures the electrical current from the detector and turns them into an image. Depending on the height and shape of the sample, at each step, we get black, grey and white dots that create image on the screen. Black happens when no electrons hit the detector. White is when all the electrons hit the detector and grey is in between black and white.

BIOLOGY OLYMPIAD

PRACTICE
PROBLEMS
2017

1. The table shows body weight and food intake of a few selected animal species.

Animal species	Average body weight	Average food intake/day
Black bear <i>Euarctos americanus</i>	135 kg	3.9 kg
Common shrew <i>Sorex cinereus</i>	5 gm	13 gm
Pigeon <i>Columba livia</i>	300 gm	100 gm
Horse <i>Equus caballus</i>	500 kg	12 kg

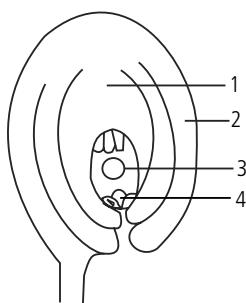
Based on the data provided, analyse the following statements.

- (i) Smaller the animal, higher is the metabolic rate.
- (ii) Larger the animal, greater is the energy requirement per unit body weight leading to larger intake of food.
- (iii) Mammals consume larger proportion of their own weight as food daily compared to birds.
- (iv) Demand for food per unit of body mass increases as the metabolic rate increases.

The correct statements are

- | | |
|--------------------|---------------------------------|
| (a) (i) and (ii) | (b) (i) and (iv) |
| (c) (ii) and (iii) | (d) (iii) and (iv). (INBO 2016) |

2. The diploid chromosome number in the leaf cell of *Pisum* is 14. The diagram given below depicts the ovule structure immediately after fertilisation. (Note : PEN refers to primary endosperm nucleus).



Structure 1-4 and the number of chromosomes present in them respectively are

- (a) nucellus 7; integument 14; PEN 21; egg cell 7
- (b) nucellus 14; integument 14; PEN 21; zygote 14
- (c) embryo sac 7; integument 14; PEN 14; zygote 14
- (d) nucellus 14; integument 7; PEN 14; zygote 14.

(INBO 2016)

3. Which is a false statement?

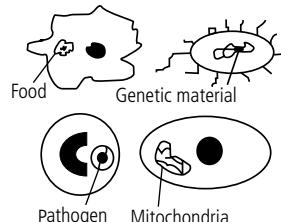
- (a) cDNA is produced from mRNA.
- (b) cDNA lacks introns.
- (c) cDNA cannot be expressed outside an eukaryotic cell.
- (d) cDNA is much shorter than the concerned gene in the genome. (NSEB 2015-16)

4. Two adjacent plant cells are depicted below. A few statements regarding them are made. Mark the correct statement.

CELL A	CELL B
$\Psi = -1200 \text{ kPa}$	$\Psi = -800 \text{ kPa}$
$\Psi_p = 800 \text{ kPa}$	$\Psi_p = 600 \text{ kPa}$
$\Psi_s = -2000 \text{ kPa}$	$\Psi_s = -1400 \text{ kPa}$

- (a) The cell A has a higher water potential than B.
- (b) The direction of movement of water by osmosis will be from cell A to cell B.
- (c) At equilibrium, the two cells will have a water potential value of -1700 kPa .
- (d) Assuming that the solute potentials of the two cells do not change at equilibrium, the pressure potential of cell B will be 400 kPa. (NSEB 2015-16)

5. Which of the following is an example of endosymbiosis?



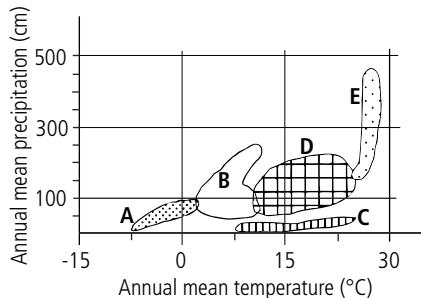
- (a) Amoeba
- (b) Bacteria
- (c) Macrophage
- (d) Eukaryotic cell

(NSEB 2015-16)

- 12.** Many molecules are chiral i.e., their mirror images are non-superimposable. Which of the following could be affected if the chirality of a molecule is changed in a biological system?

- I. Taste reception II. Smell perception
- III. Toxicity IV. Mode of action
- (a) I and II only (b) I, II and III only
- (c) III and IV only (d) I, II, III and IV (INBO 2014)

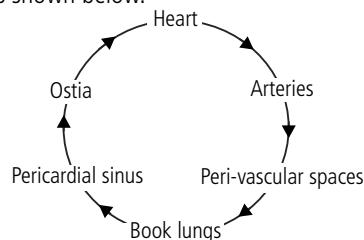
- 13.** While preparing a climograph for major types of biomes, a student prepared the following diagram. Find the correct combination of biomes and their respective characteristics shown in the diagram below.



- (i) Tropical forest
- (ii) Desert
- (iii) Coniferous forests
- (iv) Temperate broadleaved forest
- (v) Alpine and arctic tundra
- (a) (i-E), (ii-A), (iii-C), (iv-B), (v-D)
- (b) (i-E), (ii-C), (iii-B), (iv-D), (v-A)
- (c) (i-E), (ii-C), (iii-D), (iv-B), (v-A)
- (d) (i-E), (ii-A), (iii-D), (iv-B), (v-C)

(INBO 2014)

- 14.** The schematic representation of a circulatory system of a scorpion is shown below.



Mark the correct interpretation.

- (a) The schematic represents a closed vascular system.
- (b) The heart receives only oxygenated blood.
- (c) Body parts receive oxygenated and de-oxygenated i.e., mixed type of blood.
- (d) The schematic is erroneous as it indicates that pericardial sinus receives de-oxygenated blood.

(INBO 2014)

- 15.** There are various types of ATPase pumps found in different types of cells. Of these, F-type, ATPases, also known as ATP synthase, drive ATP synthesis. They are found in all of the following except

- (a) inner membrane of mitochondria
- (b) thylakoid membrane of chloroplasts
- (c) plasma membrane of prokaryotes
- (d) plasma membrane of fungi.

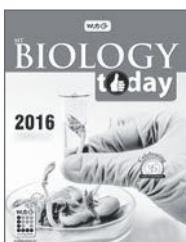
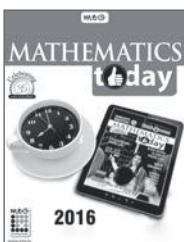
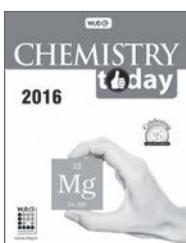
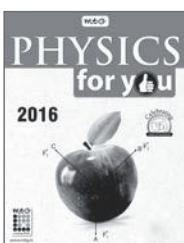
(INBO 2014)

ANSWER KEY

- | | | | | |
|---------|---------|---------|---------|---------|
| 1. (b) | 2. (b) | 3. (c) | 4. (d) | 5. (d) |
| 6. (b) | 7. (b) | 8. (b) | 9. (c) | 10. (a) |
| 11. (a) | 12. (d) | 13. (b) | 14. (b) | 15. (d) |



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CROSS WORD



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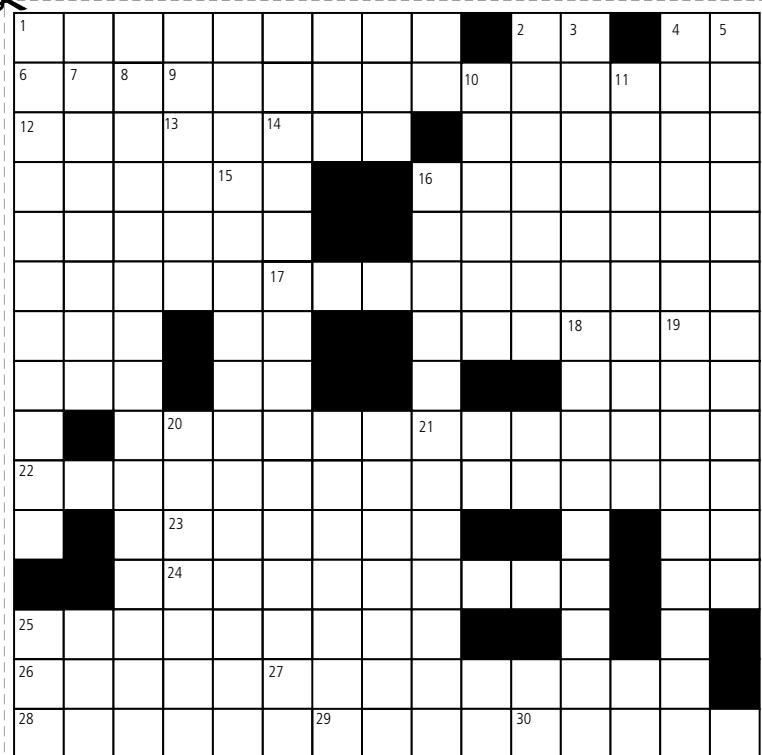
ACROSS

1. It is treatise having all information about a particular taxon like family or genus. (9)
9. A little mulberry-like structure of solid mass of cells having 8-16 blastomeres. (6)
12. A polysaccharide present as reserved food in diatoms. (8)
17. It is the smallest, cleanest and most gentle ape with remarkable vocal power. (6)
20. It is the phenomenon of moving vascular cambium to the outer side by adding new cells due to formation of secondary xylem on the inner side. (8)
22. A substance which is used as emulsifier in chocolates, ice-creams, tooth pastes, etc. (11)
23. A special device made of stainless steel that resembles a spring coil placed in an artery to ensure proper blood circulation through coronary artery. (5)
24. A scientist who discovered multiple alleles and theory for the inheritance of human blood groups. (9)
25. An early stage in the development of a moss which resembles the filamentous green algae in structure. (9)
26. A large regional unit delimited by a specific climatic zone which has a particular major vegetation zone and its associated fauna. (5)
27. A hormone secreted by thyroid gland which increases oxidative metabolism of the body cells. (9)
28. Settled suspension or semi-solid slurry produced by waste water or sewage treatment. (6)
29. A 3.2 million years old skeleton of a human female ancestor *Australopithecus afarensis*, found in 1981. (4)
30. The functional role and position of a species in its ecological system. (5)

DOWN

2. A rough rattling inspiratory noise produced by vibration of uvula or vocal cords during sleep. (7)
3. A radicide obtained from the red variety of sea onion which does not have any harmful effect on other animals. (6)
4. A sheet or broad band of fibrous connective tissue present beneath the skin or around muscles and other organs of the body. (6)
5. The process of anaerobic breakdown of proteins by microbes. (12)
6. The systematic classification based on evolutionary relationships of organisms in order of their assumed divergence from ancestral forms. (10)
7. The tiny particles of dust left over from comets which produce streaks of light as they enter the earth's atmosphere with great speed and burn out. (7)
8. Larval form of *Holothuria*. (11)

Cut Here



10. An insoluble long chain of carbon and hydrogen atoms which anchors the chlorophyll molecule into the lipid part of thylakoid membrane. (6)
11. A gelatinous substance, which is obtained from the air bladder of perches, salmons, etc., to be used in the preparation of special cement and in the clarification of wine and beer. (9)
13. A jointed stem with hollow internodes and solid prominent nodes. (4)
14. A bird that can drink salt water due to the presence of special glands that filter out the salt. (7)
15. An enzyme which is secreted by juxtaglomerular apparatus of the nephrons in the kidney. (5)
16. An oily glandular secretion which contains sterols, hydrocarbons and fatty acids. (5)
18. The oldest drug which is extracted from the bark of the *Cinchona* tree and used for the treatment of malaria. (7)
19. Onset of menstruation in young girls indicating the attainment of sexual maturity and beginning of fertile period. (8)
21. A stage in the development of an insect between two moults. (6)



HIGH YIELD FACTS



Class XI

Cell: The Unit of Life - I

- Cell is a structural and functional unit of life as no living organism can have life without being cellular. All life begins as a single cell.
- Cell is the smallest unit which is capable of independent existence and performing essential functions of life.
- Living organisms are of two types: **(i) Unicellular organisms:** Single cell is capable of independent existence. Single cell is able to perform all essential functions of life.
- (ii) Multicellular organisms:** *Division of labour*, cells become specialised to perform different functions.
- Cells are totipotent, *i.e.*, single cell has the ability to form the whole organism.

CELL THEORY

- Cell theory was proposed by **Schleiden** and **Schwann**. It states that the bodies of all organisms are made up of cells and their products so that cells are units of both structure and function of living organisms.

Fundamental features of cell theory

All living organisms are composed of cell and their products.

Each cell is made of a small mass of protoplasm containing a nucleus in its inside and a plasma membrane with or without a cell wall on its outside.

Activities of an organism are the sum total of activities and interactions of its constituent cells.

All cells are basically alike in their chemistry and physiology.

- On the basis of organisation of DNA, the cells are of two types: prokaryotic cell and eukaryotic cell.

PROKARYOTIC CELL

- It is the type of cell with naked DNA, lying in coiled form in cytoplasm. It is called nucleoid. Well organised nucleus and various cell organelles are absent. *Transcription and translation occur in cytoplasm. Ribosomes are of 70S type.*

	Analysis of various PMTs from 2012-2016				
	2012	2013	2014	2015	2016
AIPMT/NEET	6	3	4	4	8
AIMS	-	1	-	-	2
AMU	4	2	4	3	-
Kerala	3	-	2	3	-
K-CET	1	3	-	1	-
J & K	1	-	-	4	-

Components of Bacterial Cell

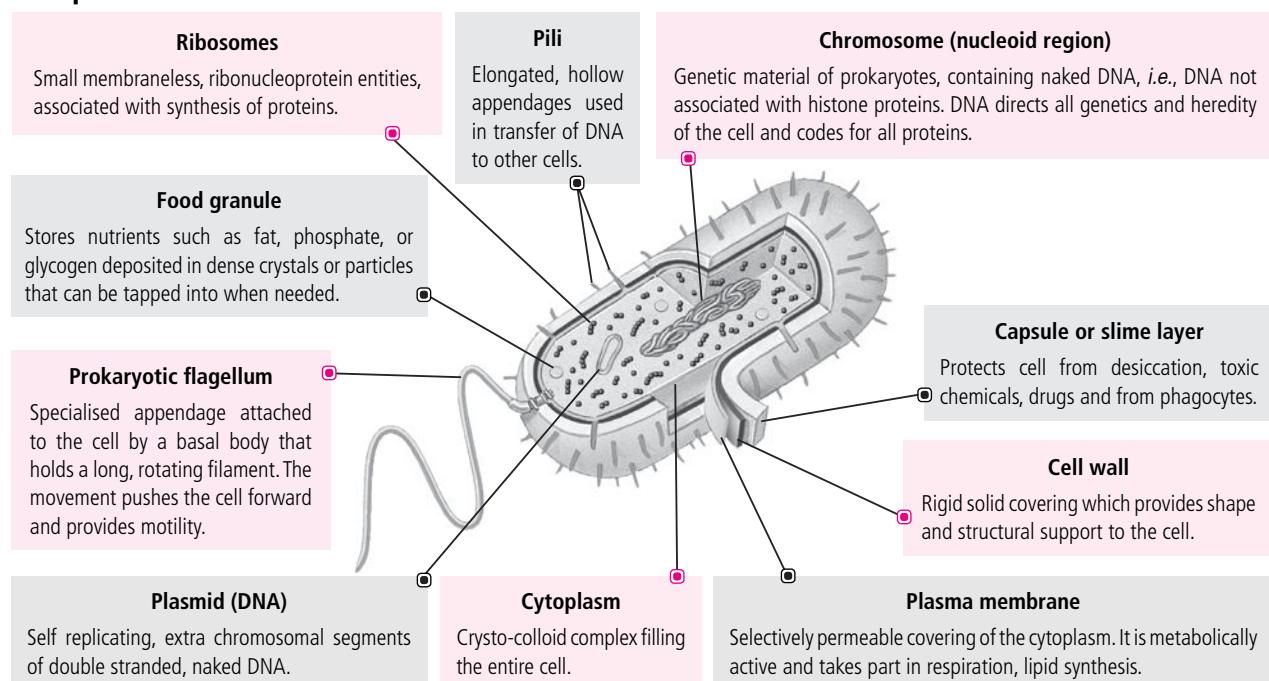


Fig.: Ultrastructure of bacterial cell

Table: Differences between Gram +ve and Gram -ve bacteria

	Gram +ve bacteria	Gram -ve bacteria
(i)	They remain coloured blue or purple with Gram stain even after washing with absolute alcohol or acetone.	The bacteria do not retain the stain when washed with absolute alcohol.
(ii)	The wall is single layered as outer membrane is absent. It is 20-80 nm thick.	The wall is two layered because outer membrane is present. It is 8-12 nm thick.
(iii)	The lipid content of the wall is quite low. Murein or mucopeptide content is 70-80%.	The lipid content of the wall is 20-30%. Murein or mucopeptide content is 10-20%.
(iv)	The wall is straight.	The wall is wavy and comes in contact with plasmalemma only at a few places.
(v)	Basal body of the flagellum has two rings of swellings.	Four rings of swellings occur in the basal body.
(vi)	Mesosomes are more prominent.	Mesosomes are less prominent.
(vii)	These bacteria are more susceptible to antibiotics. Fewer pathogenic bacteria belong to Gram +ve group.	They are more resistant to antibiotics. Most of the pathogenic bacteria are Gram -ve.
(viii)	Porins are absent.	Porins or hydrophilic channels occur in outer membrane of cell wall.
(ix)	Cell wall contains teichoic acids.	Teichoic acids are absent.

EUKARYOTIC CELL

- These cells have well organised nucleus and several membrane bound cell organelles.
- **Genetic material or DNA is organised into chromosomes and chromatin.**
- Plant cells possess cell wall, plastids and large central vacuole, that are absent in animal cells. Animal cells rather possess centrioles.

Table: Differences between eukaryotic plant and animal cells

	Plant cell	Animal cell
(i)	Plant cells are larger in size and rigid in shape.	Animal cells are smaller in size and can often change their shape.
(ii)	Cells are bound by a rigid cell wall on the exterior.	Cells are bound by plasma membrane only and cell wall is absent.
(iii)	Plastids are found.	Plastids are absent.
(iv)	Possesses large central vacuole.	Possesses many small vacuoles.
(v)	Lysosomes are rare.	Lysosomes are abundant.
(vi)	Nucleus lies on one side in peripheral cytoplasm.	Nucleus lies in centre.
(vii)	Centrioles are usually absent.	Centrioles are present.

COMPONENTS OF EUKARYOTIC CELL

Cell Wall

- It is the outer rigid protective, supportive and semi-transparent covering of plant cells, fungi and some protists.
- It is non-living extracellular secretion or matrix of the cell, which is closely appressed to it.
- It is metabolically active and capable of growth.

Structure of cell wall

- A cell wall can have three parts: middle lamella, primary wall and secondary wall.

Functions of cell wall	
Protects the cell from attack of pathogens.	Protects the protoplasm against mechanical injury.
Walls prevent bursting of plant cells by inhibiting excessive endosmosis.	Pits present in the wall help to produce a protoplasmic continuum or symplast amongst cells.
Gives strength to the land plants to withstand gravitational forces.	Cutin and suberin of the cell wall reduce the loss of water through transpiration.

Secondary wall

It is produced in mature cells, when latter have stopped growth. It is laid inner to the primary wall by **accretion** or deposition of materials over the surface of existing structure. It is thick and made up of atleast three layers: S₁, S₂, S₃.

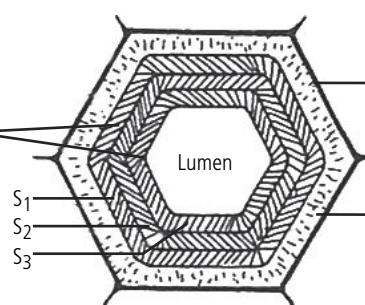


Fig.: Parts and layers of cell wall

Middle lamella

Thin, amorphous and cementing layer between two adjacent cells. It is made up of calcium and magnesium pectates. It is the first layer deposited at the time of cytokinesis.

Primary wall

It is thin and capable of extension. It grows by **intussusception** or addition of materials within existing wall. It consists of number of microfibrils embedded in the matrix or ground substance.

Cell Membrane or Biomembrane

- The term was used by **Nageli** and **Crammer**, for the membranous covering of the protoplast. It was named plasmalemma by **Plowe**.
- Various cell organelles are surrounded by cell membrane.
- Biomembranes are selectively permeable for solutes but semipermeable for water.**
- Structure of biomembrane is explained by several types of models. Fluid mosaic model is the most accepted model.

Fluid mosaic model

- It was proposed by **Singer** and **Nicolson** in 1972.
- Membrane does not have uniform deposition of lipids and proteins, but is instead a mosaic of the two.
- Membrane is quasifluid, have properties of quick repair, ability to fuse, grow during cell growth and division, endocytosis, etc.
- The mosaic arrangement implies that macromolecules have characteristic asymmetry and are oriented to carry information across the bilayer.
- They also have considerable freedom of movement within the layer (fluidity). The fluidity of lipids depends on temperature and degree of saturation.

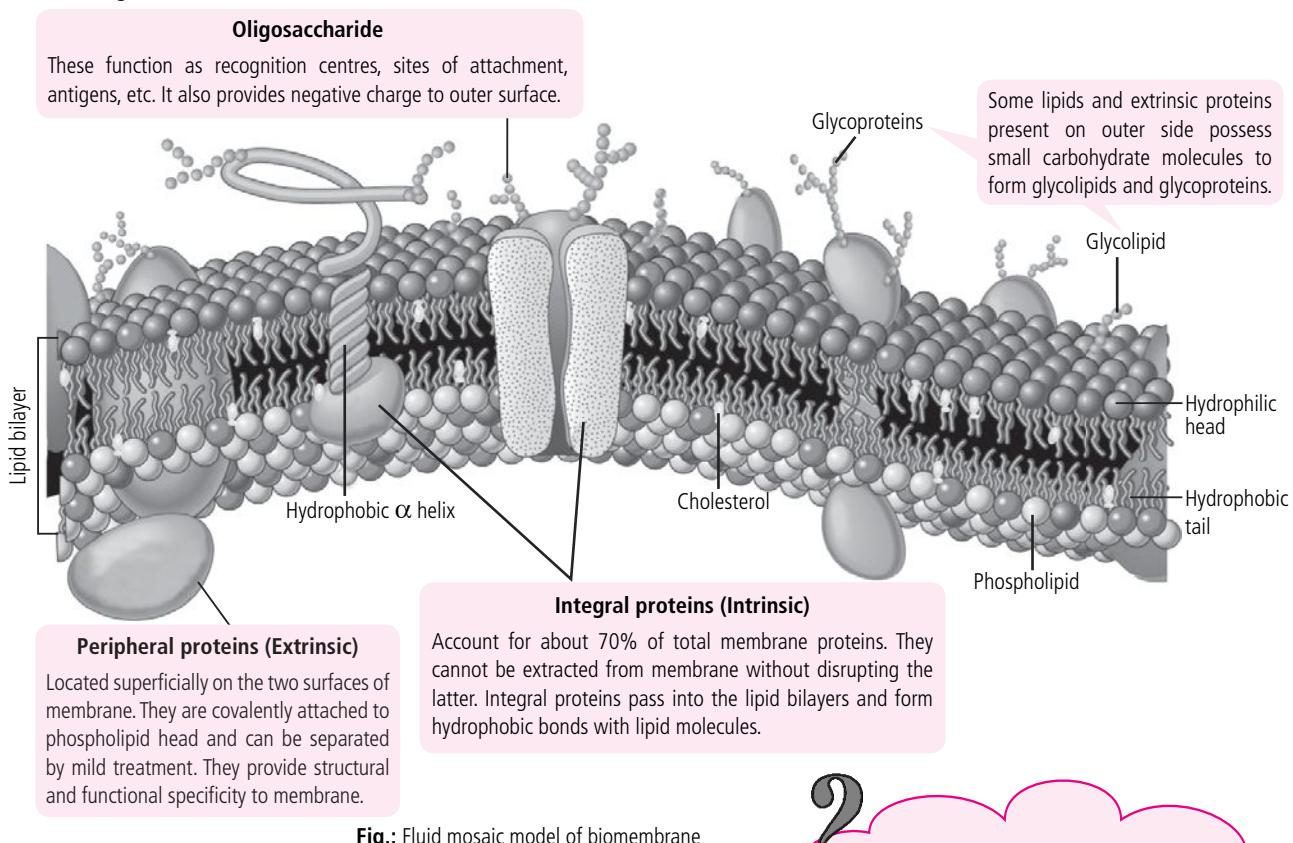
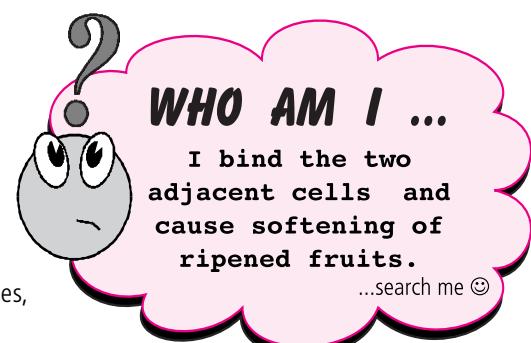


Fig.: Fluid mosaic model of biomembrane

Functions of plasma membrane

- Plasma membrane causes compartmentalisation and form organelle coverings allowing them to maintain their identity and individuality.
- They allow the movement of materials and information between different organelles of same cell or different cells.
- Plasma membrane have receptors for hormones, recognition centres, carrier proteins for active transport, enzymes, etc.
- Membrane infolds are used for bulk intake of materials by endocytosis while secretory, excretory and waste products are transported outwards by the process of exocytosis.



- Plasma membrane is selectively permeable and controls cell metabolism.
- The movement of substances across plasma membranes occur by passive transport, *i.e.*, diffusion or facilitated diffusion and active transport through carrier proteins.

Cytoplasm

- It refers to jelly-like semi-fluid general mass of protoplasm excluding the nucleus but including all other components, *i.e.*, cytoplasmic matrix, cell organelles and cell inclusions.

Cytoplasmic matrix

- It is the clear fluid part of cytoplasm that may exist in two states, **sol** and **gel**.
- Matrix is actually a crystallo-colloidal complex in water (90%) where some chemicals are present in the form of a true solution while others are present as colloidal solution, *e.g.*, minerals, sugars, amino acids, etc.

Functions

- The substances among cellular organelles are exchanged through cytoplasmic matrix.
- Matrix is the site of synthesis of a number of biochemicals like fats, nucleotides, carbohydrates, proteins, coenzymes, etc.
- Many important processes as glycolysis, pentose phosphate pathway and anaerobic respiration occur in the matrix part of cytoplasm.
- Since the cytoplasmic matrix is always in motion, *i.e.*, cytoplasmic streaming, so it helps in distribution of various materials inside the cell.

Cell organelles

- Cell organelles are sub-cellular structures with characteristic morphological forms, distinctive chemical constitutions and definite functions.
- An eukaryotic cell possesses number of cell organelles such as endoplasmic reticulum, mitochondria, ribosomes, lysosomes, etc.

Cell inclusions

- They are the non-living materials and are present in components and subcomponents of cell.
- They are also present in soluble or insoluble state and can be organic or inorganic in nature.

Endomembrane System

- It consists of membrane bound organelles which function in close coordination with one another, *viz.*, endoplasmic reticulum, Golgi complex, lysosomes and vacuoles.
- Nuclear envelope is also considered a part of endomembrane system as its lumen is in continuation with the lumen of endoplasmic reticulum.
- Organelles like plastids, mitochondria, peroxisomes and glyoxysomes are not a part of endomembrane system.

Endoplasmic Reticulum (ER)

- It was discovered and named by **Porter** in 1945.
- ER is a complicated and interconnected system of membrane lined channels that run through cytoplasm.
- ER divides the intracellular space into two distinct compartments, *i.e.*, **luminal** (inside ER) and **extra luminal** (cytoplasm) compartments.
- It is quite extensive in cells of pancreas, simple in storage cells, etc. and absent in eggs, mature RBCs, etc.

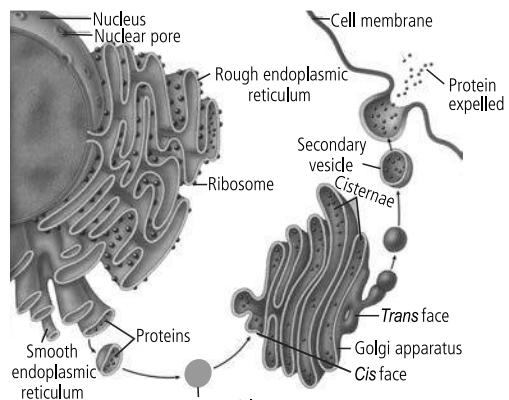


Fig.: Endomembrane system

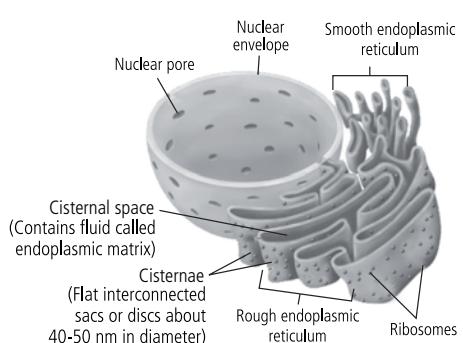
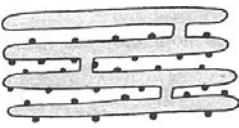
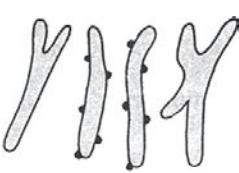


Fig.: Endoplasmic reticulum

Structure

- ER comprises of membrane lined channels or spaces enclosing a fluid called **endoplasmic matrix**. The membranes of ER are 50-60 \AA in thickness.
- It exists in three forms: cisternae, vesicles and tubules.

(i)	Cisternae - These are flat interconnected sac-like parts of ER and are about 40-50 nm in diameter. They occur in bundles, lying parallel to one another. They are found in cells involved in synthetic functions.	
(ii)	Vesicles - These are oval or rounded sacs of 25-500 nm in diameter which appear as small vacuoles. They remain isolated in cytoplasm. These are also called microsomes .	
(iii)	Tubules - They are tube-like extensions that are connected with cisternae or vesicles to form a reticular system. They may be irregular or regular, branched or unbranched with a diameter of 50-100 nm.	

Types of endoplasmic reticulum

Depending upon the nature of membranes, ER may be of two types: smooth and rough, that may be continuous with one another, plasma membrane and nuclear envelope.

Table: Types of endoplasmic reticulum

Characteristic	Smooth endoplasmic reticulum (SER)	Rough endoplasmic reticulum (RER)
Membrane	SER has smooth membranes due to absence of ribosomes.	Appears rough due to presence of number of ribosomes on membrane.
Occurrence	In glycogen storing liver cells, adipose cells, interstitial cells, etc. It is commonly found in leucocytes. It is usually peripheral and connected with plasmalemma. SER consists mainly of vesicles and tubules.	In cells which are actively engaged in protein synthesis and secretory activity, e.g., pancreatic cells, plasma cells. RER is mostly made of cisternae . Tubules are very few. It is often internal and connected with nuclear envelope.
Functions	<ul style="list-style-type: none"> It takes part in synthesis of fat (in adipose tissue), synthesis of glycogen and glycogenolysis (in liver cells). It is also involved in the synthesis of ascorbic acid, sterols and steroid hormones, interstitial cells of testis and ovary. Stores calcium for release during muscle contraction. Detoxification of toxic chemicals with the help of cytochrome P450. Passes the synthetic products of RER to Golgi complex. 	<ul style="list-style-type: none"> Consists of SRP receptors or ribophorins for providing attachment to ribosomes. RER also provides large surface area to ribosomes. It is primarily involved in the synthesis of serum proteins, membrane proteins and many other proteins. It bears enzymes for glycosylation and enzyme precursors for the formation of lysosomes by Golgi complex. RER may give rise to SER by discarding ribosomes.

Cytochrome P450

- Cytochrome P450 (CYP) enzymes are a superfamily of monooxygenases that are found in all kingdoms of life. In mammals, these enzymes are found primarily in the membranes of the endoplasmic reticulum within liver cells (hepatocytes), as well as many other cell types. These enzymes use haem iron to oxidise molecules, often making them more water-soluble for clearance. They achieve this by either adding or unmasking a polar group. CYP enzymes are responsible for the oxidative metabolism of a wide number of compounds and are the major enzymes involved in drug metabolism.
- The elimination of foreign compounds (xenobiotics) such as drugs and toxins from the body is called as detoxification, which is an essential process to protect against potential toxicity from the foods we eat. The food broken down in stomach is absorbed by the small intestine and then ferried directly to the liver portal vein. This allows the liver to detoxify compounds before they are distributed by circulatory system. In plants, the cytochrome P450 plays a role in the synthesis of toxic compounds as well as the pigments of flowers.

Golgi Complex or Golgi Apparatus

- Golgi complex was named after **Camillo Golgi** who recognised the organelle in nerve cells of barn owl (in 1898). It is present in eukaryotic cells, except in mature sieve tubes of plants, mature RBCs of mammals, sperm cells of bryophytes and pteridophytes, etc.
- It is absent in prokaryotic cells while in plants it is composed of unconnected units called **dictyosomes**.
- It is surrounded by a zone of cytoplasm which is devoid of organelles and is known as **zone of exclusion**.
- Golgi complex is in the form of a parallelly arranged interconnecting system of a cluster of smooth membranes having a central stack of flattened sacs or cisternae (size : 0.5 μm to 1.0 μm diameter). These membranes lack bound ribosomes.
- It has a complex network of tubules and vesicles and is present around or above the centriole in animal cells and scattered in cytoplasmic matrix in plant cells.
- The stack of cisternae has a definite polarity because there are two distinct faces *i.e.*, forming face (*cis* region) and a maturing face (*trans* region), that are different from one another.

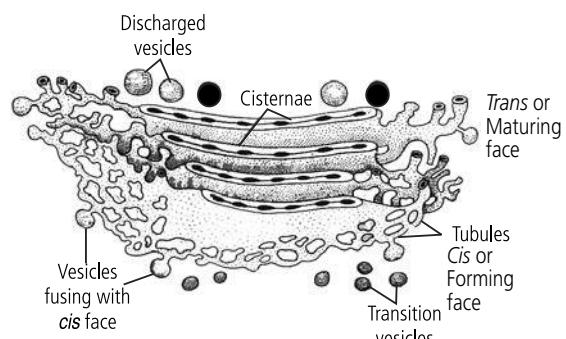


Fig.: Arrangement of membranes, tubules and vesicles in Golgi complex

Parts of Golgi complex

Cisternae

Stack of 4-8 saccules is present in Golgi complex. Saccules are curved to give definite polarity to the Golgi apparatus. Convex side is called **forming** or *cis*-face and concave side is **maturing** or *trans*-face.

Tubules

Tubules form a complicated network towards the periphery and maturing face of the apparatus. Actually tubules arise due to fenestrations of the cisternae and interconnect different cisternae.

Vesicles

Vesicles are small sacs attached to the tips of tubules at various levels in the network. They are of two types, **smooth** and **coated**. The coated vesicles have a rough surface. They elaborate membrane proteins. The smooth vesicles have a smooth surface. They contain secretory substances and are hence known as **secretion vesicles**.

Vacuoles

Golgian vacuoles are expanded parts of the cisternae. They develop from the maturing face and contain amorphous or granular substance. Some of the Golgian vacuoles function as **lysosomes**.

Functions

- Golgi apparatus helps in the recycling of broken plasma membrane during endocytosis.
- It is also responsible for concentrating and packaging the products of cells within a soluble protein coat and is sent out of cells through exocytosis or reverse pinocytosis.

- Golgi complex transforms membrane of one type into other types, e.g., membrane of ER is transformed into selectively permeable plasma membrane or differentiated membrane of lysosome.
- Synthesis of glycolipids and glycoproteins by combining carbohydrates to lipids and proteins synthesised by ER.
- Both simple (e.g., sialic acid, galactose) and complex carbohydrates (e.g., mucopolysaccharide, hyaluronic acid, chondroitin sulphate etc.) are synthesised inside Golgi complex.
- Golgi complex assists in fat transport by transferring fatty acids and glycerol absorbed by intestinal epithelium to lacteal.
- This also plays an important role in the formation of lysosomes, acrosomes, root hair, cell wall and plasmalemma, vitellogenesis, etc.

Lysosomes

- **Christian de Duve** (1949) first observed these organelles in animal cells by cell fractionation studies and **Novikoff** (1960) suggested that they are derived from pinocytic vesicles.
- These are **single membrane bound small vesicular structures** of $0.2 - 0.5 \mu\text{m}$ in diameter or larger and are **rich in hydrolysing enzymes (acid hydrolases)**.
- One important property of lysosomes is their stability in the living cell. The enzymes are enclosed by a membrane and are not readily available to the substrate. This so-called latency of the lysosomal enzymes is due to the presence of the membrane.
- The membrane is resistant to the enzymes that it encloses, and the entire process of digestion is carried out within the lysosome. In this way, it protects the rest of the cell from the destructive effect of the enzymes, and its stability is of fundamental importance to the normal function of the cell.

Structure

- Each lysosome is a small vesicle surrounded by a single membrane and contains about 50 strong hydrolytic enzymes (**acid hydrolases**), which are capable of digesting or breaking down all powerful biological substances.
- Lysosomal membrane is generally strengthened by cholesterol, cortisone, heparin, etc. They are called **membrane stabilisers**. Excess of liposoluble vitamins, steroid sex hormones, bile salts, X-rays and UV rays make the lysosomal membrane fragile. They are called **membrane destabilisers**.
- The hydrolytic enzymes act at acidic pH within the lysosomes. The various hydrolytic enzymes include:
 - Nucleases - acid ribonuclease, acid deoxyribonuclease
 - Phosphatases-acid phosphatase, acid phosphodiesterase
 - Lipases-esterases and phospholipases
 - Proteases-cathepsins, collagenase and peptidases
 - Glycosidases- β -galactosidase, β -glucuronidase, α -mannosidase and α -glucosidase
 - Sulphatases.
- **Lysosomes show polymorphism**, i.e., existence of more than one morphological form in same cells. Depending upon the morphology, content and functions, they are divided into following four forms:

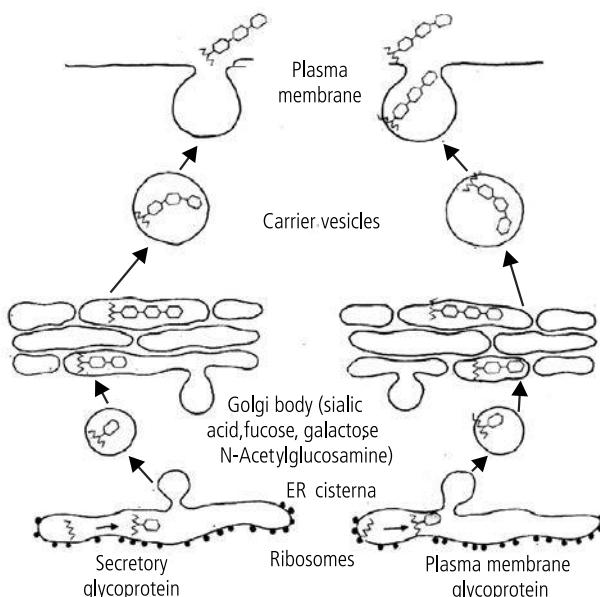


Fig.: Mechanisms for the elaboration of secretory glycoproteins (left) and plasma membrane glycoproteins (right). The glycoproteins are transported from the Golgi body by carrier vesicles and released by exocytosis at the plasma membrane.

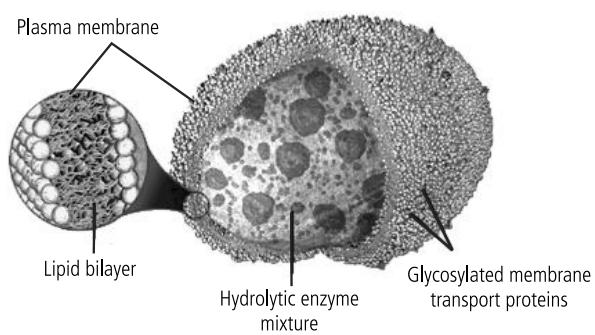
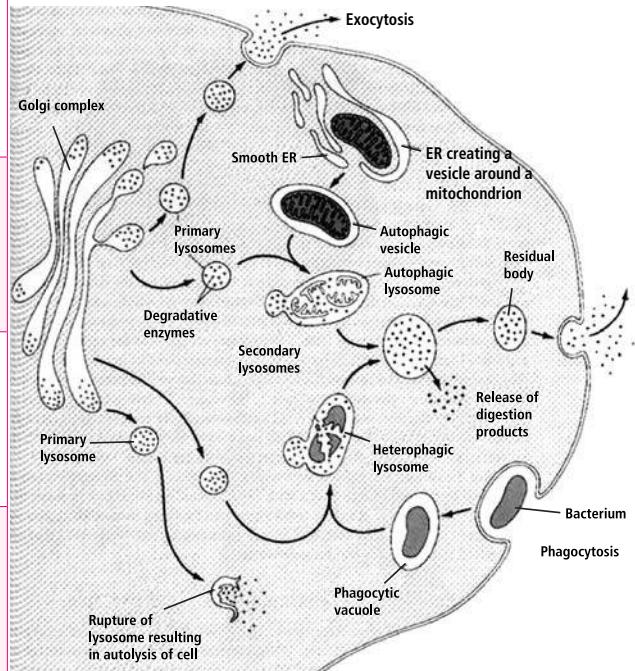


Fig.: Anatomy of the lysosome

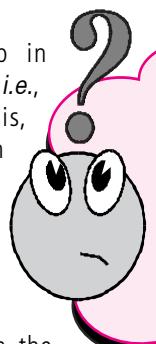
Table: Polymorphism in lysosomes

(i)	Primary lysosomes	These are small, vesicle-like newly formed structures produced from the Golgi apparatus, at <i>trans</i> face. Primary lysosomes contain inactive enzymes.
(ii)	Secondary lysosomes	These are also called heterophagosomes or digestive vacuoles , which are formed when phagosomes fuse with already existing primary lysosomes. These contain the enzymes against the material to be digested.
(iii)	Residual bodies	These are formed from digestive and autophagic vacuoles which contain only undigested materials. Residual bodies pass outwardly, come in contact with plasmalemma and throw their contents to the outside through ephagy or exocytosis.
(iv)	Autophagic vacuoles	They are formed by union of many primary lysosomes around old or dead intracellular organelles, surround them with vacuolar membrane and digest them by autolysis or autodigestion.



Functions

- The lysosomes help in intracellular digestion *i.e.*, through phagocytosis, extracellular digestion *i.e.*, through exocytosis and intracellular scavenging *i.e.*, removes old or useless organelles.
- These are involved in the renovation and turnover of cellular components by process of **autophagy**.
- They are active in the **remodelling of tissues** (*e.g.*, removal of the tadpole tail, regression of Wolffian and Muller's ducts, etc.) in development.
- Digestion of extracellular material involves the release of primary lysosomes by exocytosis** (*e.g.*, osteoclasts may do so by the release of lysosomal enzymes that degrade the organic matrix). In rheumatoid arthritis, lysosomal enzymes erode the cartilage of joints.
- Crinophagy** is a process by which excess secretory granules are removed by lysosomes.
- Lysosomal enzymes of sperm acrosome dissolve the egg membrane for the entry of sperm into ovum during fertilisation.



WHO AM I ...
I transform the membranes of one organelle into membrane of another type such as that of ER to plasma membrane.
...search me ☺

- Certain diseases are caused by nondigestion of certain components due to absence or malfunctioning of required enzymes in the lysosomes, *e.g.*, arthritic joints, gout, Hunter's syndrome, Farber's disease, etc. Some 20 genetic or congenital diseases occur in human beings due to deficiency of certain lysosomal enzymes.
- Accidental or pathological release of hydrolases from lysosomes causes breakage of chromosomes, their abnormal distribution during mitosis, which may result in cancer. The glycosidation of lipids, that leads to the synthesis of gangliosides and glycosphingolipids, may also be altered in cancerous cells.

Vacuoles

- Vacuoles are non-cytoplasmic areas present inside the cytoplasm. These are surrounded by single membrane called **tonoplast**.
- They are formed by expansion and pinching off from endoplasmic reticulum.
- They are small in animal cell and large in fungal and plant cells.
- Vacuoles may be of four types, depending upon its contents and functions.

Types of vacuoles

Sap vacuole

- These are fluid filled vesicle that are separated from the cytoplasm by a selectively permeable membrane, called tonoplast.
- The fluid present in them is called sap. A number of small sap vacuoles fuse to form large central vacuole in plant cells, so as to facilitate rapid exchange of substances.
- The tonoplast has sites for passage of number of ions and other materials into the vacuole against concentration gradient. It maintains osmotic pressure and turgidity.
- They store and concentrate waste products that are segregated from living cell.
- It stores water soluble vacuolar pigments e.g., anthocyanin.

Contractile vacuole

- These vacuoles are with highly extensible and collapsible membrane and is connected to few feeding canals. These are found in some freshwater protists and algal cells.
- They regulate osmoregulation and excretion.

Food vacuole

- These vacuoles are formed by fusion of phagosome and lysosome. They are usually found in cells of protozoan protists and phagocytes of higher animals.
- It contains digestive enzymes which help in digestion of nutrients and food.

Air vacuole

- This is not a single vesicle and is neither surrounded by a common membrane, rather consists of smaller submicroscopic vesicles.
- Each of these vesicle is surrounded by protein membrane that stores gases.
- It also provides buoyancy, mechanical strength and protection from harmful radiations.

SPEED PRACTICE

1. Choose the correct option regarding modern cell theory.
 (i) Cells are the basic units of function in living organisms.
 (ii) A cell can survive independently but its organelle cannot.
 (iii) In some organisms, the body is not differentiated into cells though it may have numerous nuclei.
 (iv) Growth of an organism involves the growth and multiplication of its cells.
 (a) (i) and (iv) only (b) (i) and (ii) only
 (c) (ii), (iii) and (iv) only (d) (i), (ii) and (iv) only
2. Which of the following statements regarding Gram (-)ve bacteria is correct?
 (a) Mesosomes are very prominent.
 (b) Cell wall contains teichoic acid.
 (c) Porins occur in outer membrane of cell wall.
 (d) Cell wall is single layered.
3. A cell organelle formed by the joint activity of endosomes, Golgi complex and ER is
 (a) vacuole (b) ribosome
 (c) peroxisome (d) lysosome.
4. Select the incorrect statement.
 (a) Lipids present on the outer and inner side of the bilayer of plasma membrane are different.
- (b) Synthetic products of RER pass on to Golgi complex through SER.
 (c) Smooth endoplasmic reticulum helps in the transport of fatty acid from intestinal lumen to lacteals fat.
 (d) Pompe's disease results due to retention of residual bodies inside the cell.
5. *Omnis cellula e cellula* (theory of cell lineage or common ancestry) was given by
 (a) Purkinje (b) Rudolf Virchow
 (c) Schleiden (d) Schwann.
6. Select the option that correctly fills the blanks.
 (i) Gram negative bacteria have ____ rings embedded in cell membrane.
 (ii) In ____ bacteria, a single flagellum occurs at or near one end.
 (iii) ____ is a fatty substance present in the wall of cork and endodermal cells.

(i)	(ii)	(iii)
(a) S and M	monotrichous	Suberin
(b) L and P	amphitrichous	Cutin
(c) S and M	amphitrichous	Suberin
(d) L and P	monotrichous	Lignin

7. Consider the following differences between SER and RER.

	SER	RER
(i)	It is mainly formed of vesicles and tubules.	It is mainly formed of cisternae and a few tubules.
(ii)	Synthesis of glycogen, lipids and steroids takes place.	Synthesis of proteins and enzymes takes place.
(iii)	It provides biochemicals for Golgi apparatus.	Provides vesicles for <i>cis</i> -face of Golgi apparatus.
(iv)	Helps in the formation of lysosomes.	Helps in the formation of sphaerosomes.

Which of the above given differences are incorrect?

- (a) (i) and (iii) only (b) (ii) and (iii) only
- (c) (iii) and (iv) only (d) (ii) and (iv) only

8. The cell organelle that takes part in detoxification with the help of cytochrome P450 is

- (a) Golgi complex (b) ribosome
- (c) lysosome (d) endoplasmic reticulum.

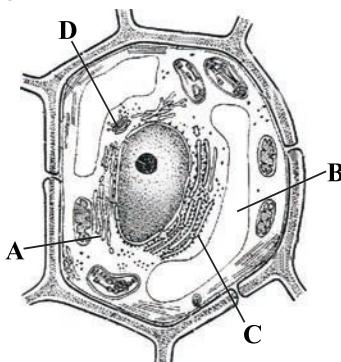
9. Golgi complex is absent in

- (a) PPLO
- (b) blue green algae
- (c) purple non-sulphur bacteria
- (d) all of these.

10. In *Mycobacterium* and *Nocardia*, cell wall contains long chain fatty acids called

- (a) teichoic acids (b) peptidoglycan
- (c) mycolic acids (d) murein.

11. Refer to the given figure and select the correct statement regarding it.



- (a) 'A' bears enzymes for glycosylation.
- (b) 'B' helps in formations of hypnotoxin of nematoblast.
- (c) 'C' contain SRP receptors for attachment of ribosomes.
- (d) 'D' helps providing nourishment during starvation.

12. Match the column I with column II.

	Column I	Column II
A.	Golgi complex	(i) Polymorphism
B.	Lysosome	(ii) Sialic acid
C.	Passive transport	(iii) K ⁺ pump
D.	Active transport	(iv) Dialysis
(a)	A-(ii), B-(i), C-(iv), D-(iii)	
(b)	A-(iii), B-(ii), C-(i), D-(iv)	
(c)	A-(iv), B-(iii), C-(ii), D-(i)	
(d)	A-(i), B-(ii), C-(iii), D-(iv)	

13. Identify the correctly matched pair.

- (a) Endoplasmic reticulum - Autolysis
- (b) Cytoplasmic matrix - Anaerobic respiration
- (c) Cell membrane - Cutin
- (d) Pili- Gram positive bacteria

14. During period of starvation, _____ provide nourishment.

- (a) tertiary lysosomes
- (b) secondary lysosomes
- (c) residual bodies
- (d) autolysosomes

15. Consider the following statements and select the option that correctly identifies the true (T) and false (F) ones.

- (i) Disappearance of larval organs during metamorphosis is due to autolysis.
- (ii) In vitellogenesis, SER functions as the centre around which yolk is deposited.
- (iii) Lysosomes remove carcinogens by engulfing and separating them.
- (iv) During pinocytosis, membrane evaginates on the periphery for receiving material.

(i)	(ii)	(iii)	(iv)
(a) T	F	T	F
(b) F	T	T	F
(c) T	T	F	F
(d) F	T	F	T

16. Plasmodesmata encloses tubular extension of endoplasmic reticulum called

- (a) symplast
- (b) phagosome
- (c) desmotubule
- (d) apoplasm.

17. In primary cell wall, matrix contains a filler substance called

- (a) cellulose
- (b) suberin
- (c) pectin
- (d) lignin.

18. In prokaryotes, hexagonal, hollow and cylindrical gas vesicles form the outer covering of

- (a) sap vacuole
- (b) gas vacuole
- (c) contractile vacuole
- (d) food vacuole.

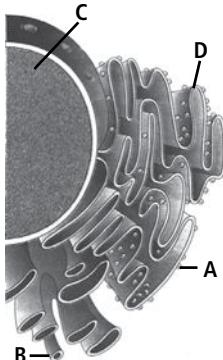
19. Hydrolysis of thyroglobulin causes formation of thyroxine with the help of

- (a) Golgi complex
- (b) lysosomes
- (c) microbodies
- (d) ribosomes.

- 20.** Read the given statements and select the correct option.
Statement A: Vacuoles are separated from the cytoplasm by a membrane called tonoplast.
Statement B: Tonoplast is permeable to water molecules and impermeable to ions and other materials.
(a) Both statements A and B are correct and B is the correct explanation of A.
(b) Both statements A and B are correct but B is not the correct explanation of A.
(c) Statement A is correct but B is incorrect.
(d) Both statements A and B are incorrect.

- 21.** Refer to the given figure of endoplasmic reticulum. Identify the labelled parts and select incorrect option regarding it.

- (a) A provide enzymes and factors for condensation of amino acid.
- (b) B helps in the formation of visual pigment from vitamin A in retinal cells.
- (c) C controls cellular activities of a cell.
- (d) Enzymes for detoxification are present on D.



- 22.** Read the following statements and choose the correct ones.
- (i) Animal cells operate a $K^+ - H^+$ exchange pump at their plasma membrane.
 - (ii) Voltage gated, mechanical gated and ligand gated are types of ion channels.
 - (iii) Movement through ion channels occur against the concentration gradient hence rate of passage is low.
 - (iv) Active transport in RBCs takes place through calcium pump.
- (a) (i) only (b) (i) and (iv) only
 - (c) (ii) and (iv) only (d) (ii), (iii) and (iv) only

- 23.** A is detachable vesicle. It fuses with lysosome to produce B.

- | | |
|-----------------|-----------------------|
| (a) A-Pinosome | B-pseudo vacuole |
| (b) A-Phagosome | B-digestive vacuole |
| (c) A-Pinosome | B-gas vacuole |
| (d) A-Phagosome | B-contractile vacuole |

- 24.** Read the given statements and select the correct option.
Statement A: A contractile vacuole has a highly extensible and collapsible membrane.

Statement B: Collapsing of a contractile vacuole, is called systole.

- (a) Both statements A and B are correct and B is the correct explanation of A.
- (b) Both statements A and B are correct but B is not the correct explanation of A.
- (c) Statement A is correct but B is incorrect.
- (d) Both statements A and B are incorrect.

- 25.** Outer surface layer of cells in many animals and protists contain

- (a) glycocalyx (b) pectin
- (c) lignin (d) murein.

- 26.** Leucocyte granules are derived from

- (a) lysosomes
- (b) smooth endoplasmic reticulum
- (c) rough endoplasmic reticulum
- (d) glyoxysomes.

- 27.** Which of the following is not a function of Golgi complex?
- (a) Formation of root hair
 - (b) Glycogenolysis
 - (c) Production of hormones
 - (d) Formation of glycoproteins
- 28.** Longer and tubular outgrowths of Gram negative bacteria are made up of protein
- (a) flagellin (b) pilin
 - (c) tubulin (d) mucopeptide.
- 29.** Self replicating, extra chromosomal DNA component when get associated with nucleoid temporarily are known as
- (a) sphaerosome (b) episome
 - (c) ribosome (d) mesosome.
- 30.** Refer to the given statements and select the correct option.
- I. Cytoplasm of prokaryotic cells shows cylosis.
 - II. A + T / G + C is > 1 in eukaryotes.
 - III. Thylakoid lies freely in cytoplasm in prokaryotes.

Of the above statements
- (a) I is correct and II and III are incorrect
 - (b) I and II are correct and III is incorrect
 - (c) II and III are correct and I is incorrect
 - (d) II is correct and I and III are incorrect.
- #### ANSWER KEY
- | | | | | |
|---------|---------|---------|---------|---------|
| 1. (d) | 2. (c) | 3. (d) | 4. (c) | 5. (b) |
| 6. (a) | 7. (c) | 8. (d) | 9. (d) | 10. (c) |
| 11. (c) | 12. (a) | 13. (b) | 14. (d) | 15. (a) |
| 16. (c) | 17. (c) | 18. (b) | 19. (b) | 20. (c) |
| 21. (d) | 22. (c) | 23. (b) | 24. (b) | 25. (a) |
| 26. (a) | 27. (b) | 28. (b) | 29. (b) | 30. (c) |
-
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CONCEPT MAP

FROG

Frog belongs to the **Class Amphibia** of **Phylum Chordata**. Frogs are found around ditches, ponds, marshes, lakes and streams. They can live in water as well as on land hence called **amphibians**. The common Indian frog is *Rana tigrina*.

Morphology

- Body of a frog is pointed anteriorly and rounded posteriorly. It is slightly flattened dorsoventrally, streamlined to swim through water and divisible into head and trunk without neck and tail.
- Skin of frog is thin, moist, smooth, slimy and green coloured with black or brown spots dorsally and lighter pale yellow ventrally. There are no scales or any other hard exoskeleton parts.
- Skin of back has dorsolateral folds or thickenings called **dermal plicae**.
- Head is roughly triangular with a short **blunt** anterior **snout** terminating in a large transverse **mouth**. It bears external nares or nostrils, eyes, brow spot and ear drums on the upper side.
- Frogs have two large and protruding eyes, having an almost immovable upper eyelid and a thin semi-transparent and freely movable lower eyelid. From lower eyelid arises **nictitating membrane** that protects eyes during swimming.
- Vocal sacs** act as resonators to intensify sound of croaking during breeding season.
- Trunk consists of **thorax, abdomen** and a pair of forelimb and hindlimb.
- Frog shows **sexual dimorphism** as male frog possesses developed **vocal sacs** and **nuptial pad** during breeding season and their body is somewhat slender and darker in colour than female frog.

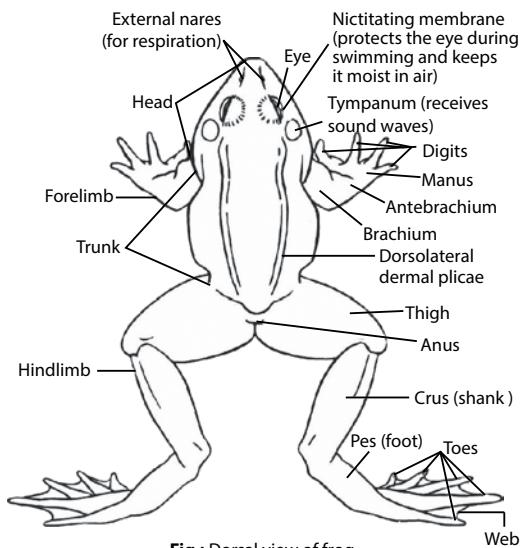


Fig.: Dorsal view of frog

Anatomy

Circulatory System

- Circulatory system of frog is closed and includes **heart, arterial system, venous system, blood** and **lymphatic system**.
- Heart is **three chambered** made up of two anterior **atria** or **auricles** and a single posterior **ventricle**. Two additional chambers are **sinus venosus** and **truncus arteriosus**.
- The two auricles, right (larger) and left, are completely separated from each other by **inter-auricular septum**. Both auricles open into single ventricle by a common large **auriculo-ventricular aperture** guarded by two pairs of **auriculo-ventricular valves**.
- The inner surface of ventricle has irregular ridges called **columnae carneae** or **trabeculae**, with depressions called **fissures**.

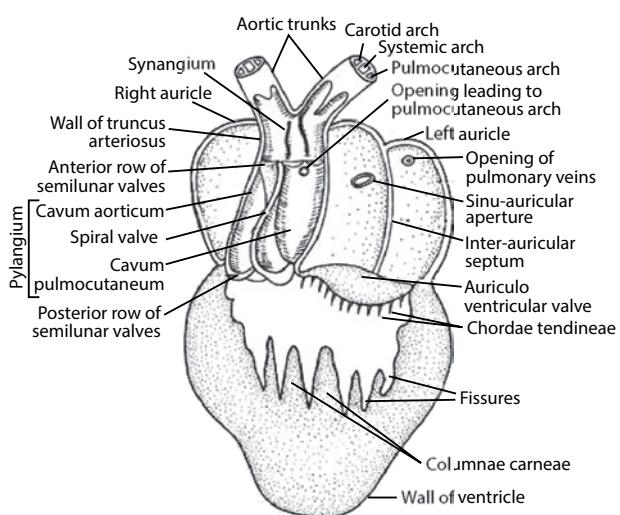


Fig.: Internal structure of heart of frog (ventral view)

Digestive System

- The digestive system mainly consists of **alimentary canal** and its associated **glands**.
- Mouth leads into a buccopharyngeal cavity which opens into oesophagus through gullet.
- Stomach** is situated behind the oesophagus and divisible into cardiac stomach and pyloric stomach.
- The small intestine is divisible into an anterior **duodenum** and a posterior **ileum**. Digestion of food and absorption of digested food occur in the small intestine.
- Ileum leads to **rectum** or large intestine. The rectum opens into the **cloaca** through the **anus**.
- Digestive glands** of frog include liver, pancreas, gastric glands and intestinal glands.

Respiratory System

Adult frog respires by three different types of respiration:

- **Cutaneous respiration** : It occurs through the highly vascular skin of frog in water or land.
- **Buccopharyngeal respiration** : It occurs on land or during partial immersion in water via mucous epithelial lining of buccopharyngeal cavity.
- **Pulmonary respiration** : It is less frequent and takes place through lungs in adult frog when the frog is outside the water.

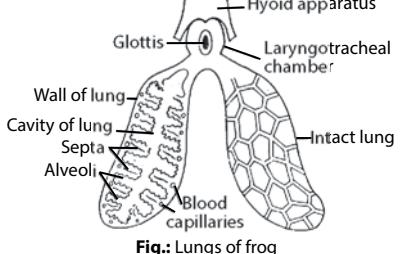


Fig.: Lungs of frog

Nervous System

- It is highly developed and comprises of:
 - **Central nervous system (CNS)** includes brain and spinal cord. **Brain** is covered by two meninges; duramater (outer) and pia-arachnoid (inner). Brain is divisible into three parts: Forebrain, midbrain and hindbrain. **Spinal cord** is located in the vertebral column and joins the medulla oblongata via **foramen magnum** of the cranium (brain case).
 - **Peripheral nervous system (PNS)** includes 10 pairs of **cranial nerves** and 9 pairs of **spinal nerves**. Rarely 10th (paired or unpaired) spinal nerve is found.
 - **Autonomic nervous system** is made up of sympathetic and parasympathetic nerves which controls and coordinates the involuntary activities of the visceral organs.
- Five types of sense organs are **skin** (tangoreceptor), **taste buds** (gustatoreceptor), **nasal chambers** (olfactoreceptor), **eyes** (photoreceptor) and **ears** (stato-acoustic organs).

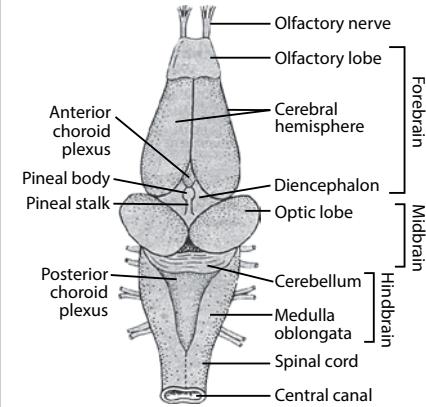


Fig.: Dorsal view of brain of frog

Urinogenital System

- In frogs, the excretory and reproductive systems are closely associated, hence they are together called urinogenital system.
- **Excretory system** comprises of kidneys, ureters in females, urinogenital ducts in males, cloaca and urinary bladder. Kidneys are the chief excretory organs which are made up of large number of **uriniferous tubules** or nephrons.
- From the kidneys, arise **ureter** in females and **urinogenital duct** in males.
- Cloaca receives faecal matter, genital products and urine (from kidney). Ventrally it is attached to urinary bladder.
- In **males**, near each kidney there is a cylindrical **testis** from which several thin **vasa efferentia**, connecting the testes to kidneys on each side. The vasa efferentia run transversely through mesorchium and open into the **Bidder's canal** which in turn opens into the **ureter**. Histologically, each testis is a compact mass of seminiferous tubules, the epithelial lining of which produces **sperms**. The sperms when mature are dropped into the lumen to pass into the ureter through vasa efferentia and Bidder's canal.
- **Females** have two ovaries where ova are produced by ovarian follicles. On each side of an ovary is an oviduct which starts posteriorly and forms uterus, which opens into the cloaca. During breeding season ova are released into the coelom and then they reach the ovarian funnels from where they pass to the ovisacs, cloaca and then outside.
- Egg of frog is **telolecithal**.

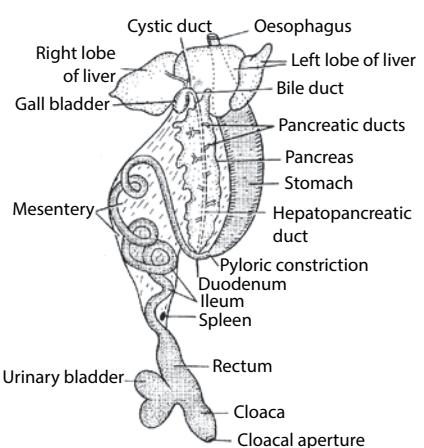


Fig.: Alimentary canal (except buccopharyngeal cavity) of frog

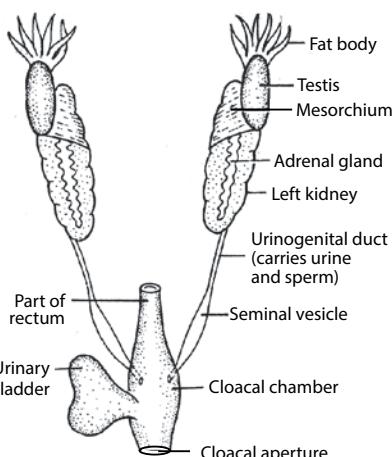


Fig.: Urinogenital system of male frog

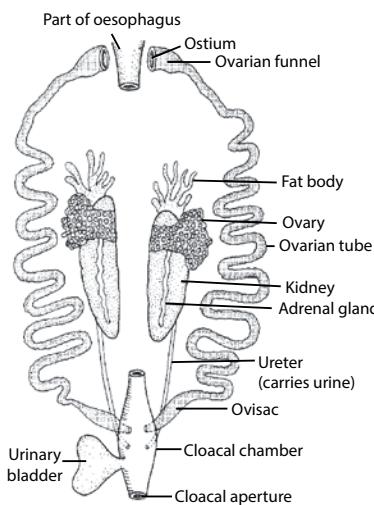
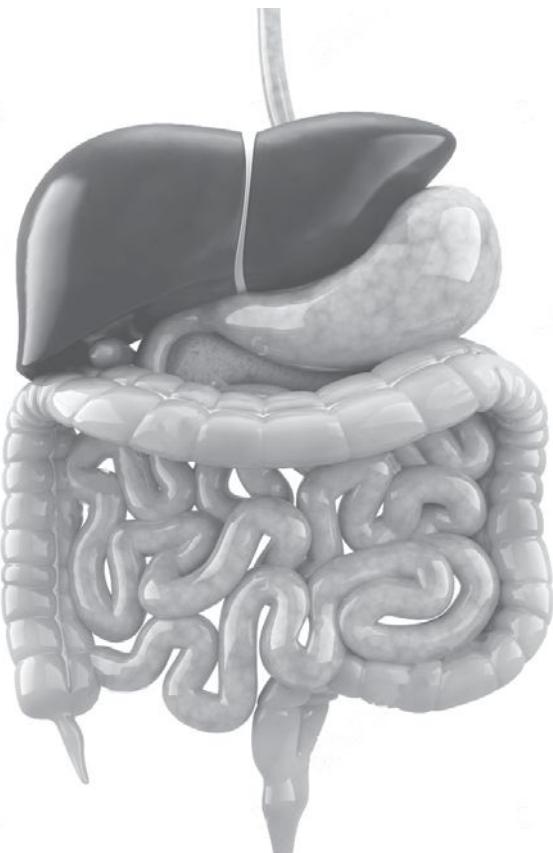


Fig.: Urinogenital system of female frog

NEET ESSENTIAL

The syllabus for NEET is very vast which impedes students from acquiring indepth knowledge and covering the entire syllabus at the same time. An essential topic for NEET is therefore presented here to enable students grasp the topic, analyse the type of questions and SCORE HIGH.



PHYSIOLOGY OF DIGESTION

- The digestive system helps the body digest food. It 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, large intestine (including the rectum and anus). Food enters the mouth and passes out through the anus. The liver, pancreas and gall bladder are the digestive glands of the digestive system.
- 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 foods 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 and drink 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.
- 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 blood stream, 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.
- 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.

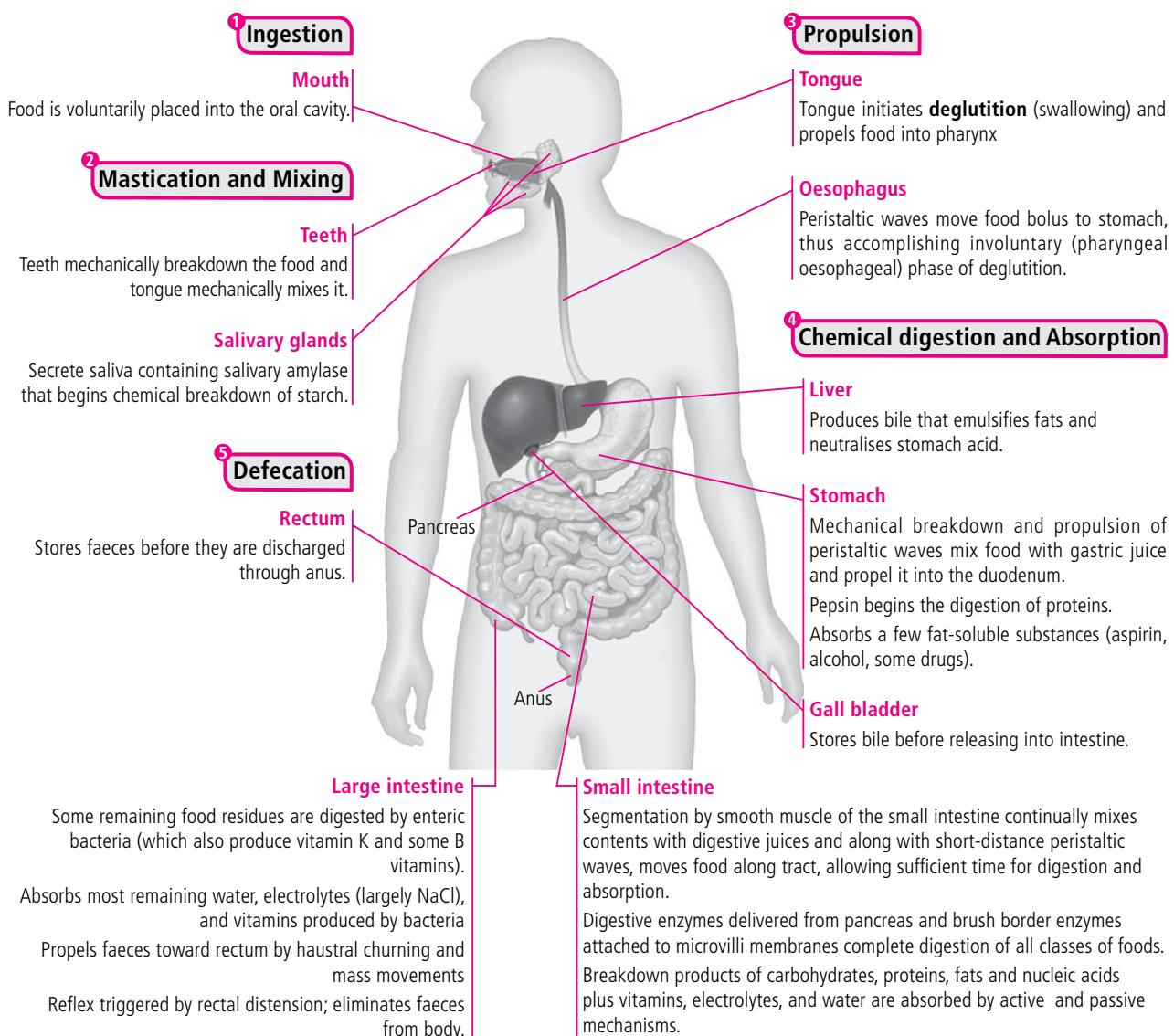


Fig.: Steps in Human Digestion

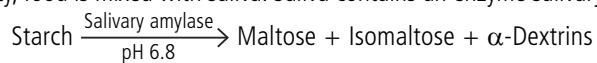
DIGESTION OF FOOD

Digestion of Carbohydrates

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

In oral cavity

- Action of Saliva:** In the oral cavity, food is mixed with saliva. Saliva contains an enzyme salivary amylase which acts on starch.



Role of different substances present in saliva

Lysozyme acts as an antibacterial enzyme.

Thiocyanate ions act as antimicrobial agent.

Bicarbonate ions neutralise the acid in food.

Mucus moistens and dissolves food. It also lubricates the oesophagus.

In small intestine

- Brunner's gland of duodenum, secrete viscous, enzyme-free, alkaline and watery mucoid fluid in response to stimuli from vagus nerve and secretin.
- 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.

1

In mouth, enzyme salivary amylase breaks starch into disaccharides i.e., maltose and isomaltose.

2 In stomach, salivary amylase is inactivated due to acidic conditions, so no carbohydrate digestion occurs.

3

In small intestine, most of the starch digestion and breakdown of disaccharides occur. Here pancreatic amylase complete the job of breaking down starch into disaccharides.

4

Enzymes attached to the brush border of the small intestinal villi complete the digestion of carbohydrates. Here, disaccharides and oligosaccharides are broken down into monosaccharides.

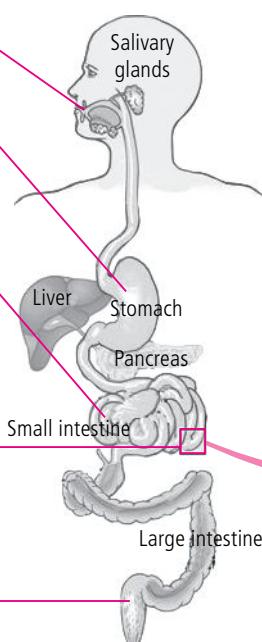
5

In large intestine, indigestible carbohydrates are partially broken down by bacteria to form short chain fatty acids and gas. Some fiber is also excreted in the faeces.

Action of Various Carbohydrases in Duodenum

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 | $\xrightarrow{\alpha\text{-Dextrinase}}$ | Glucose |



Action of pancreatic juice

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

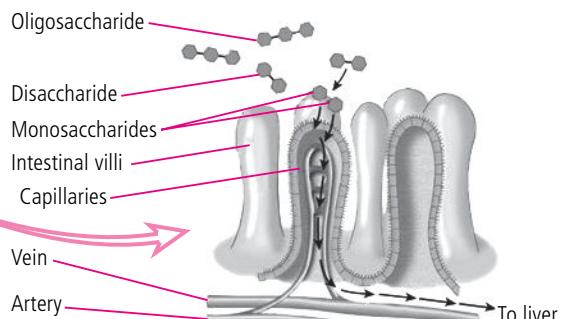
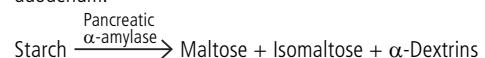


Fig.: Digestion and Absorption of Carbohydrates

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**.

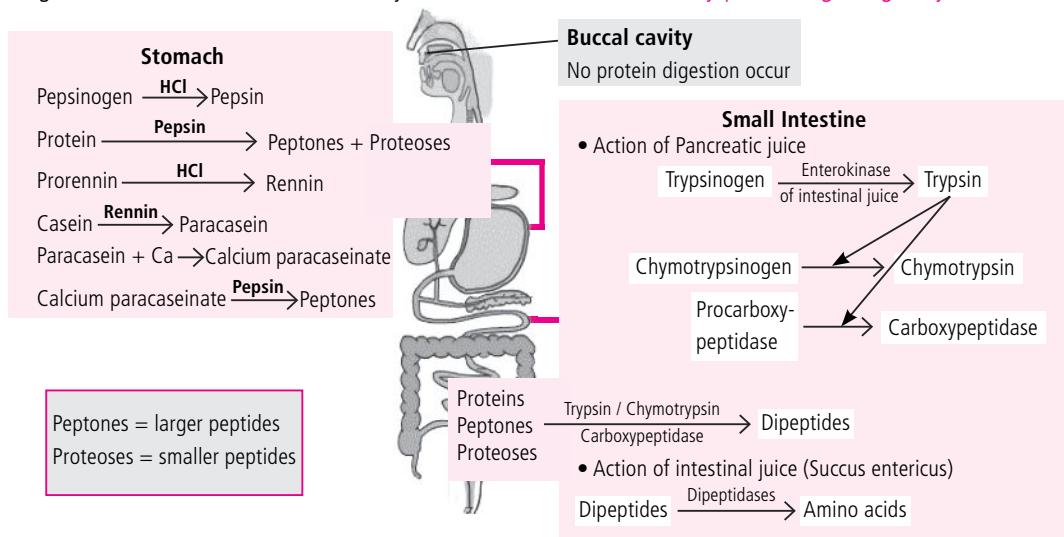
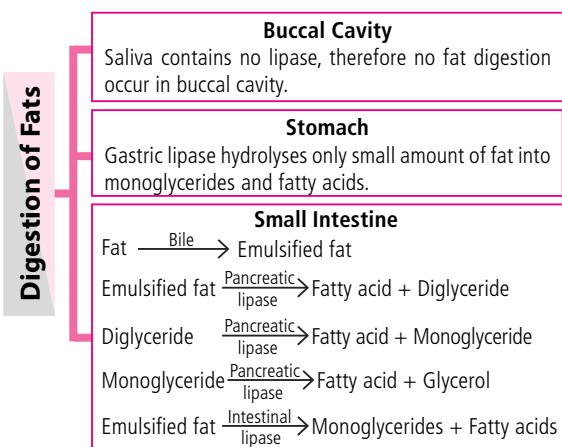


Fig.: Digestion of Proteins

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 here.
- 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.



CHYLE: It 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.

Digestion of Nucleic Acids

- Nucleic acids are digested in small intestine.



REGULATION OF DIGESTION

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

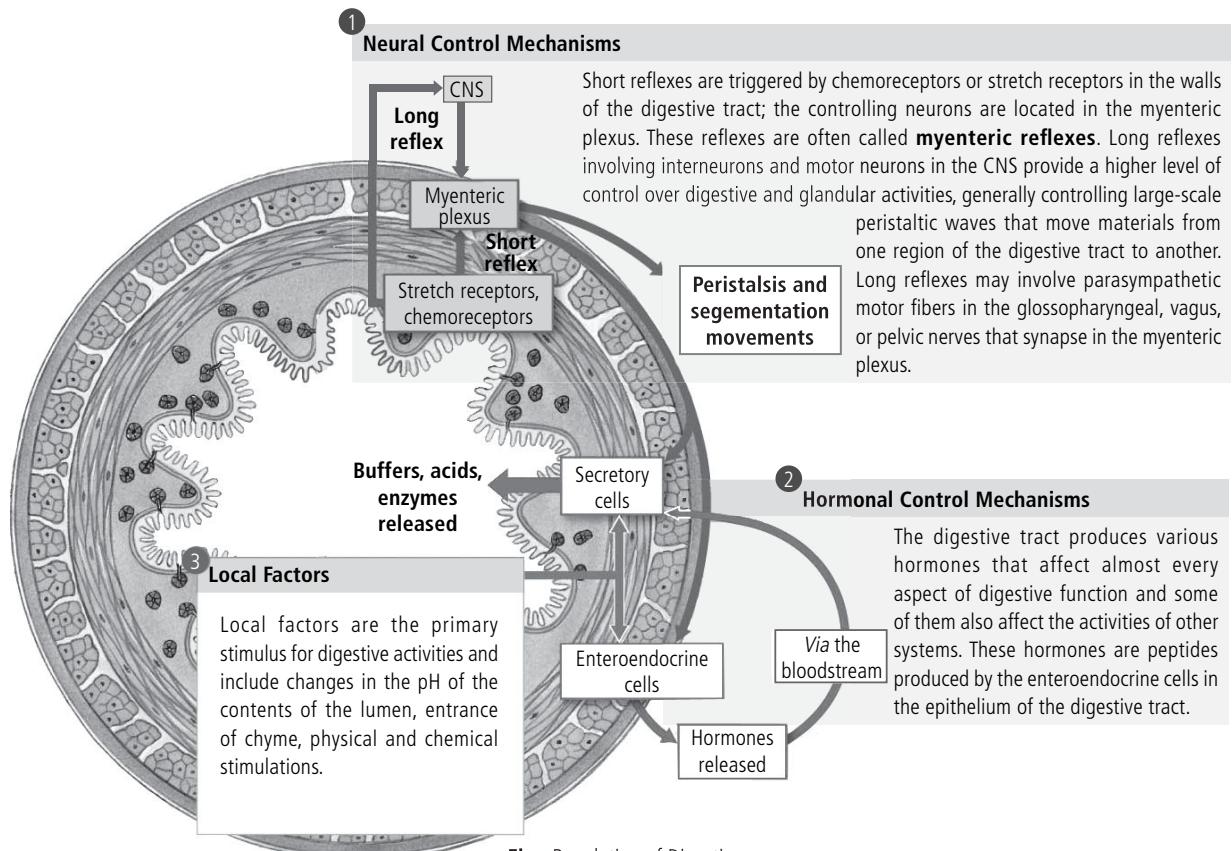


Fig.: Regulation of Digestion

Table: Summary of gastrointestinal hormones

	Hormone	Source	Target organ	Action
(i)	Gastrin	Antrum of stomach	Stomach	Stimulates gastric glands to secrete and release the gastric juice. It also stimulates gastric mobility.
(ii)	Enterogastrone (= Gastric Inhibitory Peptide-GIP)	Duodenum	Stomach	Inhibits gastric secretion and motility (slows gastric contraction).
(iii)	Secretin	Duodenum	Pancreas	Stimulates bicarbonate secretion in the pancreatic juice.
			Liver	Increases secretion of bile.
			Stomach	Decreases gastric secretion and motility.
(iv)	Cholecystokinin-Pancreozymin (CCK-PZ)	Small intestine	Gall bladder	Stimulates contraction of the gall bladder to release bile.
			Pancreas	Stimulates pancreas to secrete and release digestive enzymes in the pancreatic juice.
(v)	Duocrinin	Duodenum	Duodenum	Stimulates the Brunner's glands to release mucus and enzymes into the intestinal juice.
(vi)	Enterocrinin	Small intestine	Small intestine	Stimulates the Crypts of Lieberkuhn to release enzymes into the intestinal juice.
(vii)	Vasoactive Intestinal Peptide (VIP)	Small intestine	Small intestine and stomach	Dilates peripheral blood vessels of gut. Inhibits gastric acid secretion.
(viii)	Villikinin	Small intestine	Small intestine	Accelerates movements of villi.
(ix)	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.
(x)	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.

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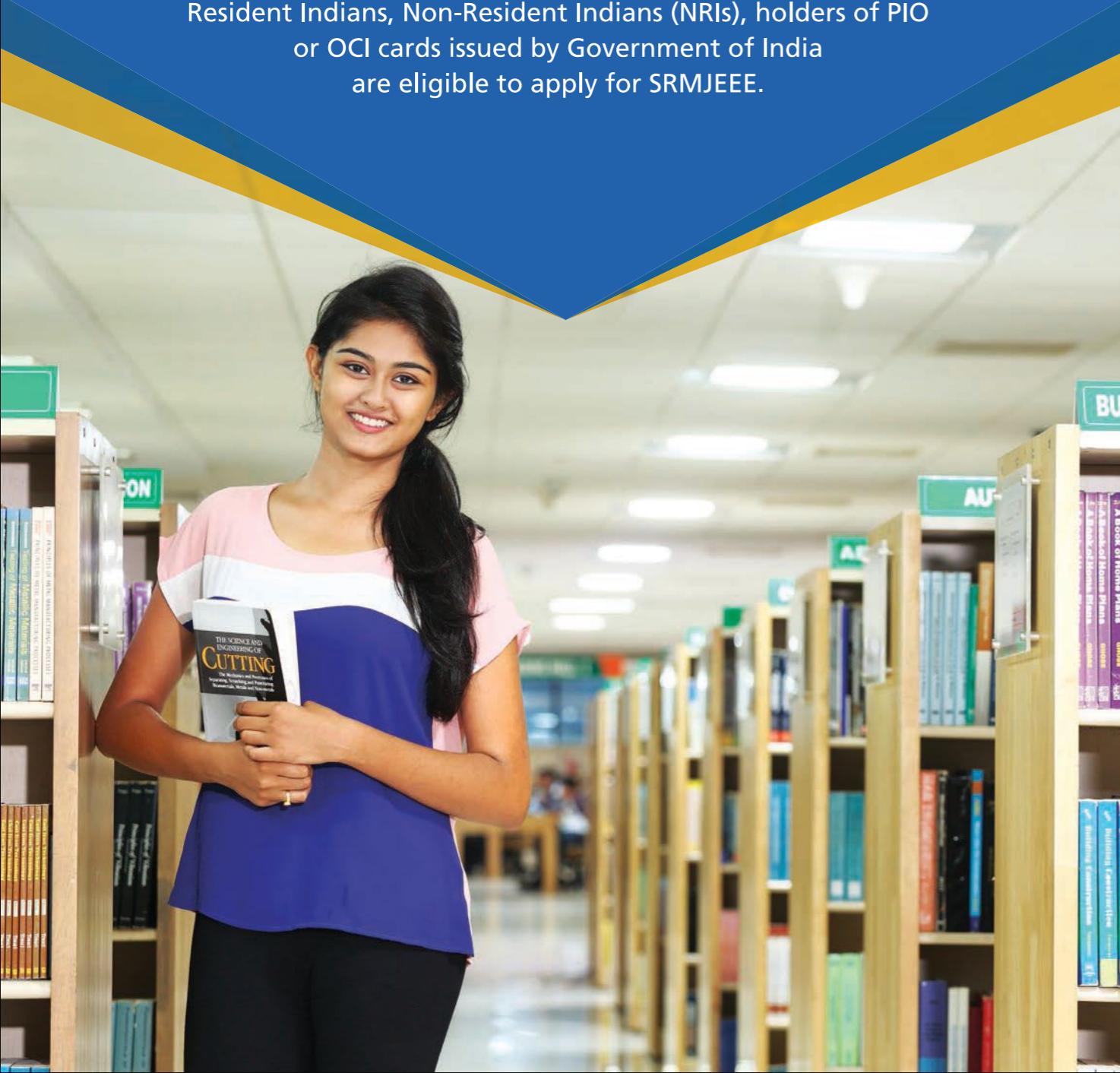
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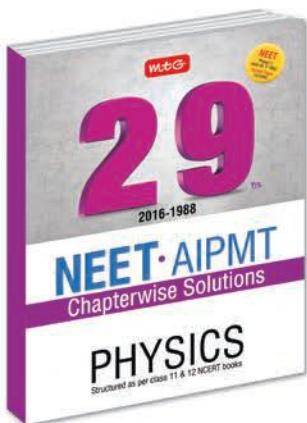
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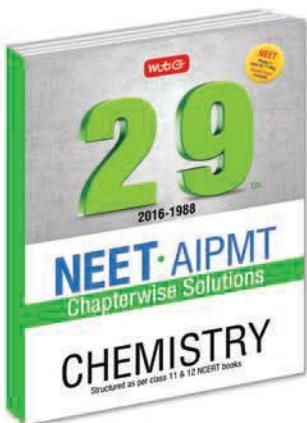
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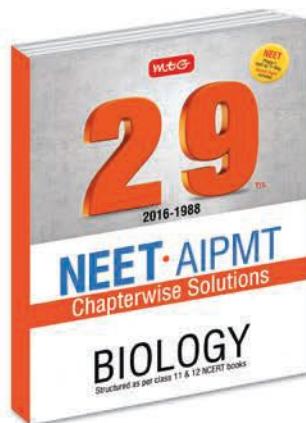
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Absorption of Carbohydrates

- All carbohydrates are absorbed as monosaccharides in stomach and jejunum. Glucose and galactose are absorbed by active transport.
- Fructose is absorbed by facilitated transport. Glucose, galactose and fructose are absorbed into the blood capillaries.

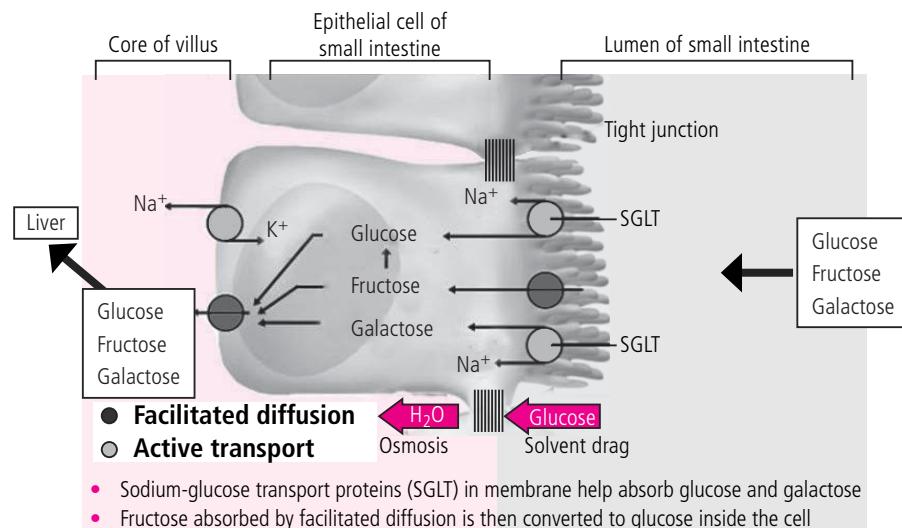


Fig.: Absorption of Carbohydrates

Absorption of Amino Acids

Amino acids are absorbed by active transport and facilitated transport. It occurs mainly in the duodenum and jejunum.

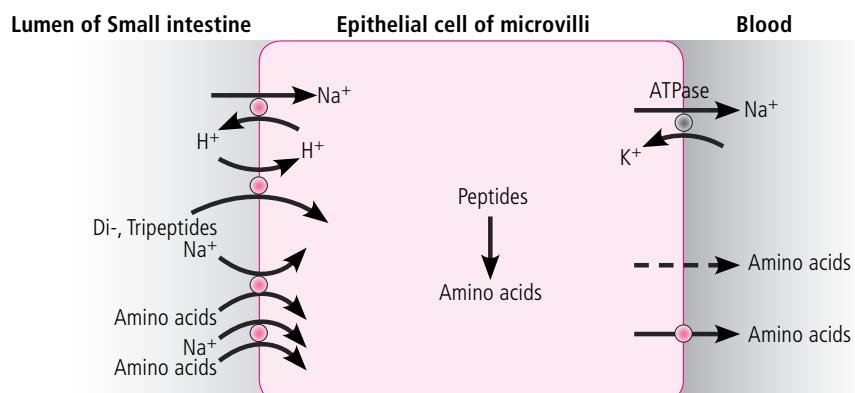


Fig.: Absorption of Amino Acids

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.

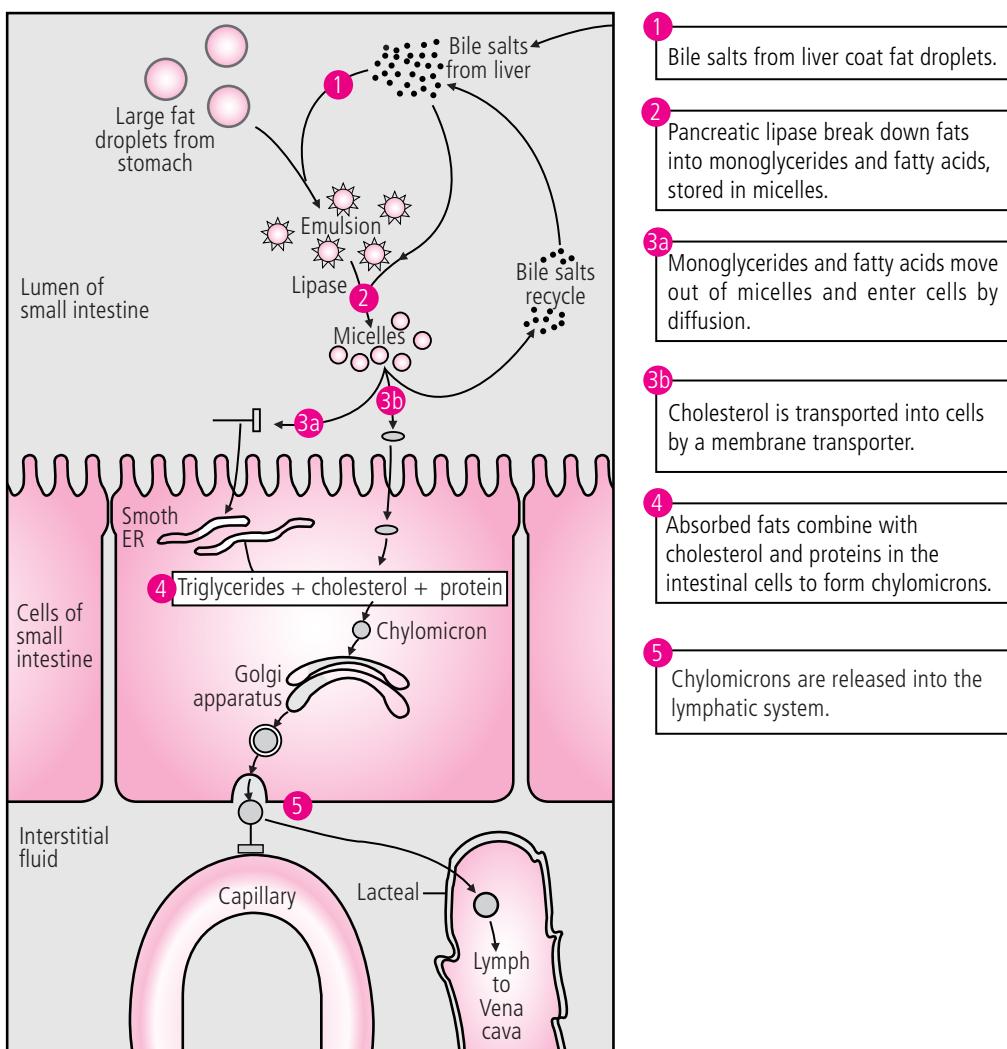


Fig.: Absorption of Fats

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.

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.

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.

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

Indigestible materials are pushed from small intestine to large intestine by peristalsis.



Water and electrolytes are absorbed from the chyme.



E.coli present in colon, feeds on undigested matter and produces vitamin K, B₁₂, B₁ and B₂ absorbed by the wall of colon.



Chyme gets converted into semi-solid faeces.



Pellets of faeces entering rectum induces 'defecation reflex'.



Reflex initiates peristalsis in the last part of colon and rectum, forcing faeces towards anus.



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.

UNSCRAMBLE ME

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

Column I

1. CONITLCUA
2. SEMYOTETIOLSI
3. LOHCNICIEC
4. EGAHOGPRYN
5. YCSPRHOLIEPS
6. PSREAIMONTI
7. IPOMSEE
8. NIUTCNI
9. REPHNOTSOEM
10. TIPOEPE

Column II

- | | |
|-----|--|
| (a) | Plasmid temporarily associated with the nucleoid. |
| (b) | First dinoflagellate in which bioluminescence was reported. |
| (c) | A cellulose-like organic substance which covers the body of adult <i>Herdmania</i> . |
| (d) | Inflammation of bone marrow, adjacent bone and epiphysial cartilage due to infection. |
| (e) | Internal opening that collects excretory matter from the coelomic fluid and blood of annelids. |
| (f) | An alkaloid used in plant breeding for doubling the chromosome number. |
| (g) | A part of antigen molecule involved in antigen-antibody interaction. |
| (h) | Organisms which live and grow at low temperature range of 0-15°C. |
| (i) | The study of migratory history of human species. |
| (j) | Process of release of the spermatozoa from the seminiferous tubules. |

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POWER EXERCISE

New MCQs

1. In Waldeyer's ring, tonsils situated around the Eustachian tube are
 - (a) pharyngeal tonsil
 - (b) palatine tonsil
 - (c) lingual tonsil
 - (d) tubal tonsil.
2. Read the following statements and select the correct option.
 - (a) Prorennin is secreted in stomach of young as well as adult mammals.
 - (b) Kupffer cells of the liver are phagocytic in nature and engulf worn out blood corpuscles.
 - (c) Somatostatin is a vasoconstrictor and stimulates the release of hormones from the digestive tract.
 - (d) Sublingual glands are the medium sized salivary glands and are located at the angles of the lower jaw.
3. The principal organ for absorption of amino acids is
 - (a) stomach
 - (b) mouth
 - (c) small intestine
 - (d) large intestine.
4. Choose the incorrectly matched pair.
 - (a) Hepatopancreatic ampulla – Ampulla of Vater
 - (b) Accessory pancreatic duct – Duct of Wirsung
 - (c) Oxytic cells – Parietal cells
 - (d) Sublingual ducts – Ducts of Rivinus
5. The pyloric canal of the stomach opens into
 - (a) oesophagus
 - (b) duodenum
 - (c) ileum
 - (d) pancreas.
6. Which of the following is not a function of hydrochloric acid?
 - (a) It changes pepsinogen into pepsin and prorennin into rennin.
 - (b) It stimulates the action of salivary enzyme.
 - (c) It kills harmful bacteria that may enter along with food.
 - (d) It provides acidic medium in the stomach for digestion.
7. Match column I with column II and select the correct option.

Column I	Column II
A. Myenteric plexus	(i) Produce serotonin
B. Argentaffin cells	(ii) Controls peristalsis
C. Meissner's plexus	(iii) Secretes heparin
D. Liver	(iv) Secretion of intestinal juice

 - (a) A-(ii), B-(i), C-(iv), D-(iii)
 - (b) A-(iv), B-(iii), C-(i), D-(ii)
 - (c) A-(ii), B-(i), C-(iii), D-(iv)
 - (d) A-(iii), B-(iv), C-(i), D-(ii)
8. Select the correct sequence of the flow of bile from the liver.
 - (a) Gall bladder → hepatopancreatic ampulla → bile duct → duodenum
 - (b) Hepatic ducts → gall bladder → bile duct → duodenum
 - (c) Bile duct → gall bladder → hepatic duct → duodenum
 - (d) Bile duct → gall bladder → hepatopancreatic ampulla → duodenum
9. Consider the following statements (i-iv) and select the option stating which ones are true (T) and which ones are false (F).
 - (i) During egestion, most of the water is absorbed by colon.
 - (ii) Contraction of the longitudinal muscles shortens the upper part of oesophagus to receive the bolus.
 - (iii) The right and left lobes of the liver are separated by common hepatic duct.
 - (iv) Peyer's patches of ileum synthesise lymphocytes.
 - (i) (ii) (iii) (iv)
 - (a) F F F T
 - (b) T F F F
 - (c) T F F T
 - (d) F T F T
10. Identify the correct sequence of layers of gut starting from the lumen to outwards?
 - (a) Mucosa → serosa → submucosa → muscular coat
 - (b) Mucosa → submucosa → muscular coat → serosa
 - (c) Serosa → muscular coat → mucosa → submucosa
 - (d) Mucosa → muscular coat → submucosa → serosa
11. Antibacterial agent present in saliva is
 - (a) salivary amylase
 - (b) lysozyme
 - (c) mucus
 - (d) hydrochloric acid.
12. The circular folds of mucous membrane of small intestine are known as
 - (a) Valves of Kerkring
 - (b) haemorrhoids
 - (c) taeniae coli
 - (d) Meissner's plexus.
13. Sphincter of Boyden is located between
 - (a) sphincter of Oddi and hepatopancreatic ampulla
 - (b) sphincter of Oddi and bile duct
 - (c) hepatopancreatic ampulla and pancreatic duct
 - (d) bile duct and pancreatic duct.
14. How is pepsin similar to trypsin?
 - (a) Both functions at acidic pH of 1.5 - 2.5.
 - (b) Both can digest collagen.
 - (c) Both are protein digesting enzymes.
 - (d) Both can hydrolyse milk protein.

15. Which among the following protect the mucosal epithelium of stomach from excoriation by the highly concentrated HCl?
- Mucus and bicarbonates
 - Pancreatic juice and bile
 - Bile and mucus
 - Pancreatic juice and mucus

Exam Section

- Which hormones do stimulate the production of pancreatic juice and bicarbonate?
 - Angiotensin and epinephrine
 - Gastrin and insulin
 - Cholecystokinin and secretin
 - Insulin and glucagon(NEET Phase-II 2016)
- Which of the following guards the opening of hepato-pancreatic duct into the duodenum?
 - Pyloric sphincter
 - Sphincter of Oddi
 - Semilunar valve
 - Ileocaecal valve(NEET Phase-I 2016)
- In the stomach, gastric acid is secreted by the
 - peptic cells
 - acidic cells
 - gastrin secreting cells
 - parietal cells.(NEET Phase-I 2016)
- The enzyme that is not present in succus entericus is
 - nucleosidase
 - lipase
 - maltase
 - nuclease.(AIPMT 2015)
- Choose the correct statement among the following.
 - The intestinal mucosal epithelium has oxytic cells.
 - Ptyalin converts proteins into proteoses and peptones.
 - Crypts of Lieberkühn are seen between the bases of villi in the intestine.
 - Sphincter of Oddi is present at the junction of oesophagus and cardiac stomach.
 - Goblet cells secrete hydrochloric acid in stomach.(Kerala PMT 2015)
- The optimum pH for pepsin is
 - 11
 - 5-6
 - 1.6-2.4
 - 4-7.(AMU 2015)
- Chylomicrons are
 - small fat globules coated with protein
 - protein molecules coated with fat
 - small granules found in gastric juice
 - neural signals that stimulate intestinal secretions
 - aerobic microbes.(Kerala PMT 2014)
- Which of the following organs does not produce any digestive enzymes?
 - Salivary gland
 - Pancreas
 - Liver
 - Stomach(WB JEE 2014)

9. Which of the following gastric secretions is correctly matched with its source?

- | | |
|------------------|------------------|
| (a) Pepsinogen | — Chief cells |
| (b) Chymotrypsin | — Parietal cells |
| (c) HCl | — Goblet cells |
| (d) Mucus | — Oxytic cells |
- (AIIMS 2013)

10. Select the correct match of the digested products in humans given in column I with their absorption site and mechanism in column II.

Column I	Column II
(a) Glycerol, fatty acids	Duodenum, move as chylomicrons
(b) Cholesterol, maltose	Large intestine, active absorption
(c) Glycine, glucose	Small intestine, active absorption
(d) Fructose, Na ⁺	Small intestine, passive absorption

(NEET 2013)

11. Main function of HCl present in gastric juice is

- digestion of starch
 - emulsification of fat
 - conversion of pepsinogen to pepsin
 - detoxification of harmful constituents of food.
- (Odisha 2012)

12. The common passage for bile and pancreatic juice is

- ampulla of Vater
 - ductus choledochus
 - duct of Wirsung
 - duct of Santorini.
- (AMU 2012)

13. One of the constituents of the pancreatic juice which is poured into the duodenum in humans is

- trypsinogen
 - chymotrypsin
 - trypsin
 - enterokinase.
- (AIPMT Mains 2011)

14. The special feature of bile juice is that it

- has no enzyme
 - has amylase
 - contains lipase
 - contains H₂O.
- (Odisha 2011)

15. The process of conversion of excess glucose into glycogen is called

- glycolysis
 - glycogenesis
 - gluconeogenesis
 - oogenesis.
- (J & K 2010)

Assertion & Reason

The following questions consist of two statements each : assertion (A) and reason (R). To answer these questions, mark the correct alternative as directed below:

- If both A and R are true and R is the correct explanation of A.
- If both A and R are true but R is not the correct explanation of A.
- If A is true but R is false.
- If both A and R are false.

- Assertion (A) :** Proteins are not digested in the oral cavity.
Reason (R) : Saliva lacks proteases.
- Assertion (A) :** Enterogastrone is also known as Gastric Inhibitory Peptide (GIP).
Reason (R) : Enterogastrone inhibits the absorption of nutrients from the gastrointestinal tract.
- Assertion (A) :** Pyloric sphincter guards the opening between the stomach and the duodenum.
Reason (R) : Pyloric sphincter permits partially digested food to leave the stomach and enter the duodenum.
- Assertion (A) :** Brunner's glands found in jejunum secrete enzyme and mucus.
Reason (R) : Mucus and enzymes protect the jejunal wall from getting digested.
- Assertion (A) :** Trypsin cannot hydrolyse milk proteins.
Reason (R) : Trypsin functions at an acidic pH.

Short Answer Type Questions

- Fill in the blanks.
 - _____ is the principal enzyme for the digestion of fat.
 - Enzyme _____, also known as activator enzyme converts trypsinogen of pancreatic juice into trypsin.
 - Conversion of pepsinogen into pepsin by the action of pepsin is a type of _____.
 - Colon part of large intestine has three longitudinal bands known as _____.
- Write short note on neural regulation of digestion.
- Differentiate between the enzymes pepsin and trypsin.
- What are the main functions of small intestine?

ANSWER KEY

New MCQs

- | | | | | |
|---------|---------|---------|---------|---------|
| 1. (d) | 2. (b) | 3. (c) | 4. (b) | 5. (b) |
| 6. (b) | 7. (a) | 8. (b) | 9. (c) | 10. (b) |
| 11. (b) | 12. (a) | 13. (d) | 14. (c) | 15. (a) |

Exam Section

- | | | | | |
|---------|---------|---------|---------|---------|
| 1. (c) | 2. (b) | 3. (d) | 4. (d) | 5. (c) |
| 6. (c) | 7. (a) | 8. (c) | 9. (a) | 10. (c) |
| 11. (c) | 12. (a) | 13. (a) | 14. (a) | 15. (b) |

Assertion & Reason

- | | | | | |
|--------|--------|--------|--------|--------|
| 1. (a) | 2. (c) | 3. (b) | 4. (d) | 5. (c) |
|--------|--------|--------|--------|--------|

Short Answer Type Questions

- (a) Pancreatic lipase
(b) enterokinase

- (c) autocatalytic reaction
(d) taeniae coli
- The gastrointestinal tract is innervated by an intrinsic nervous system as well as by extrinsic nerves. The intrinsic neural system or enteric neural system consists of (i) the Meissner's plexus situated in the submucosa and (ii) the Auerbach's plexus situated in the muscular layer. The enteric neural system controls most of the gastrointestinal functions like secretion and motility. The extrinsic innervation of the gut consists of parasympathetic and sympathetic nerves which can modify the activity of the intrinsic neural system in response to reflex activity initiated from the Gastrointestinal Tract (GIT) itself or from other parts of the body.
- The differences between pepsin and trypsin are

	Pepsin	Trypsin
(i)	It is a protease in the stomach.	It is a protease in the intestine.
(ii)	It functions at an acidic pH.	It functions at an alkaline pH.
(iii)	It can hydrolyse collagen.	Digestion of collagen is limited.
(iv)	It can hydrolyse milk proteins.	It cannot hydrolyse milk proteins.

- The small intestine completes digestion of proteins, carbohydrates, fats and nucleic acids. It absorbs nutrients into the blood and lymph. It secretes certain hormones such as cholecystokinin, secretin, enterogastrone, duocrinin, enterocrinin and villikinin. It also secretes digestive enzymes.



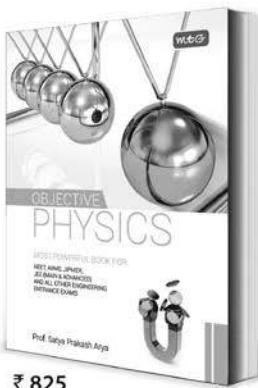
Spellathon

- Make as many biological terms as possible using the given letters. Each word should contain the letter given in circle.
- Minimum 4 letter word should be made.
- In making a word, a letter can be used as many times as it appears in the box.
- Make at least 1 seven letter word.

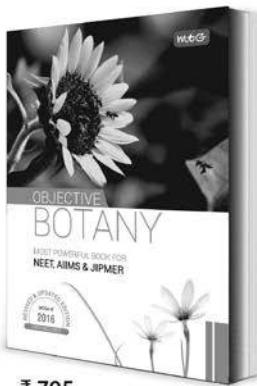


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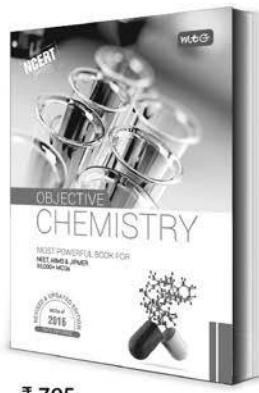
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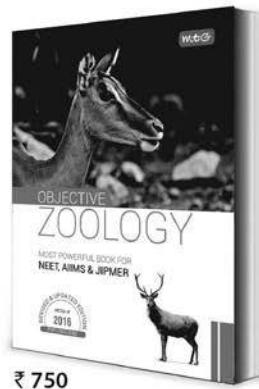
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Class-11

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- 👉 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-I : DIVERSITY IN THE LIVING WORLD

CHAPTER-1 : THE LIVING WORLD

Multiple Choice Questions

- 👉 1. Which taxon has more similar characters than the members of a family?
(a) Class (b) Order
(c) Genus (d) Division
- 👉 2. Which of the following shows correct sequence of various taxons in a taxonomic hierarchy of housefly?
(a) Genus → Class → Family → Order → Phylum → Kingdom
(b) Species → Genus → Family → Class → Division → Kingdom
(c) Species → Genus → Family → Order → Class → Division → Kingdom
(d) Genus → Family → Order → Class → Phylum → Kingdom
- 👉 3. Identify the correct scientific name of an eggplant.
(a) *Solanum Melongena*
(b) *Solanum melongena*
(c) Solanum melongena
(d) *SOLANUM MELOGENA*
- 👉 4. Which taxonomic category contains one or more related genera?
(a) Species (b) Family
(c) Phylum (d) Class
- 👉 5. Why do the plant material, collected for making herbarium, is kept in vasculum?
(a) To prevent wilting of plant
(b) To prevent fungal attack
(c) To facilitate examination of floral parts
(d) To aid in quick drying of plant
- 👉 6. Which of the following statement is incorrect?
(a) Herbaria provide information about ecology of different places.
(b) Flora used for species identification have all information about particular taxon.
(c) Botanical gardens provide living plant material for systematic work.
(d) Zoological parks provide knowledge about different native and exotic fauna.
- 👉 7. Which of the following is not correct for classical taxonomy?
(a) Delimitation of species is carried out on the basis of morphological characters.
(b) It does not study evolution of species.
(c) Species are considered to be dynamic.
(d) It has typological concept.
- 👉 8. Refer to the various taxons of wheat classification and arrange them in correct sequence of taxonomic hierarchy starting from the lowest rank.
(i) Poaceae (ii) Monocotyledonae
(iii) Angiospermae (iv) Plantae
(v) Poales (vi) *Triticum*

- (a) (vi), (i), (v), (ii), (iii), (iv)
- (b) (vi), (ii), (v), (iv), (iii), (i)
- (c) (iv), (iii), (ii), (v), (i), (vi)
- (d) (iv), (ii), (v), (iii), (i), (vi)

9. Select important functions of botanical gardens.
- (i) Help in growing and maintaining rare and endangered plants.
 - (ii) Supply seeds and material for different aspects of botanical research.
 - (iii) Depict morphological variations found in species.
 - (iv) Provide information for locating relatives of economically important plants.
- (a) (i) only
 - (b) (ii), (iii) and (iv) only
 - (c) (i) and (ii) only
 - (d) All of these

10. Which herbarium is present in Kolkata, India?
- (a) Herbarium of National Botanical Research Institute
 - (b) Royal Botanical Garden
 - (c) Central National Herbarium
 - (d) Museum of Natural History

Match The Columns

11. Match Column I with Column II.

Column I	Column II
A. National Botanical Garden	(i) Kolkata
B. Lloyd Botanical Garden	(ii) London
C. Royal Botanical Garden	(iii) Darjeeling
D. Indian Botanical Garden	(iv) Lucknow

12. Match Column I with Column II. (There can be more than one match for items in Column I).

Column I	Column II
A. Order	(i) Dicotyledonae
B. Class	(ii) Angiospermae
C. Family	(iii) Arthropoda
D. Phylum/Division	(iv) Plantae
E. Kingdom	(v) Diptera
	(vi) Muscidae
	(vii) Insecta
	(viii) Canidae
	(ix) Lamiales
	(x) Animalia

Passage Based Question

13. Complete the given passage with appropriate words or phrases.

The scientific names ensure that each organism has only (i) name. Each scientific name has two components; (ii) and (iii). This system of providing a name to organism with two components is called (iv) and was given by (v). Biological names are derived from (vi) language

and are written in (vii). In scientific name, *Homo sapiens sapiens*, third word represents (viii).

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 both A and R are false.

14. **Assertion :** Members of a family has less similarities than members of a genus.

Reason : Number of similar characters decrease as we go higher in taxonomical hierarchy.

15. **Assertion :** Herbarium serves as a quick referral systems in taxonomical studies.

Reason : Herbarium is store house of dried, pressed and preserved plant specimens.

16. **Assertion :** Anabolic reactions release energy as simple substances form complex ones.

Reason : In anabolic reactions, potential energy is changed into kinetic energy.

17. **Assertion :** In modern taxonomy, species are considered to be dynamic.

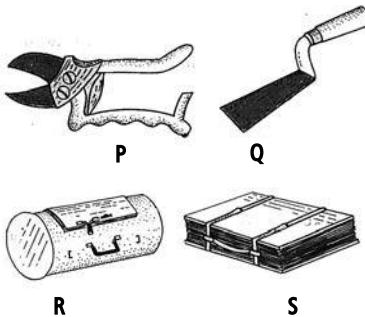
Reason : In modern taxonomy, various traits such as morphology, physiology, anatomy, cytology, etc., of whole population are studied.

18. **Assertion :** Monographs are used for identification of species.

Reason : Monographs contain information about habitat, climate, seasonal changes, etc., of species found in a particular area.

Figure Based Questions

19. Refer to the given figure showing various tools used for plant collection and answer the following questions.



- (a) Identify P, Q, R and S.
- (b) Write the significance of 'S'.
- (c) Write the use of tools 'P' and 'R'.

20. Refer to the given key of Family Ranunculaceae and answer the following questions.

- (1) Carpels 1-ovuled, fruit achenes(2)
Carpels many ovuled, fruit follicles(5)
 - (2) Leaves opposite, compound(3)
Leaves alternate, radicle(4)
 - (3) Sepals 4, petaloid, petals 0, no leaflet tendrilP
Sepals as many as petals, 4-5, terminal leaflet modified into tendril *Naravelia*
 - (4) Flowers subtended by involucreQ
Flowers without involucreR
 - (5) Carpels united at base, Flower regularS
Carpels free, flowers irregular *Aconitum*
- (a) Name and describe the type of given key.
(b) Identify P, Q, R and S in the given key.
(c) Which other genera of same family can be written in the place of *Aconitum*? Also, mention the difference between the two.

CHAPTER-2 : BIOLOGICAL CLASSIFICATION

Multiple Choice Questions

1. Which organism shows the given characteristics?

- (i) Naked DNA
- (ii) Peptidoglycan containing cell wall
- (iii) Absence of mitochondria
- (a) *Paramecium* (b) *Vibrio cholerae*
- (c) *Agaricus* (d) Paramyxo virus

2. How is cytobotany different from cladistic taxonomy?

- (a) Cytobotany is based on number, structure and banding pattern of chromosomes while cladistic taxonomy is based on origin from common ancestor.
- (b) In cytobotany, lineage can be traced with the help of chromosome studies, while in cladistic taxonomy, relationships are known using DNA analysis and protein tests.
- (c) Cladistic taxonomy helps to trace the evolution of humans from apes while cytobotany produces cladogram.
- (d) Cytobotany is based on stable and specific chemical constituents while cladistic taxonomy searches similarity due to common phylogeny.

3. Who first proposed the system of classification based on evolutionary relationship?

- (a) Aristotle
- (b) Linnaeus
- (c) Engler and Prantl
- (d) Bentham and Hooker

4. Study the given table and identify the correct statement regarding P, Q, R and S.

Kingdom	Mitochondria	Cell wall	Nutrition
P	+	+	Photosynthetic and heterotrophic
Q	+	-	Heterotrophic
R	-	+	Chemosynthetic
S	+	+	Saprophytic

- (a) Kingdom P comprises of unicellular, prokaryotic organisms having naked DNA.
- (b) Kingdom S contains achlorophyllous, multinucleate organisms having filamentous body.
- (c) Kingdom R contains unicellular eukaryotic organisms with both sexual and asexual modes of reproduction.
- (d) Kingdom Q contains multicellular organisms capable of converting dinitrogen into ammonia.

5. All of the following viruses have ssRNA as their genetic material, except

- (a) Poliomyelitis virus (b) Potato mosaic virus
- (c) Influenza virus (d) Coliphage φ X 174.

6. Read the given statements regarding viroids and select the correct ones.

- (i) They are devoid of protein coat.
 - (ii) Cause disease in both plants and animals.
 - (iii) Does not possess an initiation codon.
 - (iv) Nucleic acid can be RNA or DNA.
 - (v) Can multiply by both RNA dependent and DNA dependent replication.
- (a) (ii), (iv) and (v) only (b) (i), (iii) and (iv) only
 - (c) (i), (iii) and (v) only (d) (ii), (iii) and (v) only

7. Which of the following bacteria can destroy penicillin?

- (a) *Bacillus brevis*
- (b) *Clostridium botulinum*
- (c) *Salmonella typhimurium*
- (d) *Staphylococcus aureus*

8. Colourless dinoflagellate showing bioluminescence is

- (a) *Ceratium* (b) *Noctiluca*
- (c) *Gonyaulax* (d) *Gymnodinium*.

9. The parasite causing sleeping sickness is transmitted by

- (a) *Glossina palpalis* (b) *Phlebotomus argentipes*
- (c) *Aedes aegypti* (d) female *Anopheles*.

10. To which class of Kingdom Fungi do dung mould belong?

- (a) Ascomycetes (b) Oomycetes
- (c) Zygomycetes (d) Basidiomycetes

Match The Columns

11. Match Column I with Column II.

Column I	Column II
A. Three kingdom classification	(i) Linnaeus
B. Five kingdom classification	(ii) Copeland
C. Two kingdom classification	(iii) Whittaker
D. Four kingdom classification	(iv) Haeckel
E. Six kingdom classification	(v) Carl Woese

12. Match Column I with Column II. (There can be more than one match for items in Column I).

Column I	Column II
A. Archaebacteria	(i) <i>Collozoum</i>
B. Cyanobacteria	(ii) <i>Spirulina</i>
C. Sporozoans	(iii) <i>Monocystis</i>
D. Club fungi	(iv) <i>Methanococcus</i>
E. Amoeboid protozoa	(v) <i>Psilocybe</i>
	(vi) <i>Oscillatoria</i>
	(vii) <i>Agaricus</i>
	(viii) <i>Thermoproteus</i>
	(ix) <i>Eimeria</i>
	(x) <i>Globigerina</i>

Passage Based Question

13. Complete the given passage with appropriate words or phrases.

Archaebacteria are most primitive prokaryotes and can live under extreme hostile conditions. They are of two broad categories; (i) live under anaerobic conditions only and get killed in the presence of oxygen, while (ii) are actually aerobic archaebacteria which can bear anaerobic conditions also. Archaebacteria are of three major types : (iii) occur in marshy areas and convert formic acid and carbon dioxide into methane. Archaebacteria found in salt rich substrata are called (iv), they are able to tolerate high salt conditions due to absence of (v) and hence plasmolysis. Archaebacteria that have dual ability to tolerate high temperature and acidity are (vi). Archaebacteria are also called (vii). They are used for producing gobar gas from dung and sewage and also help in cellulose fermentation in (viii).

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 both A and R are false.

14. **Assertion** : Female bacterium develops sex pili for conjugating with male bacterium.

Reason : F-plasmids are present in female bacterium.

15. **Assertion** : *Anabaena* has the ability to fix atmospheric nitrogen.

Reason : *Anabaena* possess heterocysts.

16. **Assertion** : *Euglena* has characters of both plants and animals.

Reason : *Euglena* possesses photosensitive structures such as stigma and paraflagellar body.

17. **Assertion** : *Neurospora crassa* is a widely used model organism in experimental genetics.

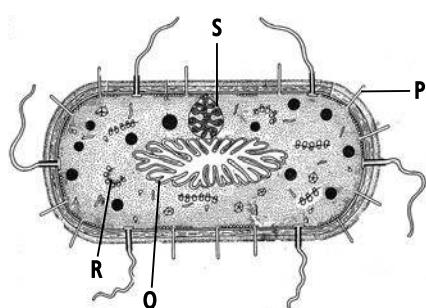
Reason : *Neurospora crassa* produces a large number of antibacterial and antifungal drugs.

18. **Assertion** : Mycorrhizae is symbiotic association between fungus and roots of higher plants.

Reason : Fungus remains restricted to cortical region of roots and do not affect vascular strand and growing point.

Figure Based Questions

19. Refer to the given figure and answer the following questions.



- (a) Identify the structure P. Briefly describe the role of P in bacterial cell.
- (b) Describe the structure R.
- (c) Identify and explain the part labelled as S.
- (d) Name and describe the part labelled as Q. Mention its one alternative name also.

- 20.** Consider the given figure and answer the following questions.
- Identify the organism shown in the figure.
 - To which group of protozoa, do the given organism belongs?
 - Name the disease caused by this organism.



CHAPTER-3 : PLANT KINGDOM

Multiple Choice Questions

- 1.** Which of the following alga reserves food in the form of floridean starch?
- Gelidium*
 - Laminaria*
 - Ectocarpus*
 - Sargassum*
- 2.** Read the given statements and select which ones are true (T) and which ones are false (F).
- Bryophytes do not achieve great heights due to absence of vascular and mechanical tissues.
 - In bryophytes, archegonium encloses single motile female gamete.
 - Dryopteris* is an aquatic fern, also called as Sorrow of Kashmir.
 - Tracheophytes possess both xylem and phloem.
 - Spermatophyta exhibits heterospory which lead to development of seed habit.
- (i) (ii) (iii) (iv) (v)
- T T F T F
 - T F F T T
 - F F T T F
 - T T F F T
- 3.** All the given algae contain photosynthetic pigment fucoxanthin, except
- Dictyota*
 - Macrocystis*
 - Caulerpa*
 - Fucus*.
- 4.** Identify the plant from the given characteristics.
- Plant has radial symmetry.
 - Sporophyte has embedded foot, elongated curved seta and terminal capsule.
 - Peristome consists of 32 a cellular teeth arranged in two whorls.
 - Produces filamentous juvenile stage known as protonema.
- Marchantia*
 - Pellia*
 - Funaria*
 - Selaginella*

- 5.** Which of the following pair is incorrectly matched?

- Adiantum* - Cleaning of utensils
- Azolla* - Nitrogen fixation
- Marsilea* - Yields starch
- Dryopteris* - Antihelminthic drug

- 6.** Ramenta refers to

- small scale present on basal adaxial surface of leaf
- scales present on young parts of plant for protection from dessication
- large aerial leaves developed in acropetal fashion from upper surface of rhizome
- dark brown underground stem.

- 7.** Which group of gymnosperms is represented by maiden hair tree?

- Ginkgopsida
- Cycadopsida
- Gnetopsida
- Coniferopsida

- 8.** Identify the incorrect statement.

- Male gametophyte of pteridophytes contain antheridium but it is absent in male gametophyte of gymnosperms.
- Female gametophyte in gymnosperms is enclosed in ovule but not enclosed in pteridophytes.
- Female gametophyte contains distinct archegonia in angiosperms but absent in gymnosperms.
- Endosperm is a pre-fertilisation structure in gymnosperms but a post-fertilisation structure in angiosperms.

- 9.** An angiospermic plant characterised by stem with open vascular bundle, pentamerous flowers and generally reticulate venation in leaves can be identified as

- bamboo
- banana
- palm
- cotton.

- 10.** Which among the following features is peculiar to *Selaginella*?

- Heterospory
- Positively geotropic rhizophores
- Young leaves showing circinate ptyxis
- Heteromorphic alternation of generation

Match The Columns

- 11.** Match Column I with Column II.

Column I	Column II
A. <i>Laminaria</i>	(i) Club moss
B. <i>Equisetum</i>	(ii) Living fossil
C. <i>Volvox</i>	(iii) Devil's apron
D. <i>Selaginella</i>	(iv) Scouring rush
E. <i>Ginkgo</i>	(v) Rolling alga

12. Match Column I with Column II. (There can be more than one match for items in Column I).

Column I	Column II
A. Rhodophyta	(i) Woody strobili
B. Hepaticopsida	(ii) Prothallus
C. Pteropsida	(iii) Phycocolloids
D. Coniferopsida	(iv) Ferns (v) <i>Marchantia</i> (vi) Liverworts (vii) <i>Araucaria</i> (viii) <i>Polypiponia</i>

Passage Based Question

13. Complete the given passage with appropriate words or phrases.

The gymnosperms are plants with naked seeds. In gymnosperms, (i) are not enclosed by any ovary wall. They generally possess tap roots. Roots of *Pinus* have fungal association in the form of (ii), while in *Cycas*, small specialised roots are called (iii) roots and are associated with (iv). In (v), male and female strobili are present on the same tree. The megasporangium undergoes (vi) to form four megasporangia. One of the megasporangium develops into (vii) gametophyte, which possess a distinct (viii). The pollen grains are released from (ix) and is carried by air currents to ovules. The pollen tube carrying male gametes grow towards archegonia and results in fertilisation by (x).

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 both A and R are false.

14. **Assertion :** Green algae resembles land plants.

Reason : Green algae and land plants show various biochemical and physiological similarities.

15. **Assertion :** Bryophytes are cryptogamic plants.

Reason : Bryophytes need external supply of water for swimming of male gametes to reach archegonia.

16. **Assertion :** Vascular plants are well adapted to the environment and dominate the land.

Reason : Vascular plants have xylem and phloem for long distance transport system.

17. **Assertion :** Heterosporous pteridophytes show traits essential for formation of seed.

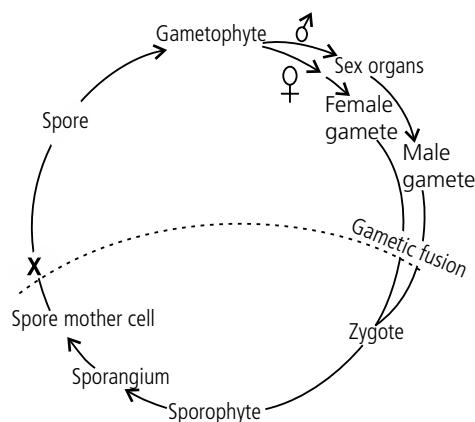
Reason : Homosporous pteridophytes produce only one type of spores and all sporangia are similar.

18. **Assertion :** *Cycas* is also called living fossil.

Reason : *Cycas* possesses characters of both extinct pteridosperms and cycads.

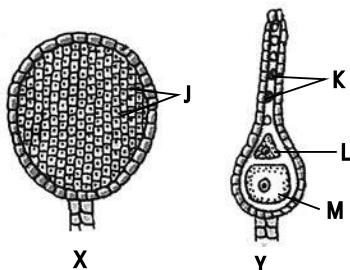
Figure Based Questions

19. Refer to the given figure and answer the following questions.



- (a) What does the given figure represent?
- (b) Identify the haploid and diploid stages in the given life cycle.
- (c) Which cell division would occur at X?
- (d) Which plant groups show this type of life cycle?

20. Refer to the given figure and answer the following question.



- (a) What does the figure X represent?
- (b) Identify the correct labellings for J, K, L and M.
- (c) Identify and describe figure Y.

CHAPTER-4 : ANIMAL KINGDOM

Multiple Choice Questions

- Q1. Identify the eumetazoan having bilateral symmetry with organ system level of organisation, showing protostomic development and a schizocoelomic body cavity.

- (a) *Adamsia*
- (b) *Beroe*
- (c) *Schistosoma*
- (d) *Hirudinaria*

- Q2.** Which of the following statements is incorrect?
- In poriferans, trophocytes present in mesophyll layer act as nurse cells for developing cells.
 - Cnidarians have a complete digestive tract.
 - In *Palaemon*, posterior end of abdomen form telson.
 - Osteichthyes have a homocercal, caudal fin.
- Q3.** Choose the correct combination.
- Spongilla* - Diploblastic - Syconoid canal system
 - Planaria* - Triploblastic - Flame cells
 - Ancylostoma duodenale* - Diploblastic - Jointed appendages
 - Antedon* - Triploblastic - Osphradium
- Q4.** In which mollusc, does one arm of male gets hectocotylised to transfer sperms into the female?
- Devil fish
 - Limax*
 - Chiton
 - Apple snail
- Q5.** Which of the following animal is anamniote?
- Heloderma*
 - Penguin
 - Blue whale
 - Salamandra*
- Q6.** Chief excretory waste of locusts and cockroaches is
- urea
 - uric acid
 - ammonia
 - both (a) and (b).
- Q7.** Identify the animal from the given characteristics.
- Bears spines and pedicellariae
 - Symmetry bilateral in larva and radial in adults
 - True enterocoelic coelom
 - Haemal system present
- Aurelia*
 - Taenia*
 - Asteria*
 - Unio*
- Q8.** Select the fish with bony endoskeleton in adults.
- Torpedo*
 - Labeo*
 - Pristis*
 - Trygon*
- Q9.** Which of the following is not a characteristic of amphibians?
- Alimentary canal, urinary and reproductive tract open into a common chamber cloaca.
 - Cold-blooded animals with 12 pairs of cranial nerves.
 - Three-chambered heart with a single ventricle.
 - Moist and smooth skin usually without scales.
- Q10.** Which of the following group contains animals with four chambered heart?
- Seal, axolotl, chameleon
 - Ichthyophis*, hedgehog, *Sorex*
 - Whale, *Echidna*, turtle
 - Crocodile, dolphin, *Walrus*

Match The Columns

11. Match Column I with Column II.

Column I	Column II
A. <i>Physalia</i>	(i) Green glands
B. <i>Dugesia</i>	(ii) Radula
C. <i>Palaemon</i>	(iii) Dactylozooids
D. <i>Pavo</i>	(iv) Uropygial gland
E. <i>Pila</i>	(v) Solenocytes

12. Match Column I with Column II. (There can be more than one match for items in Column I).

Column I	Column II
A. Annelids	(i) Colloblasts for capturing food
B. Mammals	(ii) Tornaria larva
C. Sea walnut	(iii) Respiratory pigment erythrocytins
D. Hemichordata	(iv) Tongue worm
	(v) Cydippid larva
	(vi) Clitellum
	(vii) Excretes through nephridia
	(viii) Dicondylic skull

Passage Based Question

13. Complete the given passage with appropriate words or phrases.

There are differences in the structure and forms of different animals. Animals are classified into various groups on basis of different features. Body with single cavity and one opening to the outside shows (i) body plan. Animals in which mouth of embryo develops first and then an anus, are (ii) while, animals in which anus develops prior to mouth are (iii). Type of symmetry, by which body of an individual can be divided into equal halves by any plane passing through centre from top to bottom is (iv) symmetry. This type of symmetry is shown by (v) and (vi). Animals possess body cavity called coelom. Coelom in annelids and molluscs develops as split in mesoderm sheet and is called (vii). Blood filled cavity is called (viii) and is present in (ix) and (x).

Assertion & Reason

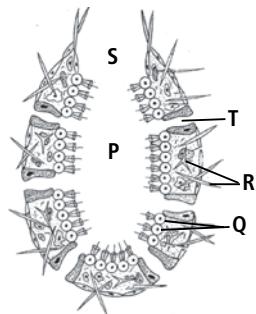
In each of the following questions, a statement of Assertion (A) is given and a corresponding statement of Reason (R) is given just below it. Of the statements, mark the correct answer as :

- if both A and R are true and R is the correct explanation of A
- if both A and R are true but R is not the correct explanation of A
- if A is true but R is false
- if both A and R are false.

14. **Assertion :** *Physalia* exhibits division of labour.
Reason : *Physalia* have different zooids for nutrition, reproduction and defence.
15. **Assertion :** Tapeworms exhibit true segmentation.
Reason : Segments of tapeworms are of embryonic origin.
16. **Assertion :** *Schistosoma* possesses suckers which act as adhesive organ.
Reason : *Schistosoma* lives as parasite in hepatic portal system and mesenteric blood vessels.
17. **Assertion :** *Trygon* is a poikilothermic animal.
Reason : Body temperature of *Trygon* changes with change in ambient temperature.
18. **Assertion :** Honeybees show holometabolous development.
Reason : A larva of honeybee differs from adult in form, structure and mode of life.

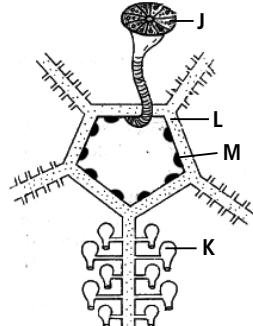
Figure Based Questions

19. Refer to the given figure showing L.S. of a simple poriferan and answer the following questions.



- (a) What does labelled part 'P' represent?
(b) Identify Q and write its function.
(c) Describe the labelled part R.
(d) Identify 'S' and 'T'.

20. Refer to the given figure and answer the following question.



- (a) What does the given figure represent?
(b) Describe the labelled part 'J'.
(c) What is the function of 'K'?
(d) Identify the structure 'L' and 'M'.

SOLUTIONS

CHAPTER-1 : THE LIVING WORLD

1. (c) 2. (d) 3. (b) 4. (b) 5. (a)
6. (b) 7. (c) 8. (a) 9. (c) 10. (c)
11. A-(iv), B-(iii), C-(ii), D-(i)
12. A-(v, ix); B-(i, vii); C-(vi, viii); D-(ii, iii); E-(iv, x)
13. (i) one (ii) specific epithet
 (iii) generic name (iv) binomial nomenclature
 (v) Linnaeus (vi) Latin
 (vii) Italics (viii) subspecies
14. (a) 15. (b) 16. (d) 17. (b) 18. (c)
19. (a) In the given figure, P is cutter, Q is digger, R is vasculum and S is plant press.
(b) Plant press (S) is used for pressing and drying the plant specimens so, that they can be easily stored. The collected specimens are spread over magazine or newspaper sheets. Leaves are properly spread and petals are separated to expose essential organs. Magazines and newspapers are now put inside the press that consists of two boards with straps for tightening.
(c) P (cutter) is used for cutting shoots having flowers, leaves and fruits and R (vasculum) is a special box with length 45-60 cm, depth 25 cm and width 20 cm. It helps to keep

specimens airtight and prevents its wilting till the time it is placed inside the drying sheets.

20. (a) The given key is a bracketed key. In this key, contrasting characters are used that are not separated by intervening sub-dividing characters. Instead, each character is given a number in brackets.
(b) P, Q, R and S are four different genera of Family Ranunculaceae:
P - *Clematis*; Q - *Anemone*; R - *Ranunculus*; S - *Nigella*
(c) Genera *Delphinium* can be written in the place of *Aconitum*. In *Aconitum*, posterior sepal enlarges to form hood whereas in *Delphinium*, posterior sepal enlarges to form spur. Rest of the characters are same in both the genera.

CHAPTER-2 : BIOLOGICAL CLASSIFICATION

1. (b) 2. (a) 3. (c) 4. (b) 5. (d)
6. (c) 7. (a) 8. (b) 9. (a) 10. (c)
11. A-(iv), B-(iii), C-(i), D-(ii), E-(v)
12. A-(iv, viii), B-(ii, vi), C-(iii, ix), D-(v, vii), E-(i, x)
13. (i) obligate anaerobes (ii) facultative anaerobes
 (iii) methanogens (iv) halophiles
 (v) sap vacuoles (vi) thermoacidophiles
 (vii) living fossils (viii) ruminants

- 14.** (d) **15.** (a) **16.** (b) **17.** (c) **18.** (b)
- 19.** (a) Structure P is pilus. Pili are long, thick tubular outgrowth which develop in response to fertility factor (F^+). They help in attaching to recipient cell and form conjugation tube.
- (b) R is polyribosome or polysome. Polysome comprises of 4-8 ribosomes attached to single strand of mRNA. It is a mechanism to synthesise several copies of the same protein.
- (c) S represents mesosome, a circular specialisation of bacterial cell formed by ingrowth from plasma membrane. It may be of two types. Septal mesosome connects nucleoid with plasma membrane and helps in replication of nucleoid. Lateral mesosome contains respiratory enzymes and is equivalent to mitochondria of eukaryotes.
- (d) Q is nucleoid. It consists of a single circular strand of DNA duplex that is supercoiled with the help of RNA and polyamines to assume a oval or spherical complex. It is also called genophore.
- 20.** (a) *Trypanosoma*
 (b) Flagellated protozoans
 (c) Sleeping sickness

CHAPTER-3 : PLANT KINGDOM

- 1.** (a) **2.** (b) **3.** (c) **4.** (c) **5.** (a)
6. (b) **7.** (a) **8.** (c) **9.** (d) **10.** (b)
- 11.** A-(iii), B-(iv), C-(v), D-(i), E-(ii)
12. A-(iii, viii), B-(v, vi), C-(ii, iv), D-(i, vii)
- 13.** (i) ovules (ii) mycorrhiza
 (iii) coralloid (iv) N₂-fixing cyanobacteria
 (v) *Pinus* (vi) meiosis
 (vii) female (viii) archegonia
 (ix) microsporangium (x) siphonogamy
- 14.** (c) **15.** (b) **16.** (a) **17.** (b) **18.** (a)
- 19.** (a) Haplodiplontic alternation of generation.
 (b) Haploid stages - Spore, gametophyte, female and male gametes.
 Diploid stages - Zygote, sporophyte, spore mother cell, sporangium.
 (c) Meiosis
 (d) Mostly bryophytes and pteridophytes show haplo-diplontic life cycle. However, *Dictyota*, a brown algae also shows this type of life cycle.
- 20.** (a) Figure X represents antheridium, i.e., male sex organ of bryophytes and pteridophytes. An antheridium forms large number of male gametes.

- (b) J - Sperm mother cells
 K - Neck canal cells
 L - Venter canal cell
 M - Oosphere (egg)
- (c) Figure Y is archegonium, i.e., female sex organs of bryophytes, pteridophytes and gymnosperms. It encloses single non-motile female gamete (oosphere or egg).

CHAPTER-4 : ANIMAL KINGDOM

- 1.** (d) **2.** (b) **3.** (b) **4.** (a) **5.** (d)
6. (b) **7.** (c) **8.** (b) **9.** (b) **10.** (d)
- 11.** A-(iii), B-(v), C-(i), D-(iv), E-(ii)
12. A-(iii, vi, vii), B-(viii), C-(i, v), D-(ii, iv)
- 13.** (i) blind sac (ii) protostomes
 (iii) deuterostomes (iv) radial
 (v) sponges (vi) cnidarians
 (vii) schizocoelom (viii) haemocoel
 (ix) arthropods (x) molluscs
- 14.** (a) **15.** (d) **16.** (b) **17.** (a) **18.** (b)
- 19.** (a) Labelled part 'P' represents body cavity called spongocoel or paragastric cavity.
- (b) Labelled part 'Q' represents flagellated choanocytes or collar cells. They beat their flagella, back and forth, to let the water enter through the sponge, to bring in nutrients and oxygen and carries out carbon dioxide and waste.
- (c) Labelled part 'R' represents calcareous or siliceous spicules which constitutes internal skeleton of the sponge.
- (d) Labelled part 'S' is an exhalent pore osculum and 'T' is an inhalent pore called ostium.
- 20.** (a) The given figure represents water vascular system of echinoderms.
 (b) Labelled part 'J' represents perforated plate madreporite, which allows water to enter into the system.
 (c) Labelled part 'K' is the tube feet that help in locomotion, capturing food and respiration.
 (d) Labels 'L' and 'M' are ring canal and Tiedmann's body respectively.



ANSWERS

WHO AM I...

- | | |
|-------------------|--------|
| 1. Middle lamella | Pg. 31 |
| 2. Golgi complex | Pg. 36 |
| 3. IUCD | Pg. 68 |
| 4. Syphilis | Pg. 75 |

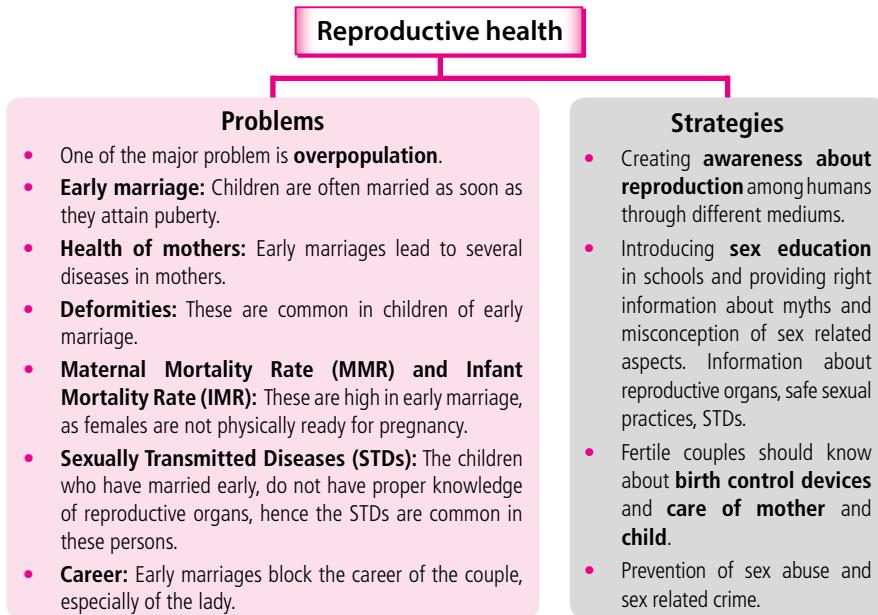
HIGH YIELD FACTS



Class XII

Reproductive Health

- Reproductive health addresses the reproductive processes, functions and systems at all stages of life. This implies that people are able to have **responsible, satisfying** and **safe sex life**. People also have the capability to reproduce and the freedom to decide if, when and how often to do so.



BIRTH CONTROL (CONTRACEPTION)

- The rapid increase in population over a short time period is called **population explosion** and it is one of the major problems of India. Better medical facilities, control of diseases resulting in lower maternal and infant mortality rate, government efforts, etc. can be the reasons for high population growth. Meanwhile, poverty, unemployment, housing

Analysis of various PMTs from 2012-2016						
	2012	2013	2014	2015	2016	
AIPMT/NEET	2	2	3	1	5	
AIIMS	-	1	-	-	1	
AMU	2	2	1	-	-	
Kerala	1	-	-	1	-	
K.CET	2	4	1	2	-	
J & K	1	-	1	-	-	

problems, etc. are the consequences of over population. To check and prevent overpopulation, various birth control measures can be used.

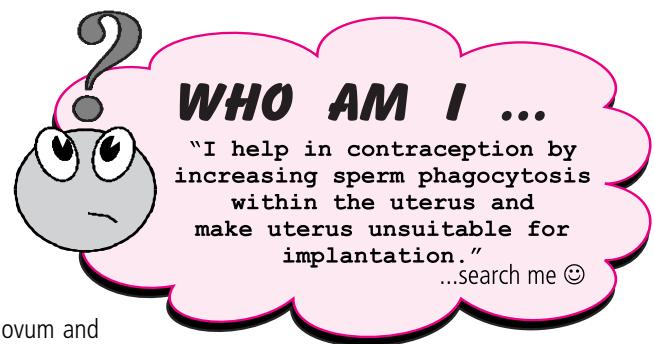
- Birth control can be achieved by preventing any one of the three major steps of reproduction:
 - (i) Preventing transport of sperm to ovum
 - (ii) Preventing ovulation
 - (iii) Preventing implantation of early embryo in the uterus.
- Various contraceptive methods are broadly grouped into two main categories: **temporary** and **permanent** methods.

Temporary Methods of Birth Control

- These methods are commonly used to postpone or to space births. These methods prevent conception only for a limited period. Their regular use is necessary for continued avoidance of pregnancy. They include:
 - Natural/ traditional methods
 - Barrier methods
 - Chemical methods
 - IUCDs (Intrauterine Contraceptive Devices)
 - Oral contraceptive pills
 - Subcutaneous implants
 - Morning after pills
 - Hormone injections

Natural Methods

- These methods work on the principle of avoiding meeting of ovum and sperms, i.e., fertilisation, without using any physical or chemical aid.



Natural methods

Periodic abstinence or rhythm method

- The couples avoid or **abstain from coitus** (copulation or intercourse) **from day 10 to 17 of the menstrual cycle** because ovulation can occur during this period.
- This is called fertile period as chances of fertilisation are very high during this period.
- The effectiveness of this method is limited because only a few women have regular menstrual cycles and the actual time of ovulation cannot be predicted.

Coitus interruptus or withdrawal method

- It involves withdrawal of the penis from the vagina by the male just before ejaculation, so that semen is not deposited into the vagina and thus, fertilisation is prevented.
- This method is only moderately effective because male produces some lubricating fluid before ejaculation that contains many sperms.

Lactational amenorrhea method

- It is based on the fact that **ovulation and the menstrual cycle do not occur during the period of intense lactation following child birth (parturition)**.
- This method is considered effective only upto a maximum period of six months following parturition.

- Periodic abstinence method is based on these facts: (a) Ovulation occurs on 14th day of menstruation. (b) Ovum remains alive for about 1-2 days. (c) Sperms remain viable for about 3 days.

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Barrier Methods

- In these methods, ovum and sperm do not meet due to physical barriers and hence, fertilisation does not occur. These methods are available for both males and females.

Condoms

- They are barriers made of thin rubber/latex sheath used to cover the penis in male or vagina and cervix in female just before coitus so that the ejaculated semen is not released in the female reproductive tract and hence prevent fertilisation.
- It is most widely used contraceptive by males in India as it is cheap and easily available. Female condoms are called **femidoms**.
- Condom should be discarded after a single use. **Condom is also a safeguard against AIDS** and other sexual diseases.



Barrier methods

Diaphragms, Cervical caps and Vault Caps

- They are also made of rubber and are inserted into the female reproductive tract to cover the cervix before coitus.
- They prevent fertilisation by blocking entry of sperms through cervix.
- These barriers are reusable. Spermicidal jellies, creams and foams are generally used alongwith these barriers to increase their efficiency.

Diaphragm

- It is a soft rubber cup that covers entrance to uterus. It prevents sperms from reaching an egg; and holds spermicide.
- It provides some protection against sexually transmitted diseases and cervical cancer.



Cervical cap

- It is a miniature diaphragm that covers cervix closely.
- It prevents sperms from reaching an egg and holds spermicide.



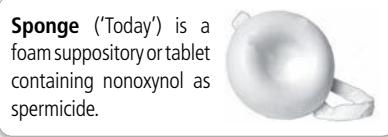
Vault cap

- It is a hemispheric dome like rubber or plastic cap with a thick rim which is meant for fitting over the vaginal vault over the cervix.

Chemical Methods

- In these methods foam tablets, creams, jellies and pastes are inserted in the vagina before intercourse to prevent sperms from entering the uterus.

Chemical methods



Sponge ('Today') is a foam suppository or tablet containing nonoxynol as spermicide.

These contain **spermicides** (kill spermatozoa) such as lactic acid, citric acid, boric acid, zinc sulphate and potassium permanganate which kill sperms.



'Delfen' is available as cream.

Intrauterine Contraceptive Devices (IUCDs)

IUCDs are plastic or metal objects inserted by doctors in the uterus or vagina. They increase phagocytosis of sperms within the uterus.

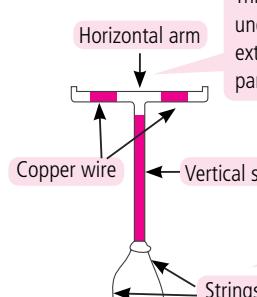
Non-medicated IUCDs

E.g., Lippes loop. It consists of a thin plastic wire bent in a series of S-shapes. It needs to be straightened when it is being inserted into the uterus but resumes its shape once inside it.



Copper releasing IUCDs

Cu ions released by these IUCDs suppress sperm motility and fertilisation capacity of the sperms, e.g., CuT, Cu7, Multiload 375.



This part of the device goes under the fundus. The arms are extended to the left and right parts of the Fallopian tubes.

The stem usually rests in the body of the cervix.

Strings remain in the vagina and can be felt by the user.

Fig.: CuT

Hormone releasing IUCDs

These IUCDs make the uterus unsuitable for implantation and the cervix hostile to the sperms e.g., LNG-20, progestasert.



Disadvantages of IUCDs

- IUCDs are expelled without the knowledge of the wearer in about 10 to 15% of the women and they run from the risk of becoming pregnant.
- Risk of perforation of uterus and also risk of infection is there.
- They can cause excessive menstrual bleeding and pain.

Oral Contraceptive Pills

- These contraceptives are taken in the form of tablets.
- Two types of oral contraceptive pills are:
 - (i) **Combined pills:** They contain synthetic progesterone and estrogen to check ovulation, e.g., Mala D and Mala N.
 - (ii) **Mini pills:** They contain progestin only (with no estrogen) e.g., Saheli.

Oral hormonal pills act in four ways:

- (i) Inhibition of ovulation
- (ii) Impairing cervix's ability to allow sperm passage
- (iii) Inhibition of motility and secretory actions of oviducts
- (iv) Alteration of uterine endometrium making it unsuitable for implantation.

Disadvantages of oral contraceptive pills

- Oral contraceptive pills increase the **risk of intravascular clotting**. Therefore, they are not recommended for women with a history of disorders of blood clotting, cerebral blood vessel damage, hypertension, heart diseases, etc.
- They can also cause acne, weight gain, depression, hypertension, leukorrhea, reduction in menstrual flow, mastalgia (breast pain), nausea, vomiting, melasma (facial skin discolouration), etc. But these effects are not strongly associated with low dose formulations.

Saheli - The non-hormonal pill

- In 1991, Central Drug Research Institute (CDRI), Lucknow, introduced world's first non-steroidal oral contraceptive pills under the brand name '**Saheli**' (initial thrice a week for three months and later once a week dosage). It contains '**centchroman**' which inhibits implantation.
- For being non-steroidal, it does not have side effects like nausea, vomiting, weight gain, etc. The only side effect known is delayed menstrual cycle in around 8% women. Thus, it is safe for long term use. It is also found beneficial for treating dysfunctional uterine bleeding, osteoporosis and premenstrual syndrome and as a drug for lower lipid levels in the blood.

Subcutaneous Implants (Norplant)

- A new contraception method is subcutaneous (under the skin) implantation of synthetic progesterone.
- It acts similarly as oral contraceptives by blocking ovulation and thickening the cervical mucus to prevent sperm transport.
- Six matchstick-sized capsules containing the steroid are 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 (5 years)**.

Morning After Pills

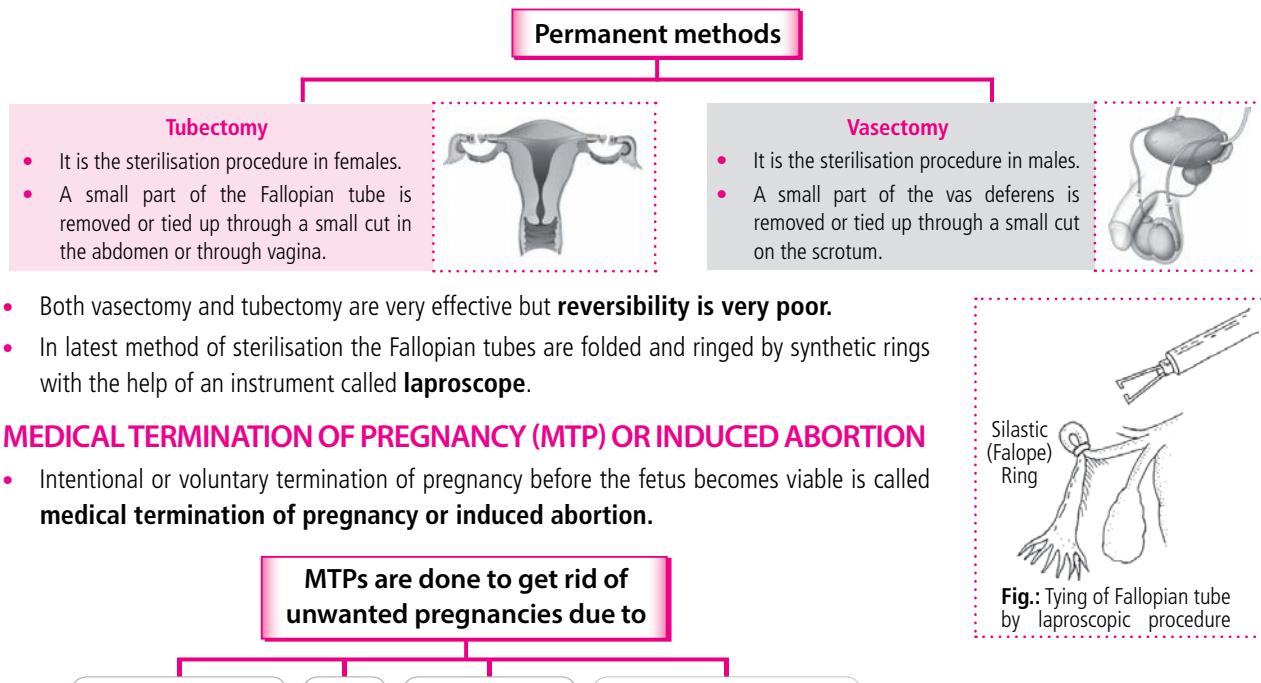
- Implantation can also be checked by so-called 'morning after' pills, also known as **emergency contraceptives**.
- **These pills can prevent pregnancy when taken within 72 hours after unprotected sexual intercourse.**
- They can either suppress ovulation or prevent fertilisation and implantation. These kits are for emergency use only. They should not be used as a substitute for ongoing contraceptive methods.

Hormone Injections (Depo-Provera)

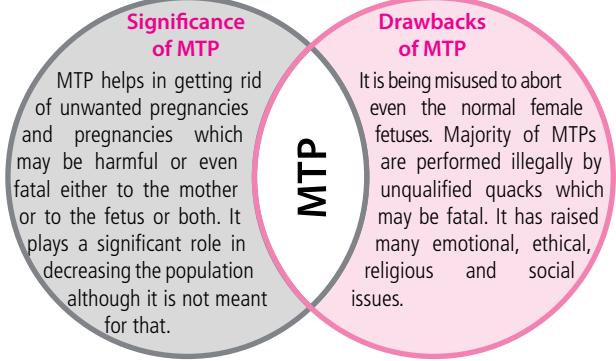
- These are progesterone derivative injections which are given once every three months, that release a hormone slowly and prevent ovulation.
- **Depot medroxyprogesterone acetate (DMPA)** and **Norethisterone enanthate (NET-EN)**; are two injectable hormonal contraceptives.
- They are convenient and highly effective with no serious side effects. There is occasional heavy menstrual bleeding.

Permanent Methods of Birth Control

- These include sterilisation (surgical methods). Surgical methods block gamete transport and prevent fertilisation.



- MTPs are considered safe during the first trimester of pregnancy (*i.e.*, upto 12 weeks of pregnancy).
- Government of India legalised MTP in 1971.**
- A pregnancy can be legally terminated in its early stages if doctors advise that its continuation would seriously affect the health of the mother, such MTP is termed **therapeutic**.
- At present, termination is legally allowed up to 28th week of pregnancy if the family physician and the gynaecologist consider the need for abortion.



SEXUALLY TRANSMITTED DISEASES (STDs)

- Diseases or infections which are transmitted through sexual intercourse with infected persons are collectively called **sexually transmitted diseases (STDs) or venereal diseases (VD) or reproductive tract infections (RTI)**.
- Early symptoms of most of the STDs are itching, fluid discharge, swelling, slight pain, etc., in the genital region.
- Except HIV infection, hepatitis B and genital herpes, all other STDs are completely curable if detected early and treated properly.
- STDs are usually caused by bacteria, viruses, chlamydia, protozoans, nematodes, arthropods (ectoparasites) and fungi.
- If proper and timely treatment is not given it may lead to complications such as pelvic inflammatory diseases (PID), abortions, stillbirths, ectopic pregnancies, infertility or even cancer of reproductive tract.

Confirmation Tests for STDs

- These include : culture and microscopic observation with specific staining, detection of specific antigen/antibody using ELISA like technique, DNA hybridisation, polymerase chain reaction (PCR), etc.

Table: Some common STDs

Disease	Pathogen	Transmission	Incubation period	Symptoms	Diagnosis	Treatment
I. STDs caused by Bacteria						
Syphilis	<i>Treponema pallidum</i>	Through sexual contact and from mother to child.	10-90 days	Symptoms of the first stage are painless ulcer or chancre 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
Gonorrhoea	<i>Neisseria gonorrhoeae</i>	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
Chancroid	<i>Haemophilus ducreyi</i>	Sexual contact	—	Appearance of ulcer at the site of infection generally over external genitalia and swelling of nearby lymph glands. Ulcer is painful and bleeds easily.	Staining of discharge and cell culture	Antibiotics, e.g., erythromycin, ciprofloxacin, trimethoprim sulphamethoxazole
II. STDs caused by Viruses						
ADS	Human Immuno-deficiency Virus (HIV)	Through semen, blood, infected mother's milk	6 months - 10 years	Fever, lethargy, pharyngitis, weight loss, nausea, headache, rashes, etc. HIV attacks helper T-lymphocytes , the patient gets immune deficient.	ELISA, PCR	Anti-retroviral drugs such as zidovudine and didanosine prolong life span of AIDS patients
Hepatitis B	Hepatitis B virus (HBV)	Blood transfusion, sexual contact, saliva, tears, intravenous drug abuse, tattooing, 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	Tenofovir or Entecavir
Genital herpes	Herpes simplex virus	Genital secretions and through contact with viroids and 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 perianal area.	Antibody detection, culture and DNA hybridisation	Cryosurgery is used in removal of warts. <i>Podophyllum</i> preparations and podoflox are useful in treatment. Imiquimod, an interferon inducer is also useful.

III. STD caused by Chlamydia	Chlamydiasis	<i>Chlamydia trachomatis</i>	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	<i>Trichomonas vaginalis</i>	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 sensations.	Culture and immuno fluorescent antibody staining	Metronidazole	
Amoebiasis	<i>Entamoeba histolytica</i>	Contaminated food and water, through sexual contact.	—	The patient passes blood along with the faeces and feels pain in the abdomen.	—	Antiamoebic tablets	
Giardiasis	<i>Giardia lamblia</i>	Transmitted by contaminated food and water but occasionally it is transmitted by sexual intercourse.	—	Parasite lives in human intestine where it interferes with digestion and absorption of food. It causes epigastric pain, abdominal discomfort, diarrhoea, headache and sometimes fever.	—	—	
V. STD caused by Nematode							
Enterobiasis	<i>Enterobius vermicularis</i> (pinworm)	Transmission occurs when patient scratches the affected area and the eggs easily get under the finger nails from where they may get into mouth. It is also transmitted by sexual intercourse.	—	Parasite causes intense itching of the anus, inflammation of mucous membrane of colon and appendix, nausea, abdominal pain and diarrhoea.	—	Anthelmintic drug	
VI. STDs caused by Arthropods (Ectoparasite)							
Scabies	<i>Sarcopias scabiei</i>	Sexual contact	—	Intense itching and patches on skin.	—	—	
Pediculosis	<i>Phthirus pubis</i>	Intimate contact or by sharing clothes, sheets and blankets, etc.	—	Painful itching and red patches on the skin of pubic region.	—	Medicated shampoos	
VII. STD caused by fungus							
Candidiasis	<i>Candida albicans</i> (vaginal yeast)	Sexual contact	—	Women with yeast infection, experience painful inflammation of the vagina often with a thick, cheesy discharge. Man may develop a painful inflammation of the urethra through sexual contact with an infected woman.	—	Antibiotics, e.g., clotrimazole, miconazole and nystatin	

Prevention of STDs

- To prevent STDs one should
 - avoid sex with unknown partner/multiple partners.
 - always use condoms during intercourse.
 - consult a qualified doctor if some symptoms appear. If STD is detected one should get complete treatment.

INFERTILITY

Infertility is a failure to conceive within one or more years of regular unprotected coitus.

Two types of infertility are:

- (i) **Primary infertility:** Patients who have never conceived.
- (ii) **Secondary infertility:** Patients had previous pregnancy but failed to conceive subsequently.

Causes of Infertility

- It is caused by defects in the male or in female or in both.

Cryptorchidism- It is a condition in which testes are unable to descend in scrotal sacs so that sperms are not produced, i.e., **azospermia**.

Impotency- Male is unable to erect and penetrate the penis into the vagina of the female.

Immotile cilia- Sperms are unable to move from vagina to the upper portion of the genital tract of the female.

Acquired infection like mumps, infection of seminal vesicle and prostate cause oligospermia (poor sperm count).

The scrotal temperature is raised in varicocela (collection of dilated veins) causing **oligospermia**.

ADAM- (Androgen Deficiency in Ageing Males) also called male menopause.

Low fructose content and high prostaglandin content in the seminal fluid.

Infertility in Males

Anovulation (no ovulation) - There is no corpus luteum formation and it causes oligoovulation (deficient ovulation).

There is **luteal phase defect** (LPD)- drug induced ovulation, decreased level of FSH and /or LH.

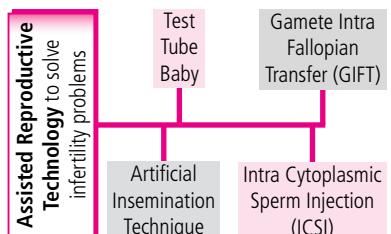
Defective growth of uterus and vagina.

Uterine factor includes unfavourable endometrium for implantation-**chronic endometritis** (TB), **fibroid uterus**, etc.

Cervical factor includes **ineffective sperm penetration**-chronic cervicitis, presence of antisperm antibody, elongation of cervix.

Fimbriae of the Fallopian tube may not pick up secondary oocyte from the ovary.

Increased sperm **phagocytosis** by macrophages.



ASSISTED REPRODUCTIVE TECHNOLOGIES (ART)

- Specialised infertility clinics can help in the diagnosis and proper treatment of some of these disorders and enable these couples to have children.
 - However, where such diagnosis and treatment are not possible, the couples can be assisted to have children through certain special techniques called **Assisted Reproductive Technologies (ART)**.
- ASSISTED REPRODUCTIVE TECHNOLOGIES (ART)**
- ART is reproductive technology used to treat infertility. It includes fertility treatments that handle both woman's egg and man's sperm. It works by removing eggs from woman's body. The eggs are then fused with sperms to make embryos, which are then put back in the woman's body. ART procedures sometimes use donor eggs, donor sperms, previously frozen embryos. It may also involve surrogate carrier.

Test Tube Baby Programme

- 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.

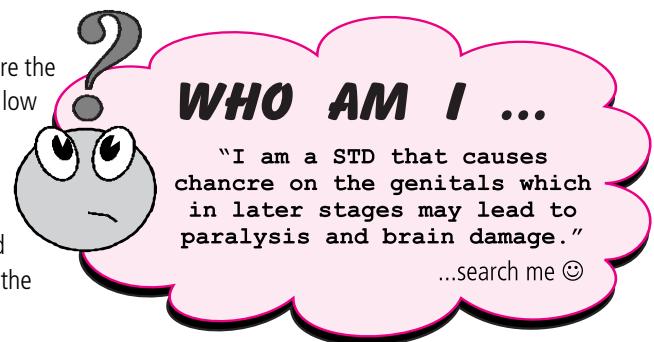
- If the embryo is with more than 8 blastomeres, then it is transferred into uterus (**IUT - Intra Uterine Transfer**) to complete its further development.
- A developing embryo can be inserted in the uterus of another female. A woman who substitutes or takes the place of real mother to nurse the embryo is called **surrogate mother**.
- The success rate of the technique of producing test tube babies is less than 20%.

First test tube baby was born in England on July 25, 1978. It was a girl named Louise Joy Brown. Later, test tube babies were produced in Australia, United States and some other countries also.

In India, the first test tube baby named Durga (alias Kanupriya Agarwal) was born on 3rd October, 1978. The doctor behind this pioneering effort was Subhash Mukhopadhyay.

Artificial Insemination (AI) Technique

- AI technique is used in cases 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 (**artificial insemination husband; AIH**) or a healthy donor (**artificial insemination donor; AID**) is artificially introduced into the vagina or uterus (IUI - intrauterine insemination) of the female.
- The success rate varies in different centres, ranging from 20-40%.



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.
- The overall success rate through this procedure is 27-30%.

Intra Cytoplasmic Sperm Injection (ICSI)

- In this technique sperm is directly injected into the cytoplasm of an ovum to form an embryo in the laboratory.
- The embryo is later transferred by ZIFT or IUT in woman.
- The fertilisation rate through ICSI is about 60-70% but the pregnancy rate is 20-40%.

DETECTION OF FETAL DISORDERS DURING EARLY PREGNANCY

- Sometimes during fetal development some disorders may occur which result in abnormal offsprings. These 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 (14th or 15th week), the location of the fetus and placenta is determined by sonography.
- 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.

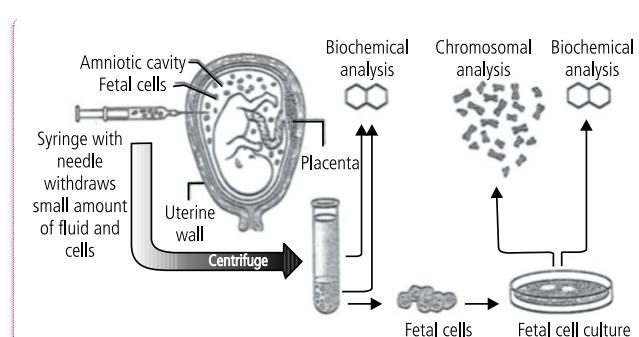


Fig.: Amniocentesis and procedure for prenatal diagnosis of biochemical and chromosomal disorders

- The amniotic fluid contains cells, from fetus skin and respiratory tract. These cells are cultured and are used to determine chromosomal abnormalities (Down syndrome, Klinefelter's syndrome, etc.) and metabolic disorders (phenylketonuria, sickle cell anemia, etc.) of the fetus.
- Unfortunately, this useful technique is being misused to kill the normal female fetuses. Therefore, it has been **legally banned for the determination of sex** to avoid female feticide.

Chorionic Villus Sampling (CVS)

- In this technique, the physician inserts a narrow, flexible tube through the mother's vagina and cervix into the uterus and withdraws a small amount of fetal tissue (chorionic villi) from the **placenta**.
- The **rapidly dividing chorionic villi cells** can be used for **karyotyping** along with some biochemical tests within a few hours.
- Being **invasive techniques**, both the amniocentesis and CVS carry with them an inherent risk to both fetus and mother.

Non-invasive Techniques

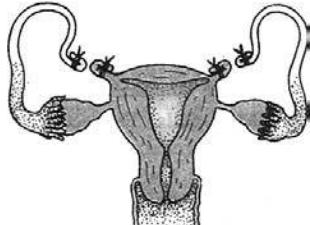
- One of the widely used non-invasive technique to determine fetal condition is **ultrasound imaging**.
- Another technique is based on the fact that a few fetal blood cells leak across the placenta into the mother's blood stream. A blood sample from the mother provides enough fetal cells that can be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



- How do diaphragm help in preventing pregnancy?
 - It is a rubber cap that prevents sperm from entering vagina.
 - It is dome-shaped plastic cap that fits over vaginal vault and kills ovum.
 - It is rubber cup that prevents sperms from reaching an egg by covering entrance to uterus.
 - It is thin latex sheath that covers uterus and kills spermatozoa.
- Presence of which of the following pair of antisperm antibodies will result in infertility in males?
 - IgG and IgD
 - IgA and IgE
 - IgM and IgD
 - IgG and IgA
- A couple is unable to bear a child despite having unprotected coitus. They decided to have a test tube baby. On being diagnosed doctor advised them for a technique which requires transfer of embryo with more than 8 blastomeres. Identify the technique adopted by the couple.
 - ICSI
 - IUT
 - ZIFT
 - AI
- Which of the following provides protection against sexually transmitted infections?
 - Condom
 - CuT
 - Saheli
 - Both (a) and (b)
- Pathogen of which of the following venereal diseases attacks helper T-cells?
 - Hepatitis B
 - AIDS
 - Gonorrhoea
 - Genital warts
- Identify the correctly matched pair.
 - Delfin - Thickens the cervical mucus to prevent sperm transport.
 - Saheli - Oral combined contraceptive pill containing progesterone and estrogen.
 - Lippes loop - Prevents release of ejaculated semen in female reproductive tract.
 - Depo-Provera - Prevents ovulation by releasing progesterone in body.
- Person X has developed benign, hard outgrowths with horny surface over the skin and mucosal surface of external genitalia. On diagnosis, it was found that X has viral infection transmitted through sexual intercourse. Identify the disease.
 - Gonorrhoea
 - Pediculosis
 - Enterobiasis
 - Genital warts
- Read the given statements and select an incorrect one.
 - Infection of hepatitis B virus can cause cirrhosis and liver cancer.
 - Chlamydia* is an obligate intracellular pathogen which causes urethritis epididymitis.

- (c) Regular use of condoms cause excess menstrual bleeding and pain.
 (d) Early marriage results in high maternal mortality rate.
- 9.** Which method is used to have a child through GIFT?
 (a) Transfer of embryo with upto 8 blastomeres in Fallopian tube.
 (b) Transfer of sperm and unfertilised oocyte in Fallopian tube.
 (c) Insertion of sperm into cytoplasm of oocyte through zona pellucida.
 (d) Introduction of sperm into uterus.
- 10.** The Cu²⁺ released from IUDs help in contraception by
 (a) inhibiting ovulation
 (b) suppressing sperm motility
 (c) making uterine endometrium unsuitable for implantation
 (d) preventing release of sperms in female reproductive tract.
- 11.** Which of the following STDs is caused by fungus?
 (a) Chancroid (b) Chlamydiais
 (c) Candidiasis (d) Trichomoniasis
- 12.** To avoid pregnancy, male withdraws his penis from vagina just before ejaculation during intercourse. Identify the contraceptive method adopted by couple.
 (a) Periodic abstinence
 (b) Coitus interruptus
 (c) Emergency contraceptive
 (d) None of these
- 13.** Which technique involves extraction of fetal tissue from placenta through mother's vagina for the diagnosis of fetal disorders?
 (a) Chorionic villus sampling
 (b) Amniocentesis
 (c) Non-invasive technique
 (d) Fetoscopy
- 14.** Match the following and select the correct option.
- | Column I | Column II |
|--|---------------------------------|
| (i) Sponge | (p) IUCD |
| (ii) LNG-20 | (q) Morning after pill |
| (iii) Mala D | (r) Spermicide |
| (iv) Unwanted 72 | (s) Combined contraceptive pill |
| (a) (i)-(r), (ii)-(p), (iii)-(s), (iv)-(q) | |
| (b) (i)-(s), (ii)-(q), (iii)-(r), (iv)-(p) | |
| (c) (i)-(p), (ii)-(q), (iii)-(s), (iv)-(r) | |
| (d) (i)-(q), (ii)-(p), (iii)-(r), (iv)-(s) | |
- 15.** All of the following STDs can be cured except
 (a) genital herpes (b) syphilis
 (c) gonorrhoea (d) chlamydiais.
- 16.** At what time one should take 'i-pill' to prevent pregnancy?
 (a) Within 72 hours of copulation.
 (b) In morning, after having unprotected sex.
- (c) Daily for 21 days starting from first 5 days of menstruation.
 (d) Once in a week after initial intake of twice a week dose for 3 months.
- 17.** Male menopause occurs due to
 (a) cryptorchidism (b) androgen deficiency
 (c) antisperm antibodies (d) low fructose in semen.
- 18.** Refer to the given figure and select the correct option.
- 
- (a) This method inhibits sperm motility and secretory activity of oviducts.
 (b) It is a termination method of conception which prevents passage of ova.
 (c) It increases phagocytosis of sperms within the uterus.
 (d) It impairs ability of cervical mucus to allow passage and transport of sperms.
- 19.** Which of the following prevents sperms from reaching an egg and thus preventing pregnancy?
 (a) Cervical cap (b) i-pill
 (c) LNG-20 (d) Saheli
- 20.** Which of the following is not a drawback of inserting Lippes loop in uterus?
 (a) It can cause excessive menstrual bleeding.
 (b) It has poor reversibility.
 (c) It might get expelled of uterus spontaneously.
 (d) It might cause egg to move down the oviduct without fertilisation.

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

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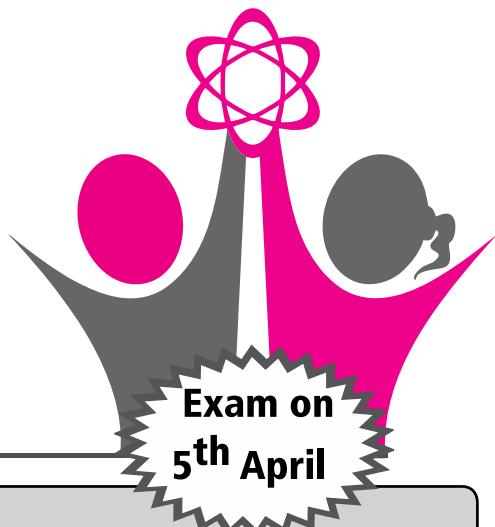
UNSCRAMBLED WORDS
FEBRUARY 2017

1-c- PASTEURISATION	2-e-AURICULARIA
3-d-NECROSIS	4-j-PHRAGMOPLAST
5-a-PLASTIDOME	6-g-RHINITIS
7-b-DYSGENICS	8-f-STROBILANTHES
9-h-PYORRHOEA	10-i-ABORICULTURE

Winners: Vinayak Aggarwal (New Delhi), Ryan Gupta (Alwar)

CBSE BOARD

PRACTICE PAPER 2017



GENERAL INSTRUCTIONS

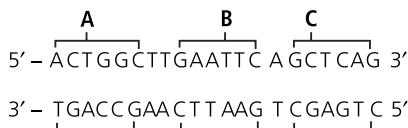
- (i) All questions are compulsory.
- (ii) This question paper consists of five Sections A, B, C, D and E. Section A contains 5 questions of one mark each. Section B contains 5 questions of two marks each, Section C contains 12 questions of three marks each. Section D contains 1 question of VBQ type with four marks and Section E contains 3 questions of five marks each.
- (iii) There is no overall choice. However, an internal choice has been provided in one question of 2 marks, one question of 3 marks and all the three questions of 5 marks weightage. A student has to attempt only one of the alternatives in such questions.
- (iv) Wherever necessary, the diagrams drawn should be neat and properly labelled.

Time Allowed : 3 hours

Maximum Marks : 70

SECTION - A

1. Pick out the monoecious plant from the following.
 - (a) *Coccinia*
 - (b) Papaya
 - (c) Cucumber
 - (d) Date palm
2. The given figure shows three different points A, B and C on a DNA strand.



Which of them can be a probable site of action of restriction enzymes and why?

3. How do virus infected cells provide innate immunity to healthy cells?
4. Suggest any two techniques which can help in early detection of bacterial/viral infections, much before the symptoms appear in the body.
5. How much time is taken by a primary succession to complete?

SECTION - B

6. What is colostrum? How is milk production regulated by hormones in human females?
7. In a certain mammal, erect ears are dominant over drooping ears. In a cross between the two types, out of the four

offsprings produced in F_2 generation, three had erect ears, and one had drooping ears. What will be the genotypes of the parents? (You may represent dominant gene as 'E').

8. Stanley Miller and Harold C. Urey performed an experiment by recreating the probable conditions of the atmosphere of the primitive earth in the laboratory.
 - (a) What was the purpose of this experiment?
 - (b) In which form was the energy supplied for the chemical reactions to occur?
 - (c) For how long was the experiment run continuously?
 - (d) Which gases were used during the experiment to simulate the primitive atmosphere?
9. Write the full form of SCID and mention the cause of this congenital disorder. Mention any one difference between SCID and AIDS.

OR

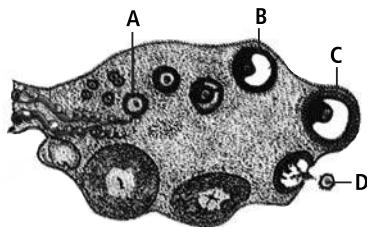
Why does our body temperature rise when we have any infection? How does moderate fever help in body defence?

10. State the differences between primary succession and secondary succession.

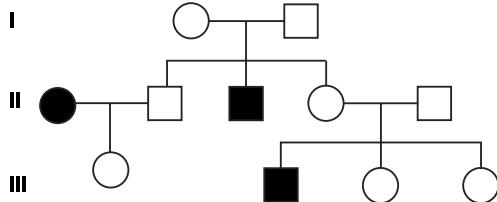
SECTION - C

11. (a) Draw a neat and labelled diagram of a fertilised embryo sac.

- (b) Describe briefly the type of fertilisation found only in angiosperms.
12. Refer to the given figure and answer the following questions.



- (a) What does the given figure show?
(b) Which of the labelled structures is a pre-birth structure and is not formed thereafter?
(c) Which of the labelled structures responds to LH surge by rupturing?
13. Study the given pedigree chart and answer the questions that follow.



- (a) Is the trait recessive or dominant?
(b) Is the trait sex-linked or autosomal?
(c) Give the genotypes of the parents in generation I and of their second and third child in generation II.
14. Study the mRNA segment given below which is to be translated into a polypeptide chain.



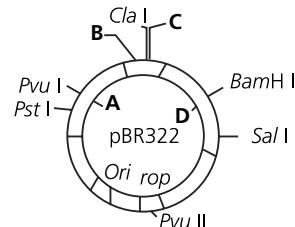
- (a) Identify the codons represented by 'X' and 'Y'.
(b) What do they code for?
(c) How is a peptide bond formed between the amino acids on the ribosome?
15. (a) How can the Hardy-Weinberg's expression be used to identify if a population is evolving?
(b) List any two factors that can disturb the genetic equilibrium.

OR

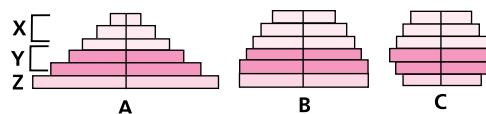
The population of light coloured peppered moth *Biston betularia* was almost replaced by the black variety during the industrial revolution in England. Explain the mechanism involved.

- 16. (a)** Name the property that enables the explants to regenerate into a new plant.
(b) A banana herb is virus-infected. Describe the method that will help in obtaining healthy banana plants from this diseased plant.

- 17. (a)** How is activated sludge produced during sewage treatment?
(b) Explain how this sludge is used in biogas production.
18. The given diagram is of an *E.coli* cloning vector.



- (a) Identify the selectable markers among (A) - (D) in it.
(b) How is the coding sequence of β-galactosidase considered a better marker than the ones identified by you in the diagram? Explain, giving reason.
19. What are bioreactors? List five growth conditions that a bioreactor provides for obtaining the desired product.
20. 'Plasmids are a boon to biotechnology'. Justify this statement quoting the production of human insulin as an example.
21. The given figure shows the different types of age pyramids for human population.



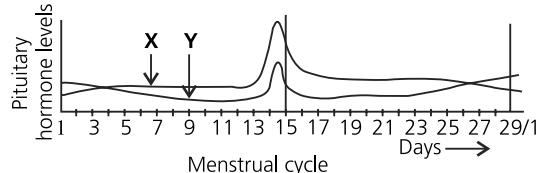
- (a) What does the parts 'X', 'Y' and 'Z' represent?
(b) Which type of population is represented by pyramids A, B and C? Explain.
22. (a) What is net primary productivity of an ecosystem?
(b) Why do temperate regions show a lower value of primary productivity as compared to tropical regions? Give two reasons.

SECTION - D

- 23.** Naresh's mother has developed diabetes. Doctor suggested her to take insulin injections to which she refused as she thinks that the injections are prepared from the body organs of slaughtered animals. Naresh convinced her mother with his knowledge of biotechnology that the insulin injections prepared these days are not made of slaughtered animals.
(a) What values have been shown by Naresh in above situation?
(b) How is human insulin produced through recombinant DNA technology?
(c) How is the insulin produced through recombinant DNA technology better than the one used earlier by diabetic patients?

SECTION - E

- 24.** Study the graph given below and answer the questions that follow:



- (a) Name the hormones 'X' and 'Y'.
 (b) Identify the ovarian phases and explain the ovarian events under the influence of hormones 'X' and 'Y' during a menstrual cycle:
 (i) 5th day to 12th day (ii) 14th day
 (iii) 16th day to 28th day

OR

- (a) Give a diagrammatic representation of spermatogenesis in humans.
 (b) At which stage of life, does gametogenesis begin in human male and female?
 (c) Name the organs where gametogenesis gets completed in human male and female respectively.
25. Define the term 'biofertiliser'. How does each of the following serve as a biofertiliser?
 (i) *Azospirillum* (ii) Endomycorrhiza
 (iii) *Rhizobium* (iv) *Azolla*

OR

- (a) Mention any three useful applications of *Lactobacillus*.
 (b) Name the microbes from which cyclosporin A (an immunosuppressive drug) and statins (blood cholesterol lowering agents) are obtained.
 (c) Why *Nucleopolyhedrovirus* is considered as an important component of integrated pest management (IPM) programme?

- 26. (a)** Explain BOD.

- (b) At a particular segment of a river near a sugar factory, the BOD is much higher than the normal level. What it indicates? What will happen to the living organisms in this part of the river?
 (c) Under what conditions will the BOD be lowered in the river? How will it affect the aquatic life?
 (d) Explain the phenomenon which is responsible for the death of submerged plants in a water body due to nutrient enrichment?

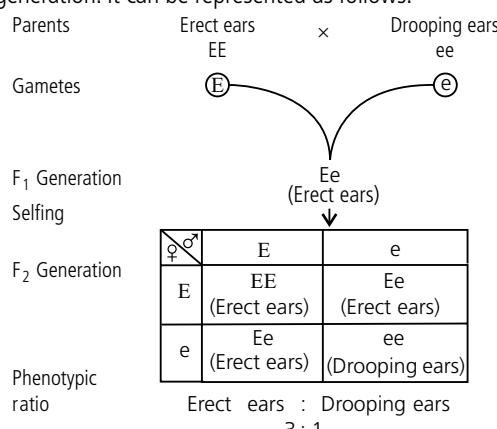
OR

- (a) What is meant by ozone shield? Why it is suggested to reduce the emission of CFCs? Give one harmful effect of ozone shield damage each on plants and animals.
 (b) Why is global warming a warning to mankind?

SOLUTIONS

1. Cucumber is monoecious while *Coccinia*, papaya and date palm are dioecious plants.
2. Restriction enzymes act within palindromic sequences. In the given DNA strand, point B shows a palindromic sequence. Thus, it can be a probable site of restriction enzyme action.
3. Virus infected cells produce antiviral proteins called interferons, which make uninfected cells resistant to viral infection. Thus, they provide innate immunity.
4. PCR and ELISA are the most commonly used techniques for the early detection of infections.
5. Primary succession takes a very long time for completion i.e., from one to several thousand years.
6. The milk produced by mother during the initial few days of lactation is called colostrum, which contains several antibodies (primarily IgA) absolutely essential to develop passive immunity in the new-born babies. Secretion and storage of milk generally begins after the birth of child, usually within 24 hours, under the influence of hormone prolactin (PRL), secreted by anterior lobe of the pituitary gland. However, the ejection of milk is stimulated by the hormone oxytocin (OT), released from the posterior lobe of the pituitary gland.

7. According to the given information, the F₂ progeny shows a typical Mendelian monohybrid phenotypic ratio of the dominant and recessive phenotypes i.e., 3 : 1. It indicates that both the parents are homozygous, one for dominant trait and the other for recessive trait. Thus, the genotypes of the parents will be EE and ee. The cross between the heterozygous progenies produced in F₁ generation (Ee) results in three offsprings with erect ears, and one with drooping ears in F₂ generation. It can be represented as follows:



- 8.(a) The purpose of Miller and Urey's experiment was to prove that life has originated spontaneously from non-living matter, i.e., to provide experimental evidence for the theory of abiogenesis or chemical evolution.

- (b) Energy was supplied in the form of electrical discharges from electrodes at 800°C.
 (c) The experiment was run continuously for a week.
 (d) The gases used during experiment to simulate the primitive atmosphere were methane (CH_4), ammonia (NH_3), hydrogen (H_2) and water vapour.

9. SCID is Severe Combined Immunodeficiency Disease. It is a congenital disease caused due to absence of T and B-lymphocytes, that are necessary for fighting infections, since birth.

It differs from AIDS in the respect that in AIDS, T-helper cells which stimulate antibody production by B-cells are reduced due to viral attack while in SCID, both T and B-cells are absent due to deficiency of an enzyme adenosine deaminase from birth.

OR

During infection our body temperature rises due to release of certain chemicals called endogenous pyrogens from damaged tissues and cells involved in inflammation. When enough pyrogen reaches the brain, the body's thermostat is reset to a higher temperature, allowing the temperature of the entire body to rise.

Mild fever strengthens the defence mechanism by activating the phagocytes, and by inhibiting the growth of microbes. A very high temperature, however, may prove dangerous.

10. Differences between primary and secondary succession are:

	Primary succession	Secondary succession
1.	It occurs in an area which has been bare from the beginning.	It occurs in an area which has been denuded recently.
2.	Soil is absent when primary succession starts.	Soil is present in the area where secondary succession begins.
3.	Reproductive structures of any previous community are absent.	Reproductive structures of the previous occupants are present in the area.
4.	Pioneer community comes from outside.	Pioneer community develops partly from propagules of previous occupants and partly from migrants.
5.	Seral communities are many.	Seral communities are a few.

11. (a)

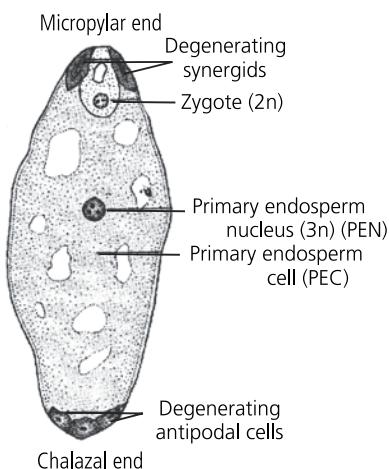


Fig.: Fertilised embryo sac

(b) Double fertilisation is the characteristic feature of angiosperms. It is the fusion of two male gametes, brought by a pollen tube, with two different cells of the same female gametophyte, in order to produce two different structures. One male gamete fuses with the egg, resulting in a diploid zygote. This is called syngamy or generative fertilisation. The second male gamete fuses with two haploid polar nuclei (or the diploid secondary nucleus), resulting in a triploid primary endosperm nucleus. This is called triple fusion or vegetative fertilisation.

12. (a) The given figure shows the sectional view of the human ovary.

(b) The structure labelled A i.e., primary follicle is a pre-birth structure of a female individual. Oogenesis starts during embryo development where millions of oogonia are formed whose development arrests at primary follicle stage. No more oogonia, thus, no more primary follicles, are formed after birth.

(c) The structure labelled as C is called Graafian follicle. It responds to LH surge by rupturing and releasing the secondary oocyte, resulting in ovulation.

13. (a) Both the parents in generation I do not express the trait, yet it appears in the progeny. It indicates that the trait in question is a recessive trait which was present in heterozygous parents and is expressed in the progeny which is homozygous for the trait.

(b) It is an autosomal trait. If it has been a sex linked trait (either X linked or Y linked) then, the father in generation I must express the trait as it has only one chromosome of each type (X and Y) and thus, recessive genes on any of the chromosomes must be expressed.

- (c) Generation I → Aa and Aa
 Generation II → Second child - aa
 Third child - Aa

- 14. (a)** 'X' may represent start codons AUG or GUG.
 'Y' may represent any of the stop codons i.e., UAA, UAG and UGA.
(b) AUG codes for methionine and GUG codes for valine. They are the initiation codons. UAA, UAG and UGA do not code for any amino acid, but bring about termination of polypeptide synthesis.
(c) During elongation of the polypeptide chain, peptide bond is formed between the amino acids carried by tRNA at P-site, and the newly arrived amino acid carried by tRNA attached at A site, both on the smaller subunit of the ribosome. The reaction is catalysed by enzyme peptidyl transferase.

- 15. (a)** Hardy-Weinberg's principle states that allele frequencies in a population are stable and constant from generation to generation. The gene pool (the total genes and their alleles in a population) remains constant. This is called genetic equilibrium.

According to this principle, sum total of all the allelic frequencies is 1. In a diploid organism, the frequency of alleles A and a is represented as p and q respectively. The frequency of AA individuals in a population i.e. the probability that an allele A with frequency of p appears on both the chromosomes of a diploid individual is simply the product of the probabilities, i.e., p^2 . Similarly, frequency of aa is q^2 , of Aa is $2pq$. Hence, $p^2 + 2pq + q^2 = 1$. This is the binomial expression of $(p + q)^2$.

When frequency measured differs from expected values, the difference indicates the extent and direction of evolutionary change. Disturbance in genetic equilibrium or Hardy-Weinberg equilibrium, i.e., change of frequency of alleles in a population would then be interpreted as resulting in evolution.

- (b)** The two factors known to affect Hardy-Weinberg equilibrium are as follows :
 (a) Gene migration or gene flow
 (b) Genetic recombination

OR

The case of peppered moth, *Biston betularia*, commonly found in parts of England is one of the most striking example of natural selection. Natural selection is the process by which those organisms that are best suited to their environment survive and reproduce. Two types of moths, white winged moths and dark winged or melanised

moths occur in nature. Due to industrial smoke and soot, the pale tree trunks became more and more blackened. As a result, the light coloured moth variety stood out in contrast to its background, increasing the possibility of being easily detected and eaten by their predators, such as birds, in much greater number than the dark melanic variety. In course of time, there was a gradual decrease in the number of light coloured moths and increase in the number of dark coloured, melanic variety. Also, evolution favoured the melanic moths to reproduce more successfully due to adaptation in the polluted areas of England. This evolution of dark, melanic variety of moths, in response to industrial pollution is known as industrial melanism.

- 16. (a)** The property to generate a whole plant from any cell/explant is called totipotency.
(b) In case of asexually reproducing crops like banana, virus infections spread rapidly. This is because the vegetative propagules from virus-infected plants contain virus particles. But the shoot apical meristems and some young tissues surrounding them are often free from viruses. Meristem culture, therefore, is often useful in recovering virus-free plants from virus-infected plants. Meristem culture involves the development of an already existing shoot meristem and later on the regeneration of adventitious roots from the developed shoots.
- The explants commonly used in meristem culture are shoot tips and nodal segments. These explants are cultured on a medium containing a cytokinin (generally BAP). The plantlets thus obtained are subjected to hardening and, ultimately, established in the field.
- 17. (a)** During secondary treatment, the effluent from primary treatment is passed into large aeration tanks, where it is agitated mechanically and air is pumped into it. This allows vigorous growth of useful aerobic microbes. The aerobic microbes consisting of algae (*Chlorella pyrenoidosa*), some fungi, bacteria and protozoa, grow into "flocs", and consume a major part of organic matter. This reduces the BOD of sewage. Now, the effluent is passed through a sedimentation tank, where microbial flocs are allowed to settle down. The settled material is called 'activated sludge'.
(b) A small part of the activated sludge obtained in settling tanks is pumped back into the aeration tank, to serve as the inoculum. The remaining major part of the activated sludge is pumped into large tanks called anaerobic sludge digesters. The anaerobic bacteria digest the organic mass, bacteria and fungi in the sludge. During the process, methanogenic bacteria produce mixture of gases like, methane, hydrogen sulphide and CO₂, which constitute biogas.

18. (a) A = Ampicillin resistance gene (amp^R), B = Recognition site for *EcoRI*, C = Recognition site for *Hind* III, D = Tetracycline resistance gene (tet^R).

(b) The markers in pBR322 vector are antibiotic resistance genes. Selection of recombinants due to inactivation of antibiotics is a cumbersome procedure because it requires simultaneous plating on two plates having different antibiotics. Therefore, alternative selectable markers have been developed, like the coding sequence for β -galactosidase. β -galactosidase metabolises a chromogenic substrate X-gal to produce a blue coloured precipitate which gives blue colour to colonies. Cells containing a vector carrying β -galactosidase coding sequence without DNA insert give blue colonies while cells containing vectors with a DNA insert within the β -galactosidase coding sequence produce white coloured colonies and thus these colonies are easily identified as recombinant colonies. This is because, when a recombinant DNA is inserted within the coding sequence of the enzyme β -galactosidase, it results in inactivation of the enzyme, which is referred to as insertional inactivation.

19. A bioreactor is a device, in which a substrate of low economic value is utilised by living cells or enzymes to generate a product of higher economic value. Bioreactors can be regarded as large sized vessels in which large volumes (100 to 1000 litres) of raw materials, in culture medium are biologically converted into specific products or individual enzymes, etc., using microbial, plant, animal or human cells. A bioreactor provides the optimal growth conditions.

Growth conditions that a bioreactor provides for obtaining the desired products are :

- (i) controlled environment for optimum product yield
- (ii) aseptic fermentation for a number of days and prevention of escape of viable cells
- (iii) adequate mixing and aeration for optimum growth and production, without damaging the microorganism
- (iv) easy and dependable temperature control
- (v) facility of sampling.

20. Plasmids are autonomously, self-replicating, circular, extra-chromosomal double stranded DNA. They are capable of replicating within bacterial cells, independent of the control of the chromosomal DNA. The plasmid molecules may vary from 1-2 copies per cell to 15-100 copies per cell and even higher than this. If an alien or foreign DNA is linked with the plasmid DNA, we can multiply its number equal to the copy number of the plasmid. This principle was used by Eli Lilly, an American company, to prepare human insulin.

In 1983, Eli Lilly, first prepared two DNA sequences corresponding to A and B chains of human insulin and introduced them in plasmids of *E. coli* to produce insulin

chains. The chains, A and B, were produced separately, extracted and combined by creating disulfide bonds to form human insulin (sold under trade name of humulin).

21. (a) X, Y and Z represent, different age groups (male and female) found in a population. Here X is post-reproductive, Y is reproductive group and Z is pre-reproductive group.

(b) Pyramid A is triangular age pyramid which represents expanding population. Here, number of pre-reproductive individuals is very large, number of reproductive individuals is moderate and post-reproductive individuals are fewer.

B is bell shaped age pyramid that represents stable population because number of pre-reproductive and reproductive individuals is almost equal but post-reproductive individuals are fewer.

C is urn shaped age pyramid representing declining population with higher proportion of reproductive age group than pre and post-reproductive age group.

22. (a) Net primary productivity (NPP) refers to the biomass available for the consumption to heterotrophs (herbivores, carnivores and decomposers). It is equal to the gross primary productivity (GPP) minus respiration losses (R).

$$\text{NPP} = \text{GPP} - \text{R}$$

The annual net primary productivity of the whole biosphere is approximately 170 billion tons (dry weight) of organic matter.

(b) The two reasons for less primary productivity (PP) in temperate regions ($8 \text{ t ha}^{-1} \text{ year}^{-1}$) as compared to tropics ($20 \text{ t ha}^{-1} \text{ year}^{-1}$) are :

- (i) temperate regions receive less amount of sunlight, due to which photosynthesis is low.
- (ii) temperate regions have cold climate, that severely limits the PP.

23. (a) Naresh shows a sense of responsibility towards his parents and a good knowledge of science as he is aware of various biotechnological applications. He uses his knowledge to convince his mother.

(b) DNA containing insulin gene is isolated from the human cell. The two DNA sequences corresponding to A and B chains of human insulin are introduced into the plasmids of *E. coli* to produce insulin chains A and B. The extracted chains A and B were combined by creating disulphide bonds to form human insulin (humulin).

(c) The insulin prepared by rDNA technology does not produce sensitive allergic reactions and other immunological reactions whereas those used earlier produced allergic reactions and other complications because they were foreign proteins extracted from pancreas of slaughtered cattle or pigs.

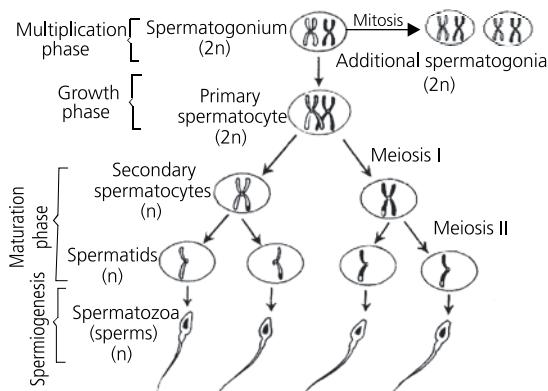
24. (a) X – Luteinising hormone (LH)

Y – Follicle stimulating hormone (FSH)

- (b)**
- (i) Proliferative phase or follicular phase usually occurs from 5th to 12th day of menstrual cycle. In this phase, the follicle stimulating hormone (FSH) secreted by the anterior lobe of the pituitary gland which stimulates the ovarian follicle to secrete estrogens that stimulate the proliferation of the endometrium of the uterine wall.
 - (ii) On 14th day (middle of the cycle), both LH and FSH attain a peak level and rapid secretion of LH induces rupturing of Graafian follicle and thereby ovulation. This is called ovulatory phase.
 - (iii) The ovulatory phase is followed by luteal phase or secretory phase from 15th to 28th day of menstrual cycle during which the remaining cells of the ovarian follicles are stimulated by the LH to develop corpus luteum that secretes large amount of progesterone. Progesterone is essential for maintenance of the endothelium which is necessary for implantation of the fertilised ovum and other events of pregnancy.

OR

- (a)** Stages in the process of spermatogenesis in man can be illustrated as follows:



- (b)** Gametogenesis occurs at puberty in the human male. In the female, it begins before birth and arrests at the primary follicle stage. Further development of gametes resume at puberty.

- (c)** In human male, gametogenesis is completed in human testes, while in a human female, it is completed in the Fallopian tube.

- 25.** Biofertilisers are microorganisms which bring about nutrient enrichment of soil by enhancing the availability of nutrients like nitrogen (N) and phosphorus (P) to crops. The microorganisms which act as biofertilisers are bacteria, cyanobacteria (blue green algae) and mycorrhizal fungi.

- (i) *Azospirillum* bacteria live in close contact with the

roots of cereals like maize and Brazilian grasses and fix nitrogen. Some of the fixed nitrogen is absorbed by the roots.

- (ii) Endomycorrhizae stimulate the absorption of phosphorus and various other elements by roots. They enhance nodulation in legumes and secrete antimicrobial substances to protect the plants from pathogen attack.
- (iii) *Rhizobium* is one of the most important symbiotic nitrogen fixing bacteria. It forms nodules on the roots of legume plants and provides plant with usable nitrogen.
- (iv) *Azolla pinnata*, a small free floating fresh water fern, harbours a symbiotic blue green algae, *Anabaena azollae* in the leaf cavities, which fixes nitrogen. A part of the fixed nitrogen is excreted in the cavities and becomes available to the fern. The decaying fern plants release the same for utilisation of the rice plants. When field is dried at the time of harvesting, the fern functions as the green manure, being decomposed and thus enriching the field for the next crop.

OR

- (a)** *Lactobacillus* converts lactose sugar of milk into lactic acid. Lactic acid causes coagulation of milk protein casein. This property of *Lactobacillus* has following useful applications:

- (i) Indian curd is prepared by inoculating cream and skimmed milk with *Lactobacillus acidophilus* at a temperature of about 40°C or less.
- (ii) Yoghurt is produced by curdling milk with the help of *Streptococcus thermophilus* and *Lactobacillus bulgaricus*. It has a flavour of lactic acid and acetaldehyde. It is often sweetened and flavoured with fruits.
- (iii) Cheese consists of curd separated from liquid part or whey. In preparation of raw cheese milk is curdled with the help of lactic acid bacteria.

- (b)** Cyclosporin A (an immunosuppressive drug) is obtained from fungus *Trichoderma polysporum* while statins (blood cholesterol lowering agents) are obtained from yeast *Monascus purpureus*.

- (c)** *Nucleopolyhedrovirus* a genus of baculovirus are useful in controlling many insects and other arthropods. They are species specific, narrow spectrum bioinsecticides with no side effects on plants, mammals, birds, fish and non-target insects. Therefore, they serve as an important component of integrated pest management programme in dealing with ecological sensitive areas. These properties are useful in organic farming.

- 26.** (a) BOD stands for Biochemical Oxygen Demand. BOD is a measure of oxygen required by aerobic decomposers for the biochemical degradation of organic remains of a unit mass. Higher the BOD, lower would be the dissolved oxygen.
- (b) A higher BOD indicates that the particular segment of the river is highly polluted. As a result, there will be sharp decline in the dissolved oxygen content in this part. It will result in mortality of fishes and other aquatic organisms.
- (c) When the amount of organic matter in the river will decrease, BOD will decrease too. As a result, aquatic life will start flourishing.
- (d) Passage of sewage and run off from fertilised fields into water bodies causes nutrient enrichment particularly with nitrogen and phosphorus. Nutrients present in sewage and fertilisers cause dense growth of plants and planktonic algae. The excess growth of planktonic algae that imparts a distinct colour to water bodies is called algal bloom. They are toxic to animals and humans. Algal blooms and floating plants cut off light from submerged plants and the latter die. There is drastic decrease in oxygen replenishment inside water. It causes organic loading of water and death of fish

and other animals. The phenomenon responsible for this is eutrophication.

OR

- (a) Ozone shield is the region of stratosphere, where ozone is present in high concentration. It is called ozone shield because it protects the living beings from harmful effects of ultraviolet radiations. Chlorofluorocarbons (CFCs) are greenhouse gases which contribute to 14% of global warming. CFCs cause ozone hole. In the stratosphere, chlorofluorocarbon is degraded in the presence of UV- radiation, releasing Cl atoms. Cl acts as catalyst in the degradation of ozone releasing molecular oxygen therefore, it is necessary to limit the release of CFCs as far as possible. Damage to ozone shield results in impairment of photosynthetic machinery in plants and skin cancer in humans.
- (b) Global warming is a warning to mankind because:
- Rise in temperature is leading to increased melting of polar ice-caps as well as of other places like the Himalayan snow caps. This will result in a rise in sea level that can submerge many coastal areas.
 - Changes in temperature result in odd weather and climate changes, e.g., El Nino effect.



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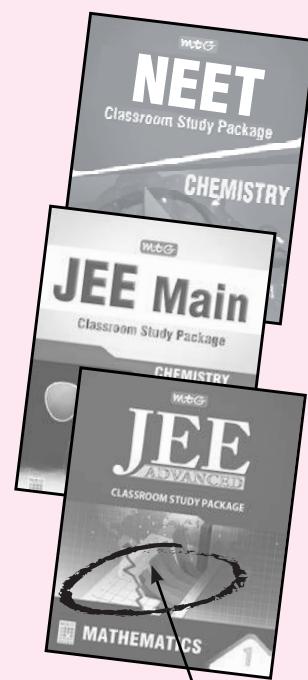
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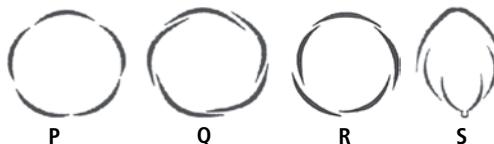
- Stirred-tank bioreactors have been designed for
 - ensuring availability of oxygen throughout the process
 - addition of preservatives to the product
 - purification of the product
 - ensuring anaerobic conditions in the culture vessel.
- Which one of the following is not a correct statement?
 - A museum has collection of photographs of plants and animals.
 - Key is a taxonomic aid for identification of specimens.
 - Herbarium consists of dried, pressed and preserved plant specimens.
 - Botanical gardens have collection of living plants for reference.

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

Column I	Column II
A. Ascomycetes	(i) <i>Ustilago</i>
B. Phycomycetes	(ii) <i>Saccharomyces</i>
C. Basidiomycetes	(iii) <i>Trichoderma</i>
D. Deuteromycetes	(iv) <i>Albugo</i>
(a) A-(ii), B-(i), C-(iv), D-(iii)	
(b) A-(iv), B-(iii), C-(ii), D-(i)	
(c) A-(ii), B-(iv), C-(i), D-(iii)	
(d) A-(iii), B-(iv), C-(i), D-(ii)	

- Select the incorrect statement.
 - Proteins are heteropolymers made of amino acids.
 - Ribozymes are nucleic acids with catalytic power.
 - Nucleic acids serve as genetic material.
 - Proteins, nucleic acids and polysaccharides are the only three types of macromolecules found in the living system.

- Select the correct statement regarding protein synthesis.
 - When the small subunit of the ribosome encounters mRNA, the process of translation begins.
 - Peptidase catalyses the formation of peptide bond.
 - UTRs are present between the start codon and stop codon.
 - At the end of translation, the release factor binds to the initiation codon.
- The following diagrams represent the types of aestivation in corolla. Identify the correct combination of labelling.



- P-Valvate, Q-Vexillary, R-Twisted, S-Quincuncial
 - P-Vexillary, Q-Imbricate, R-Quincuncial, S-Valvate
 - P-Valvate, Q-Imbricate, R-Twisted, S-Vexillary
 - P-Valvate, Q-Twisted, R-Quincuncial, S-Vexillary
- The digestive enzymes of cellular compounds are confined to
 - lysosomes
 - ribosomes
 - peroxisomes
 - polysomes.
- Which of the following correctly matches with a phase of the cell cycle?
 - S-phase - immediately precedes cell division
 - M-phase - duplication of DNA
 - G₁-phase - immediately follows cell division
 - G₂-phase - cell division
- A genetic unit that codes amino acid sequence of a complete functional polypeptide could be termed as
 - recon
 - intron
 - muton
 - cistron.

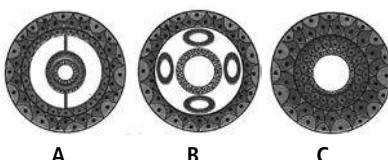
10. Which of the following extra embryonic membrane stores metabolic wastes?
 (a) Yolk sac (b) Chorion
 (c) Allantois (d) Amnion

11. Most carbon dioxide from catabolism of glucose is released during
 (a) glycolysis (b) Krebs cycle
 (c) lactate fermentation (d) oxidative phosphorylation.

12. Which of the following archaebacteria are found in marshy areas?
 (a) *Halobacterium* (b) *Thermoproteus*
 (c) *Methanococcus* (d) *Halococcus*

13. Which of the following statements are correct regarding Phylum Aschelminthes?
 (i) They are commonly known as flatworms.
 (ii) They have organ-system level of body organisation.
 (iii) They are bilaterally symmetrical, triploblastic and acoelomate animals.
 (iv) They are dioecious.
 (a) (i) and (iii) only (b) (i), (ii) and (iii) only
 (c) (ii), (iii) and (iv) only (d) (ii) and (iv) only

14. Study the given sectional view of three organisms A, B and C and select the correct statement regarding it.



- (a) A could be *Limulus* whereas C could be *Ascaris*.
 (b) B could be *Ancylostoma* whereas C could be *Taenia*.
 (c) A could be *Ascaris* whereas B could be *Nereis*.
 (d) A could be *Wuchereria*, B could be *Laccifer* whereas C could be *Fasciola*.

15. *Saccharum officinarum*, a monocot plant has
 (a) dumb-bell shaped guard cells
 (b) pinnately compound leaves
 (c) pentamerous flowers
 (d) reticulate venation.

16. The floral formula, $EBr \oplus K_5 C_5 A_0 \bar{G}_{(3)}$ belongs to Family
 (a) Solanaceae (b) Cucurbitaceae
 (c) Gramineae (d) Liliaceae.

17. Choose the correct sequence of tissues from the outside to the inside in a dicotyledonous stem.
 (a) Phellem → Pericycle → Endodermis → Phloem
 (b) Phellem → Phloem → Endodermis → Pericycle
 (c) Phellem → Endodermis → Pericycle → Phloem
 (d) Pericycle → Phellem → Endodermis → Phloem

18. Read the following statements and select the correct option.
Statement 1 : Mitochondria are common to both plant and animal cells.

- Statement 2 :** The number of mitochondria in a cell is independent of the function of the cell.
 (a) Both statements 1 and 2 are true and statement 2 is the correct explanation of statement 1.
 (b) Both statements 1 and 2 are true but statement 2 is not the correct explanation of statement 1.
 (c) Statement 1 is true and statement 2 is false.
 (d) Both statements 1 and 2 are false.

19. Which of the following is correct regarding plasma membrane?
 (a) It is impermeable and is fluid mosaic of lipids and proteins.
 (b) It is permeable but does not show fluid mosaic pattern between lipids and carbohydrates.
 (c) It is selectively permeable and is fluid mosaic of proteins and lipids selectively.
 (d) It is semipermeable but does not show fluid mosaic pattern between proteins and lipids.

20. Which of the following is not caused by deficiency of minerals in plants?
 (a) Chlorosis
 (b) Etiolation
 (c) Shortening of internodes
 (d) Necrosis

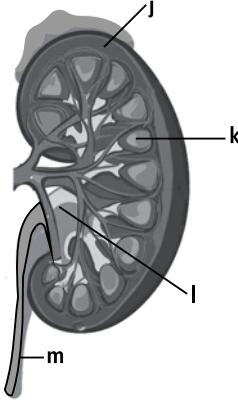
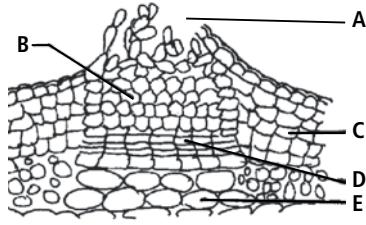
21. The common passage for the bile and pancreatic juices is
 (a) ampulla of Vater (b) ductus Choledochus
 (c) duct of Wirsung (d) duct of Santorini.

22. If a colourblind man marries a girl who is normal (homozygous) for this character, then genetically
 (a) sons and daughters will be normal
 (b) sons will be colourblind, daughters will be normal
 (c) sons will be normal, daughters will be carrier
 (d) both sons and daughters will be colourblind.

23. In the PCR technology the DNA segment is replicated over a billion times. Which enzyme catalyses the cycle of repeated replication?
 (a) Topoisomerase
 (b) *Taq* polymerase
 (c) DNA dependent RNA polymerase
 (d) Primase

24. Which of the following processes will be most adversely affected if microorganisms are removed from a forest ecosystem?
 (a) Solar energy fixation and nutrient cycling
 (b) Decomposition of organic matter and photosynthesis

- (c) Nitrogen fixation and decomposition of organic matter
 (d) Carbon assimilation and nitrogen fixation
- 25.** An immature male gametophyte differs from a mature male gametophyte in that it
 (a) has not yet left the pollen sac
 (b) has not yet germinated and its generative cell has not divided into two male gametes
 (c) is a microspore that has not yet divided by mitosis
 (d) still consists of microsporocytes.
- 26.** Biogenetic law as given by Haeckel states that
 (a) ontogeny recapitulates phylogeny
 (b) phylogeny recapitulates ontogeny
 (c) ontogeny and phylogeny go together
 (d) there is no relationship between phylogeny and ontogeny.
- 27.** The carrying capacity of environment for a given population can be represented by the equation
 (a) $dN = rN - \frac{N}{K}$ (b) $\frac{dN}{dt} = rN - 1$
 (c) $\frac{dN}{dt} = rN - \frac{1}{K}$ (d) $\frac{dN}{dt} = rN(1 - \frac{N}{K})$.
- 28.** Which among the following responds to pressure?
 (a) Meissner's corpuscles (b) Pacinian corpuscles
 (c) Ruffini's corpuscles (d) All of these
- 29.** The correct sequence of seral stages in hydrosere is
 (a) plankton, submerged, floating, reed swamp, sedge meadow, woodland
 (b) plankton, floating, submerged, reed swamp, sedge meadow, woodland
 (c) plankton, submerged, floating, sedge meadow, reed swamp, woodland
 (d) plankton, submerged, floating, sedge meadow, woodland, reed swamp.
- 30.** Which of the following cartilages of larynx does not occur in pair?
 (a) Arytenoid (b) Cricoid
 (c) Corniculate (d) Cuneiform
- 31.** Which statement is incorrect ?
 (a) Mast cells and basophils secrete histamine and heparin.
 (b) Mast cells are long lived while basophils are short lived.
 (c) Mast cells with multilobed nucleus are smaller than basophils with a bilobed nucleus.
 (d) Mast cells are relatively sessile while basophils are mobile.
- 32.** What would be the genotype of parents if progeny consists of all daughters carrier for haemophilia and all normal sons?
 (a) X^hX and XY (b) X^hX and X^hY
 (c) X^hX^h and XY (d) XX and X^hY
- 33.** In the mesozoic era, the correct sequence of the periods, beginning with the earliest is
 (a) triassic, jurassic, cretaceous
 (b) jurassic, cretaceous, triassic
 (c) cretaceous, triassic, jurassic
 (d) cretaceous, jurassic, triassic.
- 34.** Sacred forests are those that
 (a) have rich growth of endemic plants which have become extinct elsewhere
 (b) have high degree of threat to habitat due to its degradation
 (c) have low lying marshy areas filled with rainwater
 (d) none of these.
- 35.** The opposite leaves on a plant are generally of the same size but in certain rare cases they are of unequal size. This is known as
 (a) heterophyllly (b) anisophyllly
 (c) heterophyllotaxy (d) none of these.
- 36.** The start signal in mRNA for protein synthesis is
 (a) AUG (b) UAG
 (c) GUA (d) UGA.
- 37.** Pollination brought about by different flowers of the same individual plant is called
 (a) xenogamy (b) autogamy
 (c) cleistogamy (d) geitonogamy.
- 38.** Which of the following statements is correct?
 (a) During meiosis cytokinesis generally takes place.
 (b) During meiosis cytokinesis does not take place.
 (c) During meiosis cytokinesis takes place after first phase but does not occur after second phase of meiosis.
 (d) All of these
- 39.** What is the first derived product of pyruvic acid after it enters into mitochondria for respiration?
 (a) Citric acid (b) Malic acid
 (c) Isocitric acid (d) Oxaloacetic acid
- 40.** CuT is an effective method of contraception which is achieved primarily by
 (a) suppressing fertilising capacity of sperms
 (b) preventing ovulation
 (c) preventing the entry of sperms into cervix
 (d) none of these.

- 41.** Stop codons are
 (a) AUG, GUG (b) UAA, UGA, UAG
 (c) UAC, UGG (d) AGU, AGA, UAC.
- 42.** Gases found in primitive atmosphere were
 (a) CH₄, NH₃, H₂, water vapour
 (b) CH₄, NH₃, CO₂, water vapour
 (c) CH₄, H₂O, CO₂
 (d) CH₄, O₂, CO₂.
- 43.** A baby has been born with a small tail. It is the case exhibiting
 (a) retrogressive evolution
 (b) mutation
 (c) atavism
 (d) metamorphosis.
- 44.** Short-lived immunity acquired by fetus from mother across placenta or through mother's milk is categorised as
 (a) active immunity (b) passive immunity
 (c) cellular immunity
 (d) innate non-specific immunity.
- 45.** In order to obtain virus free plants through tissue culture, the best method is
 (a) protoplast culture (b) embryo rescue
 (c) anther culture (d) meristem culture.
- 46.** Refer the following diagram and identify the parts of a kidney indicated.

 (a) j = nephron, k = pelvis, l = renal papilla, m = hilum
 (b) j = medulla, k = nephron, l = pelvis, m = ureter
 (c) j = cortex, k = medulla, l = calyx, m = pelvis
 (d) j = cortex, k = medulla, l = pelvis, m = ureter
- 47.** Which of the following is the source of most preferred genetic vector in plants?
 (a) *Bacillus thuringiensis*
 (b) *Agrobacterium tumefaciens*
 (c) *Pseudomonas putida*
 (d) All of these
- 48.** Transgenic plants are produced by
 (a) growing a new plant from meristem of an older plant
 (b) micropropagation of existing plants
 (c) developing a new plant from a cell containing foreign DNA
 (d) selecting somaclonal variants.
- 49.** Choose the correct combination of labellings of a lenticel.

 (a) A - pore, B - secondary cortex, C - cork cambium, D - cork, E - complementary cells
 (b) A - pore, B - cork cambium, C - secondary cortex, D - cork, E - complementary cells
 (c) A - pore, B - cork, C - complementary cells, D - cork cambium, E - secondary cortex
 (d) A - pore, B - complementary cells, C - cork, D - cork cambium, E - secondary cortex
- 50.** Match the hormone in column I with their functions in column II.
- | Column I | Column II |
|------------------------|--|
| P. FSH | 1. Prepare endometrium for implantation |
| Q. LH | 2. Develops female secondary sexual characters |
| R. Progesterone | 3. Contraction of uterine wall |
| S. Estrogen | 4. Development of corpus luteum |
| (a) P-5, Q-4, R-1, S-2 | 5. Maturation of Graafian follicle |
| (b) P-4, Q-5, R-2, S-1 | |
| (c) P-4, Q-3, R-2, S-5 | |
| (d) P-5, Q-1, R-2, S-4 | |

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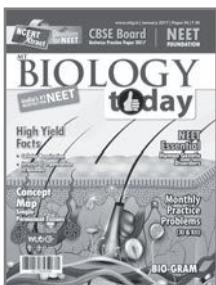
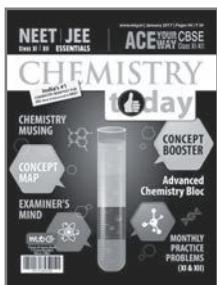
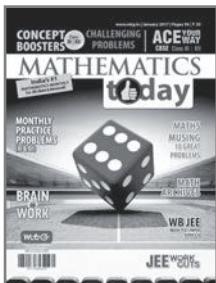
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