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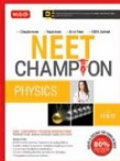


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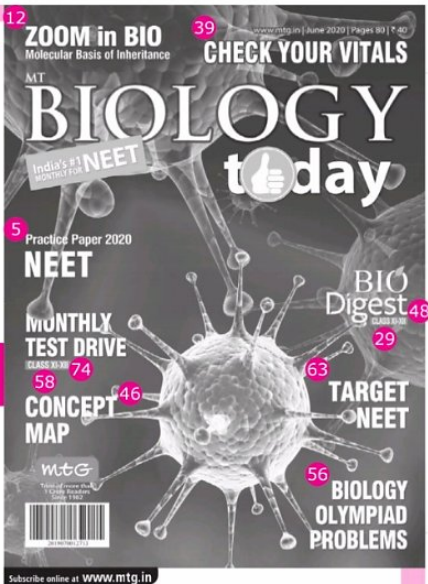
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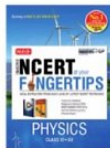
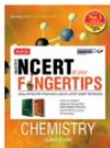
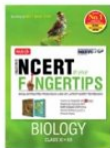
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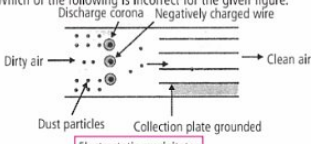
PRACTICE PAPER

NEET

Exam on
26th July 2020

- Which of the following period is known as the age of fishes?
(a) Ordovician period (b) Silurian period
(c) Devonian period (d) Carboniferous period
- Read the following statements and select the correct one.
(i) Juvenile phase is the pre-reproductive phase in the life cycle of an individual.
(ii) *Bambusa tulda* is a monocarpic plant.
(iii) Carrot and radish are polycarpic.
(iv) In estrus cycle, broken endometrium is passed out.
(a) (i) and (iii) (b) (ii) and (iv)
(c) (i) only (d) (i) and (ii)
- Which is not true about euglenoids?
(a) They have a protein rich layer called pellicle instead of cell wall.
(b) Mixotrophic mode of nutrition is found among them.
(c) In most forms the cells have stiff cellulose plates.
(d) They occur in fresh water habitat and in damp soils.
- The epiphytic roots of *Vanda*
(a) absorb mineral salts and moisture from the dust collected on bark
(b) possess velamen which helps to absorb water from moist atmosphere
(c) helps in the fixation on the surface of host plant
(d) arise from nodes and store air from the atmosphere.
- The (i) cartilage forms articular surface at the joints of long bones and (ii) cartilage occurs in the pubic symphysis.
(a) (i)-hyaline (ii)-white fibrous
(b) (i)-calcified (ii)-hyaline
(c) (i)-white fibrous (ii)-calcified
(d) (i)-hyaline (ii)-calcified
- The given plant
(a) is vascular but cryptogamæ
(b) do not have vessels in its xylem
(c) have assimilatory tissues in its vegetative propagules
(d) is aquatic species of hornworts.

- In some organisms karyokinesis is not followed by cytokinesis as a result of which multinucleate condition arises leading to the formation of syncytium as in case of
(a) embryo development
(b) liquid endosperm of coconut
(c) trophoblasts
(d) scutellum development.
- Match the column I with column II and select the correct option.

Column I	Column II
A. Marginal placentation	(i) <i>Dianthus</i>
B. Free central placentation	(ii) Marigold
C. Axile placentation	(iii) <i>Acacia</i>
D. Basal placentation	(iv) Lemon

(a) A-(i), B-(iv), C-(ii), D-(iii)
(b) A-(iii), B-(i), C-(iv), D-(ii)
(c) A-(ii), B-(iv), C-(i), D-(iii)
(d) A-(i), B-(ii), C-(iv), D-(iii)
- A mRNA, consisting of 282 nucleotides can produce a polypeptide chain of
(a) 282 amino acids (b) 120 amino acids
(c) 94 amino acids (d) 141 amino acids.
- Ganong's respirometer is used to determine
(a) vital capacity
(b) total lung capacity
(c) inspiratory reserve volume
(d) respiratory quotient.
- Which of the following is incorrect for the given figure.


(a) Most widely used instrument, for the removal of particulate matter.
(b) It can remove over 99% particulate matter present in the exhaust from a thermal power plant.
(c) It works on the principle of dust separation by centrifugation force.
(d) The velocity of the air between the plates must be low enough to allow the dust to fall.

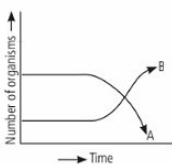
12. Which of the following bacteria is not associated with denitrification?
 (a) *Nitrocystis* (b) *Pseudomonas*
 (c) *Thiobacillus* (d) *Micrococcus*
13. Read the given statements and select the correct option.

Statement A : Veins have valves which prevent backward flow of blood.

Statement B : The flow of blood in veins is not very fast because the blood flows under low pressure.

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

14. The following graph depicts changes in two populations (A and B) of herbivores in a grassland. A possible reason for these changes is that



- (a) Population 'A' produced more offspring than population 'B'.
 (b) Population 'A' consumed the members of population 'B'.
 (c) Population 'B' competed more successfully for food than population 'A'.
 (d) Both plant populations shows allelopathy relationship.

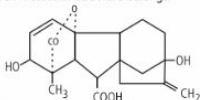
15. Read the following statements and select the correct ones.

- (i) In simple cuboidal epithelium nuclei are rounded and lie in the centre of the cells.
 (ii) Non-keratinised epithelium is impermeable to water.
 (iii) Yellow elastic fibrocartilage makes cartilage flexible.
 (iv) Areolar tissue forms a shock absorbing cushion around the eye balls and kidneys.
- (a) (i) and (iii) (b) (i) and (ii)
 (c) (iii) and (iv) (d) (ii) and (iv)

16. *Cladonia rangiferina* is

- (a) regarded as 'bread of heaven' by Jews
 (b) the staple food of reindeer
 (c) used to prepare perfumes
 (d) the source of litmus.

17. Select the correct option regarding the phytohormone to which the given molecular structure belongs.

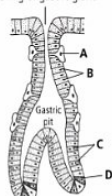


- (a) This hormone promotes femaleness in most flowers.
 (b) This hormone promotes apical dominance.
 (c) This hormone usually decreases the size of stem, leaves, flowers and fruits.
 (d) This hormones breaks seed dormancy by synthesis of certain enzymes.

18. If we take out a small drop of each of the following separately on glass slides which will not coagulate?
 (a) Blood from hepatic portal vein
 (b) Blood from pulmonary vein
 (c) Blood plasma (d) Blood serum

19. Examine the figure of gastric glands given below and identify the labelled parts A to D.

Opening of gastric gland



- | | | | |
|----------------------|---------------|--------------|------------------|
| A | B | C | D |
| (a) Oxyntic cell | Chief cells | Mucous cells | Argentaffin cell |
| (b) Argentaffin cell | Oxyntic cells | Mucous cells | Chief cell |
| (c) G cell | Chief cells | Mucous cells | Argentaffin cell |
| (d) Oxyntic cell | G cells | Mucous cells | Chief cell |

20. Which of the following statements is correct?

- (a) Vasa recta is well developed in cortical nephrons.
 (b) PCT and DCT are situated in the medulla of the kidney.
 (c) The glomerulus encloses the Bowman's capsule.
 (d) The ascending limb of the Henle's loop extends as the DCT.

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

Column I

(Skeletal Part)

- A. Cranium
 B. Skull
 C. Face
 D. Hindlimb
 E. Ribs

Column II

(Number of bones)

- (i) 29
 (ii) 8
 (iii) 14
 (iv) 24
 (v) 30

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

22. The 3rd, 6th and 11th cranial nerves are respectively

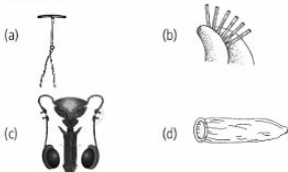
- (a) oculomotor, abducens and spinal accessory
 (b) oculomotor, trigeminal and spinal accessory
 (c) optic, facial and spinal accessory
 (d) trochlear, abducens and vagus.

23. The given table enlists various hormones and their chemical nature. Select the option which completes the table.

Hormone	Chemical composition
(i)	Peptide
Testosterone	(ii)
Thyroxine	(iii)
(iv)	Amino-acid derivative

	(i)	(ii)	(iii)	(iv)
(a)	Cortisol	Steroid	Polypeptide	Estradiol
(b)	Insulin	Protein	Polypeptide	Epinephrine
(c)	Cortisol	Protein	Amine	Estradiol
(d)	Insulin	Steroid	Amine	Epinephrine

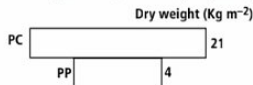
24. Select the correct pathway of water movement inside the root.
- (a) Epidermis → Endodermis → Cortex → Pericycle → Xylem
 (b) Epidermis → Cortex → Endodermis → Pericycle → Xylem
 (c) Epidermis → Endodermis → Pericycle → Cortex → Xylem
 (d) Epidermis → Cortex → Pericycle → Endodermis → Xylem
25. It is a common practice to keep few riped bananas with unripened bananas so that,
- (a) riped bananas can be prevented from rotting
 (b) unripened bananas ripe quickly
 (c) unripened bananas stay as it is for a longer time
 (d) none of these.
26. Which of the following contraceptive methods has poor reversibility?



27. Read the given statements and select the correct option.
Statement A : Test cross is used to determine an unknown genotype within one breeding generation.
Statement B : Test cross is a cross between F_1 hybrid and dominant parent.
- (a) Both statements A and B are correct and statement B is the correct explanation of statement A.
 (b) Both statements A and B are correct but statement B is not the correct explanation of statement A.
 (c) Statement A is correct and statement B is incorrect.
 (d) Both statements A and B are incorrect.
28. The preserved fossil remains of *Archaeopteryx* show that
- (a) it was a flying reptile from the permian period
 (b) reptiles gave rise to birds during jurassic period
 (c) it was a flying reptile in the triassic period
 (d) reptiles gave rise to birds during permian period.
29. A disease sometimes found in persons above the age of 40 years which is characterised by poor CNS coordination, forgetfulness and tremors of hands is
- (a) epilepsy (b) Alzheimer's disease
 (c) migraine (d) schizophrenia.
30. Study the following statements regarding inbreeding and select the incorrect ones.
- (i) The inbreeding strategies allow the desirable qualities of two different breeds to be combined.
 (ii) It increases homozygosity.
 (iii) It also helps in elimination of less desirable genes.
 (iv) Continued inbreeding increases fertility and productivity.

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

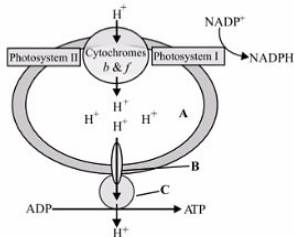
31. The purpose of biological treatment of waste water is to
- (a) reduce BOD (b) increase BOD
 (c) reduce sedimentation (d) increase sedimentation.
32. Read the following statements and select the correct ones.
- (i) Same kind of sticky ends are produced when a DNA has been cut by different restriction enzymes.
 (ii) Exonucleases make cuts at specific positions within the DNA.
 (iii) *Hind II* was the first restriction endonuclease to be isolated.
 (iv) A bacteriophage has the ability to replicate within bacterial cells by integrating its DNA with bacterial DNA.
 (v) Presence of more than one recognition sites within the vector facilitates the gene cloning.
- (a) (i), (iii) and (v) (b) (i) and (iv)
 (c) (iii) and (iv) (d) (ii), (iii) and (iv)
33. Which of the following is not a benefit of transgenic animals?
- (a) Investigation of new treatments for diseases
 (b) Early detection of diseases
 (c) Testing the safety of vaccines
 (d) To produce useful biological products
34. Many freshwater organisms cannot live for long in seawater because the surrounding water will be ___ to body cells and ___ may occur.
- (a) hypertonic, exosmosis (b) hypertonic, endosmosis
 (c) hypotonic, exosmosis (d) hypotonic, endosmosis
35. Which kind of pyramid is represented by the given figure?



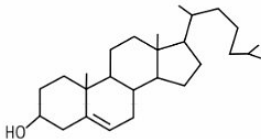
- (a) Pyramid of numbers in terrestrial ecosystem
 (b) Pyramid of biomass in terrestrial ecosystem
 (c) Pyramid of biomass in aquatic ecosystem
 (d) Pyramid of numbers in aquatic ecosystem
36. 'Every species has a right to live'. What kind of value implies on the conservation of biodiversity?
- (a) Narrowly utilitarian (b) Broadly utilitarian
 (c) Ethical (d) Aesthetic
37. The radioactive fallout can cause
- (i) near-immediate effect only
 (ii) mutation in the DNA of living cells
 (iii) long term effect on future generation
 (iv) tissue damage and killing of cells only
- (a) (i) and (ii) are correct. (b) (ii) and (iii) are correct.
 (c) (ii) and (iv) are correct. (d) only (ii) is correct.
38. Select the correctly matched pair.
- (a) Supermale – XXYY (b) Klinefelter's syndrome – XO
 (c) Superfemale – XXXX (d) Sterile male – XY
39. Highly pleomorphic, smaller microorganisms, forming elementary bodies are
- (a) actinomycetes (b) mycoplasma
 (c) diatoms (d) virus.

40. Tensor tympani and stapedius muscles are present in
 (a) external ear (b) middle ear
 (c) inner ear (d) cochlea and utriculus.
41. Which event causes depolarisation of neuron?
 (a) influx of K^+ (b) Influx of Na^+
 (c) Influx of any positively charged ion
 (d) Efflux of negatively charged organic ions
42. Absence of enterokinase causes
 (a) no conversion of chymotrypsinogen into chymotrypsin
 (b) no secretion of gastric juice
 (c) more secretion of gastric juice and gastric motility also increases
 (d) inhibition in release of bile juice from gall bladder.
43. In our tissues dissociation of oxyhaemoglobin occurs due to the
 (a) low O_2 concentration and high CO_2 concentration
 (b) low concentration of O_2 and CO_2 both
 (c) high concentration of O_2 and CO_2 both
 (d) high O_2 concentration and low CO_2 concentration.
44. After organ transplantation cyclosporin A is given to the patient because
 (a) it is an immune enhancer drug
 (b) it is an immunosuppressive drug
 (c) it is an immunologically inert substance
 (d) it increases the count of WBCs in recipient.
45. Head of cockroaches can move in all directions because
 (a) tentorium of head is very flexible which provide greater mobility
 (b) prothorax forms an extension which behaves as flexible neck
 (c) head capsule forms an extension which behaves as flexible neck
 (d) whole neck is made up of arthroal membrane.
46. What is the location of troponin in the process of muscle contraction?
 (a) Attached to myosin filament
 (b) Attached to tropomyosin
 (c) Attached to myosin cross-bridges
 (d) Attached to T-tubule
47. The permissible use of technique amniocentesis is for
 (a) detecting sex of the unborn foetus
 (b) artificial insemination
 (c) transfer of embryo into the uterus of a surrogate mother
 (d) detecting any genetic abnormality.
48. Introduction of genetically modified food is not desirable because
 (a) it will affect economy of developing countries
 (b) the products are less tasty
 (c) they are costly
 (d) they could affect the biodiversity and environment.
49. The process of introduction of weakened inactivated pathogen into human body is called
 (a) immunisation (b) vaccination
 (c) attenuation (d) none of these.
50. Genetic material found in human immuno deficiency virus (HIV) is
 (a) double-stranded RNA
 (b) two strands of single-stranded RNA
 (c) double-stranded DNA
 (d) single-stranded DNA.

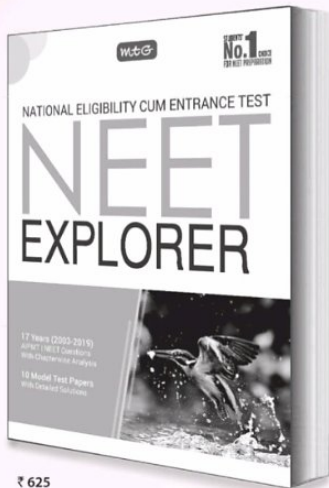
51. Identify the parts marked as A, B and C in the given figure showing ATP synthesis through chemiosmosis.



- | A | B | C |
|-----------------------|-------|-------|
| (a) Thylakoid lumen | F_0 | F_1 |
| (b) Thylakoid lumen | F_1 | F_0 |
| (c) Chloroplast lumen | F_0 | F_1 |
| (d) Chloroplast lumen | F_1 | F_0 |
52. A test tube containing molasses solution and yeast is kept in a warm place overnight. The gas collected from this mixture
 (a) extinguishes the flame
 (b) bursts into flame when ignited
 (c) turns lime water milky
 (d) both (a) and (c).
53. Which of the following does not affect the genetic variation in a population?
 (a) Chromosomal mutation (b) Gene migration
 (c) Genetic drift (d) Balanced polymorphism
54. Which of the following shows the correct sequence of steps of plant tissue culture?
 (a) Sterilisation \rightarrow hardening \rightarrow selection of explant \rightarrow inoculation \rightarrow regeneration \rightarrow plantlet transfer
 (b) Selection of explant \rightarrow inoculation \rightarrow regeneration \rightarrow sterilisation \rightarrow hardening \rightarrow plantlet transfer
 (c) Selection of explant \rightarrow sterilisation \rightarrow inoculation \rightarrow regeneration \rightarrow hardening \rightarrow plantlet transfer
 (d) Hardening \rightarrow sterilisation \rightarrow selection of explant \rightarrow inoculation \rightarrow regeneration \rightarrow plantlet transfer
55. A jacket of sterile cells around the sperms and eggs is an adaptation to life on land, in
 (a) *Ficcia* (b) *Fucus*
 (c) *Laminaria* (d) *Ulothrix*.
56. Given structural formula is correctly identified alongwith its related function by which of the following options?



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- (a) Cholesterol – A component of animal cell membrane
 (b) Lecithin – A component of cell membrane
 (c) Triglyceride – An energy source
 (d) Adenosine – A component of nucleic acids

57. Which is the best way to separate intact chloroplast from green leaves of angiospermic plant?

- (a) Petrol-ether (b) Chloroform
 (c) 10% sucrose solution (d) Alcohol

58. Phragmoplast is related to

- (a) division of nucleolus (b) cell elongation
 (c) cytokinesis
 (d) assemblage of chromosomes at metaphase.

59. Flowering plants have developed certain outbreeding devices to discourage self-pollination and to encourage cross-pollination. One of these is not an example of such outbreeding device.

- (a) Dicliny (b) Dichogamy
 (c) Herkogamy (d) Cleistogamy

60. The early stage human embryo distinctly possesses

- (a) gills (b) gill slits
 (c) external ear (pinna) (d) eyebrows.

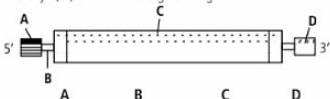
61. Read the following statements carefully and select the correct statement(s).

- (i) hPL plays a major role in parturition.
 (ii) Foetus shows movements first time in the 7th month of pregnancy.
 (iii) Signal for parturition comes from fully developed foetus and placenta.
 (iv) Embryo's heart is formed after the 2nd month of pregnancy.
 (a) (ii) and (iii) (b) (iii) only
 (c) (ii) and (iv) (d) (i) and (iv)

62. Which of the following equations correctly represents Verhulst-Pearl logistic growth?

- (a) $dN/dt = rN \left(\frac{K-N}{K} \right)$ (b) $dN/dt = \frac{rN}{K}$
 (c) $dN/dt = \frac{N(K-N)}{K}$ (d) $dN/dt = r \left(\frac{K-N}{K} \right)$

63. Identify A, B, C and D in the given diagram of mRNA.

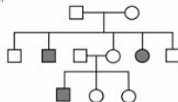


- | | A | B | C | D |
|-----|----------------|-------------------|-------------------|----------------|
| (a) | Methylated cap | Initiation codon | Termination codon | Poly A tail |
| (b) | Poly A tail | Termination codon | Initiation codon | Methylated cap |
| (c) | Methylated cap | Non-coding region | Coding region | Poly A tail |
| (d) | Methylated cap | Coding region | Non-coding region | Poly A tail |

64. The rate of formation of new organic matter by rabbit in a grassland, is called

- (a) net productivity (b) secondary productivity
 (c) net primary productivity (d) gross primary productivity.

65. Study the pedigree chart of a family showing the inheritance of sickle-cell anaemia.



The trait traced in the above pedigree chart is

- (a) dominant X-linked (b) recessive X-linked
 (c) autosomal dominant (d) autosomal recessive.

66. Scientific names are derived from Latin language or are Latinised. This is because

- (a) Latin is a dead language
 (b) Latin is more popular than other languages
 (c) Latin is the oldest language
 (d) all of these.

67. *Halobacterium* is

- (a) aerobic chemoautotroph (b) aerobic photoautotroph
 (c) anaerobic chemoautotroph
 (d) heterotroph.

68. Cysteine and methionine contain one common element that is

- (a) magnesium (b) sulphur
 (c) nitrogen (d) potassium.

69. Which one is incorrect among the followings?

- (a) Metaxylem is the later formed xylem.
 (b) Protoxylem elements are capable of being stretched.
 (c) Metaphloem is made up of smaller and narrower elements.
 (d) Protoxylem is short lived and gets crushed.

70. Insects with incomplete metamorphosis are

- (a) hemimetabolous (b) ametabolous
 (c) paurometabolous (d) holometabolous.

71. Triglycerides are fatty acid esters of glycerol, which are formed by the esterification of _____ molecule(s) of fatty acids with _____ molecule(s) of glycerol.

- (a) one, two (b) one, three
 (c) three, one (d) two, one

72. The biochemical objective of PS I is to

- (a) oxidise NADPH (b) hydrolyse ATP
 (c) phosphorylate ADP (d) reduce NADP⁺.

73. When two molecules of acetyl-CoA enter the TCA cycle, net gain at the end of the cycle is

- (a) 2NADH₂ + 2FADH₂ + 1GTP
 (b) 3NADH₂ + 2FADH₂ + 2GTP
 (c) 6NADH₂ + 2FADH₂ + 2GTP
 (d) 3NADH₂ + 1FADH₂ + 4GTP.

74. Which of the following statements is incorrect?

- (a) Mucosal epithelium has goblet cells which secrete mucus for lubrication.
 (b) Mucosa forms gastric glands in the stomach and crypts in between the bases of villi in intestine.
 (c) Cells lining the villi has brush border or microvilli.
 (d) All the four basic layers in the wall of gut never show modifications in different parts of the alimentary canal.

75. The anther wall consists of four wall layers where
 (a) tapetum lies just inner to endothecium
 (b) middle layers lie between endothecium and tapetum
 (c) endothecium lies inner to middle layers
 (d) tapetum lies next to epidermis.
76. The sperms undergo physiological maturation, acquiring increased motility and fertilising capacity in
 (a) seminiferous tubules (b) vasa efferentia
 (c) epididymis (d) vagina.
77. Chromosome maps/ genetic maps were first prepared by
 (a) Sutton and Boveri (1902)
 (b) Bateson and Punnett (1906)
 (c) Morgan (1910)
 (d) Sturtevant (1911).
78. In transcription in eukaryotes, heterogenous nuclear RNA (hnRNA) is transcribed by
 (a) RNA polymerase I (b) RNA polymerase II
 (c) RNA polymerase III (d) all of these.
79. The pathogen *Microsporium* responsible for ringworm disease in humans belongs to the same kingdom as that of
 (a) *Taenia*, a tapeworm (b) *Ascaris*, a roundworm
 (c) *Rhizopus*, a mould (d) *Wuchereria*, a filarial worm.
80. Which of the following is an example of mutation breeding?
 (a) Pusa Swarnim, resistant to white rust
 (b) Mung bean, resistant to yellow mosaic virus
 (c) Pusa Sadabahar, resistant to chilli mosaic virus
 (d) Pusa Gaurav, resistant to aphids
81. Nitrogen fixation in root nodules of *Alnus* is brought about by
 (a) *Frankia* (b) *Azorhizobium*
 (c) *Bradyrhizobium* (d) *Clostridium*.
82. In a polymerase chain reaction after the denaturation step why the mixture needs to cool down to a lower temperature?
 (a) To permit specific annealing of the primers.
 (b) To give a halt to the reaction mixture.
 (c) To increase the activity of enzyme *Taq* polymerase.
 (d) To obtain the multiple copies of the DNA.
83. Which variety of rice was patented by a U.S. company even though the highest number of varieties of this rice are found in India?
 (a) Sharbati Sonora (b) Co-667
 (c) Basmati (d) Lerma Rojo
84. The prickly pear cactus became unusually abundant after its introduction in Australia, because it
 (a) had no coevolved herbivores
 (b) formed new mycorrhizal association
 (c) lost its thorns
 (d) all of these.
85. In a comparative study of grassland ecosystem and pond ecosystem, it may be observed that
 (a) the abiotic components are almost similar
 (b) the biotic components are almost similar
 (c) both biotic and abiotic components are different
 (d) primary and secondary consumers are similar.
86. Identify the wrong statement regarding post-fertilisation development.
 (a) The ovary wall develops into pericarp.
 (b) The outer integument of ovule develops into tegmen.
 (c) The fusion nucleus (triple nucleus) develops into endosperm.
 (d) The ovule develops into seed.
87. A patient of diabetes mellitus excretes glucose in urine even when he is kept on a carbohydrate free diet. It is because
 (a) fats are catabolised in adipose tissues to form glucose
 (b) amino acids are catabolised in kidney to form glucose
 (c) amino acids are discharged in blood stream from liver
 (d) glycogen from muscles is released in blood stream.
88. Cell bodies of neurons bringing afferent information into the spinal cord are located in
 (a) dorsal root ganglia (b) ventral root ganglia
 (c) gray matter of the spinal cord
 (d) white matter of the spinal cord.
89. Which of the following statement is incorrect regarding biodiversity?
 (a) Biodiversity deals with biological and geographical units such as genes, chromosomes, species, families and biogeographic regions.
 (b) Biodiversity is an addition sum of genetic, taxonomic and ecosystem diversity.
 (c) It is a measure of the amount of resources shared by the human population.
 (d) None of these
90. A lake near a village suffered heavy mortality of fishes within a few days. Which of the following statements could be the correct explanation for this?
 (i) Lots of urea and phosphate fertilizers were used in the crops in the nearby fields.
 (ii) The croplands of the village were sprayed with DDT.
 (iii) The lake water turned green and stinky.
 (iv) Phytoplankton populations in the lake declined initially thereby greatly reducing photosynthesis.
 (a) (i) and (iii) (b) (i) and (ii)
 (c) (ii) and (iii) (d) (iii) and (iv)

ANSWER KEY

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



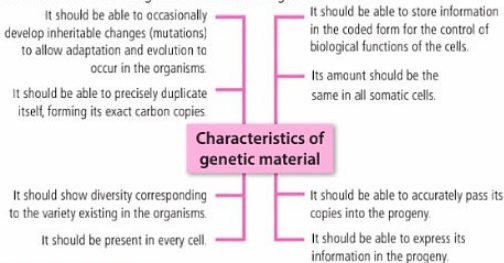
ZOOM IN BIO



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

MOLECULAR BASIS OF INHERITANCE

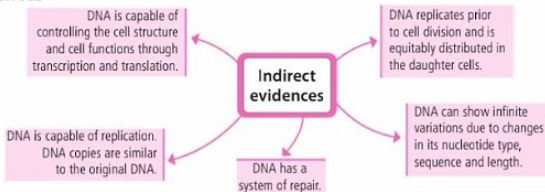
- Genetic material** is the substance which not only controls the formation and expression of traits in an organism but can also replicate and pass on from a cell to its daughter cell or from one generation to next.



DNA AS GENETIC MATERIAL

- Various indirect as well as direct evidences indicate DNA is the genetic material.

Indirect evidences

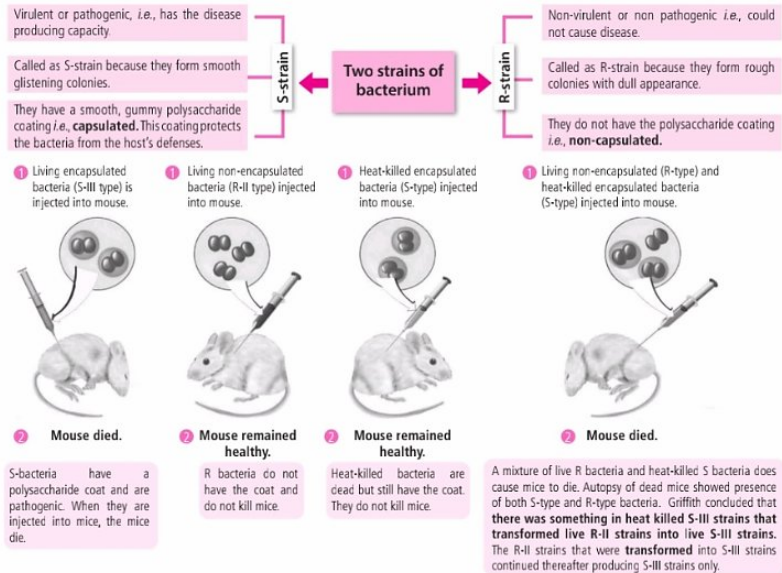


Direct evidences

- The most conclusive evidences in support of DNA as the genetic material came from the following three avenues of approach on microorganisms – **transformation of bacteria, mode of infection of bacteriophages and conjugation of bacteria.**

Transformation - Griffith's experiment

- Transformation is the movement of gene from one organism to another. Griffith found that extracts of dead pathogenic strains of the bacterium *Streptococcus pneumoniae* can transform live harmless strains into live pathogenic strains. Later, Avery analysed the extract and demonstrated that the material that had passed from dead to living bacteria was DNA.



Biochemical characterisation of transforming principle

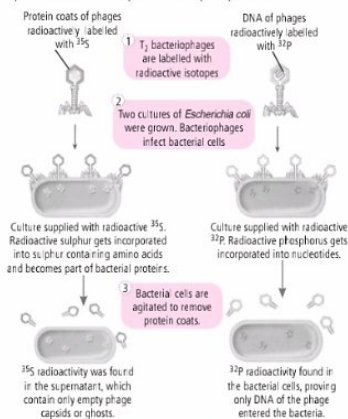
- Three scientists Avery, McCleod and McCarty fractionated the killed S-type bacteria into three components-DNA, carbohydrate and protein and performed following experiment.



- In experiments (i), (ii) and (iv), DNA of heat killed S-III strains was intact and so it transformed live R-II strains into S-III types, but in experiment (iii) the enzyme disintegrated the DNA and so R-II strains were not transformed.
- It clearly showed that the DNA component of heat killed S-III strains transformed live R-II strains into live S-III strains and thus, DNA forms molecular basis of heredity.

Transduction

- It is the process in which bacterium infecting virus (bacteriophage) serves as a vector transferring DNA from one bacterium cell to another, e.g., T_2 bacteriophage. **Hershey and Martha Chase** performed an experiment to confirm that DNA of **bacteriophage** (virus infecting bacteria) enters into host (bacterial) cell and carries the necessary information for formation of new phages. Their experiment was based on the fact that DNA contains phosphorus but no sulphur whereas proteins contain sulphur but no phosphorus.

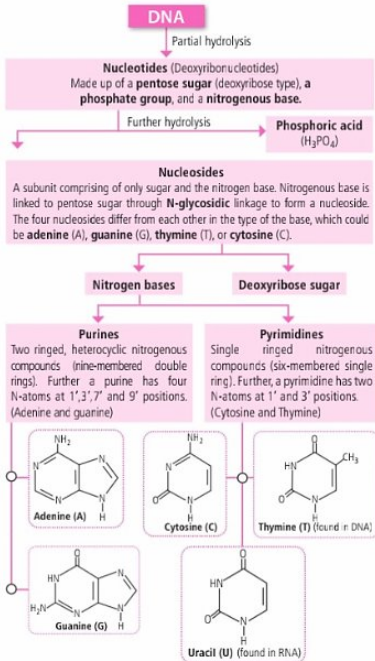


Steps in Hershey and Chase's Experiment

- The progeny of the two types of bacteriophages was tested for radioactivity. Radioactivity was absent in the viruses derived from parents having labelled protein. The viruses derived from parents having labelled DNA possessed radioactivity. This shows that the genetic material is DNA and not the protein.

DNA - DEOXYRIBONUCLEIC ACID

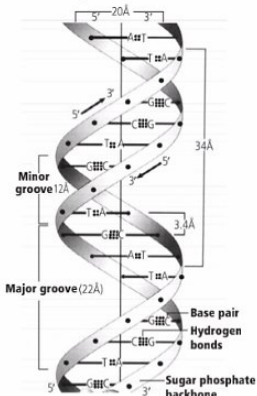
- DNA is long, unbranched, spirally coiled in eukaryotes and circular in prokaryotes as well as in mitochondria and plastids.
- It is the **largest macromolecule** which consists of two complementary strands of **deoxyribonucleotides** that run antiparallelly and are held together by hydrogen bonds between their complementary nitrogen bases.
- DNA is composed of small monomeric units called **nucleotides**. The length of DNA is defined as number of nucleotides present in it, which is the characteristic of an organism.



Structure of DNA

- Adjacent nucleotides are joined together by **phosphodiester bonds** between C-3 and C-5 of different deoxyribose sugars of two adjacent nucleotides (3'-5' phosphodiester linkage) to form a polynucleotide chain.
- The polynucleotide chains **show polarity** as one end of the chain has a sugar residue with C-3 not linked to another nucleotide having free 3'-OH group and the other end has sugar residue with C-5 linked to a phosphate group (not linked to another nucleotide). These are named as 3' and 5' ends (three and five prime ends) of polynucleotide chain, respectively.
- The two polynucleotide chains are **antiparallel** to each other. One has phosphodiester linkage in 3' → 5' direction while the other has phosphodiester linkage in 5' → 3' direction.
- The two polynucleotide chains in a DNA double helix are held together by hydrogen bonding between specific pairs of purines and pyrimidines.

- The unique features of pairing between N-bases are:
 - Purines (A and G) pair with pyrimidines (C and T).
 - The pairing will always be between **A and T** and **G and C**.
 - There are **two hydrogen bonds** between A and T and **three** between G and C.
- The stacking of bases create two types of grooves called **major** and **minor grooves**.



Watson-Crick double helical DNA molecule

Chargaff's Rules

The DNA molecule, irrespective of its source, always has the A – T base pairs equal in number to the G – C base pairs.

In human DNA, A = 30.9%, T = 29.4%, G = 19.9% and C = 19.8%.

The purines and pyrimidines are always in equal amounts *i.e.*, **A + G = T + C**.

The base ratio A + T / G + C may vary from one species to another, but is constant for a given species. This ratio can be used to identify the source of DNA and can help in classification.

The amount of adenine is always equal to that of thymine, and the amount of guanine is always equal to that of cytosine, *i.e.*, **A = T** and **G = C**. However, amount of A + T is not necessarily equal to G + C.

The deoxyribose sugar and phosphate components occur in equal proportions.

Types of DNA

Features	B	Z	A	C	D
1. Handedness of helix	Right handed	Left handed	Right handed	Right handed	Right handed
2. Pitch of helix per turn	34 Å	46 Å	25 Å	30 Å	24 Å
3. Diameter of helix	20 Å	18 Å (thinnest)	26 Å (widest)	19 Å	–
4. Stability	Stable and physiologically active form	Unstable	Unstable	Unstable	Unstable
5. Base pairs per turn of helix	10	12	11	9.33	8
6. Distance between 2 base pairs	3.4 Å	3.8 Å	2.5 Å	3.3 Å	3.03 Å
7. Repeating unit	Mononucleotide	Dinucleotide	Mononucleotide	Mononucleotide	Mononucleotide

Functions of DNA

DNA is a genetic material which carries all the **hereditary information** coded in the arrangement of its nitrogen bases *i.e.*, **genetic code**.

Changes in sequence and number of nucleotides produce **mutations**. Mutations are the raw materials of all variations and formation of new species.

DNA gives rise to RNAs through **transcription**.

DNA controls the metabolic reactions of cells through RNAs and RNA-directed synthesis of proteins, enzymes and other biochemicals.

Table : Differences between prokaryotic and eukaryotic DNA

	Prokaryotic DNA	Eukaryotic DNA
1.	DNA occurs freely inside the cytoplasm.	DNA does not lie freely in the cytoplasm and the most of it is present inside the nucleus.
2.	Organelle DNA is absent.	DNA is present in mitochondria and plastids.
3.	It is naked.	Nuclear DNA is associated with histones while organelle DNA is naked.
4.	It is generally circular.	Nuclear DNA is linear. Organelle DNA may be circular or linear.
5.	Introns are absent.	A cistron contains non-coding regions or introns.
6.	Nonfunctional regions are fewer.	Nonfunctional DNA is quite abundant.
7.	Transposons do not occur.	Transposons or jumping genes occur at places.

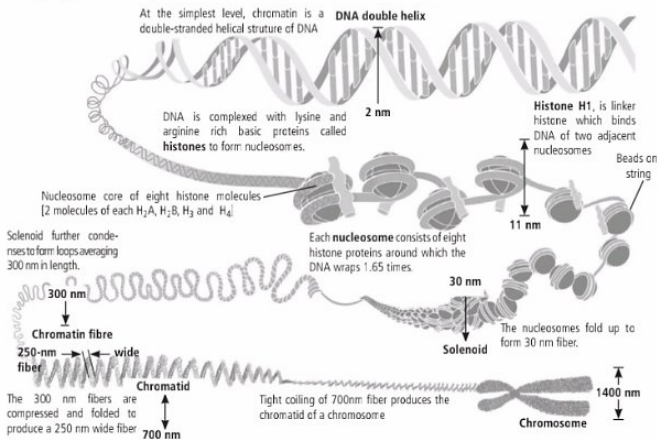
PACKAGING OF DNA HELIX

- The long sized DNA are accommodated in small areas (about $1\ \mu\text{m}$ in *E. coli* and $5\ \mu\text{m}$ nucleus in human beings) only through packing or compaction.
- DNA is acidic due to presence of a large number of phosphate groups. Compaction occurs by folding and attachment of DNA with basic proteins, **nonhistone in prokaryotes and histones in eukaryotes**.

DNA packaging in prokaryotes

- DNA lies in cytoplasm. It is supercoiled (coiled and recoiled) with the help of RNAs and nonhistone basic proteins like polyamines. The compacted mass of DNA is called **nucleoid** or **prochromosome**.

DNA packaging in eukaryotes



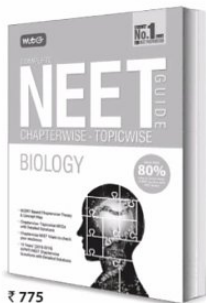
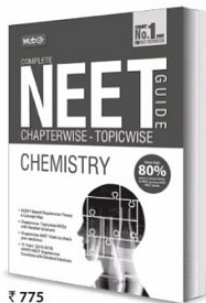
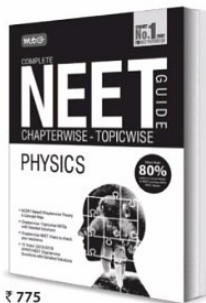
Chromatin

Euchromatin is loosely packed and lightly stained. It is active transcriptionally.

Heterochromatin is densely packed, darkly stained chromatin. It is transcriptionally inactive.

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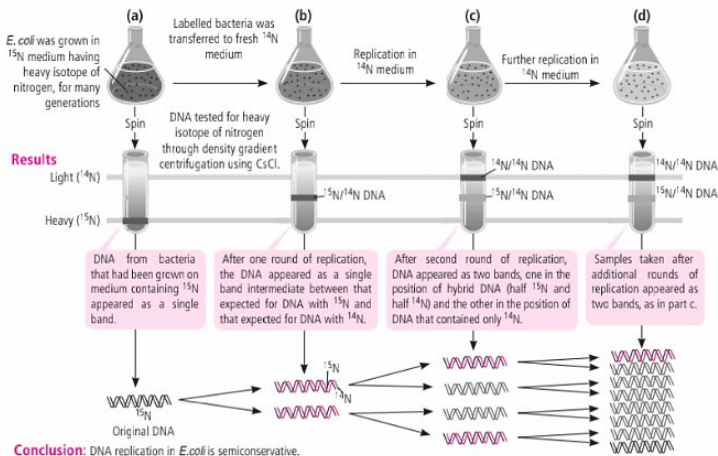
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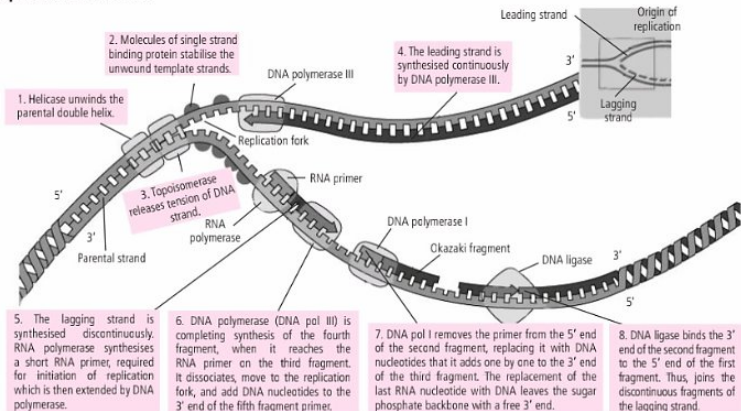
DNA REPLICATION

- Replication is the process of formation of carbon copies or duplication of DNA. DNA function as its own template and therefore, DNA replication is an autocatalytic function of DNA.
- Meselson and Stahl experimentally proved that DNA replicates by semiconservative method.

Meselson and Stahl's Experiment



Replication of DNA



DNA polymerases in prokaryotes

DNA polymerase I has $5' \rightarrow 3'$ polymerising activity (due to which it removes or excises RNA primers from Okazaki fragments and fills it with DNA) as well as $5' \rightarrow 3'$ and $3' \rightarrow 5'$ exonuclease activity due to which mispaired nucleotide is removed. This is called **proof reading function**.

DNA polymerase II has $5' \rightarrow 3'$ polymerising activity as well as $3' \rightarrow 5'$ exonuclease activity but lacks $5' \rightarrow 3'$ exonuclease activity.

DNA polymerase III has essential role in DNA replication. It has both $5' \rightarrow 3'$ polymerising activity as well as $3' \rightarrow 5'$ exonuclease activity (proofreading activity).

DNA polymerases in eukaryotes

DNA polymerase α -main enzyme of DNA replication, synthesise DNA on lagging strand.

DNA polymerase β -nuclear polymerase found only in vertebrates.

DNA polymerase γ -mitochondrial polymerase.

DNA polymerase δ - synthesises DNA on leading strand.

DNA polymerase ϵ - help in elongation of lagging strand.

Proof-reading and DNA repair

DNA polymerase III sense a wrong base introduced during replication. It goes back, removes the wrong base, allows addition of proper base and then proceeds forward.

There is a separate repair mechanism for any damage caused to DNA due to mutation, UV exposure or mismatching that escapes proof-reading mechanism.

A nick or break is caused by an endonuclease near the region of repair. **DNA polymerase I** removes the mismatched or wrong nucleotides if present and synthesises a correct replacement by using the intact strand as template. The newly formed segment is sealed by **DNA ligase**.

Table: Differences between prokaryotic and eukaryotic DNA replication.

S. No.	Prokaryotic DNA replication	Eukaryotic DNA replication
1.	It occurs inside the cytoplasm.	It occurs inside the nucleus.
2.	There is single origin of replication.	Origin of replications are numerous.
3.	DNA polymerase III carry out both initiation and elongation.	Initiation is carried out by DNA polymerase α while elongation by DNA polymerase δ and ϵ .
4.	DNA repair and gap filling are done by DNA polymerase I.	The same are performed by DNA polymerase β .
5.	RNA primer is removed by DNA polymerase I.	RNA primer is removed by DNA polymerase β .
6.	Okazaki fragments are large, 1000-2000 nucleotides long.	Okazaki fragments are short, 100-200 nucleotides long.
7.	Replication is very rapid, some 2000 bps per second are added.	Replication is slow, some 100 nucleotides per second are added.

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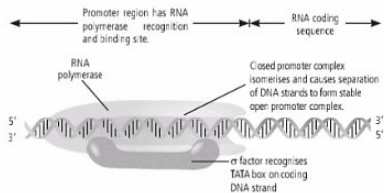
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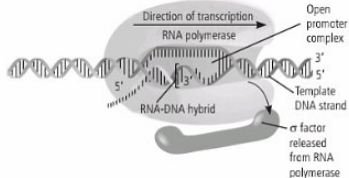
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TRANSCRIPTION

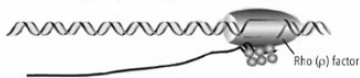
- The process of transferring information stored in DNA to RNA through the synthesis of mRNA over the template of DNA is called **transcription**. It takes place in following three steps.
- (a) **Initiation:** The RNA polymerase holoenzyme first recognises the promoter at the -35 region and binds to the full promoter. As initiation continues, RNA polymerase binds more tightly to the promoter at the -10 region, accompanied by a local untwisting of the DNA in that region.



- (b) **Elongation:** After eight to nine nucleotides have been polymerised, the sigma factor dissociates from the core enzyme. As the RNA polymerase elongates the new RNA chain synthesised from $5' \rightarrow 3'$ end, the enzyme untwists the DNA ahead of it, keeping a single-stranded transcription bubble spanning about 25 bp. About 9 bases of the new RNA are bound to the single-stranded DNA bubble, with the remainder exiting the enzyme in a single-stranded form.

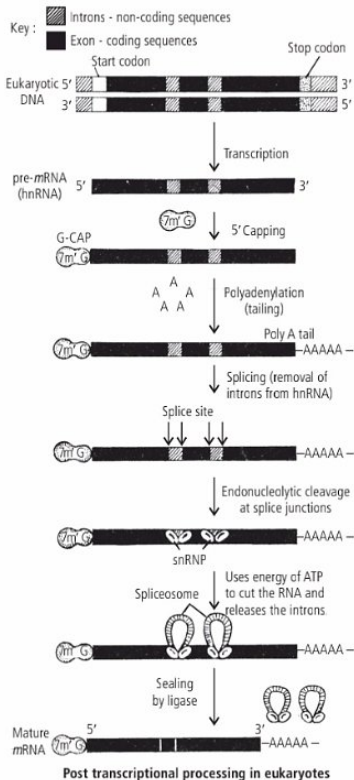


- (c) **Termination:** As polymerase transcribes away from the promoter, rho factor binds to RNA and follows the polymerase when polymerase reaches some sort of pause site, rho factor catches up with polymerase and unwinds the DNA-RNA hybrid, resulting in release of polymerase.



Post-transcriptional processing

- Transcription in eukaryotes occurs within the nucleus and hnRNA moves out of the nucleus into the cytoplasm for translation. The functional mRNA is processed from the primary RNA transcript, and the process is called **maturation**.
- Initially a **cap** (consisting of 7-methyl guanosine or 7 mG) at the $5'$ end and a tail of poly A at the $3'$ end are added. It is known as **capping** and **tailing** respectively. The cap is a chemically modified molecule of guanosine triphosphate (GTP).

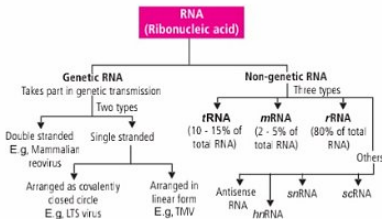


RIBONUCLEIC ACID OR RNA

- RNA or ribonucleic acid is a single stranded polyribonucleotide which functions as carrier of genetic or hereditary information from DNA to cytoplasm, and takes part in protein and enzyme synthesis.
- It is non-hereditary nucleic acid except in some viruses (e.g., retroviruses). At places RNA may appear partially double stranded due to folding or coiling of single strand. Double stranded RNA can be seen in viruses only.
- The axis or back bone of RNA is formed of alternate residues of phosphate and ribose sugar. Phosphate combines with 5' carbon of its sugar and 3' carbon of next sugar similar to the arrangement found in DNA strand. Nitrogen bases are attached to sugars at 1' carbon of the latter and are of four types — adenine (A), guanine (G), cytosine (C) and uracil (U).

Types of RNA

- Two broad categories of RNA are **genetic RNA** and **non-genetic RNA**.



Types of non-genetic RNA

mRNA (messenger RNA)

- Messenger RNA brings **coded information** from DNA and takes part in its translation by bringing amino acids in a particular sequence during the synthesis of polypeptide.
- The **codons** of mRNA are recognised by **anticodons** of their adaptor molecules.



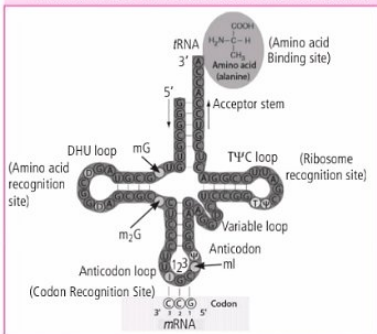
The structure of a typical human mRNA including the untranslated regions (UTRs)

rRNA (ribosomal RNA)

- Makes up the bulk of ribosomes. **rRNA attract and provide large surface for spreading of mRNA** over ribosomes during translocation process of protein synthesis. It is **involved in the translation of message of DNA**. rRNA forms the structural work bench on which a polypeptide is formed, during protein synthesis.

tRNA (transfer RNA)

- It is the soluble and smallest RNA.
- Transfers an amino acid from cytoplasm to the site of protein synthesis.
- It has a cloverleaf shaped (2D) structure with four recognisable sites: **Amino acid binding site** at 3', **anticodon loop** (codon recognition sites), **DHU loop** (amino acid recognition site) and **T Ψ C loop** (Ribosome recognition site).
- In this particular example the tRNA carrying the amino acid alanine will bind to codon GCC on the mRNA chain while in the ribosome.



CENTRAL DOGMA OF MOLECULAR BIOLOGY

- Crick (1958)** proposed the central dogma of molecular biology.
- Central dogma says there is the **unidirectional flow of information from DNA to RNA and from RNA to polypeptide**.
- Many tumour viruses contain RNA as genetic material and replicate by first synthesising a complementary DNA. This process is called **reverse transcription**.
- It is carried out by an RNA-dependent DNA polymerase called **reverse transcriptase**. RNA of these viruses first synthesises DNA through reverse transcription. DNA then transfers information to RNA which takes part in translation of coded information to form polypeptide.



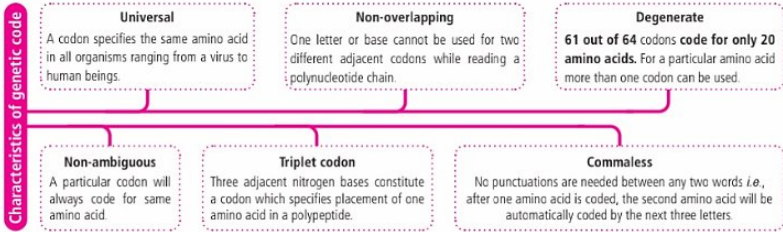
One way flow of information (central dogma).

GENETIC CODE

- The genetic representation of codon through which information in RNA is decoded in a polypeptide chain is called **genetic code**.
- The codons which initiate the protein synthesis are called **initiation codons**. They are **AUG** for methionine and

GUG for valine. GUG when present in beginning codes for methionine, but when present in intermediate position, codes for valine.

- The codons which do not code for any amino acid are called **non-sense codons** or **termination codons**. Three codons viz **UAG (amber)**, **UAA (ochre)** and **UGA (opal)** are non-sense codons.

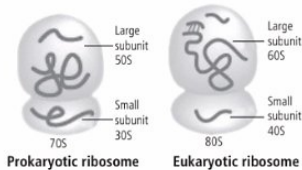


- One gene one enzyme hypothesis** given by **Beadle and Tatum** states that a gene controls a structural or functional trait through controlling the synthesis of a specific protein or enzyme formed by the latter.
- It has also been proved that a single protein may have number of polypeptides (like haemoglobin has 4 polypeptides - 2 α and 2 β) and each polypeptide is controlled by a separate gene. As a result, one gene-one enzyme hypothesis was replaced by **one gene-one polypeptide hypothesis**.
- Additional modification came when gene was identified as a functional unit or cistron and the same was called **as one cistron-one polypeptide hypothesis**. Basically, all the three tenets suggest that the genes control the synthesis of polypeptides.

According to the **wobble hypothesis** only the first two position of a triplet codon on mRNA have a precise pairing with the bases of the tRNA anticodon. The pairing of the third position bases of the codon may be **ambiguous**, and varies according to the nucleotide present in this position. Thus a single tRNA type is able to recognise two or more codons differing only in the third base. The same is called **wobble position**.

RIBOSOMES

- Ribosomes are called protein factories as protein synthesis occurs over the ribosomes.

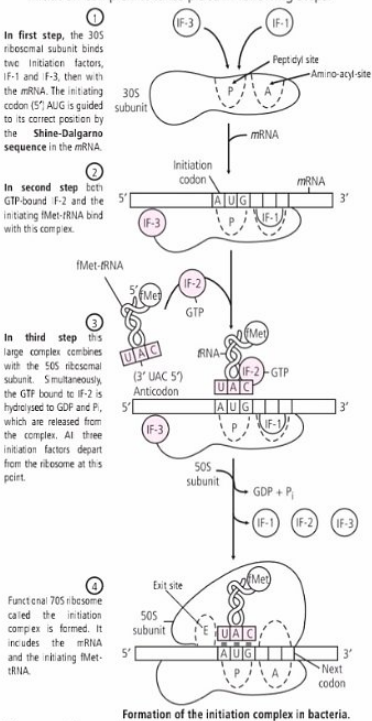


TRANSLATION

- It is a process in living cells in which the genetic information encoded in messenger RNA (mRNA) in the form of a sequence of nucleotide triplets (codons) is translated into a sequence of amino acids in a polypeptide chain during protein synthesis.
- Translation takes place in three steps.

Initiation

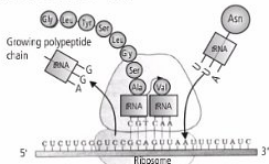
- The translation of *mRNA* begins with the formation of initiation complex. It takes place in following steps:



Elongation

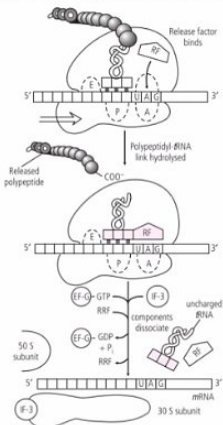
- In the first step of the elongation cycle, the appropriate incoming aminoacyl-tRNA binds to a complex of **GTP-bound EF-Tu**.
- The resulting aminoacyl-tRNA-EF-Tu-GTP complex binds to the **A site** of the 70S initiation complex.
- The GTP is hydrolysed and an EF-Tu-GDP complex is released from the 70S ribosome. The EF-Tu-GTP complex is regenerated in a process involving **EF-Ts** and **GTP**.
- In the next step, a **peptide bond** is formed between the two amino acids bound by their tRNAs to the **A and P sites** on the ribosome.

- This occurs by the transfer of the initiating N-formylmethionyl group from its tRNA to the amino group of the second amino acid, now in the A site.
- This reaction produces a dipeptidyl-tRNA in the A site and the now uncharged (deacylated) tRNA^{Met} remains bound to the P site. The enzymatic activity that catalyses peptide bond formation has been referred to as **peptidyl transferase**.
- In the **final step** of the elongation cycle (translocation), the ribosome moves one codon towards the 3' end of the *mRNA*.
- This movement shifts the anticodon of the dipeptidyl-tRNA from the A site to the P site, and shifts the deacylated tRNA from the P site to the E site, from where the **deacylated tRNA** is released into the **cytosol**.
- The third codon of the *mRNA* now lies in the A site and the second codon in the P site.



Termination

- Termination, is signalled by the presence of one of three **termination codons** in the *mRNA* (**UAA, UAG, UGA**), immediately following the final coded amino acid.



OPERON SYSTEM

- An operon is a part of genetic material (or DNA) which acts as a single regulated unit having one or more structural genes, an operator gene, a promoter gene, a regulator gene, a repressor and an inducer or corepressor (from outside.)

Table : Differences among regulator, operator, promoter and structural genes

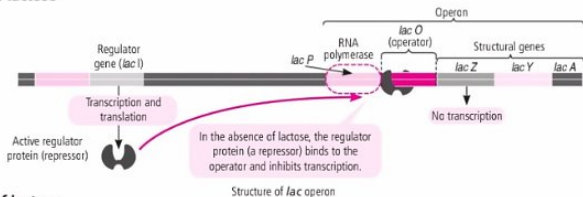
	Regulator Gene	Operator Gene	Promoter Gene	Structural Gene
1.	It controls the functioning of operator gene.	It determines the functioning of structural genes.	It is site for binding of RNA polymerase.	The gene is connected with transcription or formation of mRNA for synthesis of particular polypeptide.
2.	Regulator gene produces a repressor or aporepressor for blocking operator gene.	Operator gene functions only when it is not blocked by repressor.	It is functional only when operator gene allows passage of RNA-polymerase to structural genes.	Structural gene functions only when it receives complementary nucleotides and RNA polymerase.
3.	It is commonly a large gene.	The gene is small.	The gene is small.	The gene is moderately long to large depending upon the polypeptide to be synthesised.
4.	It functions through the formation of an mRNA of repressor.	It functions through the presence or absence of repressor.	It functions by providing recognition and binding sites for RNA polymerase.	It functions through the formation of mRNA for structural or enzymatic polypeptide.

Inducible Operon

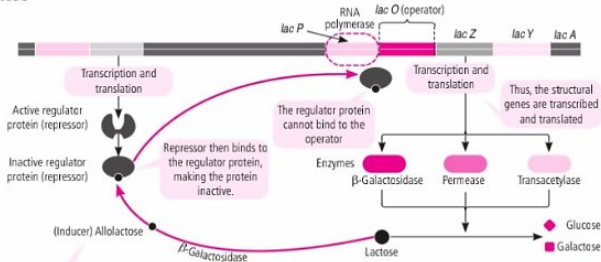
An inducible operon system is a regulated unit of genetic material which is switched on in response to the presence of a chemical (inducer). It is usually found in catabolic pathways.

The *lac* operon : The *lac* operon consists of the promoter (*P*) operator (*O*) sites and structural genes that code for the protein. The operon is regulated by the product of the regulatory gene (*I*).

(a) Absence of lactose



(b) Presence of lactose

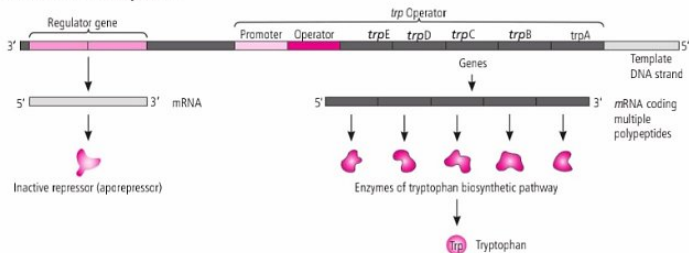


When lactose is present, some of it is converted into allolactose. When the inducer allolactose binds to the repressor protein, the inactivated repressor can no longer block transcription. The structural genes are transcribed, ultimately resulting in the production of the enzymes needed for lactose catabolism.

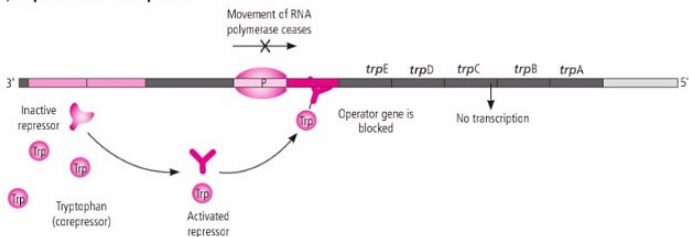
Repressible Operon

- Repression is blocking of the operator gene of operon through a complex repressor that is formed by union of aporepressor formed by regulator gene and corepressor, a product of anabolic pathway.

(a) In absence of corepressor



(b) In presence of corepressor



HUMAN GENOME PROJECT

- It is called **International Human Genome Sequencing Consortium** and is aimed at finding out all the genes in each of the human chromosomes determining their function and hopefully understanding how they together form the complete organism.
- The goals of the human genome project are as follows :
 - To develop a genetic linkage map of human genome by identifying thousands of genetic markers and mapping them in the genome.
 - To obtain a physical map of human genome by cloning genomic DNA into YACs and cosmids.
 - To sequence the entire human genome.
- The two factors that made this possible are :
 - Genetic engineering techniques, which made it possible to isolate and clone any segment of DNA.
 - Availability of simple and fast techniques, for determining the DNA sequences.

Methodologies of HGP

The methods involved two major approaches :

- One approach called as **Expressed Sequence Tags (ESTs)**, focussed on identifying all the genes that expressed as RNA.
- Second approach called as **Sequence Annotation**, was to simply sequence the whole set of genome, that included all the coding and non-coding sequences and later assigning functions to different regions in the sequences. The steps involved are as follows :

- The total DNA from the cell is isolated and converted into random fragments of relatively smaller sizes.
- These fragments are then cloned in suitable hosts using specialised vectors, the commonly used hosts are bacteria and yeast and the vectors are bacterial artificial chromosomes (BAC) and yeast artificial chromosomes (YAC).
- The fragments are then sequenced using automated DNA sequencers, which work on the principle developed by Frederick Sanger.
- The sequences were then arranged on the basis of certain overlapping regions present in them, this required the generation of overlapping fragments for sequencing.
- Specialised computer based programmes were developed for alignment of the sequences.
- These sequences were annotated and assigned to the respective chromosomes.
- The next task was to assign the genetic and physical maps on the genome. This was generated using the information on polymorphism of restriction endonuclease recognition sites and certain repetitive DNA sequences, called **microsatellites**.

Applications of HGP are as follows :

- (i) Having the complete sequence of human genome, will enable a radically new approach to biological research, *i.e.*, a systematic approach on a much broader scale.
- (ii) All the gene in a genome or all the transcripts in a particular tissue/organ/tumor can be studied.
- (iii) It will be possible to understand how the enormous number of genes and proteins work together in interconnected network in the chemistry of life.

DNA FINGERPRINTING

- DNA fingerprinting is a technique of determining certain nucleotide sequences, generally repeated sequences (Satellite DNA) in the human genome that produce a pattern of bands which is unique for every individual. The basis of DNA fingerprinting are short nucleotide repeats in DNA called the **Variable Number of Tandem Repeats** or **VNTRs** that vary in number from person to person, but are inherited.

Technique for DNA Fingerprinting

- DNA fingerprints can be prepared from extremely minute amounts of blood, semen, hair bulb or any other cells of the body. The major steps are as follows :
- DNA is extracted from the cells in high-speed refrigerated centrifuge. If the content of DNA is limited, it can be amplified by using polymerase chain reaction. DNA is cut into fragments with restriction enzymes and subjected to **restriction fragment length analysis**. These DNA fragments are separated through **gel electrophoresis**. The separated fragments can be visualised by staining them with a dye that fluoresces under ultraviolet radiation. Double-stranded DNA, is then spilt into single-stranded DNA using alkaline chemicals. Separated DNA sequences are transferred from gel onto a nitrocellulose or nylon membrane (**Southern blotting**). The nylon sheet is then exposed to probes or markers that are radioactive, synthetic DNA segments and complementary to known sequences. The probes target a specific nucleotide sequence, which is complementary to VNTR sequences and hybridise them. Lastly, X-ray film is exposed to the nylon sheet containing radioactive probes. Dark bands develop at the probe bound DNA sites. Thus, hybridised fragments are detected by **autoradiography** and the film developed represents **DNA fingerprint**.

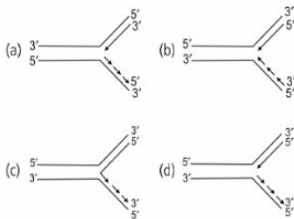
Applications of DNA Fingerprinting

- **Paternity / Maternity disputes** : For identifying the true (biological) father/mother, DNA samples of the child, mother and father are taken. The bands of child's DNA should match the DNA prints of the biological parents.
- **Identification of the criminal** : DNA fingerprints of suspects from blood or hair or semen picked up from the scene of crime are prepared and compared. The DNA fingerprint of the person matching the one obtained from sample obtained from the scene of crime can give a clue to the actual criminal.
- It is used to determine and study human lineages.
- It can be used to identify genes associated with hereditary disorders.
- It is useful in determining population and genetic diversities.

POWER EXERCISE

1. External supply of tryptophan in *Escherichia coli* brings about
- switching off of tryptophan operon
 - switching on of tryptophan operon
 - switching off of *lac* operon
 - switching on of *lac* operon.
2. Which of the following steps of translation does not consume a high energy phosphate bond?
- Peptidyl transferase reaction
 - Aminoacyl tRNA binding to A-site
 - Translocation
 - Amino acid activation

3. Which one of the following correctly represents the manner of replication of DNA?



4. Which DNA molecule among the following will melt at lowest temperature ?

- 5'-A-A-T-G-C-T-G-C-3'
3'-T-T-A-C-G-A-C-G-5'
- 5'-A-A-T-A-A-A-G-C-T-3'
3'-T-T-A-T-T-T-C-G-A-5'
- 5'-G-C-A-T-A-G-C-T-3'
3'-C-G-T-A-T-C-G-A-5'
- 5'-A-T-G-C-T-G-A-T-3'
3'-T-A-C-G-A-C-T-A-5'

5. *Escherichia coli* with completely radioactive DNA was allowed to replicate in non-radioactive medium for two generations. Percentage of bacteria with radioactive DNA is

- 50%
- 12.5%
- 100%
- 25%

6. The genetic code is called degenerate because
- one codon has many meanings
 - more than one codon has the same meaning
 - one codon has one meaning
 - there are 64 codons present.

7. Match the components of '*lac* operon' of *E. coli* given under Column I with their function listed in Column II. Choose the answer with correct combination of alphabets of the two columns.

Column I
(Components of '*Lac* operon')

Column II
(Function)

- | | |
|--------------------|--|
| i. Structural gene | p. Binding site for repressor protein |
| ii. Operator gene | q. Codes for repressor protein |
| iii. Promoter gene | r. Induces lactose transport from the medium |
| iv. Regulator gene | s. Codes for enzyme proteins |
| | t. Binding site for RNA-polymerase. |

(i) (ii) (iii) (iv)

- | | | | |
|-------|---|---|---|
| (a) q | t | p | r |
| (b) r | s | t | p |
| (c) s | p | t | q |
| (d) t | s | q | p |

8. Read the following statements and choose the correct option.

- RNA polymerase associates transiently with 'Rho' factor to initiate transcription.
 - In bacteria, transcription is coupled to translation.
 - RNA polymerase I is responsible transcription of tRNA.
 - When hnRNA undergoes capping process, adenylate residues are added at 3'-end.
 - hnRNA is the precursor of mRNA.
- Only II
 - II, III and IV
 - III and IV
 - II, IV and V

9. In *lac* operon if mutation occurs in the middle gene of the 'structural gene' then

- β -galactosidase will not be synthesised
- permease will not be synthesised
- transacetylase will not be synthesised
- lactose digestion will be rapid.

10. The result of the following reaction/experiment carried out by Avery *et al.* on *Streptococcus pneumoniae* has proved that DNA is the genetic material.

- Live 'R' strain + DNA from 'S' strain + DNase
- Heat killed 'R' strain + DNA from 'S' strain + DNase
- Live 'R' strain + DNA from 'S' strain + RNase
- Live 'R' strain + DNA of 'S' strain + protease.

11. A-DNA is
 (a) left handed helix with 12 nucleotide pairs per turn
 (b) right handed helix with 11 nucleotide pairs per turn
 (c) right handed helix with 12 nucleotide pairs per turn
 (d) left handed helix with 11 nucleotide pairs per turn.
12. An analysis of DNA (double-stranded) sample yielded 18% cytosine. What would be the percentage of other bases in this sample?
 (a) T-32%, A-32%, G-18%
 (b) T-32%, A-18%, G-32%
 (c) T-18%, A-32%, G-32%
 (d) T-40%, A-22%, G-20%
13. Which one of the following is correct?
 (a) Introns are present in mRNA and exons are present in rRNA
 (b) Codons are present in mRNA and anticodons in rRNA
 (c) Every intron is a set of three terminator codons.
 (d) Exons are present in eukaryotes while introns are present in prokaryotes.
14. During protein synthesis, AUG functions as the initiation codon in mRNA. What should be the anticodon on the tRNA molecule that picks up and brings the amino acid specified by the codon?
 (a) UAC (b) TAC
 (c) CAU (d) GUA
15. The enzyme required to catalyse the polymerisation of deoxynucleotides is
 (a) DNA ligase (b) DNA polymerase
 (c) β -galactosidase (d) transacetylase.
16. Experiments using N^{15} (heavy nitrogen) to confirm the semiconservative replication of DNA were carried out by
 (a) Meselson and Stahl (b) Hershey and Chase
 (c) Beadle and Tatum (d) Watson and Crick.
17. Reverse transcriptase is
 (a) RNA dependent RNA polymerase
 (b) DNA dependent RNA polymerase
 (c) DNA dependent DNA polymerase
 (d) RNA dependent DNA polymerase.
18. The term genome is used for the
 (a) diploid set of chromosomes
 (b) polyploid set of chromosomes
 (c) triploid set of chromosomes
 (d) haploid set of chromosomes.
19. Transcription is initiated, when RNA polymerase binds to
 (a) operator (b) structural genes
 (c) promoter (d) inducer.
20. Okazaki fragments are joined by enzyme
 (a) DNA helicase (b) DNA ligase
 (c) DNA polymerase II (d) RNA polymerase II.
21. Consider the following statements.
 The genetic codes said to be degenerate and universal, which means that
 I. amino acids may have more than one codon
 II. all amino acids have more than one codon
 III. codons are common for higher and lower organisms
 IV. codons are not found in bacteria.
Codes :
 (a) I, II and III are correct
 (b) I and II are correct
 (c) I, II and IV are correct
 (d) I and III are correct
22. Read the statements A and B and select the correct option.
Statement A : Synthesis of mRNA takes place in 5' - 3' direction.
Statement B : The DNA strand with polarity 5' \rightarrow 3' is called sense strand and takes part in transcription.
 (a) Both the statements are wrong.
 (b) Statement A is wrong, B is correct.
 (c) Statement B is wrong, A is correct.
 (d) Both the statements A and B are correct.
23. Aminoacylation of tRNA is essential for
 (a) replication of RNA
 (b) formation of peptide bond
 (c) splicing
 (d) initiation of transcription.
24. During the transcription, if nucleotide sequence of DNA strand, being coded is ATACG, then the nucleotide sequence of mRNA would be
 (a) UATGC (b) TATGC
 (c) UAUGC (d) TATGG.
25. A molecule to act as a genetic material has the following properties
 (i) should be able to replicate
 (ii) should be structurally more stable
 (iii) should be more reactive and labile
 (iv) should provide scope for slow changes.
 Choose the correct option.
 (a) (i), (ii) and (iii) are correct
 (b) (ii) alone is correct
 (c) (ii) and (iv) are correct
 (d) (i), (ii) and (iv) are correct.

ANSWER KEY

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

BIO

Digest

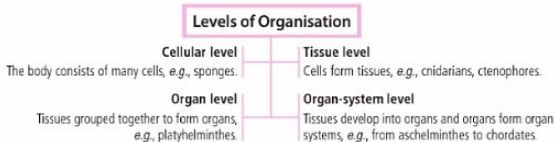
This article covers high yield facts of the given topic.

Animal Kingdom

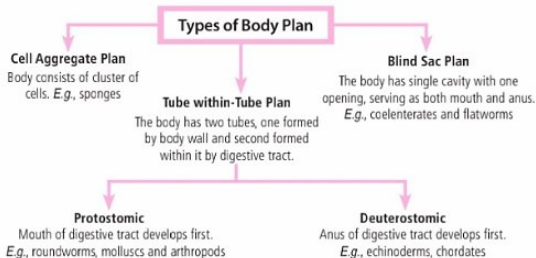
Although there are differences in structure and forms of different animals, yet there are common fundamental features in various individuals in relation to the arrangement of cells, body symmetry, nature of coelom, patterns of digestive, excretory, circulatory or reproductive systems. These features form basis of animal classification.

BASIS OF ANIMAL CLASSIFICATION

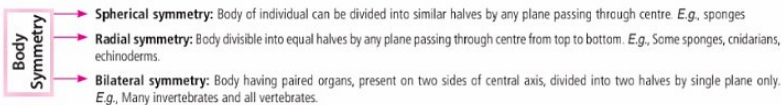
- Four levels of organisation found in animals are:



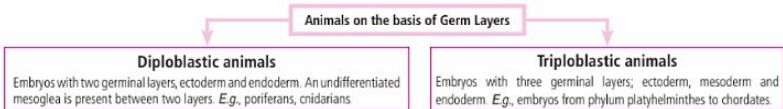
- Animals have three types of body plans:



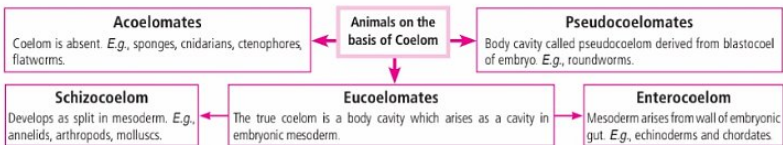
- Body symmetry is the similarity of parts in different regions and directions of the body.



- Animals are divided into two groups depending on the number of germinal layers:



- Animals are divided into three main groups on the basis of coelom (body cavity):



EXCLUSIVE FEATURES OF MAJOR PHyla

PHylum PORIFERA (The Sponges)

- Body wall consists of three layers:
 - Outer **pinacoderm**, consists of flattened pinacocytes and oval porocytes.
 - Inner **choanoderm**, having specialised flagellated collar cells or choanocytes, and
 - Gelatinous non-cellular **mesenchyme** in between. It consists of skeletal elements and amoebocytes.
- Canal system system consists of pores and canals for ingress and egress of water currents. In sponges, three types of canal systems are found:
 - Asconoid** canal system- simplest type, *e.g.*, *Leucosolenia*
 - Syconoid** canal system- more complex than ascon type *e.g.*, *Sycon*.
 - Leuconoid**- Most complex canal system, found in *Spongilla*.
- Development includes free swimming **amphiblastula** (in *Sycon*) and **parenchymula** (in *Leucosolenia*) larvae.

Classification: Phylum Porifera is divided into three classes

	Class	Skeleton	Examples
1.	Calcarea	Calcareous spicules	<i>Leucosolenia</i> , <i>Sycon</i> (Scypha)
2.	Hexactinellida	Siliceous spicules with six rays	<i>Euplectella</i> (The venus flower basket), <i>Hyalonema</i> (The glass rope sponge)
3.	Demospongiae	Skeleton of spongin fibres or spongin fibres with siliceous spicules	<i>Euspongia</i> (bath sponge), <i>Cliona</i> (boring sponge), <i>Spongilla</i> (fresh water sponge)

PHYLUM CNIDARIA

- Body wall comprises of outer epidermis, inner gastrodermis and non-cellular gelatinous mesoglea between two layers.
- Epidermis consists of **cnidoblasts** (stinging cells), cnidoblast has **nematocyst** (stinging organ) for defense and offence.
- **Statocyst**, a sense organ for balance, is developed for first time in Cnidaria.
- Holoblastic cleavage: In *Obelia*, planula larva is present, and in *Aurelia*, planula, scyphistoma and ephyra larvae are found.
- **Metagenesis**: In *Obelia*, polyps reproduce medusae asexually and medusae form polyps sexually, such alternation of sexual and asexual phase is called metagenesis.

Coelenterata

Divided into three classes on the basis of dominance of medusoid or polypoid phase in the life cycle.

Hydrozoa

Only polypoid or both polypoid and medusoid stages present. *E.g., Hydra, Obelia.*

Scyphozoa

Medusoid stage dominant. Polypoid stage either reduced or absent. *E.g., Aurelia.*

Anthozoa

Only polypoid stage is present. Medusoid stage is absent. *E.g., Adamsia.*

Physalia (The Portuguese-man-of-war): Exhibits polymorphism and division of labour. Three types of zooids and tentacles are found hanging down below pneumatophore:

- (a) **Dactylozooids** - organ of defense, secrete neurotoxic poison for catching food.
(b) **Gastrozooids** - nutritive zooids, and (c) **Gonozooids** - reproductive zooids.

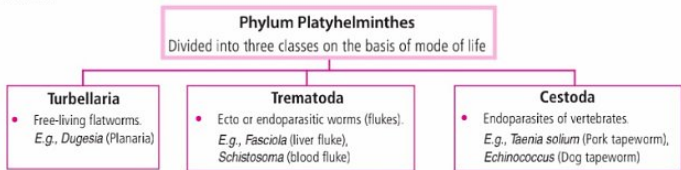
PHYLUM CTENOPHORA (The Comb Jellies or Sea Walnuts)

- Ctenophores show **bioluminescence**, the property of living organisms to emit light.
- External surface of body have comb like 8 ciliary plates, called **comb plates** for locomotion.
- Nematocysts are absent. Instead, special adhesive and sensory cells, called **colloblasts** or **lasso cells** are present on tentacles for capturing food and prey.
- Development includes **cydippid** larva.
- Examples : *Pleurobrachia, Beroe.*

PHYLUM PLATYHELMINTHES (The Flat worms)

- The flat worms are mostly parasites, but some are free-living.
- Excretion through **flame cells (solenocytes/protonephridia)**.
- Larval stages in life cycle of liver fluke are **miracidium, sporocyst, redia, cercaria** and **metacercaria**. In tapeworm, **oncosphere, hexacanth** and **cysticercus** larvae are found.

Classification



Peculiar features of parasitic platyhelminthes:

- The thick tegument (body covering) resistant to the host's digestive enzymes and anti-toxins.
- Adhesive organs like suckers in flukes and the hooks and suckers in tapeworms for a firm grip on or in the host's body.
- Loss of locomotory organs and sense organs.
- Absence of digestive organs in tapeworms as digested and semidigested food of the host is directly absorbed through the body surface.

PHYLUM ASCHELMINTHES (The Roundworms)

- Body wall consists of nonliving, resistant cuticle, **syncytial epidermis** and muscle layer (longitudinal muscles only).
- Sense organs include (i) **Papillae** - tactile in function (ii) **Amphids** - chemoreceptors (iii) **Phasmids** - glandulosensory in nature.
- Indirect development includes following larval stages- **filariform** larva in *Ancylostoma* (hook worm), **microfilaria** larva in *Wuchereria* (filarial worm) and **rhabditiform** larva in *Ascaris* and *Enterobius*.

Ascaris lumbricoides - An endoparasite of small intestine of human beings.

Table: Differences between male and female *Ascaris*

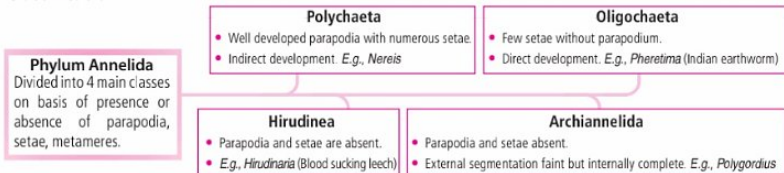
Male		Female
It is smaller than female.	<p>Fig.: <i>Ascaris lumbricoides</i>, Adult worms in lateral view, A - Male, B - Female</p>	It is larger than male.
Posterior end is curved.		Posterior end is straight.
A cloaca, for receiving anus and genital opening is present. The cloaca opens outside through cloacal aperture.		There are separate anus and genital apertures. No cloaca is present.
Two equal chitinous spicules (pineal setae) project through cloacal aperture.		Spicules (pineal setae) are absent.

Wuchereria - (The filarial worm) - An endoparasite in lymphatic vessels and lymph nodes of human beings (primary host). The mosquito (*Culex*) is an intermediate host. It causes **elephantiasis** (= Filariasis), in which limbs or other body parts grow to enormous size.

PHYLUM ANNELIDA (The segmented animals)

- **Metameric segmentation**- Body divided externally (by annuli) and internally (by transverse septa) into true segments or metameres.
- Presence of **closed** blood vascular system. Blood is red due to presence of pigment **haemoglobin** or **erythrocrurin**.
- Excretory system consisting of metamericly disposed coiled tubes, called **nephridia**.
- Receptors include **tactile receptors** (sensitive to touch), **gustatoreceptors** (taste receptors) and **photoreceptors** (sensitive to light). Some forms have **statocysts** (balancing organs).
- Mostly show direct development but indirect development includes **trochophore** larva.

Classification



PHYLUM ARTHROPODA (Animals with jointed feet or appendages)

- Body is covered with thick, tough, non-living chitinous cuticle, which forms exoskeleton. Comprises of **haemocoel**.
- Respiratory organs are **gills** or **book gills** in aquatic forms and **tracheae** or **book-lungs** in terrestrial forms.
- Excretory organs are either **green glands** or **Malpighian tubules**.

Classification : The Phylum Arthropoda is divided into seven classes

Class	Body Division	Appendages	Examples
1. Crustacea	Body divisible into cephalothorax and abdomen.	2 pairs of antennae and a pair of stalked compound eyes.	<i>Palaemon</i> (Prawn)
2. Chilopoda	Body divisible into head and trunk.	Single pair of antennae. Each trunk segment bears a pair of legs. First pair of legs are modified into poison claws.	<i>Scolopendra</i> (Centipede)
3. Diplopoda	Body is divided into head, thorax and abdomen.	Single pair of antennae. Each thoracic segment bears a pair of legs (except first segment). Each abdominal segment has two pairs of legs.	<i>Julus</i> (Millipede)
4. Insecta	Body is divided into head, thorax and abdomen.	A pair of antennae and a pair of compound eyes. Thorax has 3 segments with 3 pairs of legs and 2 pairs of wings.	Silver fish, cockroach, bed bug, wasp etc.
5. Arachnida	Body divisible into cephalothorax and abdomen.	Cephalothorax bears simple eyes and 6 pairs of appendages (one pair of chelicerae, one pair of pedipalpi and four pair of legs). Antennae are absent.	Scorpion, spider, tick, mite
6. Merostomata	Body divided into cephalothorax and abdomen.	5-6 pairs of abdominal appendages with book gills.	<i>Limulus</i> (King crab) living fossil
7. Onychophora		Single pair of antennae, eyes and jaws.	<i>Peripatus</i> (Connecting link between Annelida and Arthropoda)

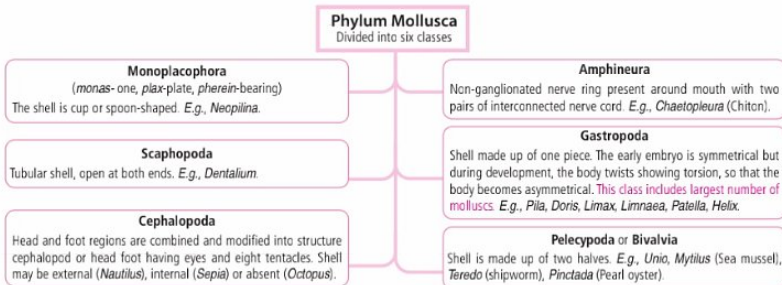
Economically important insects- *Apis* (Honey bee), *Bombyx* (silkworm), *Laccifer* (lac insect)

Vectors- *Anopheles*, *Culex* and *Aedes* (mosquito) **Gregarious pest -** *Locusta* (locust)

PHYLUM MOLLUSCA (Soft bodied animals)

- Body of molluscs is unsegmented with distinct head, muscular foot and visceral hump.
- **Shell** secreted by mantle is made up of calcium carbonate.
- **Mantle** (Pallium) is thin, fleshy fold of dorsal body wall more or less covering the body.
- Blood is usually blue due to presence of a copper containing blue respiratory pigment **haemocyanin**.
- Sense organs are **statocysts (balancing organs)** and **osphradium** for testing chemical and physical nature of water.
- Oviparous and indirect development includes **veliger, trocophore** or **glochidium** larvae.

Classification



PHYLUM ECHINODERMATA (Spiny skinned animals)

- **Ambulacral system** (Water vascular system) is an exclusive feature of Phylum Echinodermata.
- Water vascular system is of coelomic origin. A perforated plate called **madreporite** is present in this system. The pores of the madreporite allow water into the system. Most peculiar and interesting role of water vascular system is to bring out locomotion by providing hydraulic pressure mechanism.
- Tube feet help in anchoring the body to the substratum, capturing and handling food and respiratory exchange of gases through thin walls.
- Echinoderms bears spines and **pedicellariae**. Spines are protective in function while the pedicellariae keep the body surface clear of debris and minute organisms.

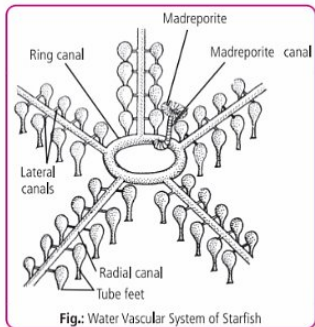


Fig.: Water Vascular System of Starfish

Classification

Phylum Echinodermata Divided into five classes

Astroidea (Star fishes or sea stars)

Body star like, five arms not sharply marked off from central disc. Larval forms are **Bipinnaria** and **Brachiolaria**. E.g., *Asterias* (starfish), *Pentaceros*

Ophiuroidea (Brittle stars)

Star like body, arms sharply marked off from central disc. Ambulacral grooves and pedicellariae are absent. **Ophioputeus larva**. E.g., *Ophiothrix*, *Ophiura*.

Echinoidea (Sea urchins)

Globular or disc like body. Biting and chewing apparatus with teeth called **Aristotle's Lantern** is present. Ambulacral grooves are absent. **Puteus** and **Echinoputeus larva**. E.g., *Echinus* (Sea urchin), *Clypeaster* (cake urchin).

Holothuroidea (Sea cucumbers)

Elongated and cylindrical body. Ambulacral grooves, spines and pedicellariae are absent. Larval forms are **Auricularia** and **Doliolaria**. E.g., *Holothuria*, *Cucumaria*.

Crinoidea (Sea lilies)

Body has central disc, which is attached to substratum. Spines, pedicellariae and madreporite are absent. **Doliolaria larva**. They are commonly called feather stars or sea lilies. E.g., *Antedon* (feather star).

PHYLUM HEMICHORDATA

- Exclusively marine. Body divisible into proboscis, collar and trunk.
- Excretion occurs through single proboscis gland or glomerulus situated in proboscis.
- Indirect development through free swimming **tornaria larva**.
- E.g., *Balanoglossus*, *Saccoglossus* and *Rhabdopleura*.

Balanoglossus (Acorn or Tongue worm)- Marine animal, lives in U-shaped burrows in bottom sand. It feeds on organic matter ingested along with sand. It is unisexual and shows external fertilisation.

CHORDATES

Diagnostic characters of chordates

All chordates possess 4 diagnostic characters either in the embryonic or adult stage.

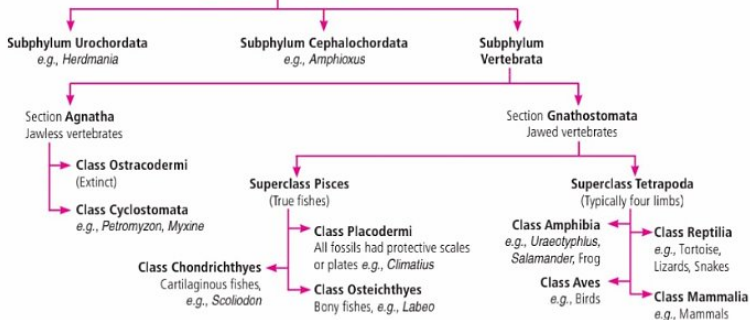
Notochord
Solid, unjointed, flexible rod-like structure on dorsal side of body.

Pharyngeal gill slits
Gill slits on lateral sides of pharynx at some stage of life.

Dorsal hollow nerve cord
Always hollow and lies dorsal to the notochord

Tail
Post-anal part of body, reduced or absent in many adult chordates.

Phylum Chordata



SUB-PHYLUM UROCHORDATA

- This sub-phylum is also called **Tunicata**, because the adult body is enclosed within leathery **test** or **tunic** formed of cellulose like substance **tunicin**.
- The notochord and dorsal tubular nerve cord are found only in larval stage.
- The larva is motile and undergoes retrogressive metamorphosis i.e., change from better developed larva to less developed adult.
- E.g., *Herdmania* (sea squirt), *Ascidia*, *Doliolum*, *Salpa*.

SUB-PHYLUM CEPHALOCHORDATA

- The notochord and tail persist throughout the life.
- Pharyngeal gill slits are more numerous and better developed.
- Shows progressive metamorphosis.
- E.g., *Branchiostoma*, *Amphioxus*.

SUB-PHYLUM VERTEBRATA OR CRANIATA

- Have cranium around brain.

- Notochord present only in embryonic stage and is replaced by vertebral column in adult forms.
- Nervous system consists of CNS, PNS and ANS.
- No asexual reproduction.

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Super Class Pisces (Bears fins)

True fishes

- Fishes are cold blooded (poikilothermic or ectothermic).
- Heart is 2 chambered (one auricle and one ventricle).
- Most forms are oviparous or ovoviviparous.

	Characteristics	Chondrichthyes (Cartilaginous fishes)	Osteichthyes (Bony fishes)
1.	Habitat	Mostly marine	Both marine and freshwater
2.	Scales	Placoid scales	Cycloid, ctenoid and ganoid scales
3.	Caudal fin	Heterocercal-asymmetrical	Homocercal-symmetrical
4.	Mouth	Ventrally placed. Digestive tract leads into the cloaca.	The mouth is terminal. Digestive tract leads into anus, cloaca is absent.
5.	Fertilisation	Internal	External
6.	Chief nitrogenous waste	Urea	Ammonia
7.	Examples	<i>Torpedo</i> (Electric ray), <i>Trygon</i> (Sting ray), <i>Scoliodon</i> (Dog fish).	<i>Labeo rohita</i> (Rohu), <i>Exocoetus</i> (flying fish), <i>Anguilla</i> (fresh water eel)

Class Amphibia (Vertebrates with dual life)

- Amphibians in nature, i.e., can live both on land as well as in water. They are ectothermic (cold blooded).
- Skull is **dicondylic**, i.e., two occipital condyles for articulation with vertebral column.
- The respiratory organs are lungs, buccopharyngeal cavity, skin and gills.
- The heart is 3 chambered, having 2 auricles and 1 ventricle. RBCs are oval, biconvex and nucleated.
- Fertilisation is external and are oviparous. However in Salamander, fertilisation is internal and is viviparous.

Classification

Amphibians

Divided into three orders

Apoda

- Blind worms
- Limbless, scales present. E.g., *Ichthyophis*

Urodela

- Tail present
- E.g., *Necturus*, *Salamandra*

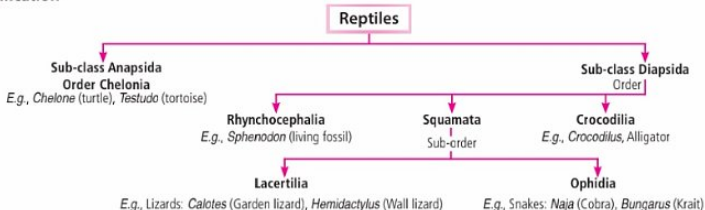
Anura

- Tail absent
- E.g., *Rana*, *Hyla*, *Bufo*, *Xenopus*

Class Reptilia (Creeping vertebrates)

- Creeping and burrowing vertebrates, with rough and dry skin bearing epidermal scales.
- Respiration takes place through lungs.
- Heart consists of 3 chambers (2 auricles and a partially divided ventricle). In crocodiles, heart is four chambered (2 auricles and 2 ventricles). RBCs are nucleated.
- Crocodiles are ammonotelic, turtles and alligators are ureotelic and lizards and snakes are uncutelic.

Classification

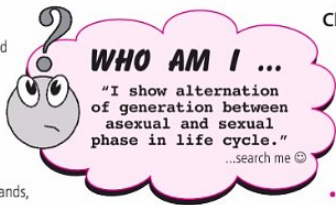


Class Aves

- Birds are bipedal, feathered and warm blooded animals.
- Fore limbs are modified into wings and hind limbs are used for walking, swimming or perching, etc.
- Skin is dry and without glands, except for the presence of **urophygial gland** (oil or preen gland) at the base of tail.
- The upper and lower jaws are modified into beak, which lacks teeth.
- The alimentary canal has additional chambers, the **crop** and **gizzard**. The crop stores and softens the food while gizzard helps in crushing and churning the food.
- Air sacs are connected to lungs for supplement respiration. Voice is produced by special organ **syrix**.
- Fully ossified (bony) endoskeleton with hollow, pneumatic bones to reduce weight. Sternum with a median **keel** for attachment of flight muscles.

Flightless Birds- Ostrich, Rhea, Emu, Kiwi, Cassowary, Penguin, Dodo (extinct).

Flying Birds- *Corvus* (crow), *Psittacula* (Parrot), *Columba* (Pigeon), *Pavo* (Peacock).



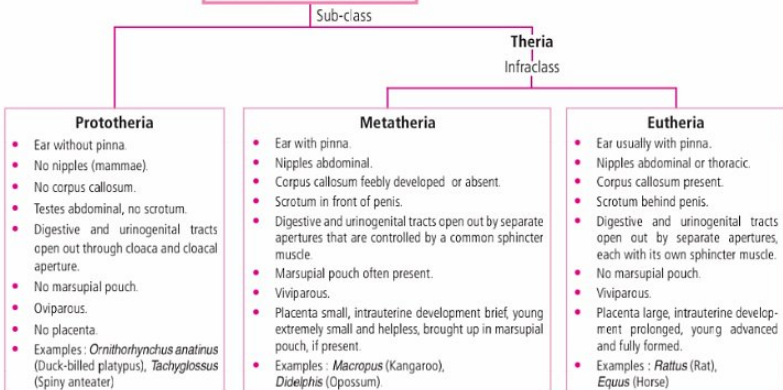
Class Mammalia

- Mammals are warm blooded (homoiothermous), hairy and have mammary or milk producing glands. They are the only animals to nourish their young ones with milk.
- **Sebaceous** glands (oil glands) and **sudoriferous** glands (sweat glands) are present.
- Dentition is **heterodont** (different types of teeth), **thecodont** (embedded in sockets of jaws) and **diphyodont** (develop twice during lifetime).
- Possess muscular diaphragm, dividing trunk into thorax and abdomen.
- Heart is four chambered (2 auricles and 2 ventricles). RBCs are enucleated.
- Viviparous and well developed placenta, except in egg laying mammals.

Examples - Oviparous - *Ornithorynchus* (Duck billed platypus), *Echidna* (Spiny anteater)

Viviparous - *Macropus* (kangaroo), *Macaca* (monkey), *Rattus* (rat), *Felis* (cat), *Panthera tigris* (tiger) etc.

Classification of Mammals



Some of the principal orders of placental mammals are:

Insectivora

- Primitive placental mammals with abdominal testes
- Sharp teeth, prolonged snout, plantigrade feet with claws
- E.g., *Talpa micra* (Mole), *Crocidura murina* (Musk shrew), *Sorex* (Shrew), *Paraechinus* (Hedgehog).

Lagomorpha

- Upper jaw contains two pairs of incisors while lower jaw has one pair of them.
- Pinnae are large.
- Diastema occur.
- E.g., *Oryctolagus* (Rabbit), *Lepus* (Hare).

Carnivora

- Large canines, powerful jaws and claws.
- Mammary are abdominal
- Testes descend into scrotal sac.
- E.g., *Panthera leo* (Lion), *Panthera tigris* (Tiger), *Panthera pardus* (Panther), *Felis domestica* (Cat), *Canis lupus* (Wolf).

Chiroptera

- Forelimbs are modified into wings (patagium).
- Nocturnal, arboreal.
- Toothless
- E.g., *Pteropus* (Large bat or Flying fox), *Desmodus* (Vampire bat).

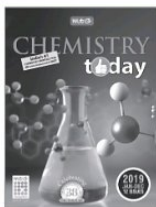
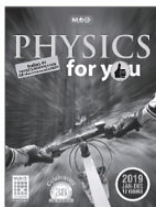
Rodentia

- Sharp chisel like incisors growing throughout life.
- Diastema in the jaw.
- Testes abdominal
- E.g., *Rattus* (Rat), *Mus musculus* (Mouse).

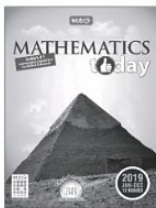
Primates

- Highly developed brain.
- Long limbs.
- Large convoluted cerebral hemispheres.
- Forwardly directed eyes, binocular vision.
- First digit usually opposable – an adaptation for grasping.
- E.g., Lemur, Tarsiers, Monkey, Apes, Man

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- 2 Application question or question which requires 2 or 3 concepts - indicated by 2 fingers.
- 3 Application question or question which requires 3 or more concepts - indicated by 3 fingers.

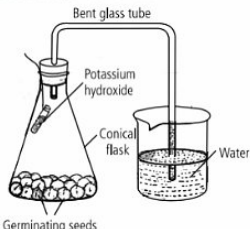
UNIT-V : PLANT PHYSIOLOGY

CHAPTER-14 : RESPIRATION IN PLANTS

Multiple Choice Questions

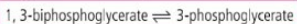
1. In electron transport system within the inner mitochondrial membrane, complex II and complex III respectively are
 - (a) NADH-Q reductase and succinate Q-reductase
 - (b) succinate-Q reductase and QH₂-cytochrome c reductase
 - (c) NADH-Q reductase and succinate - Q reductase
 - (d) succinate-Q reductase and cytochrome c oxidase.
2. How much amount of energy will be liberated from 2 mole of glucose through cellular respiration?
 - (a) 686 kcal
 - (b) 1372 kcal
 - (c) 870 kcal
 - (d) 2870 kcal
3. Which of the following statement(s) is/are correct?
 - (i) Toxic products like ammonia are produced by protoplasmic respiration.
 - (ii) In anaerobic respiration, more substrate is decomposed, as a result little part of it is left for growth and repair in plants.
 - (iii) A plant growth is maximum at compensation point because there is very little loss of organic matter due to respiration.
 - (iv) The gas exchange demand is very high in plants and each plant part takes care of its own gas exchange needs.
 - (a) (i) and (iii)
 - (b) (iii) and (iv)
 - (c) (i) and (ii)
 - (d) (iv) only

4. In the given experiment, test tube containing potassium hydroxide is suspended so that



- (a) oxygen released by germinating seeds is absorbed, creating a partial vacuum that causes the rise of water in the beaker
 - (b) carbon dioxide released by the germinating seeds is absorbed, creating a partial vacuum that causes the rise of water in bent tube
 - (c) water vapour is absorbed creating a partial vacuum that causes the rise of water in the beaker
 - (d) oxygen present in the conical flask is completely absorbed to create anaerobic condition.
5. If C₄H₆O₅ is broken down as respiratory substrate under aerobic conditions, the respiratory quotient will be
 - (a) more than one
 - (b) equal to one
 - (c) less than one
 - (d) zero.

6. The given reaction is completed in the presence of



- (a) triose phosphate isomerase
- (b) phosphoglycerate kinase, Mg^{2+}
- (c) phosphoglycerate mutase, K^{+}
- (d) phosphofructokinase.

7. The complete oxidation of pyruvate by the stepwise removal of all the hydrogen atoms, give rise to

- (a) two molecules of NADPH
- (b) two molecules of $FADH_2$
- (c) two molecules of CO_2
- (d) four molecules of NADH.

8. Select the incorrect pair of statements about the common process of aerobic and anaerobic respiration.

- (i) It is the process of complete oxidation of glucose.
 - (ii) Two molecules of pyruvic acid are produced through the process.
 - (iii) The entire process is mediated by ten enzymes.
 - (iv) Net gain of 3ATP and 2NADH, is achieved during the process.
- (a) (i) and (ii)
 - (b) (ii) and (iii)
 - (c) (i) and (iii)
 - (d) (i) and (iv)

9. Select the correct sequence of formation of intermediates in Krebs' cycle.

- (a) Isocitrate \rightarrow α -Ketoglutarate \rightarrow Oxalosuccinate \rightarrow Succinyl CoA
- (b) Oxalosuccinate \rightarrow Isocitrate \rightarrow α -Ketoglutarate \rightarrow Succinyl CoA
- (c) Isocitrate \rightarrow Oxalosuccinate \rightarrow α -Ketoglutarate \rightarrow Succinyl CoA
- (d) Oxalosuccinate \rightarrow α -Ketoglutarate \rightarrow Succinyl CoA \rightarrow Isocitrate

10. Which of the following steps is associated with NADH formation during TCA cycle?

- (a) Acetyl CoA \rightarrow Citrate
- (b) Citrate \rightarrow *cis* Aconitate
- (c) Isocitrate \rightarrow Oxalosuccinate
- (d) Succinyl CoA \rightarrow Succinate

11. If both fatty acids and carbohydrates are available to muscles, which will be consumed first during respiration?

- (a) Carbohydrates
- (b) Fatty acids
- (c) Both at the same time
- (d) None of these

12. (i) is found in aerobic respiration towards the end of the (ii) process.

- | | |
|------------------------|-----------|
| (i) | (ii) |
| (a) Glycolysis | anaerobic |
| (b) Terminal oxidation | catabolic |
| (c) Glycolysis | catabolic |
| (d) Terminal oxidation | anaerobic |

13. Consider the following statements and select the correct option.

- (i) Acetaldehyde is reduced to ethyl alcohol or ethanol by alcohol dehydrogenase in yeasts during anaerobic condition.
 - (ii) Succinyl CoA, produced during glycolysis, forms cytochrome and chlorophyll.
 - (iii) Enzyme fumarase helps to convert fumarate into malate by addition of one molecule of water.
 - (iv) Fermentation generally utilises NADH produced during glycolysis.
- (a) (i) and (ii) are incorrect.
 - (b) (ii), (iii) and (iv) are incorrect.
 - (c) (iii) and (iv) are incorrect.
 - (d) Only (ii) is incorrect.

14. Antimycin A is a respiratory poison that inhibits

- (a) electron transport chain
- (b) formation of phosphoenol pyruvate
- (c) oxidation of glyceraldehyde 3-phosphate
- (d) formation of acetyl CoA from pyruvic acid.

15. How many protons are used up for synthesis of one ATP molecule during electron transport chain?

- (a) 2
- (b) 3
- (c) 5
- (d) 10

Match The Columns

16. Match Column I with Column II.

- | Column I | Column II |
|---------------------------|----------------------------------|
| A. Lactic acid | (i) Respiratory quotient |
| B. Respirometer | (ii) Oxidative decarboxylation |
| C. Pyruvate dehydrogenase | (iii) Muscle fatigue |
| D. Cytochromes | (iv) Isomerisation |
| E. Phosphoglyceromutase | (v) Inner mitochondrial membrane |

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

- | Column I | Column II |
|--------------------------------|---------------------------------|
| A. Fructose 1,6-biphosphate | (i) Aconitase |
| B. Fumarate | (ii) $FADH_2$ |
| C. Fermentation | (iii) Zymosis |
| D. Cytochrome <i>c</i> oxidase | (iv) Aldolase |
| E. Citrate | (v) Succinate |
| | (vi) Glyceraldehyde 3-phosphate |
| | (vii) Lactic dehydrogenase |
| | (viii) Cytochrome <i>a</i> |
| | (ix) <i>cis</i> aconitate |
| | (x) Electron transport chain |

Passage Based Questions

18. (A) Complete the given passage with appropriate words or phrases.

Glycolysis is the (i) stage of breakdown of (ii) through a series of (iii) enzyme mediated reactions. Glycolysis has two phases : (iv) and (v). In glycolysis, (vi) molecules of ATP are consumed during formation of fructose 1,6-bisphosphate from glucose and (vii) molecules of ATP are produced by substrate level phosphorylation. (viii) molecules of NADH are also formed. Oxygen is (ix) for glycolysis.

- (B) Read the given passage and correct the errors, wherever present.

In fermentation, the incomplete oxidation of glucose is achieved under aerobic conditions. The two common products are ethanol and pyruvic acid. It is normal mode of respiration of plants. Less quantity of O_2 is evolved and there is no requirement of peroxisomes. 686 kcal of energy are formed per gm mole of glucose. NADH produced during Krebs' cycle is used up.

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.

19. **Assertion :** Yeast produces ethyl alcohol during anaerobic respiration.

Reason : Accumulation of alcohol, produced by fermentation, beyond a certain limit can kill the microorganism.

20. **Assertion :** About 50% of the energy liberated during cellular respiration is used for synthesis of biomolecules and other life activities.

Reason : Energy is liberated in controlled fashion in several steps and is mostly stored in ATP.

21. **Assertion :** An intermediate RQ value is obtained where an organism is undergoing both aerobic and anaerobic respiration.

Reason : RQ values indicate that living organisms always use a single respiratory substrate.

22. **Assertion :** 3-phosphoglycerate is changed to 2-phosphoglycerate by isomerisation during glycolysis.

Reason : Isomerisation of 3-phosphoglycerate is an energy spending phase of glycolysis.

23. **Assertion :** F_1 particles are present in the inner mitochondrial membrane.

Reason : An electron gradient formed on the inner mitochondrial membrane forms ATP.

24. **Assertion :** The passage of electrons in electron transport chain is a downhill journey.

Reason : Electron passes from one enzyme to the next with a loss of energy at each step.

25. **Assertion :** Substrate level phosphorylation is not present in Krebs' cycle.

Reason : Substrate level phosphorylation requires electrons to move through electron transport chain.

26. **Assertion :** Oxidative phosphorylation is linked to terminal oxidation of reduced coenzymes NADH and $FADH_2$ in respiration.

Reason : The coenzymes release electrons that pass over a series of carriers in electron transport chain.

27. **Assertion :** Fats are used as respiratory substrates by a number of organisms.

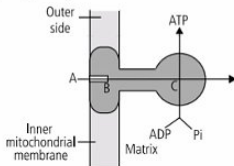
Reason : Fats contain more energy as compared to carbohydrates.

28. **Assertion :** Glycolysis uses oxygen as terminal oxidant.

Reason : Glycolysis is connected with oxidative phosphorylation.

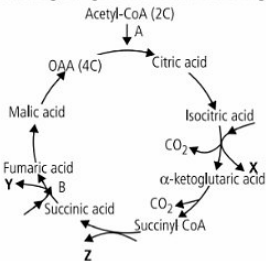
Figure Based Questions

29. Study the given figure and answer the following questions.



- (a) Identify A, B and C in the given figure.
 (b) How does a proton gradient develop in the system?
 (c) At which condition will C produce ATP?

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



- (a) Identify X, Y and Z in the given figure.
 (b) Give the reactions and also identify A and B in the given figure.
 (c) In the given cycle, how many times oxidative decarboxylation takes place? Explain.

CHAPTER-15 : PLANT GROWTH AND DEVELOPMENT

Multiple Choice Questions

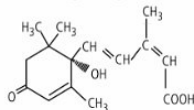
1. The growth curve of meristematic cells at growing tip of a plant and an embryo will be
 (a) linear and Y-shaped respectively
 (b) J-shaped and Y-shaped respectively
 (c) Y-shaped and J-shaped respectively
 (d) linear and J-shaped respectively.
2. Naphthalene acetic acid is applied on an apple tree. The tree will produce
 (a) more dwarf shoots and more apples
 (b) more long branches and more apples
 (c) long root for deep penetration within soil
 (d) less side branches and more apical growth.
3. Which of the following is not true about gibberellins?
 (i) Mevalonic acid is a precursor for GA synthesis.
 (ii) A mixture of GA₄ and GA₇ is used commercially.
 (iii) Transport is both basipetal and acropetal.
 (iv) A single plant possesses only one kind of GA.
 (a) (i) and (ii) (b) (ii) and (iii)
 (c) (iii) and (iv) (d) (iv) only
4. Read to the given statements and identify X, Y and Z.
 (i) X delays the senescence of leaves and other organs by mobilisation of nutrients.
 (ii) Spraying of Y on sugarcane crop increases length of stem and yield of sugarcane.
 (iii) Z increases resistance of plants to cold and other types of stresses.
 (a) X-Auxin; Y-Gibberellin; Z-Ethylene
 (b) X-Cytokinin; Y-Gibberellin; Z-Abscissic acid
 (c) X-Gibberellin; Y-Auxin; Z-Cytokinin
 (d) X-Ethylene; Y-Cytokinin; Z-Auxin
5. The critical period of a long day plant is 9 hrs. Four potted plants of the same species are exposed with different light periods.

Potted plant	Photoperiod
I	10 hrs.
II	8 hrs
III	11 hrs.
IV	15 hrs.

Which plants would show flowering after exposure?

- (a) I and III only (b) I, III and IV only
 (c) III and IV only (d) II only

6. Apical bud of a tea plant is plucked and painted with a paste of auxin at the cut portion. It will cause
 (a) dense bushy growth of the plant
 (b) less number of lateral buds
 (c) early flowering of the plant
 (d) increased number of leaves.
7. *Chrysanthemum* is a short day plant with a critical day length of 15 hrs. Under which of the following condition the plant will flower?
 (a) Normal seedling with 16 hrs. photoperiod.
 (b) Defoliated seedling with 12 hrs. photoperiod.
 (c) Seedling with one intact leaf in 12 hrs. photoperiod.
 (d) Defoliated seedling with 15 hrs. photoperiod.
8. Minimum vegetative growth, required for the plant to produce flower in *Xanthium* is represented by
 (a) 8-leaved stage (b) 7-leaved stage
 (c) 5-leaved stage (d) there is no such limit.
9. Initial size of a leaf was 50 cm². In one day time period it is increased upto 55 cm². What is the absolute growth rate of the leaf?
 (a) 5 cm²/day (b) 55 cm²/day
 (c) 0.5 cm²/day (d) 0.5 cm²/hr
10. Which of the following statements is/are correct related to the compound in the given figure?



- (i) It stops mitosis in vascular cambium towards the approach of winter.
 (ii) It is known to promote flowering in long day plants.
 (iii) It increases transpiration rate by opening of stomata.
 (iv) It induces a positive surface potential on cell membrane.
 (a) (i), (ii) and (iii) (b) (ii) and (iv)
 (c) (i), (ii) and (iv) (d) (i) and (iv)
11. In *Hyoscyamus niger*, the low temperature required for inducing flowering is
 (a) 0° – 5°C (b) 3° – 17°C
 (c) 12° – 18°C (d) 0° – 2°C
12. Critical photoperiod of plant X is 12 hrs. Now in one set of plants, the night phase is interrupted by red light and in another set of plants night phase is interrupted first by red light and then by far red light. In first condition plants do not produce flower but in second condition plant produce flower. X is a
 (a) short day plant (b) long day plant
 (c) day neutral plant (d) short night plant.

13. Which of the following growth regulator promotes rapid elongation of leaf bases and internodes in deep water rice plant?

- (a) GA (b) IAA
(c) Ethylene (d) ABA

14. A set of tomato plants with minimum vegetative growth are exposed to certain given conditions.

- (i) Continuous night phase
(ii) Night phase interrupted by red light
(iii) Night phase interrupted first by red light and then by far red light

In which of the given conditions flowering will occur?

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

15. _____ inhibits gibberellin mediated amylase formation during germination of cereal grains.

- (a) ABA (b) Zeatin (c) NAA (d) 2,4-D

Match The Columns

16. Match Column I with Column II.

- | Column I | Column II |
|--------------------|-----------------------|
| A. IAA | (i) SDP |
| B. <i>Xanthium</i> | (ii) Coconut milk |
| C. Cucumber | (iii) Tryptophan |
| D. Spinach | (iv) LDP |
| E. Cytokinin | (v) Day neutral plant |

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

- | Column I | Column II |
|------------------|----------------------------------|
| A. Gibberellin | (i) Epicotyl hook formation |
| B. Auxin | (ii) Phytochrome |
| C. Ethylene | (iii) Vernalin |
| D. Photoreceptor | (iv) Avena curvature bioassay |
| E. Vernalisation | (v) Barley endosperm bioassay |
| | (vi) Low temperature |
| | (vii) NAA |
| | (viii) Bolting in rosette plants |
| | (ix) Ethephon |
| | (x) Root growth inhibition assay |

Passage Based Questions

18. (A) Complete the given passage with appropriate words or phrases.

(i) is the universal natural auxin present in plants. Natural auxin passes from (ii) to the region of (iii). Movement of auxin is (iv) which is (v) in stem and (vi) in root. In higher concentration, auxin (vii) growth. In an old senescent leaf, an external application of auxin promotes (viii). It is due to triggering of (ix) biosynthesis. Both auxin and (ix) hasten the (x) formation in senescent leaf.

(B) Read the given passage and correct the errors, wherever present.

The long day plants come to flower after receiving photoperiod below a critical length. These plants also called long night plants because they require darkness above a critical level. They can flower under complete darkness. Flowering is inhibited if dark period is interrupted by light. Supply of auxins induce flowering in many cases under inductive photoperiods.

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.

19. **Assertion :** Abscisic acid is known as dormin.
Reason : Abscisic acid is employed for breaking of seed and bud dormancy.
20. **Assertion :** Genetically male plants of *Cannabis* can be induced to produce female flowers in the presence of gibberellin.
Reason : Gibberellin has feminising effect in some plants.
21. **Assertion :** Defoliated seedlings of *Xanthium* cannot flower even with 12 hrs. photoperiod.
Reason : Photoperiodic stimulus is picked up by the fully developed leaves causing photoperiodic perception.
22. **Assertion :** TIBA acts as antiauxin by blocking the transport of auxin.
Reason : Bound auxin cannot be extracted easily except with the help of organic solvents.
23. **Assertion :** Florigen is different in different plant species, produced in response to specific photoperiodicity typical of a plant type.
Reason : Florigen is produced only when the plant is under the juvenile stage.
24. **Assertion :** Vernalisation has no role in inducing flowering.
Reason : The stimulus of vernalisation is perceived only by meristematic cells.
25. **Assertion :** ABA promotes rooting in stem cuttings of *Poinsettia*.
Reason : ABA promotes growth by cell division.
26. **Assertion :** Maximum synthesis of ethylene occurs during climacteric ripening of fruits and tissues undergoing senescence.
Reason : Ethylene inhibits transverse growth and stimulates longitudinal growth.
27. **Assertion :** Response to a PGR may differ from one plant organ to another.

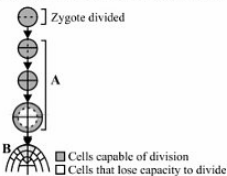
Reason : The site of production and the site of action of PGRs may be different.

28. **Assertion :** Juvenile conifers sprayed with mixture of GA_4 and GA_7 reach early maturity.

Reason : Gibberellins help in cell growth of stem, leaves and other aerial parts.

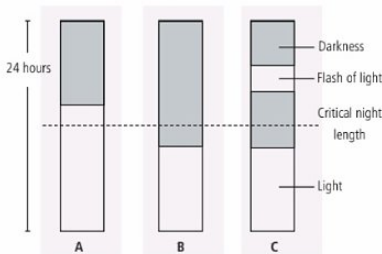
Figure Based Questions

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



- (a) Identify A and B in the given figure.
 (b) What is the equation and graphical representation of B?
 (c) How is exponential growth achieved by A?

30. Study the given figure on a short day plant and answer the following questions.



- (a) Which of the given conditions produce flower?
 (b) How does the flash of light in C affect flowering?
 (c) What would happen if plants are treated with a far red light before the treatment with flash of light?

SOLUTIONS

CHAPTER-14 : RESPIRATION IN PLANTS

1. (b) 2. (b) 3. (c) 4. (b) 5. (a)
 6. (b) 7. (c) 8. (d) 9. (c) 10. (c)
 11. (a) 12. (b) 13. (d) 14. (a) 15. (b)
 16. A-(iii); B-(i); C-(ii); D-(v); E-(iv)
 17. A-(iv, vi); B-(ii, v); C-(iii, vii); D-(viii, x); E-(i, ix)
 18. (A) (i) first (ii) glucose
 (ii) ten (iv) preparatory
 (v) pay off (vi) two
 (vii) four (viii) Two
 (ix) not required
 (B) In fermentation, the incomplete oxidation of glucose is achieved under aerobic anaerobic conditions. The two common products are ethanol and pyruvic lactic acid. It is normal mode of respiration of plants microorganisms. Less quantity of Θ_2 CO_2 is evolved and there is no requirement of peroxisomes mitochondria. 686 39-59 kcal of energy are formed per gm mole of glucose. NADH produced during Krebs' glycolysis cycle is used up.
 19. (b) 20. (b) 21. (c) 22. (c) 23. (a)
 24. (a) 25. (d) 26. (a) 27. (a) 28. (d)
 29. (a) The given figure is showing ATP synthesis by $F_0 - F_1$ particle. Here, A is $2H^+$, B is F_0 and C is F_1 .
 (b) $F_0 - F_1$ particles are present in the inner mitochondrial membrane. ATP synthase becomes active when there is a

proton gradient having higher concentration of H^+ on the F_0 side as compared to F_1 side. Increased proton concentration in outer surface of inner mitochondrial membrane is produced by the pushing of protons with the help of energy liberated by passage of electrons from one carrier to another during electron transport chain.

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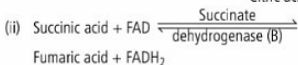
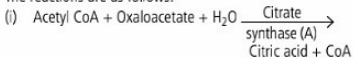
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(c) The flow of protons through the F_0 channel induces F_1 particle to function as ATP synthase. The energy of the proton gradient is used in attaching a phosphate radical to ADP by high energy bond and this helps in producing ATP.

30. (a) The given figure is of citric acid cycle. Here X is NADH, Y is $FADH_2$ and Z is GTP.

(b) The reactions are as follows:



(c) In the citric acid cycle, oxidative decarboxylation takes place three times. During (i) oxidation of pyruvate to acetyl-CoA, (ii) formation of α -ketoglutarate and (iii) when α -ketoglutarate is both dehydrogenated and decarboxylated by an enzyme, α -ketoglutarate dehydrogenase.

CHAPTER-15 : PLANT GROWTH AND DEVELOPMENT

1. (d) 2. (a) 3. (d) 4. (b) 5. (b)

6. (b) 7. (c) 8. (a) 9. (a) 10. (d)

11. (b) 12. (a) 13. (c) 14. (d) 15. (a)

16. A-(ii); B-(i); C-(v); D-(iv); E-(ii)

17. A-(v, viii); B-(iv, vii, x); C-(i, ix); D-(ii); E-(iii, vi)

18. (A) (i) IAA (ii) shoot tip
(iii) elongation (iv) polar
(v) basipetal (vi) acropetal
(vii) inhibits (viii) leaf fall
(ix) ethylene (x) abscission zone

(B) The long day plants come to flower after receiving photoperiod below above a critical length. These plants also called long short night plants because they require darkness above below a critical level. They can't flower under complete darkness. Flowering is inhibited stimulated if dark period is interrupted by light. Supply of auxins gibberellins induce flowering in many cases under inductive non-inductive photoperiods.

19. (c) 20. (d) 21. (a) 22. (b) 23. (d)

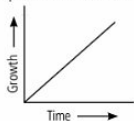
24. (b) 25. (c) 26. (c) 27. (b) 28. (a)

29. (a) Given figure shows embryo development with geometric and arithmetic phases. A represents geometric phase and B represents arithmetic phase.

(b) Arithmetic growth is a type of growth in which the growth rate is constant and growth occurs in arithmetic progression. Mathematically it is expressed as $L_t = L_0 + rt$

L_t = length after time t, L_0 = length at the beginning, r = growth rate.

The graphical representation is a linear curve.



(c) In geometric growth every cell divides. Number of cells is small initially so, the initial growth is slow. But as every cell is dividing in first generation, and the process is repeated, there is a rapid growth at exponential rate. It is also called exponential growth.

30. (a) Flowers will be produced in condition B only. Photoperiod is higher than critical night length in A and night phase is interrupted by flash of light in C. These conditions will not produce flowers in a short day plant.

(b) Short day plants require a continuous critical dark period for flowering. If the plant is exposed to a flash of light before achieving a critical dark period, flowering is prevented. It is called light break reaction.

(c) The effect of light flash (red) can be inhibited by immediately providing far-red light. But it does not impart an effect if far-red light exposure is given before red light exposure - because plant response is determined by the last exposure only.



INFORMANTS

Mimic Octopus

Thaumoctopus mimicus, the mimic octopus, was first discovered in Indonesia. The octopus mimics the physical likeness and movement of more than 15 different species depending on the threat it faces. If it is threatened by a damselfish, the mimic octopus will imitate a banded sea snake, which is a predator of the damselfish, in order to save its own life. Most of the imitations that the mimic octopus makes are that of venomous sea animals such as flat fish, lion fish, sea snake, etc., making it a highly optimised and successful survival strategy. Originally it is a small brown octopus with white spots or stripes that grows up to an average length of about 60 - 70 cm or 2 ft. The mimic octopus makes use of chromatophores present in the pigment sacs on its skin to transform its appearance. These pigment sacs can be expanded or contracted by the octopus to get the desired change of color and appearance.

CONCEPT MAP

SEXUAL REPRODUCTION

The process of development of new individuals through the formation and fusion of male and female gametes is known as sexual reproduction or amphimixis or syngensis.

TYPES

Syngamy

It is the complete and permanent fusion of male and female gametes to form the zygote.

Endogamy

It is the fusion of male and female gametes of the same parent, hence, uniparental e.g., *Taenia*.

Exogamy

It is the fusion of two gametes produced by different parents, hence, biparental e.g., Rabbit.

Conjugation

A process of sexual reproduction in which organisms of the same species temporarily couple and exchange or in some cases transfer their genetic material. It takes place in *Paramecium*, *Spirogyra*, bacteria etc.

Isoamy

It involves the fusion of gametes which do not differ morphologically but may be different physiologically. It takes place in *Chlamydomonas*.

Anisogamy

It involves the fusion of gametes which differ in size or form. It takes place in *Chlamydomonas*, red algae etc.

Oogamy

It involves the fusion of large non-motile female gamete and a small motile male gamete. It takes place in some algae, vertebrates including human beings and higher invertebrates.

Hologamy

It involves the fusion of two organisms. It occurs in yeasts.



PHASES OF LIFE

Juvenile/Vegetative phase

It is pre-reproductive phase. The period of growth between the birth upto the reproductive maturity of an organism is called the juvenile phase. In plants, it is known as vegetative phase.

Reproductive phase

The period when organisms start producing offspring is called reproductive phase. On the basis of it, plant can be **monocarpic** (flower only once in their life cycle, e.g., bamboo) or **polycarpic** (flower every year in a particular season, e.g., apple).

- On the basis of time of breeding, animals are of two types:
- (i) **Seasonal breeders:** These animals reproduce at a particular period of the year such as frog, lizard etc.
 - (ii) **Continuous breeders:** These animals continue to breed throughout their sexual maturity e.g., mice, cattle, etc.

Senescent phase

It is the post-reproductive phase that begins from the end of the reproductive phase. The terminal irreversible stage of ageing is called senescence. It is the last phase of life span and ultimately leads to death.

EVENTS IN SEXUAL REPRODUCTION

Pre-fertilisation events

These events of sexual reproduction take place before the fusion of gametes. These include:

Gametogenesis

It is the formation of gametes. Gametes can be **isogametes** (morphologically similar) or **heterogametes** (morphologically dissimilar). Gametes are formed as a result of meiosis which can be of three types:

Sporic meiosis occurring inside the sporangia



Gametic meiosis occurring in the germinal cell



Zygotic meiosis occurring in the zygote



Gamete transfer

It is the transfer of gametes to bring them together for fertilisation. In algae, bryophytes and pteridophytes water serves as the medium. In flowering plants it is done by pollination. Animals have copulatory organs to transfer male gametes.

Fertilisation

It is the complete and permanent fusion of two gametes from different or same parent to form a diploid zygote (syngamy). It can be of two types.

External fertilisation

When fertilisation occurs outside the body of the organism, it is called external fertilisation or external syngamy. It requires an external medium such as water, e.g., bony fish and amphibians.

Internal fertilisation

When egg is retained inside female body where it fuses with the male gamete, the process is called internal fertilisation or internal syngamy, e.g., reptiles, birds, mammals etc.

Parthenogenesis

Development of egg (ovum) into a complete individual without fertilisation is known as parthenogenesis. It occurs in rotifers, arthropods, insects etc. It is of two types:

Natural

It occurs regularly in the life cycle of certain animals. It can be complete (occurs in animals which breed exclusively by parthenogenesis), incomplete (occurs in animals in which both sexual reproduction and parthenogenesis occur) and paedogenetic (occurs in larva).

Artificial

In this type, the ovum is induced to develop into a complete individual by artificial stimuli. The stimuli can be physical or chemical.

Neoteny

When the larva retains adult characters such as gonads and starts producing young ones by sexual reproduction, it is called neoteny. It occurs in axolotl larva.

Embryogenesis

During embryogenesis zygote undergoes mitotic cell division and cell differentiation. On the basis of development of zygote, animals can be **oviparous** (egg-laying; zygote develops outside the female body) e.g., all birds, most reptiles etc., **viviparous** (zygote develops inside the female body) e.g., mammals (except egg laying mammals) or **ovoviviparous** (retains egg inside; zygote development is internal) e.g., sharks. In flowering plants, zygote is formed inside the ovule. After fertilisation the ripened ovary forms the fruit. The ovules mature and get converted into seeds. The ovary wall produces pericarp which protects the seeds.

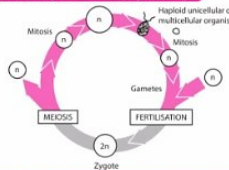
Post-fertilisation events

It includes development of zygote and embryogenesis.

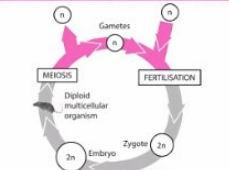
Development of zygote

The zygote formed by fusion of two gametes is always diploid. It is a link between one generation and next generation. The development of zygote depends upon the type of life cycle of the organisms and environmental conditions. There are three types of life cycles:

Haploic life cycle occurs in many algae and fungi



Diploic life cycle occurs in higher animals and seed bearing plants



Diplohaploic life cycle occurs in bryophytes, pteridophytes and some algae



SPECIAL MODES OF REPRODUCTION



This article covers high yield facts of the given topic.

Human Health and Diseases

- **Health** is defined as the state of being sound in mind, body and spirit and not merely the absence of diseases or infirmity.
- **Disease** is a condition that impairs normal functioning of living organism and is typically manifested by distinguishing signs and symptoms.

COMMUNICABLE DISEASES

- These diseases are caused by microorganisms such as bacteria, viruses, parasites, etc., that can spread directly or indirectly from one person to another.

Viral Diseases

- Non-living infectious agents are responsible for many human diseases. Viruses cause influenza, common cold, yellow fever, polio, rabies, AIDS, etc.

Table : Some important viral diseases of human

	Disease	Pathogen	Epidemiology
(i)	Hepatitis	Hepatitis virus	Fever, headache, gastrointestinal disturbances, dark urine, jaundice.
(ii)	AIDS (Acquired Immuno-Deficiency Syndrome)	Human Immuno-deficiency Virus (HIV)	Fever, lethargy, nausea, headache, rashes, etc.
(iii)	Chicken pox	Varicella zoster	Mild fever, rashes, spread through contact with infected individuals
(iv)	Herpes	Herpes simplex virus	Fever, blisters, spread through contact with infected saliva, exhibits latency - disease can be dormant for several years.
(v)	Measles	Rubeola virus	Reddish rash appears on the neck which spreads over body.
(vi)	SARS (Severe Acute Respiratory Syndrome)	Coronavirus	Spreads through patients secretions from nose, mouth and throat. Results in high fever, chills, dizziness, headache, sore throat.

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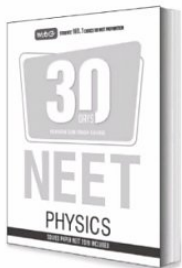
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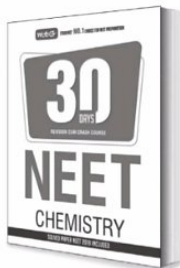
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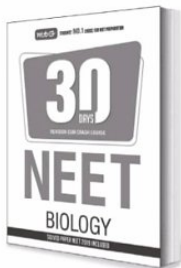
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- NCERT based crisp theory
- Exam Drill exercises for each day with detailed solutions
- OMR sheets at the end of each exercise to improve the skills to attempt actual question paper
- 5 Unit Tests for formative assessment during the preparation
- 2 Mock Test Papers at the end to give the real exam feeling
- NEET 2019 solved paper included

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- Symptoms : Elevated glucose concentration in blood, resulting in excessive urination and dehydration. Extreme thirst leading to frequent drinking of water, polydipsia.
- (ii) **Cardiovascular diseases**
- (a) Hypertensive heart diseases -
- **Arteriosclerosis** : Hardening and loss of elasticity of the arteries.
 - **Atherosclerosis** : Thickness develops on inner walls of the arteries, preventing their dilation.
- (b) Coronary heart diseases include angina pectoris, myocardial infarction.



INTEXT PRACTICE QUESTIONS

1. Explain the term health. Also mention two ways of maintaining it.
2. Define cardiovascular diseases. Also give an example of this disease with symptoms.

IMMUNITY

- **Immunity** is the ability of an organism to resist particular infection or toxin by the action of specific antibodies or sensitised white blood cells.
- Immunity is of two types - **innate** and **acquired**. Acquired immunity can be passive or active.

Innate Immunity

- It is the immunity with which an individual is born. It is because of genetic constitutional make up and has no relationship with previous bacterial infection and immunisation.
 - It is non-specific, *i.e.*, lacks specific response to specific invaders.
 - Innate immunity consists of four types of defence barriers.
- (i) **Physical barrier** include skin (**the first line of defence**) and mucous membranes.
- **Skin** has outer tough layer called **stratum corneum**, which forms impenetrable barrier to viruses and microorganisms. Skin provides defence with chemical weapons on surface, such as oil and sweat glands that give skin surface a pH of 3-5, acidic enough to inhibit growth of microbes.
 - **Mucous membrane** - Cells lining bronchi and bronchioles secrete sticky mucus that traps microorganisms and immobilise them. The cilia sweeps the mucus loaded with microorganisms and dust particles into pharynx and are expelled through vomiting, coughing and sneezing.
- (ii) **Physiological barrier** include body temperature, pH of body fluids, various secretions like lysozyme, bile, cerumen (ear wax), vaginal secretion, acid of stomach, etc., that prevents growth of many disease causing microorganisms.
- (iii) **Cellular barrier** - The surface defenses of the vertebrate body are very effective but are occasionally breached, allowing invaders to enter the body. At this point, the body uses a host of non-specific cellular and chemical devices to defend itself referred to as **the second line of defense**. These are certain white blood corpuscles (leucocytes), macrophages, natural killer cells, inflammation, fever, antimicrobial substances, etc., and each kills invading microorganisms differently.
- **Macrophages** kill microbes by ingesting them through phagocytosis. Within the macrophage, the membrane-bound vacuole containing the bacterium fuses with a lysosome. Fusion activates lysosomal enzymes that kill the microbe by liberating large quantities of oxygen free-radicals. Macrophages engulf viruses, cellular debris and dust particles in the lungs.
 - **Neutrophils** are leucocytes that ingest and kill bacteria by phagocytosis. In addition, neutrophils release chemicals that kill other bacteria in the neighbourhood as well as neutrophils themselves.
 - **Inflammatory response** - Inflammation aids the fight against infection by increasing blood flow to the site and raising temperature to retard bacterial growth.
 - This response is a localised, non-specific response to infection. Infected or injured cells release chemical alarm signals, **histamine** and **prostaglandins**. These chemicals promote the dilation of local blood vessels, which increases the flow of blood to the site of infection or injury and causes the area to become red and warm. They also increase the permeability

of capillaries in the area, producing the edema (tissue swelling) so often associated with infection. The more permeable capillaries allow phagocytes (monocytes and neutrophils) to migrate from the blood to the extracellular fluid, where they can attack bacteria. Neutrophils arrive first, spilling out chemicals that kill the bacteria in the vicinity (as well as tissue cells and themselves). Monocytes change into macrophages and engulf pathogens and cellular debris.

- (iv) **Cytokine barrier** - Cytokines (chemical messengers of immune cells) are low molecular weight proteins that stimulate or inhibit the differentiation, proliferation or function of immune cells. They are involved in the cell to cell communication such as interleukines, lymphokines, tumour necrosis factor and interferons (IFNs).

Acquired Immunity

- Acquired immunity obtained either from development of antibodies in response to exposure to an antigen as from vaccination or attack from infectious disease, etc., which stimulates antibody production.

Characteristics of acquired immunity

- (i) **Specificity** is the ability to differentiate between various foreign molecules (foreign antigens).
- (ii) **Diversity** can recognise a vast variety of foreign molecules (foreign antigens).
- (iii) **Discrimination between self and non-self** : It can recognise and respond to foreign molecules (non-self) and can avoid response to those molecules that are present within the body (self) of the animal.
- (iv) **Memory** : When the immune system encounters a specific foreign agent, (e.g., a microbe) for the first time, it generates immune response and eliminates the invader. It is called **first encounter**. The immune system retains the memory of the first encounter and as a result, response to a second encounter occurs more quickly than the first encounter.



WHO AM I ...

"I am caused by rubeola virus and I can cause reddish rash on the neck which spreads all over the body".

...search me ☺

Components of acquired immunity

- (i) **Antibody mediated immune system (AMIS) or humoral immunity**
- It consists of antibodies that circulate in the body fluids like blood plasma and lymph.
 - B-lymphocytes (B-cells) produce antibodies that regulate humoral immunity. T-lymphocytes themselves do not secrete antibodies but help B-lymphocytes produce them. AMIS protects the body from viruses, some bacteria and toxins that enter the body fluids like blood and lymph.
- (ii) **Cell-mediated immune system (CMIS) or T-Cell immunity**
- Lymphocytes are of two types : T-lymphocytes or T-cells and B-lymphocytes or B-cells, produced in the **bone marrow**.
 - T-cells play two important functions : **Effector** and **regulatory**. The effector function includes **cytolysis** (destruction of cells by immune processes) of cells infected with microbes and tumour cells and **lymphokine production**. The regulatory functions are either to increase or to suppress other lymphocytes and accessory cells. **CMIS** protects the body against viruses and bacteria which have entered the host's cells. It also reacts against tissue transplants and also against the body's own cells which become cancerous.

Types of acquired immunity

- (i) **Active immunity** - Person's own cells produce antibodies in response to infection or vaccination. It may be **natural** or **artificial**. **Natural** antigens are introduced through natural exposure while **artificial** antigens are deliberately introduced through vaccination.
- (ii) **Passive immunity** - Ready-made antibodies directly injected into a person to protect the body against foreign agents. **Natural** antibodies from the mother are transferred to her child across the placenta or in milk and **artificial** antibodies produced by another person or an animal are injected.

Immune Response

- (i) **Primary immune response** is initial encounter of a naive immune-competent lymphocytes with an antigen. There is slow rise in antibody titer, first IgM, followed by IgG.

- (ii) **Secondary immune response** is more rapid and heightened immune response due to subsequent contact of host with same antigen.

Antigen

- These are the substances foreign to the body that evoke an immune response either alone or after forming complex with larger molecules (such as protein) that is capable of binding with product (antibody or T-cell) of immune response.
- **Antigen Presenting Cells (APCs)** engulf antigens and present fragments to T-cells, e.g., macrophages, dendritic cells and B-cells.

Antibodies

- Antibodies are immunoglobulins (Igs) produced in the body in response to the antigen or foreign bodies. Antibodies are produced by B-lymphocytes and plasma cells. In fact, B-lymphocytes get transformed into plasma cells. There are five types of antibodies:
 - (a) **IgA** is the second most abundant class of antibody. It is mainly found in sweat, tears, saliva, mucus, colostrum. IgA excreted through faeces is called **coproantibody**.
 - (b) **IgD** is mainly found on the surfaces of B-cells as antigen receptors, where it activates B-cells for antigen recognition.
 - (c) **IgE** is located on mast cells and basophils releasing histamine. It is involved in allergic and hypersensitivity reactions and also provides protection against parasitic worms.
 - (d) **IgG** is the most abundant class of Ig. It protects the body against bacteria and viruses by enhancing phagocytosis, neutralising toxins and complement activation. It is the only class of antibody to cross the placenta from mother to fetus.
 - (e) **IgM** is the largest Ig that is secreted first by the plasma cells and also the earliest immunoglobulin to be synthesised by the fetus.
- **Antibody structure** - Each antibody molecule consists of **two light chains** and **two heavy chains**. The four chains in the antibody molecule are held together by disulfide ($-S-S-$) bonds, forming a Y-shaped molecule. Heavy and light chains are joined by disulfide bond, which also joins two heavy chains. This region of antibody is called hinge region.

Immune System in the Body

- Human immune system consists of lymphoid organs, tissue cells and antibodies.

Lymphoid organs

- Organs where B-lymphocytes and T-lymphocytes mature and acquire their antigen - specific receptors, are primary lymphoid organs, such as bone marrow and thymus. After maturation, lymphocytes migrate to secondary lymphoid organs, where they undergo proliferation and differentiation, it includes lymph nodes, spleen, tonsils, etc.

Vaccination

- Vaccine is a preparation or suspension of dead or attenuated (weakened) germs of a disease which on inoculation (injection) into a healthy person provides immunity by inducing antibodies formation. Vaccines work on the basis of property of 'memory' of the immune systems.

Disorders of Immune System

- (i) **Autoimmunity** - Failure of immune system to recognise self from non-self and start destroying body's own cells. Self destruction occurs. For example, Diabetes mellitus, Grave's disease, Hashimoto's thyroiditis, multiple sclerosis, Myasthenia gravis, Rheumatoid arthritis.
- (ii) **Allergies** - Allergy is the hypersensitiveness of a person to some foreign substance coming in contact with or entering the body. The common allergens are dust, pollen, mould, spores, fabrics, lipsticks, nail paints, feathers, fur, plants, bacteria, foods, heat, cold sunlight, etc. The allergic tendency is characterised by the presence of large quantities of IgE antibodies in the blood. First exposure to antigen causes primary immune response, but it does not cause allergy. When an allergen enters the body second time, it causes second immune response reaction and a subsequent allergic reaction occurs. It causes marked dilation of all the peripheral blood vessels and the capillaries become highly permeable so that large amounts of fluid leak out from the blood into the tissues. The blood pressure decreases drastically, e.g., hay fever, asthma, anaphylaxis.

(iii) **Immunodeficiency diseases** - These diseases are the conditions in which the defence mechanisms of the body are weakened, leading to repeated microbial infections. For example, a person suffering from SCID may be without B-cells or T-cells or both from the birth. It is **primary immunodeficiency disease**.

• **Secondary immunodeficiency diseases** are due to variety of factors such as malnutrition, infections, metabolic disorders, malignancy and cytotoxic drugs may lead to defects in specific and non-specific immunity, examples; AIDS and Hodgkin's disease.

Acquired Immuno Deficiency Syndrome (AIDS)

• AIDS is a disorder of cell-mediated immune system of the body. There is a reduction in the number of helper T-cells which stimulate antibody production by B-cells. This results in the loss of natural defence against viral infection. The infection by **human immuno-deficiency virus (HIV)** causes AIDS. The incubation period of AIDS ranges between 6 months to 10 years.

Transmission of AIDS virus

- Use of contaminated needles and syringes to inject drugs or vaccines.
- Use of contaminated needles for boring pinnae.
- From infected mother to child through placenta.
- Organ transplantation.
- Transfusion of infected blood.
- Use of contaminated razors.
- Sexual intercourse with an infected partner without a condom.
- Artificial insemination.

Mode of action of HIV

- Infection** : Virus enters the body of person and reaches macrophages (cells of immune system).
- Reverse transcription** : The viral RNA is converted to viral DNA with the help of reverse transcriptase enzyme.
- Integration** : Viral DNA is incorporated into the host cell's DNA and gets replicated.
- Multiplication** : The viral DNA replicates along with infected host cell. Thus, the infected macrophages acts as HIV factory.
- Assembly of virus** : The viral proteins formed are assembled to form new viral particles which are released from the infected cell. They mature and target T-cells of body (destroy them).
- Since the number of helper T-lymphocytes decreases in the body, the person starts suffering from infections of bacteria, viruses, fungi and even parasites like *Toxoplasma*.



CANCER

- An elaborative description on the topic cancer has been given in August 2018 issue of our magazine.



INTEXT PRACTICE QUESTIONS

3. Describe the role of macrophages in providing immunity to humans.
4. Normal cell do not show cancerous growth. Why?

ALCOHOL ADDICTION

- Alcohol refers to ethyl alcohol or ethanol (C_2H_5OH) manufactured by fermentation of sugars.
- Drinking of excessive alcohol that impairs one's physical, physiological and psychological functions, refers to **alcohol abuse**. The dependence or addiction of alcohol is called **alcoholism** and the addict is termed as **alcoholic**. WHO declared in 1964 that alcoholism is a disease.

Problems Caused by Alcohol

- **Social problems** : These include absence from work, unemployment, marital (marriage) tensions, child abuse, financial difficulties and problems with law, including violence and traffic offences.
- **Psychological problems** : Heavy drinking causes depression. Suicide attempt is much common in alcoholics than in the rest of society. Sexual relationship is usually deteriorated because of impotence or rejection by the partner.
- **Physical problems** : These are variable and can affect virtually any organ in the body.

DRUG ADDICTION

- **Drug addiction or drug abuse** is taking drugs for purpose other than clinical use, in amount, concentration or frequency that impairs physical, physiological and psychological functions of the body. The drugs, which are commonly abused are **opioids, coca alkaloids** and **cannabinoids**.

Habituating Drugs

- (i) **Psychotropic drugs** : Mood altering drugs that affect behaviour and mental activity. It includes tranquilisers, sedatives, hypnotics, opioids and stimulants.
- Opiate/Opioid/narcotics** : Drugs derived from dried latex of unripe fruits of poppy plant (*Papaver somniferum*). They are also called painkillers and have narcotic, analgesic, astringent (that causes contraction of body parts) and sedative effect, e.g., opium (afeem), heroin, smack, etc.
- (ii) **Psychedelic drugs**: Drugs change one's behaviour, thoughts, feelings and perceptions without any actual sensory stimulus. It includes LSD, mescaline, psilocybine, cannabinoids, etc.
- **Cocaine** is natural coca alkaloid obtained from leaves of coca (or cocca) plant (*Erythroxylum coca*). Cocaine has **vasoconstrictor properties** and acts as a good local anaesthetic. It is a powerful CNS stimulant. Its overdose causes **hallucinations**.
 - **Hemp or cannabis compounds** (hallucinogenic chemicals) are obtained from leaves, resin and flowering tips (inflorescence) of hemp plant that naturally have sedative effects, e.g., bhang, charas, ganja, marijuana, etc.
 - **Tobacco** has volatile poisonous alkaloid called **nicotine** which causes addiction. High concentration of nicotine paralyses nerve cells and may also lead to heart diseases.

Addiction and Dependence

- **Addiction** is a psychological attachment to certain effects such as euphoria and a temporary feeling of well-being that is associated with drugs and alcohol.
- **Dependence** is an adaptive state that develops from repeated drug administration. It can result in withdrawal syndrome (anxiety, nausea, shivering), if the drug is abruptly discontinued.
- Effects/symptoms of drug abuse include reckless behaviour, vandalism, violence, socially inactive, lack of concentration, etc.

Prevention and Control

- Psychologists, psychiatrists, deaddiction and rehabilitation specialists are available to help individuals who fall in the trap of drug, tobacco or alcohol abuse.
- Teachers and parents should always be careful to look for and identify danger signs that can indicate tendency to go in for addiction.
- Avoid undue pressure on child because every child has his/her own choice and personality. So, a child should not be pressurised unduly to do beyond his/her capacities, be it studies, sports, etc.



INTEXT PRACTICE QUESTIONS

5. How would you explain addiction and dependence on drug/alcohol abuse in youth?



BIOLOGY

OLYMPIAD PROBLEMS

1. A tuberculosis patient died within a few minutes of second intravenous administration of streptomycin and the post-mortem report gave anaphylactic shock as the cause of death. This is explained as
- a sudden surge in IgM synthesis leading to complement activation causing fatal drop in blood pressure
 - a vigorous precipitation of soluble antigens in body fluids triggered by the IgA insurgence leading to blockage of capillaries to vital organs
 - IgE induced mast cell degranulation triggering abrupt dilation of peripheral blood vessels resulting in a precipitous drop in blood pressure
 - IgD induced agglutination of antigen-bearing cells in vital organs leading to multi-organ failure.
- (INBO 2017)
2. In which of the following animals is the 'heart' located dorsally?
- Flightless birds
 - Lungfish
 - Snakes
 - Crabs
- (INBO 2016)
3. Metamerism is a salient feature found in Annelids, dividing the body into a series of similar segments, each containing repeated arrangement of many of the internal organ systems. One of the following system which is not metameric is the
- integumentary system
 - nervous system
 - digestive system
 - excretory system.
- (INBO 2016)
4. A polycarpellary, apocarpous flower normally gives rise to
- composite fruit
 - aggregate fruit
 - simple fleshy fruit
 - simple dry fruit.
- (NSEB 2015-16)
5. Which of the following enzymes involved in Krebs' cycle is not present in the mitochondrial matrix?
- Aconitase
 - Malate dehydrogenase
 - Fumarate
 - Succinate dehydrogenase
- (NSEB 2015-16)
6. Among the following components required to construct a phylogenetic tree, which one needs to be determined first?
- Polyphyletic status
 - Derived character state
 - Outgroup member
 - Ancestral character state
- (INBO 2015)
7. If a bacteriophage with a lytic life cycle infects bacteria in a culture medium containing radioisotope of sulphur, the subsequent generation of the phage will have
- radioactive core
 - radioactive coat
 - radioactive core and coat
 - no radioactivity.
- (NSEB 2014-15)
8. Carbonic anhydrase is an enzyme that accelerates the formation of carbon dioxide from carbonic acid (H_2CO_3) and is found in high concentrations inside the red blood cells. Indicate which of the following would be true for the activity levels of this enzyme in the following animals.
- Elephant > Man > Rat
 - Rat > Man > Elephant
 - Man > Elephant > Rabbit
 - Rat > Man > Elephant
- (NSEB 2014-15)
9. One can determine the age of an oak tree by counting the annual rings of _____ formed by the _____.
- primary xylem, apical meristem
 - secondary pith, vascular cambium
 - dermal tissue, cork cambium
 - secondary xylem, vascular cambium
- (INBO 2013)
10. Which of the following correctly depicts a reaction involved in the nitrogen cycle?
- $N_2 + H^+ + e^- + ATP \rightarrow NH_3 + ADP + Pi$
 - $N_2 + H^+ + e^- + ADP + Pi \rightarrow NH_3 + ATP$
 - $NO_2^- + e^- + ADP + Pi \rightarrow NH_3^+ + ATP$
 - $NO_3^- + H^+ + e^- + ADP + Pi \rightarrow NH_3^+ + NO_2^- + ATP$
- (INBO 2013)
11. A few major discoveries in cell biology are listed.
- Schleiden and Schwann proposed the cell theory.
 - Leeuwenhoek discovered bacteria.
 - Golgi stained cells with silver nitrate, discovered Golgi apparatus.
 - First transmission electron microscope was developed.
- The correct chronological order of these events starting with the earliest event is
- I, II, III, IV
 - II, III, I, IV
 - II, I, III, IV
 - II, I, IV, III.
- (NSEB 2013-14)

12. Which of the following represents the correct order of electron flow during photosynthesis?
 (a) Chlorophyll to NADPH to water
 (b) Water to NADPH to chlorophyll
 (c) Chlorophyll to water to NADPH
 (d) Water to chlorophyll to NADPH (NSEB 2013-14)
13. To a culture medium containing cells in the phase of differentiation, a marker molecule capable of binding to the newly synthesising cellulose molecules was added. The marker will appear in
 (a) middle lamella (b) primary wall layer
 (c) secondary wall layer (d) both (b) and (c). (NSEB 2012-13)
14. Forest fires are natural means of
 I. secondary succession
 II. elimination of predators
 III. mineralisation of nutrients
 IV. discouraging primary consumption.
 (a) I and III (b) II and III
 (c) I, II and III (d) I, II and IV (NSEB 2012-13)
15. Which of the following primarily contribute to the 'cytomembrane system' of a cell?
 I. Endoplasmic reticulum
 II. Vesicles
 III. Microtubules
 IV. Mitochondria
 V. Golgi apparatus
 (a) I and V only (b) I, II, IV and V
 (c) I, II and V (d) I, II, III, IV and V (INBO 2011)

SOLUTIONS

1. (c) : Anaphylaxis or anaphylactic shock is a serious allergic reaction that is rapid in onset and may cause death. Allergy is caused due to immediate immune reactions mediated by IgE. The interaction between allergens and IgE cause a rapid release of mediators from effector cells, *i.e.*, mast cells and basophils. In this case, streptomycin acts as allergen to the patient, with the second administration anaphylaxis sets in because of sudden high dose of allergen. Blood pressure drops suddenly due to abrupt dilation of blood vessels and leakage of the blood capillaries.
2. (d) : In vertebrates, the heart lies in the middle of the ventral part of the body generally surrounded by a pericardium. In invertebrates, the heart (if present) is located in the dorsal part of the body.
3. (c) : In Annelids metamerism is conspicuously visible both externally as well as internally. Most of annelids have a numerous body segments and all body being repeatedly segmented. Even the coelom is segmentally divided into compartments by intersegmental transverse mesenteries called septa. Only the digestive tract escapes the metamerism and it extends through every segment.
4. (b) : An aggregate fruit is a group of simple fruitlets that develop from the free ovaries of a single flower.
5. (d) : Succinate dehydrogenase is a membrane based complex enzyme that is present in the inner mitochondrial membrane. It carries out dehydrogenation of succinate into fumarate.
- $$\text{Succinate} + \text{FAD} \xrightleftharpoons[\text{dehydrogenase}]{\text{Succinate}} \text{Fumarate} + \text{FADH}_2$$
6. (d) : A phylogenetic tree is a diagram that represents evolutionary relationships among organisms. The pattern of branching in a phylogenetic tree reflects how species of other groups evolved from a series of common ancestors. Thus, ancestral character is to be determined first in order to construct a phylogenetic tree.
7. (b) : Radioactive sulphur, in a culture medium containing bacteria, gets incorporated into sulphur containing amino acids (cystein and methionine) and therefore, becomes part of bacterial protein. Bacteriophage, after infecting these bacteria, uses host machinery to synthesise genetic material as well as the protein coat. The latter will be radioactive due to the radioactive sulphur containing protein.
8. (d) : Metabolic rate is highest for rat followed by man and elephant. When metabolic rate is high (more CO₂ production) carbonic anhydrase enzyme is required in more concentration.
9. (d)
10. (a) : Biological nitrogen fixation can be presented by the following equation :

$$\text{N}_2 + 8\text{H}^+ + 8\text{e}^- + 16 \text{ATP} \rightarrow 2\text{NH}_3 + \text{H}_2 + 16\text{ADP} + 16\text{P}_i$$
 This reaction is carried out exclusively by prokaryotes using an enzyme complex termed as nitrogenase. The reaction occurs while N₂ is bound to the nitrogenase enzyme complex.
11. (c) : Schleiden and Schwann formulated the cell theory in their joint paper in 1839. Leeuwenhoek observed bacteria in 1676. Golgi discovered Golgi apparatus in 1898 in the nerve cells of horn owl and cat by means of metallic impregnation method. The first transmission electron microscope was developed by Knoll and Ruska in 1931.
12. (d)
13. (c) : During cell differentiation, mainly secondary wall formation occurs thus cellulose molecules will be deposited only in the secondary cell wall. Marker will bind only on newly synthesised cellulose. Thus, only secondary cell wall will show the marker.
14. (a) : Forest fires are naturally responsible for secondary succession and mineralisation of nutrients.
15. (a) : 'Cytomembrane system' is a group of some membrane bound cell organelles which function in close coordination with one another. Endoplasmic reticulum, Golgi apparatus, lysosomes and vacuoles contribute to the cytomembrane system of a cell. ☺☺

MONTHLY TEST DRIVE



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

Total Marks : 160

- **Structural Organisation in Animals**
- **Cell - The Basic Unit of Life**

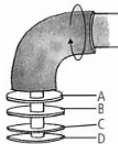
Time Taken : 40 Min.

- Metabolically active cells are small in size due to
 - lower nucleocytoplasmic ratio and lower surface volume ratio
 - higher nucleocytoplasmic ratio and higher surface volume ratio
 - higher nucleocytoplasmic ratio and lower surface volume ratio
 - lower nucleocytoplasmic ratio and higher surface volume ratio.

- The given figure shows lower region of flagellum of a Gram negative bacteria. The basal body bears ring-like swellings in the region of plasma membrane and cell wall.

The rings embedded in the plasma membrane are

- (a) A, B, C, D (b) A, B, C
(c) C, D (d) B, C, D.

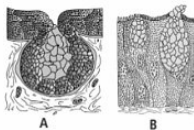


- Read the following statements and select the correct option.
 - Salivary glands, intestinal glands and most of the sweat glands are merocrine glands.
 - Areolar tissues possess macrophages but lack mast cells.
 - Brown fat occurs in infants and generates more heat than white fat.
 - Smooth muscle fibres may have branches and are bound together in a connective tissue sheath.

(a) (i) and (iv) are correct.
(b) (ii) and (iii) are correct.
(c) (i), (ii), (iii) are incorrect.
(d) (ii) and (iv) are incorrect.
- Primary lysosomes are newly pinched off vesicles from
 - convex side of Golgi apparatus

- concave side of Golgi apparatus
- smooth endoplasmic reticulum
- granular endoplasmic reticulum.

- Identify the given glands A and B and choose the correct option accordingly.



Gland type	Location	Secretion
(a) A- Unicellular	Intestine	Intestinal juice
(b) B-Endocrine	Alimentary canal	Mucous
(c) A-Multicellular	Buccal cavity	Saliva
(d) B-Multicellular	Skin	Sweat

- Which among the following statements is incorrect in relation to difference between euchromatin and heterochromatin?
 - Euchromatin is lightly stained and diffused but heterochromatin is darkly stained and condensed.
 - Euchromatin lacks active genes and does not take part in transcription but heterochromatin contains active genes and takes part in transcription.
 - Crossing over is common in euchromatin but heterochromatin inhibits crossing over.
 - Euchromatin forms bulk of chromatin but heterochromatin is present at certain places in chromatin.
- Select the incorrect match among the given pairs.
 - Protoplasmic astrocytes – White matter of CNS
 - Bipolar neurons – Cochlear ganglia
 - Lymphocytes – Secrete antibodies
 - Mucoid connective tissue – Umbilical cord

8. The larger subunit of ribosome in *Chlamydomonas* is
 (a) 50 S (b) 60 S (c) 40 S (d) 80 S.
9. Read the following statements and select the correct option.
Statement A : The medullated nerve fibres of brain and spinal cord lack neurilemma.
Statement B : The medullated fibres of brain and spinal cord do not regenerate after injury due to lack of neurilemma.
 (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.

10. Match the column I with column II.

Column I

Column II

- | | |
|--------------------------------|--------------------------|
| A. Simple ciliated epithelium | (i) Urinary bladder |
| B. Pseudostratified epithelium | (ii) Ventricles of brain |
| C. Transitional epithelium | (iii) Iris of eyes |
| D. Simple cuboidal epithelium | (iv) Human male urethra |
- (a) A-(ii), B-(iv), C-(iii), D-(i)
 (b) A-(ii), B-(iv), C-(i), D-(iii)
 (c) A-(iii), B-(iv), C-(i), D-(ii)
 (d) A-(iii), B-(i), C-(iv), D-(ii)

11. Which of the following is correct for frog?
 (a) Inner finger of female frogs contains amplexusory pads.
 (b) Frogs have acrodont teeth fixed in socket like humans.
 (c) Buccopharyngeal respiration in male frog is performed by sternoal and petrohyal muscles.
 (d) Both male and female frogs have a pair of vocal sacs.
12. Identify the given blood corpuscles and choose the correct option.

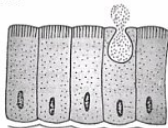


- (a) 'A' transports oxygen and some amount of carbon dioxide.
 (b) 'B' is a granulocyte secreting heparin and histamine.
 (c) 'C' is largest of all types of leucocytes.
 (d) 'A' is a granulocyte with phagocytic activity.
13. Lysosomes show polymorphism. Identify the type of lysosome from given characters.
 (i) Formed by fusion of phagosome with lysosome.
 (ii) Digestion occurs in this lysosome.
 (iii) Also known as digestive vacuole.
 (a) Primary lysosome (b) Secondary lysosome
 (c) Residual lysosome (d) Autolysosome

14. Which of the following is not an example of multi-unit smooth muscles?
 (a) Muscles of the walls of large blood vessels
 (b) Ciliary muscles in the eye
 (c) Muscles of urinary bladder
 (d) Arrector pili muscles of skin dermis
15. Which of the following statements are correct?
 (i) Dedifferentiated cells are post-mitotic cells specialised to perform specific functions.
 (ii) Outermost mucilage layer of bacterial cell provides protection from toxic chemicals, viruses and phagocytes.
 (iii) Bacterial plasma membrane is selectively permeable and metabolically active.
 (iv) Plasmids permanently associated with nucleoid are called episomes.
 (v) Activities of an organism are sum total of activities and interactions of its constituent cells.
 (a) (i), (ii) and (v) (b) (ii), (iii) and (iv)
 (c) (ii), (iii) and (v) (d) (i), (iii) and (iv)
16. _____ present in cell wall of Gram +ve bacteria forms surface antigens and receptor sites.
 (a) Teichoic acid (b) Mycolic acid
 (c) Mucopeptide (d) Lysine
17. Identify the mis-matched pair in relation to cockroach.
 (a) Labium – Responds to taste and smell
 (b) Pulvillus – Firmly grasps substratum
 (c) Stomodaeal valve – Present between mid gut and ileum
 (d) Uricose glands – Discharge uric acid over spermatophore during copulation
18. Which of the following is not a common feature between mitochondria and plastid?
 (a) Presence of double membrane envelope
 (b) Possess their own DNA, RNA and 80S ribosomes
 (c) Presence of naked DNA
 (d) Production of ATP and taking part in energy transduction.
19. Match the organelle given in column I with their functions in column II.
- | | |
|--------------------|-----------------------------|
| Column I | Column II |
| A. Lysosomes | (i) Vitellogenesis |
| B. Golgi apparatus | (ii) Carbohydrate synthesis |
| C. Mitochondria | (iii) Sperm lysins |
| D. Glyoxysomes | (iv) Amino acid synthesis |
- (a) A-(i); B-(ii); C-(iv); D-(iii)
 (b) A-(iii); B-(ii); C-(iv); D-(i)
 (c) A-(i); B-(iv); C-(ii); D-(iii)
 (d) A-(iii); B-(i); C-(iv); D-(ii)

20. Read the given statements and select which ones are true (T) or false (F).
- Change of colour from green to red during ripening of tomato is due to transformation of chromoplast to chloroplast.
 - Flagella present in choanocytes of porifers help in movement of water.
 - Enzymes for detoxification of toxic chemicals are present in rough endoplasmic reticulum.
 - Astrocytes communicate with one another through calcium channels.
 - Simple ciliated epithelium is also called urothelium.
- (i) (ii) (iii) (iv) (v)
- T T F T F
 - F T F T F
 - F T T F T
 - T F T F T

21. Select the incorrect option for the type of epithelium shown in the given figure.



- Epithelium contains mucus secreting cells.
 - In intestine, epithelium has microvilli to increase absorptive surface area.
 - It has secretory role in gastric glands and pancreatic lobules.
 - The cells of deepest layer are columnar and in outer few layers, cells replace cytoplasm with keratin.
22. Which type of neurons are present in dorsal root ganglia of spinal nerves in adult vertebrates?
- Pseudounipolar
 - Unipolar
 - Multipolar
 - Bipolar
23. Read the given statements about earthworm and select the option which correctly fills the blanks.
- _____ nephridia are ectonephric and keep the skin moist for cutaneous respiration.
 - Part of digestive system that helps in grinding food is present in segment(s) _____.
 - The secretion of _____ keep two earthworms close together during copulation.

- | | (i) | (ii) | (iii) |
|-----|---------------|-----------------------------------|------------------|
| (a) | Septal | 4 th | seminal vesicle |
| (b) | Pharyngeal | 5 th – 7 th | prostate gland |
| (c) | Integumentary | 8 th | accessory glands |
| (d) | Pharyngeal | 7 th – 9 th | vasa deferentia |

24. Read the following statements and state them as true (T) or false (F).
- Tonofibrils are microfilaments made up of actin and keratin proteins.
 - Reticular connective tissues are present in the liver, spleen, thymus, lymph nodes.
 - Cilia and microvilli may be covered by glycocalyx.
 - Hyaline cartilage is present in the pubic symphysis and intervertebral discs.
- | | A | B | C | D |
|-----|---|---|---|---|
| (a) | F | T | T | F |
| (b) | T | T | F | F |
| (c) | F | T | F | F |
| (d) | F | F | F | T |

25. Endomembrane system comprises of
- endoplasmic reticulum, Golgi complex, mitochondria and plastids.
 - lysosomes, vacuoles, peroxisomes and Golgi complex.
 - mitochondria, Golgi complex, lysosomes and endoplasmic reticulum.
 - Golgi complex, lysosomes, vacuoles and endoplasmic reticulum.
26. Which part of nucleus is the principal site for the development of ribosomal RNAs?
- Nucleoplasm
 - Nucleolus
 - Nuclear matrix
 - Nuclear envelope
27. Plastids present in aleurone cells of maize grain are
- proteoplast
 - amyloplast
 - elaioplast
 - phaeoplast.
28. Read the following statements and select the correct option.
- Statement A :** Centrioles are capable of replication.
- Statement B :** Centrioles contain DNA, RNA and proteins.
- Both statements A and B are correct and B is the correct explanation of A.
 - Both statements A and B are correct but B is not the correct explanation of A.
 - Statement A is correct but B is incorrect.
 - Both statements A and B are incorrect.
29. _____ secreted by mast cells of connective tissue act as vasoconstrictor to arrest bleeding and increase blood pressure.

ANSWERS

WHO AM I ...

- | | |
|--------------------|--------|
| 1. <i>Obelia</i> | Pg. 37 |
| 2. Innate immunity | Pg. 50 |
| 3. Measles | Pg. 52 |

- (a) Serotonin (b) Histamine
(c) Reticulin (d) Heparin

30. Joints between skull bones are immovable due to the presence of

- (a) yellow elastic connective tissue
(b) white fibrous connective tissue
(c) calcified cartilage
(d) white fibrocartilage.

31. Identify the incorrect statement in context of fluid mosaic model of biomembrane.

- (a) Tunnel proteins are integral proteins that run throughout the length of lipid bilayer.
(b) Extrinsic proteins form covalent bonds with hydrophobic tail of lipid molecules.
(c) External surface of proteins of a biomembrane have oligosaccharides.
(d) Biomembrane being quasifluid can grow during cell growth and cell division.

32. Read the given statements and select the option which correctly fill the blanks.

- (i) Ca^{2+} ions required during muscle contraction is stored in _____.
(ii) _____ synthesises acrosome of spermatocytes.
(iii) Water soluble pigment anthocyanin is present in _____.
(iv) New mitochondria develops from pre-existing mitochondria by _____.

- | | (i) | (ii) | (iii) | (iv) |
|-----|-----------------------|-----------------|--------------|---------------------|
| (a) | Endoplasmic reticulum | Mitochondria | air vacuole | division |
| (b) | Ribosomes | Golgi apparatus | chloroplast | sexual reproduction |
| (c) | Endoplasmic reticulum | Golgi apparatus | sap vacuoles | binary fission |
| (d) | Golgi apparatus | Mitochondria | plastids | budding |

33. Study the given table and identify P, Q, R and S.

(i)	Loose connective tissue	P	Forms shock absorbing cushion around eyeballs.
(ii)	Skeletal tissue	Hyaline cartilage	Q
(iii)	Bones	R	Formed in soft organs, such as heart of ruminants.
(iv)	S	Ligament	Connects bone to another bone.

P Q R S

- (a) Areolar tissue Hyoid apparatus Sesamoid bones Yellow fibrous sheets
(b) Adipose tissue Nasal septum Replacing bones Dense irregular connective tissue
(c) Areolar tissue Tracheal rings Investing bones White fibrous cords
(d) Adipose tissue Sternal parts of ribs Visceral bones Yellow elastic connective tissue

34. Lampbrush chromosomes were first observed by

- (a) Flemming (b) Kollar
(c) Ruckert (d) Balbiani.

35. Match the following.

- | Column I | Column II |
|---------------------------------|-------------------------------------|
| A. <i>Periplaneta americana</i> | (i) Choragogen cells |
| B. <i>Rana tigrina</i> | (ii) Cannibalism |
| C. <i>Pheretima posthuma</i> | (iii) Paurometabolous metamorphosis |
| | (iv) 10 pairs of cranial nerves |
| | (v) Porphyrin pigment |
| | (vi) Corpora cardiaca |
| | (vii) Bidder's canal |

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

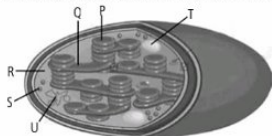
36. How many of the given statements are correct?

- (i) Non-keratinised stratified squamous epithelium is impermeable to water.
(ii) Connective tissue develops from embryonic mesoderm.
(iii) Areolar tissue is present under the skin as subcutaneous tissue in between and around muscles.
(iv) Erythrocytosis causes oxygen shortage in blood and tissues and stimulate secretion of hormone erythropoietin.
(v) Both skeletal and smooth muscle fibres are syncytial in nature.
(a) 3 (b) 5 (c) 2 (d) 4

37. Read the given statements and identify various structures from their functions.

- (i) Help in the formation and retraction of pseudopodia.
(ii) Cranial nerve of frog which helps in hearing and balancing organs.
(iii) Tubular appendage present in Gram -ve bacteria which helps in forming conjugation tube.
- | | (i) | (ii) | (iii) |
|-----|------------------------|------------------------|----------|
| (a) | Microfilaments | Auditory nerve | Pili |
| (b) | Intermediate filaments | Vagus nerve | Fimbriae |
| (c) | Microtubule | Glossopharyngeal nerve | Flagella |
| (d) | Cilia | Abducens nerve | Pili |

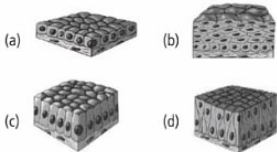
38. Select the option showing correct labellings in given figure.



- (a) P-Thylakoid, R-Granum; S-Lamella
 (b) P-Granum; Q-Lamella, U-DNA
 (c) S-Ribosome; T-Lamella; U-DNA
 (d) Q-Lamella; R-Thylakoid; T-Starch granule
39. All the given statements are incorrect, except
 (a) In polysomes, the different ribosomes are connected by strand of rRNA.

- (b) Cell bodies of non-medullated neurons and their dendrites constitute grey matter of the brain.
 (c) Heart of frog is neurogenic.
 (d) Lysosome helps in osteogenesis, i.e., formation of bone from cartilage.

40. Pseudostratified columnar epithelium is shown in



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TARGET NEET

Exam on
26th July 2020

- The sequence of nitrogenous bases in one strand of DNA are 3' TAC GCG ACG 5'. The complementary DNA strand should have
(a) 5' AUG CGC TGC 3' (b) 3' ATG CGC TGC 5'
(c) 5' UAC GCG ACG 3' (d) 5' ATG CGC TGC 3'
- Match the entries in Column I with those of Column II and choose the correct answer.

Column I

- A. Restriction endonucleases
B. Polymerase chain reaction
C. DNA fingerprinting
D. Monoclonal antibodies
- (i) Kohler and Milstein
(ii) Alec Jeffreys
(iii) Arber
(iv) Kary Mullis
- (a) A-(ii), B-(iv), C-(ii), D-(i)
(b) A-(iii), B-(ii), C-(iv), D-(i)
(c) A-(i), B-(iii), C-(iv), D-(i)
(d) A-(ii), B-(iv), C-(iii), D-(ii)

Column II

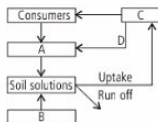
- Match Column I with Column II and select the correct option.

Column I

- A. Ascomycetes
B. Phycmycetes
C. Basidiomycetes
D. Deuteromycetes
- (i) *Ustilago*
(ii) *Saccharomyces*
(iii) *Trichoderma*
(iv) *Albugo*
- (a) A-(ii), B-(i), C-(iv), D-(iii) (b) A-(iv), B-(ii), C-(ii), D-(i)
(c) A-(ii), B-(iv), C-(i), D-(iii) (d) A-(iii), B-(iv), C-(i), D-(ii)

Column II

- Given below is a simplified model of phosphorus cycling in a terrestrial ecosystem with four blanks (A-D). Identify the blanks.



	A	B	C	D
(a)	Rock minerals	Detritus	Litter fall	Producers
(b)	Litter fall	Producers	Rock minerals	Detritus
(c)	Detritus	Rock minerals	Producers	Litter fall
(d)	Producers	Litter fall	Rock minerals	Detritus

- Match the microbial products listed under Column I with the related microbes given under Column II. Choose the appropriate option from the given choices.

Column I

- A. Citric acid
B. Cyclosporin A
C. Statin
D. Gobar gas

Column II

- (i) *Methanobacterium*
(ii) *Monascus purpureus*
(iii) *Aspergillus niger*
(iv) *Trichoderma polysporum*
(v) *Clostridium butylicum*
- (a) A-(ii); B-(iv); C-(v); D-(iii)
(b) A-(iii); B-(iv); C-(ii); D-(i)
(c) A-(iii); B-(iv); C-(ii); D-(v)
(d) A-(v); B-(ii); C-(iv); D-(iii)

- During which phase(s) of cell cycle, amount of DNA in a cell remains at 4C level if the initial amount is denoted as 2C?

- (a) G₀ and G₁ (b) G₁ and S
(c) G₂ (d) G₂ and M

- Match the following and choose the correct combination from the options given.

Column I

- Chemical compounds**
A. Nitrogen base
B. Nucleoside
C. Nucleotide
D. Nucleic acid

Column II

- Example**
(i) RNA
(ii) Thymidylic acid
(iii) Cytidine
(iv) Uracil

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

8. Which of the following characters are not applicable to the anatomy of dicot stem and choose the correct statements given below?

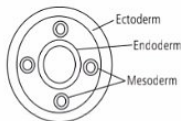
- A. Collenchymatous hypodermis
 B. Exarch xylem
 C. Pith is absent
 D. Open vascular bundle
 E. Presence of medullary rays
 Of these

- (a) A, D and E only (b) B and C only
 (c) B and E only (d) A, B and C only

9. In dicotyledonous stem, which of the following is the sequence of tissues from inside to outside?

- (a) Pith, phloem, cambium, protoxylem, metaxylem, pericycle, parenchyma, collenchyma, endodermis and epidermis
 (b) Pith, cambium, phloem, protoxylem, metaxylem, pericycle, endodermis, parenchyma, collenchyma and epidermis
 (c) Pith, phloem, protoxylem, metaxylem, cambium, pericycle, endodermis, parenchyma, collenchyma and epidermis
 (d) Pith, protoxylem, metaxylem, cambium, phloem, pericycle, endodermis, parenchyma, collenchyma and epidermis

10. The kind of coelom represented in the diagram given below is characteristic of



- (a) round worm (b) earthworm
 (c) tape worm (d) cockroach.

11. Identify the given figure and select the correct option.

- (a) Neutrophil - phagocytic cell which destroy foreign organisms entering the body.
 (b) Eosinophil - their number increases during allergic infection.
 (c) Lymphocyte - small sized non-motile and non-phagocytic.
 (d) Monocyte - motile and phagocytic in nature.



12. Which of the following groups of algae belongs to Class Rhodophyceae?

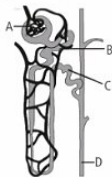
- (a) *Laminaria, Fucus, Porphyra, Volvox*
 (b) *Gelidium, Porphyra, Dictyota, Fucus*
 (c) *Gracilaria, Gelidium, Porphyra, Polysiphonia*
 (d) *Volvox, Spirogyra, Ulothrix, Sargassum*

13. Read the following statements and identify the correct options given.

- A. Angiosperms range in size from microscopic *Wolffia* to tall trees of *Eucalyptus*.
 B. In angiosperms, the seeds are enclosed by fruits.
 C. Double fertilisation is an event unique to angiosperms.
 D. In angiosperms, each cell of an embryo sac is diploid.
 E. In angiosperms, the zygote develops into an endosperm.
 Of the above statements

- (a) A, B and D alone are correct.
 (b) A, B and E alone are correct.
 (c) A, B and C alone are correct.
 (d) B, C and D alone are correct.

14. Refer the given figure of nephron.



Identify A, B, C and D and select the correct option regarding them

- (a) A-Glomerulus - a tuft of capillaries formed by afferent arteriole.
 (b) B-PCT-reabsorption of HCO_3^- and selective secretion of H^+ and K^+ occurs here.
 (c) C-DCT-almost all glucose, amino acids, water, Na^+ , K^+ and uric acid are absorbed here.
 (d) D-Collecting duct-extends from the cortex of the kidney to the inner parts of medulla. Large amount of water is secreted in this region.
15. Choose the wrongly matched pair.
- (a) Portion of myofibril - Sarcomere
 between two 'Z' lines
 (b) Isotropic band - Actin
 (c) Anisotropic band - Myosin
 (d) Central part of I-band - M-line
16. Which of the following statement(s) about taxonomic aids is/are true?
- i. Keys are used to identify plants and animals based on similarities and dissimilarities.

- II. Flora contains the account of habitat and distribution of plants in a given area.
 III. Flora provides an index to the plant species found in a particular area.
 IV. Monographs provide information for identifying the species found in an area.

- (a) I and II only (b) I, II and III only
 (c) I and IV only (d) I only

17. Match the mineral in column I with the enzyme activated by it in column II and choose the correct option.

Column I

- A. Magnesium
 B. Molybdenum
 C. Zinc

- (a) A - II, B - III, C - I
 (b) A - I, B - II, C - III
 (c) A - II, B - I, C - III
 (d) A - III, B - II, C - I

Column II

- I. Alcohol dehydrogenase
 II. Phosphoenolpyruvate carboxylase
 III. Nitrogenase

18. A man whose father was colour blind marries a woman who had a colour blind mother and normal father. What percentage of male children of this couple will be colour blind?

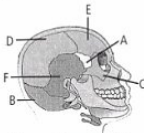
- (a) 25% (b) 0%
 (c) 50% (d) 75%

19. If 20 J of energy is trapped at producer level, then how much energy will be available to peacock as food in the following chain?

Plant → Mice → Snake → Peacock

- (a) 0.02 J (b) 0.002 J
 (c) 0.2 J (d) 0.0002 J

20. Label the parts marked in the human skull and select the correct option.



- (a) A-temporal bone; B-parietal bone; C-sphenoid bone; D-frontal bone; E-zygomatic bone; F-occipital bone
 (b) A-frontal bone; B-zygomatic bone; C-occipital bone; D-sphenoid bone; E-parietal bone; F-temporal bone
 (c) A-sphenoid bone; B-occipital bone; C-zygomatic bone; D-parietal bone; E-frontal bone; F-temporal bone
 (d) A-sphenoid bone; B-zygomatic bone; C-occipital bone; D-frontal bone; E-temporal bone; F-parietal bone

21. Match the items listed under column-I with those given under column-II. Choose the appropriate option from the given choices.

Column-I

- A. Residual volume (RV)
 B. Inspiratory Reserve Volume (IRV)
 C. Vital capacity (VC)
 D. Expiratory Reserve Volume (ERV)
 E. Inspiratory capacity (IC)

Column-II

- p. 4000 mL - 4600 mL
 q. 1100 mL - 1200 mL
 r. 1000 mL - 1100 mL
 s. 3000 mL - 3500 mL
 t. 2500 mL - 3000 mL

A B C D E

- (a) t q s r p
 (b) q r s t p
 (c) q t p r s
 (d) r p q s t

22. Which of the following is correct?

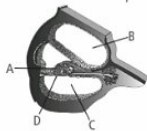
- (a) Population change = (Birth + immigration) - (death + emigration)
 (b) Population change = (Birth + immigration) + (death + emigration)
 (c) Population change = (Birth + emigration) + (death - immigration)
 (d) Population change = (Birth - immigration) - (death + emigration)

23. In this diagram showing the L.S. of an embryo of grass, identify the answer having the correct combination of alphabets with the right part.



- (a) A - Epiblast, B - Scutellum, C - Coleoptile, D - Radicle, E - Coleorhiza, F - Shoot apex
 (b) A - Root cap, B - Coleoptile, C - Scutellum, D - Coleorhiza, E - Epiblast, F - Shoot apex
 (c) A - Epiblast, B - Radicle, C - Coleoptile, D - Scutellum, E - Coleorhiza, F - Shoot apex
 (d) A - Shoot apex, B - Epiblast, C - Coleorhiza, D - Scutellum, E - Coleoptile, F - Radicle

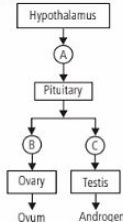
24. Given is the diagrammatic representation of the sectional view of cochlea. Select the correct option regarding it.



- (a) A - Organ of Corti-responsible for maintenance of balance of the body and posture.

- (b) B - Scala vestibuli-filled with endolymph that ends at the oval window.
 (c) C - Scala tympani - terminates at the round window which opens to the middle ear.
 (d) D - Basilar membrane - nerve impulses are generated against it.

25. Identify the hormones 'A', 'B' and 'C' that are labelled in the given flow chart.



- (a) A-GnRH, B-PRL, C-ICSH
 (b) A-GnRH, B-ICSH, C-ISH
 (c) A-GnRH, B-FSH, C-LH
 (d) A-GH, B-FSH, C-LH

26. The figure shows blood circulation in humans with labels A to D. Select the option which gives correct identification of label and functions of the part.



- (a) B - Capillary-Thin without muscle layer and wall two cell layers thick
 (b) C - Vein-Thin walled and blood flows in jerks/sprts
 (c) D - Pulmonary vein-Takes oxygenated blood to heart, $P_{O_2} = 95$ mmHg
 (d) A - Artery-Thick walled and blood flows evenly

27. Match the items in Column I with those in Column II, and choose the correct answer.

Column I	Column II
A. Control of weeds	(i) Gibberellin
B. Induction of germination	(ii) Cytokinin
C. Ripening of fruit	(iii) 2, 4-D
D. Delaying of senescence	(iv) Ethylene

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

28. Select the plants pollinated by water.

- A. Water hyacinth B. *Zostera*
 C. *Amorphophallus* D. *Vallisneria*
 E. *Yucca*

- (a) A, D and E only
 (b) B and E only
 (c) B and D only
 (d) B, C and D only

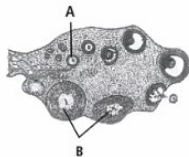
29. Out of 38 molecules of ATP produced upon aerobic respiration of glucose, the break up in ATP production in glycolysis (P), pyruvate to acetyl-CoA formation (Q) and Krebs' cycle (R) is as follows :

- (a) P = 2, Q = 6, R = 30
 (b) P = 8, Q = 6, R = 24
 (c) P = 8, Q = 10, R = 20
 (d) P = 2, Q = 12, R = 24

30. Identify the DNA segment which is not a palindromic sequence.

- (a) 5' GGATCC 3'
 3' GGATCC 5'
 (b) 5' GAATTC 3'
 3' CTTAAG 5'
 (c) 5' GCGGCCGC 3'
 3' CGCCGGCG 5'
 (d) 5' CCCGGG 3'
 3' GGGCCC 5'

31. The figure shows a section of human ovary. Select the option which gives the correct identification of either A or B with function/characteristic.



- (a) B- Corpus luteum - Secretes progesterone
 (b) A- Tertiary follicle - Forms Graafian follicle
 (c) B- Corpus luteum - Secretes testosterone
 (d) A- Primary oocyte - It is in the prophase-I of the meiotic division

32. Put the following parts of a reflex arc in the correct order beginning with the sensory receptor.

- A. Motor neuron B. Interneuron
 C. Effector D. Sensory neuron
 E. Sensory receptor.
 (a) E, D, B, A, C (b) E, D, A, B, C
 (c) A, B, C, D, E (d) A, E, D, B, C

33. Find the wrongly matched pair.
- (a) Endemism - Species confined to one region and not found anywhere else
- (b) Hotspots - Regions with species richness
- (c) Alien species to India - *Clarias gariepinus*
- (d) *In situ* conservation - IVF
34. Select the option which correctly matches the endocrine gland with its hormone and its function.

Endocrine	Hormone	Function
(a) Placenta	Estrogen	Initiates secretion of the milk
(b) Corpus luteum	Estrogen	Essential for maintenance of endometrium
(c) Leydig's cells	Androgen	Initiates the production of sperms
(d) Ovary	FSH	Stimulates follicular development and the secretion of estrogens

35. Some of the steps of DNA fingerprinting are given below. Identify the correct sequence from the options given.
- A. Electrophoresis of DNA fragments
- B. Hybridisation with DNA probe
- C. Digestion of DNA by REs
- D. Autoradiography
- E. Blotting of DNA fragments to nitrocellulose membrane
- (a) C - A - B - E - D (b) C - A - E - B - D
- (c) A - E - C - B - D (d) A - C - E - D - B

36. Which of the following is not vestigial organ in human beings?
- (a) Rudimentary ear muscles and third molars
- (b) Coccygeal (tail) vertebrae and scalp muscles
- (c) Vermiform appendix and nictitating membrane of the eye
- (d) Ear pinna, patella, olecranon process

Organ	Phylum	Function
Parapodia	Annelida	? A
? B	Ctenophora	Locomotion
? C	Mollusca	Rasping organ
Malpighian tubules	Arthropoda	? D
Cnidoblasts	Coelenterata	? E

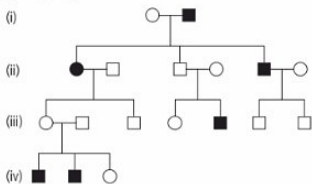
From the above table find out the missing organ or function- A, B, C, D and E respectively

- (a) A-swimming, B-comb plates, C-radula, D-excretion, E-defense
- (b) A-defense, B-radula, C-comb plates, D-excretion, E-swimming

- (c) A-defense, B-radula, C-comb plates, D-swimming, E-excretion
- (d) A-protection, B-parapodia, C-visceral mass, D-locomotion, E-excretion

38. Each 100 mL of human arterial blood carries 'P' mL of O₂ and 'Q' mL of CO₂ whereas each 100 mL of venous blood carries 'R' mL of O₂ and 'S' mL of CO₂. Choose the correct value of P, Q, R and S.
- (a) P - 48 mL, Q - 19-20 mL, R - 52 mL, S - 14-15 mL
- (b) P - 19-20 mL, Q - 48 mL, R - 14-15 mL, S - 52 mL
- (c) P - 14-15 mL, Q - 52 mL, R - 19-20 mL, S - 48 mL
- (d) P - 52 mL, Q - 14-15 mL, R - 48 mL, S - 19-20 mL

39. In the following human pedigree, the filled symbols represent the affected individuals. Identify the type of given pedigree.



- (i) (a) Autosomal recessive (b) X-linked dominant
- (ii) (c) Autosomal dominant (d) X-linked recessive
40. Match the items in Column I with those in Column II, and choose the correct answer.

Column I	Column II
P. Mitosis	(i) Occurs in diploid cells only
Q. Meiosis	(ii) Occurs in both haploid and diploid cells
	(iii) Daughter and parent cells have same chromosome numbers
	(iv) Synapsis of homologous chromosomes
(a) P-(i), Q-(ii)	(b) P-(ii), Q-(iii)
(c) P-(iii), Q-(iv)	(d) P-(iv), Q-(i)

41. Which of the following statements about plasmolysis is/are true?

- I. Plasmolysis occurs when water moves into the cell.
- II. Cells shrink in hypotonic solutions.
- III. If the external solution balances the osmotic pressure of the cytoplasm, it is said to be isotonic.
- (a) I only (b) II only
- (c) III only (d) I and II only

42. Match the following and select the correct option.

Column - I

- A. *Pteris*
B. *Cycas*
C. *Sphagnum*
D. *Sargassum*

Column - II

- (i) Gymnosperm
(ii) Bryophyte
(iii) Algae
(iv) Pteridophyta

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

43. $\frac{1}{4}Tt : \frac{1}{2}Tt : \frac{1}{4}tt$ is the binomial expansion of

- (a) $\left(\frac{1}{2}T + \frac{1}{2}t\right)^2$ (b) $\left(\frac{1}{4}T + \frac{1}{4}t\right)^2$
(c) $\left(\frac{1}{4}T + \frac{1}{2}t\right)^2$ (d) $\left(\frac{1}{2}T + \frac{1}{4}t\right)^2$

44. Choose the wrong pair

- (a) Divergent evolution - Forelimbs of whales, bats, cheetah and human
(b) Convergent evolution - Flippers of penguins and dolphins
(c) Homologous structures - Vertebrate hearts
(d) Analogous structures - Tendrils of *Bougainvillea* and thorns of *Cucurbita*

45. Read the statements.

- (i) IgE antibodies are produced in an allergic reaction.
(ii) B-lymphocytes mediate cell mediated immunity.
(iii) The yellowish fluid colostrum has abundant IgE antibodies.
(iv) Spleen is a secondary lymphoid organ.
Of the above statements

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

46. In the ribose of RNA, unlike DNA, every nucleotide residue has an additional

- (a) COOH group in the 2' position
(b) OH group in the 5' position
(c) OH group in the 2' position
(d) Phosphate group in the 2' position

47. Progestasert is an IUD which makes the uterus unsuitable and cervix hostile to the sperms as they are

- (a) hormone releasing IUDs
(b) copper releasing IUDs
(c) ideal contraceptive
(d) non-medicated IUDs.

48. Golden rice is a genetically modified crop plant where the incorporated gene is meant for biosynthesis of

- (a) omega 3 (b) vitamin A
(c) vitamin B (d) vitamin C.

49. *Triticale* is an example of

- (a) autopolyploidy (b) allopolyploidy
(c) aneuploidy (d) none of these.

50. Maximum absorption of light by chlorophyll a occurs in which regions of the absorption spectrum?

- A. Blue B. Red
C. Green D. Yellow
(a) A and B only (b) B and C only
(c) A and D only (d) B and D only

51. Identify the correctly matched structure and its secretion.

- (a) Brunner's gland - Salivary amylase
(b) Intestinal mucosa - Insulin
(c) Gall bladder - Bile
(d) Salivary gland - Lysozyme

52. Which of the following statements does not apply to eutrophication?

- (a) It is the natural aging of a lake by nutrient enrichment of its water.
(b) In a young lake the water is cold and clear and supports less life.
(c) The nutrients such as sulphur and phosphorus encourage the growth of aquatic organisms in the lake.
(d) Pollutants released by man radically accelerate the aging process of a lake.

53. Given here is a pie chart representation of the extent of global diversity of invertebrates. What groups the four portions (A-D) represent respectively?



- | | A | B | C | D |
|-----|-------------|---------------------|---------------------|---------------------|
| (a) | Insects | Crustaceans | Other animal groups | Molluscs |
| (b) | Crustaceans | Insects | Molluscs | Other animal groups |
| (c) | Molluscs | Other animal groups | Crustaceans | Insects |
| (d) | Insects | Molluscs | Crustaceans | Other animal groups |

54. Match the following and select the correct answer.

- A. Centriole (i) Infoldings in mitochondria
B. Chlorophyll (ii) Thylakoids
C. Cristae (iii) Nucleic acids
D. Ribozymes (iv) Basal body of cilia or flagella

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

55. Match the hormones secreted by various endocrine structures and choose the correct option.

I. Hypothalamus	A. Melanocyte stimulating hormone
II. Pars intermedia	B. Aldosterone
III. Pineal gland	C. Gonadotrophin releasing hormone
IV. Adrenal medulla	D. Melatonin
V. Adrenal cortex	E. Catecholamines

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

56. A fall in glomerular filtration rate (GFR) activates

- (a) juxtaglomerular cells to release renin
 (b) adrenal cortex to release aldosterone
 (c) adrenal medulla to release adrenaline
 (d) posterior pituitary to release vasopressin.

57. Choose the wrong statement.

- (a) Solubility of CO_2 in blood is 20-25 times higher than that of O_2 .
 (b) The total volume of air accommodated in the lungs at the end of a forced inspiration is called the 'vital capacity'.
 (c) O_2 can bind with haemoglobin in a reversible manner to form oxyhaemoglobin.
 (d) Every 100 mL of deoxygenated blood delivers approximately 4 mL of CO_2 to the alveoli.

58. Choose the wrong statement.

- (a) Cells swell in hypertonic solutions and shrink in hypotonic solutions.
 (b) Water potential is the kinetic energy of water which helps in the movement of water.
 (c) The absorption of water by seeds and dry wood takes place by a special type of diffusion called imbibition.
 (d) Solute potential or ψ_s is always negative.

59. Find out the mismatched pair.

- (a) C_4 plants → Kranz anatomy
 (b) Primary CO_2 acceptor → RuBP of C_3 plants
 (c) Calvin pathway of C_4 plants occurs in → Bundle sheath
 (d) C_3 plants → Maize

60. Which one of the following organelle in the figure correctly matches with its function?

- (a) Golgi apparatus, formation of glycolipids
 (b) Rough endoplasmic reticulum, protein synthesis



- (c) Rough endoplasmic reticulum, formation of glycoproteins
 (d) Golgi apparatus, protein synthesis

61. Identify the tissue shown in the diagram and match with its characteristics and its location.



- (a) Smooth muscles, show branching, found in the wall of the heart.
 (b) Cardiac muscles, unbranched muscles, found in the walls of the heart.
 (c) Striated muscles, tapering at both-ends, attached with the bones of the ribs.
 (d) Skeletal muscles show striations and are closely attached with the bones of the limbs.

62. Select the answer which correctly matches the endocrine gland with the hormone it secretes and its function/deficiency symptom.

Endocrine gland	Hormone	Function/Deficiency symptoms
(a) Thyroid gland	Thyroxine	Lack of iodine in diet results in goitre
(b) Corpus luteum	Testosterone	Stimulates spermatogenesis
(c) Anterior pituitary	Oxytocin	Stimulates uterus contraction during child birth
(d) Posterior pituitary	Growth Hormone(GH)	Oversecretion stimulates abnormal growth

63. Which of these is/are not a property of facilitated transport?

- A. Requires special membrane proteins
 B. Highly selective
 C. Uphill transport
 D. Requires ATP energy
- (a) A and B only (b) C and D only
 (c) A and C only (d) B and C only

64. The site on antigen that are recognised by antibodies and receptors present on T- and B-cells are

- (a) antigenic determinants
 (b) epitopes
 (c) paratopes
 (d) both (a) and (b).

65. Protein encoded by gene *cryIIAb* controls the infestation of which of the following insects

- (a) cotton boll worm
 (b) anopheles mosquito
 (c) corn borer
 (d) aedes mosquito.

66. RNA interference which is employed in making tobacco plant resistant to *Meloidogyne incognita* is essentially involved in

- (a) preventing the process of replication of DNA

- (b) preventing the process of translation of mRNA
 (c) preventing the process of splicing of hnRNA
 (d) preventing the process of transcription.

67. Which of the following statements is correct?
 (a) Sporopollenin can be degraded by enzymes.
 (b) Sporopollenin is made up of inorganic materials.
 (c) Sporopollenin can withstand high temperatures as well as strong acids and alkalis.
 (d) Sporopollenin can withstand high temperatures but not strong acids.

68. Starting from the maximum, arrange the following male reproductive accessory organs in the correct order, based on the amount of secretion.

- (i) Prostate gland
 (ii) Seminal vesicle
 (iii) Bulbourethral gland

- (a) (i) > (ii) > (iii) (b) (iii) > (ii) > (i)
 (c) (ii) > (iii) > (i) (d) (ii) > (i) > (iii)

69. Read the following statements and choose the correct option.

- A. Increase in melanised moths after industrialisation in Great Britain is a proof for natural selection.
 B. When more individuals of a population acquire a mean character value, it is called disruption.
 C. Changes in allelic frequency in a population will lead to Hardy-Weinberg equilibrium.
 D. Genetic drift changes the existing gene or allelic frequency in future generations.

- (a) B alone is correct.
 (b) D alone is correct.
 (c) A and D alone are correct.
 (d) A and C alone are correct.

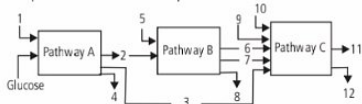
70. Photochemical smog formed in congested metropolitan cities mainly consists of

- (a) ozone, peroxyacyl nitrate and NO_x
 (b) smoke, peroxyacyl nitrate and SO_2
 (c) hydrocarbons, SO_2 and CO_2
 (d) hydrocarbons, ozone and SO_x .

71. Which of the following statements about productivity is true?

- (a) The annual net primary productivity of the whole of the biosphere is 17 billion tons (dry weight) of organic matter.
 (b) Net primary productivity is the amount of biomass available for consumption by carnivores.
 (c) Secondary productivity is defined as the rate of formation of new organic matter by decomposers.
 (d) Primary productivity depends on the plant species inhabiting a particular area.

72. The three boxes in this diagram represent the three major biosynthetic pathways in aerobic respiration. Arrows represent net reactants or products.



Arrows numbered 4, 8 and 12 can all be

- (a) H_2O (b) FAD^+ or FADH_2
 (c) NADH (d) ATP.

73. Match the entries in Column - I with those of Column - II and choose the correct answer given below.

Column - I

- (A) Cytokinins
 (B) Auxins
 (C) Abscisic acid
 (D) Ethylene

Column - II

- (p) Stress hormone
 (q) Ripening of fruits
 (r) Apical dominance
 (s) Bolting
 (t) Richmond Lang effect

- (a) A - (t), B - (r), C - (p), D - (q)
 (b) A - (t), B - (r), C - (p), D - (s)
 (c) A - (r), B - (s), C - (q), D - (p)
 (d) A - (q), B - (q), C - (t), D - (r)

74. The two reducing powers of light reaction are used in dark reaction during formation of

- (a) 3-phosphoglycerate from ribulose-1, 5-bisphosphate
 (b) glyceraldehyde 3-phosphate from 3-phospho-glycerate
 (c) sucrose from triose phosphate
 (d) ribulose-1, 5-bisphosphate from triose phosphate.

75. Read the following statements and select the correct option.

- A. Circulatory system in arthropods is of closed type.
 B. Parapodia in annelids help in swimming.
 C. Phylum Mollusca is the second largest animal phylum.
 D. Aschelminthes are dioecious.

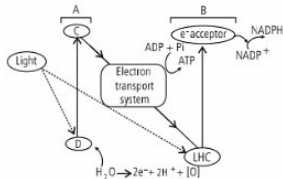
- (a) A and C alone are wrong
 (b) A alone is wrong
 (c) C alone is wrong
 (d) C and D alone are wrong

Monthly Test Drive CLASS XII ANSWER KEY

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

76. Global warming can be controlled by
- increasing deforestation, slowing down the growth of human population.
 - increasing deforestation, reducing efficiency of energy usage.
 - reducing deforestation, cutting down use of fossil fuel.
 - reducing reforestation, increasing the use of fossil fuel.
77. The restriction endonucleases are used in genetic engineering, because
- they can cut DNA at specific base sequences
 - they are nucleases that cut DNA at variable sites
 - they can degrade harmful proteins
 - they can join different DNA fragments

78.



Which of the following is correctly labelled for the given figure?

- A : PS II ; B : PS I ; C : e^- acceptor ; D : LHC
 - A : LHC ; B : e^- acceptor ; C : PS I ; D : PS II
 - A : PS I ; B : PS II ; C : e^- acceptor ; D : LHC
 - A : e^- acceptor ; B : LHC ; C : PS II ; D : PS I
79. Consider the following statements with respect to respiration.
- Glycolysis occurs in the cytoplasm of the cell.
 - Aerobic respiration takes place within the mitochondria.
 - Electron transport system is present in the outer mitochondrial membrane.
 - $C_{51}H_{98}O_6$ is the chemical formula of Tripalmitin, a fatty acid.
 - Respiratory quotient = $\frac{\text{Volume of } O_2 \text{ evolved}}{\text{Volume of } CO_2 \text{ consumed}}$
- Of the above statements
- A, B and D alone are correct
 - B, C and D alone are correct
 - C, D and E alone are correct
 - B, D and E alone are correct
80. Choose the wrong statement.
- Lipases and nucleases are not present in pancreatic juice.

- Goblet cells secrete mucus.
- Brunner's glands are sub-mucosal glands.
- Carboxypeptidase catalyses conversion of proteins, peptones and proteoses to dipeptides.

81. For a plasmolysed cell which equation is correct?
- $DPD = OP + TP$
 - $DPD = -TP$
 - $DPD = OP$
 - $DPD = OP - TP$
82. Cortisol is secreted by the adrenal cortex in response to stress. In addition to its function in a stress response, it functions in negative feedback by
- inhibiting the hypothalamus so that corticotropin releasing hormone (CRH) secretion is reduced.
 - inhibiting the anterior pituitary's ability to respond to CRH by reducing the pituitary's sensitivity to CRH.
 - both (a) and (b) are correct.
 - none of these.
83. Which of the following statement(s) regarding coelenterates is/are wrong?
- Cnidocytes are present on the tentacles and on the body.
 - Diploblastic with cellular level of organization.
 - Polyp forms are free swimming.
 - Exhibits metagenesis.
 - Polyps produce medusae sexually and medusae form polyps asexually.
- II and IV only
 - III and V only
 - I, II and III only
 - II, III and V only
84. Which of these is/are wrongly matched?
- Alkaloid – Codeine
 - Lectin – Morphine
 - Toxin – Abrin
 - Terpene – Curcumin
- I and II only
 - II and III only
 - II and IV only
 - III and IV only
85. Match Column - I with Column - II and choose the correct option from below.
- | Column - I | Column - II |
|--------------------------|---------------|
| A. Marginal placentation | (i) Sunflower |
| B. Axile placentation | (ii) Mustard |
| C. Parietal placentation | (iii) Lemon |
| D. Basal placentation | (iv) Pea |
- A - (iv), B - (iii), C - (ii), D - (i)
 - A - (iv), B - (iii), C - (i), D - (ii)
 - A - (iv), B - (i), C - (ii), D - (iii)
 - A - (iii), B - (iv), C - (i), D - (i)
86. According to the modern concept of cellular membranes the structure of the cell membrane is as follows

- (a) there is a continuous lipid bilayer with interspersed proteins on the outside as well as some on the inside
 (b) there is a continuous lipid bilayer with continuous protein layer on the outside
 (c) there is a continuous lipid bilayer with continuous protein layer on the inside
 (d) both (b) and (c).

87. Match the name of the animal (Column I), with one characteristic (Column II), and the phylum / class (column III) to which it belongs.

Column I	Column II	Column III
(a) <i>Limulus</i>	Body covered by chitinous exoskeleton	Pisces
(b) <i>Adamsia</i>	Radially symmetrical	Porifera
(c) <i>Petromyzon</i>	Ectoparasite	Cyclostomata
(d) <i>Ichthyophis</i>	Terrestrial	Reptilia

88. Select the wrong statement.

- (a) In Oogamy, female gamete is smaller and motile, while male gamete is larger and non-motile.
 (b) *Chlamydomonas* exhibits both isogamy and anisogamy and *Fucus* shows oogamy.
 (c) Isogametes are similar in structure, function and behaviour.
 (d) Anisogametes differ either in structure, function or behaviour.

89. Which of the following is correctly matched without exception in regard to plant classification?

- (a) Family – Poaceae – ae
 (b) Division – Pteridophyta – phyta
 (c) Class – Bryopsida – sida
 (d) Genus – *Solanum* – um

90. (i) They help in respiration.
 (ii) They help in cell wall formation.
 (iii) They help in DNA replication.
 (iv) They increase surface area of plasma membrane.

Which of the following prokaryotic structures has all the above roles?

- (a) Ribosome (b) Mesosome
 (c) Lysosome (d) Polysome

91. Match Column I with Column II.

Column I	Column II
P. Pollen grains	(i) Photochemical smog
Q. PAN	(ii) Particulate pollution
R. CO ₂	(iii) Global warming
S. Cadmium	(iv) Itai itai disease

- (a) P-(ii), Q-(i), R-(iii), S-(iv)
 (b) P-(iv), Q-(ii), R-(i), S-(iii)
 (c) P-(i), Q-(ii), R-(iii), S-(iv)
 (d) P-(ii), Q-(i), R-(i), S-(iv)

92. IUDs which are used by females

- (a) are implanted under the skin and they release progesterone and estrogen
 (b) act as spermicidal jellies
 (c) release copper ions in the uterus that increase phagocytosis of sperm
 (d) block the entry of sperms into vagina.

93. Entry of pollen tube through micropyle is termed as

- (a) mesogamy (b) porogamy
 (c) syngamy (d) chalazogamy

94. Lindeman for the first time gave energy transfer law, which states that

- (a) only 20% of the energy is transferred to each trophic level
 (b) only 10% of the energy is transferred to each trophic level
 (c) only 30% of the energy is transferred to each trophic level
 (d) only 50% of the energy is transferred to each trophic level.

95. Which of the following statements about enzymes is wrong?

- (a) Enzymes are denatured at high temperatures.
 (b) Enzymes are mostly proteins but some are lipids also.
 (c) Enzymes are highly specific.
 (d) Enzymes require optimum pH and temperature for maximum activity.

96. Find the wrongly matched pair.

- (a) Unicellular glandular cells – Goblet cell
 (b) Fusiform fibres – Smooth muscle
 (c) Cartilage – Areolar tissue
 (d) Intercalated discs – Cardiac tissue.

Monthly Test Drive CLASS XI ANSWER KEY

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

97. The solid linear cytoskeletal elements having a diameter of 6 nm and made up of a single type of monomer are known as
 (a) microtubules (b) microfilaments
 (c) intermediate filaments (d) lamins.
98. In most simple type of canal system of porifera, water flows through which one of the following ways ?
 (a) Ostia → Spongocoel → Osculum → Exterior
 (b) Spongocoel → Ostia → Osculum → Exterior
 (c) Osculum → Spongocoel → Ostia → Exterior
 (d) Osculum → Ostia → Spongocoel → Exterior.
99. In the gastrointestinal tract the Meissner's plexus and the Auerbach's plexus occur respectively in the
 (a) lamina propria and muscularis mucosa
 (b) submucosa and muscularis externa
 (c) submucosa and mucosa
 (d) mucosa and muscularis externa.
100. Select the wrong statement.
 (a) The term '*contagium vivum fluidum*' was coined by M. W. Beijerinck.
 (b) Mosaic disease in tobacco and AIDS in human being are caused by viruses.
 (c) The viroids were discovered by D.J. Ivanowsky.
 (d) W.M. Stanley showed that viruses could be crystallised.

ANSWER KEY

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



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Total Marks : 160

- Strategies for Enhancement in Food Production
- Microbes in Human Welfare

Time Taken : 40 Min.

1. Refer to the given breeds of chicken.
- (i) Aseel, (ii) Rhode Island Red, (iii) Busra, (iv) Dorking
(v) Jersey Black Giant, (vi) Tennis, (vii) New Hampshire,
(viii) Sussex
- Which of the following are American breeds?
- (a) (ii), (iv), (v) and (vii) only
(b) (ii), (v), (vii) and (viii) only
(c) (ii), (v) and (viii) only
(d) (ii), (iii), (vi) and (viii) only
2. Fill the blank spaces in the table given below by selecting the correct option.

Type of microbes	Scientific name	Products formed
Fungus	A	Penicillin
Bacterium	B	Lactic acid
Fungus	<i>Trichoderma polysporum</i>	C
D	<i>Monascus purpureus</i>	Statins

- (a) A-*Aspergillus niger*, B-*Streptococcus*,
C-Citric acid, D-Fungus
- (b) A-*Claviceps purpurea*, B-*Clostridium butyricum*,
C-Acetic acid, D-Bacterium
- (c) A-*Penicillium notatum*, B-*Lactobacillus* sp.
C-Cyclosporin-A, D-Yeast
- (d) A-*Claviceps purpurea*, B-*Acetobacter aceti*,
C-Ergot alkaloids, D-Yeast
3. Read the following statements and select the correct option.
- (i) M.S. Swaminathan is considered as the "Father of White Revolution".
- (ii) Genome is the total genetic material present in a cell.
- (iii) Callus is irregular, unorganised and undifferentiated mass of actively dividing cells.
- (iv) Fusion of protoplast involves fusion of nuclei and not of cytoplasm.

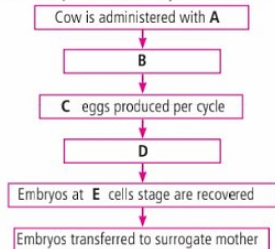
- | | | | | |
|-----|-------|-------|-------|-------|
| | (i) | (ii) | (iii) | (iv) |
| (a) | False | True | False | False |
| (b) | True | True | False | False |
| (c) | True | False | True | False |
| (d) | False | True | True | False |
4. Natural toxic insecticide produced by *Bacillus thuringiensis* is
- (a) squill (b) thurioside
(c) pyrethrum (d) nicotine.
5. Refer to the given statements and select the option that correctly fills in the blanks.
- (i) In protoplast culture, the protoplast of the two plants are brought together and made to fuse in a solution of A.
- (ii) An excess of auxin promotes B, whereas that of cytokinin promotes C.
- (a) A-cellulose; B-meristem culture; C-endosperm culture
(b) A-polyethylene glycol; B-root culture; C-shoot culture
(c) A-benzyl aminopurine; B-protoplast culture; C-shoot culture
(d) A-pectinase; B-protoplast culture; C-endosperm culture
6. Match column I with column II and select the correct option.

Column I	Column II
A. Streptokinase	(i) <i>Mortierella renispora</i>
B. Rennet	(ii) Stain remover
C. Protease	(iii) Clot buster
D. Lipase	(iv) <i>Mucor</i>

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

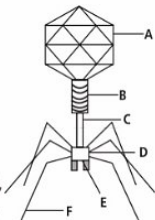
7. _____ decoded the language of "bee dances" and got Nobel Prize for this.
- (a) Dr. Borlaug (b) Ernest Spytzner
(c) Charles Darwin (d) Prof. Karl Von Frisch

8. Which of the following statements is incorrect?
- Azotobacter* increases crop yield as well as save nitrogen fertilisers.
 - In the root nodules of leguminous plants, *Rhizobium* is present in bacteroid form.
 - Frankia* is a nitrogen fixing mycelial bacterium.
 - Azolla* performs biological nitrogen fixation with the help of *Bacillus* sp.
9. Study the given flow chart representing events of MOET and select the option that correctly fill in the blanks.



- A-Luteinising hormone; B-Follicular maturation; C-2-8; D-Cross breeding; E-16-32 and super ovulation
- A-Follicle stimulating hormone; B-Follicular maturation and super ovulation C-6-8; D-Artificial insemination; E-8-32
- A-Interstitial cell stimulating hormone; B-Superovalution; C-5-10; D-Cross breeding; E-12-24
- A-Gonadotropin releasing hormone; B-Gamete formation; C-4-8; D-Artificial insemination; E-7-14

10. Refer to the given diagram of a virus bacterio-phage. In which option all the six parts A, B, C, D, E and F are correctly labelled?



- A-Head, B-Tail, C-Collar, D-Pins, E-Plate, F-Prongs
 - A-Head, B-Collar, C-Tail, D-Plate, E-Pins, F-Prongs
 - A-Head, B-Tail, C-Collar, D-Plate, E-Prongs, F-Pins
 - A-Head, B-Collar, C-Tail, D-Pins, E-Plate, F-Prongs
11. Karan Swiss is a high milk yielding cross-breed of
- Tharparkar cow × Sahiwal bull
 - Sahiwal cow × Jersey bull
 - Sahiwal cow × Brown Swiss bull
 - Jersey cow × Brown Swiss bull.
12. Rectified spirit is _____ alcohol whereas absolute alcohol is _____ alcohol.

- 45%, 100%
- 85%, 95%
- 95%, 100%
- 75%, 95%

13. Honey bees suck the nectar and convert its sucrose into _____ and _____ by the action of _____ enzyme.

- A-dextrose, B-leulose, C-invertase
- A-glucose, B-ribose, C-amylase
- A-fructose, B-glucose, C-invertase
- A-glycogen, B-glucose, C-trypsin

14. Super bugs refers to

- strains of bacteria that have become multiresistant due to repeated transformation
- species of insects that can infect different variety of plants
- species of microorganisms that can be used as manure in different crop fields
- strains of bacteria that are used for making broad spectrum antibiotics.

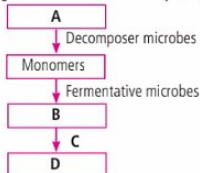
15. The removal of anthers from a bisexual flower, before the anthers mature is called _____.

- bagging
- pureline
- emasculation
- artificial pollination

16. Choose the correct pairs from the following.

- Bacillus thuringiensis* - Cry protein
 - Mycorrhiza - Leguminous plants
 - Statins - Inhibit cholesterol synthesis
 - Trichoderma polysporum* - Cycloporin A
- (i), (ii) and (iii)
 - (i), (ii) and (iv)
 - (i), (iii) and (iv)
 - (ii), (iii) and (iv)

17. Study the given flow chart and identify A, B, C and D.



- A-Organic waste, B-Organic acid, C-Methanogenic bacteria, D-Biogas
- A-Organic waste, B-Organic acid, C-*Bacillus brevis*, D-Biogas
- A-Inorganic fertilisers, B-Organic acid, C-Methanogenic bacteria, D-Biogas
- A-Organic waste, B-Organic acid, C-Methanogenic bacteria, D-H₂S gas

18. Inland fisheries refers to

- capturing fishes from sea coast
- deep sea fishing
- extracting by-products from marine fishes
- raising and capturing of fresh water fishes.

19. *Anabaena*, a N_2 fixer, is present in the leaf cavities of
 (a) *Marselia* (b) *Pistia*
 (c) *Azolla* (d) *Salvinia*.
20. Which of the following crop varieties is resistant to jassids and aphids?
 (a) Pusa Gaurav (b) Pusa A-4
 (c) Pusa Sem 2 (d) Pusa Sawani
21. Tissue Plasminogen Activator is also known as
 (a) pectinases (b) streptokinase
 (c) amylase (d) proteases.
22. Match column I with column II and select the correct option.
- | Column I | Column II |
|--------------|---|
| A. Isinglass | (i) Skin of sharks and rays |
| B. Chrysalis | (ii) A unit of clonal colony in plants |
| C. Shagreen | (iii) Obtained from air bladder of Indian Salmon and cat fish |
| D. Ramet | (iv) Pupal stage of butterfly |
- (a) A-(iii), B-(iv), C-(i), D-(ii)
 (b) A-(i), B-(iii), C-(ii), D-(iv)
 (c) A-(ii), B-(i), C-(iii), D-(v)
 (d) A-(iv), B-(iii), C-(i), D-(ii)
23. **A** is a methane rich fuel gas produced by **B** breakdown of biomass with the help of **C** bacteria.
 (a) A-CNG, B-aerobic, C-methanogenic
 (b) A-Biogas, B-anaerobic, C-methanogenic
 (c) A-LPG, B-anaerobic, C-Gram negative
 (d) A-Biogas, B-aerobic, C-methanogenic
24. Various steps involved in plant breeding are given below. Read the statements and select the option that shows the correct order of these sequences.
 I. Cross-hybridisation among selected parents for bringing their traits together in the progeny.
 II. Selection and testing the hybrid plants to find superior recombinant.
 III. Germplasm or all the diverse alleles for all genes are collected.
 IV. Testing the hybrids for their yield and agronomic traits and finally new cultivars are commercially released for the farmers.
 V. Evaluation and selection of germplasm to identify plant with desired traits.
 (a) III \rightarrow V \rightarrow I \rightarrow II \rightarrow IV
 (b) I \rightarrow II \rightarrow III \rightarrow IV \rightarrow V
 (c) II \rightarrow IV \rightarrow I \rightarrow III \rightarrow V
 (d) V \rightarrow IV \rightarrow III \rightarrow II \rightarrow I
25. Baker's yeast is
 (a) *Saccharomyces cerevisiae*
 (b) *Propionibacterium shermanii*
 (c) *Lactobacillus*
 (d) *Aspergillus niger*.
26. Gaddi, Gurez, Lohi and Merinos are the breeds of
 (a) buffalo (b) sheep
 (c) goat (d) cow.
27. Read the given statements carefully.
 (i) Leghaemoglobin acts as a oxygen scavenger in leguminous plants.
 (ii) Toddy is made by fermentation of sap of palms.
 (iii) Gluconic acid causes partial digestion of milk protein called casein.
 (iv) Release of carbon dioxide and ethyl alcohol during fermentation causes puffing of dough.
 Which of the following statements are correct?
 (a) (ii) and (iv) only (b) (i), (ii) and (iv)
 (c) (i), (ii) and (iv) (d) None of these
28. *Milch breed* of cattle is _____.
 (a) siri (b) shival
 (c) malvi (d) nagori
29. VAM is commonly called **A**. It lives in cortex of **B** and provide **C** to the plants.
 (a) A-mycorrhiza, B-shoots, C-calcium
 (b) A-ectomycorrhiza, B-roots, C-nitrogen
 (c) A-endomycorrhiza, B-roots, C-phosphate
 (d) A-ectomycorrhiza, B-stem, C-minerals
30. High yielding semi-dwarf rice varieties, introduced in India are
 (a) Sonalika and Kalyan Sona
 (b) Jaya and Ratna
 (c) Sonalika and Ratna (d) Himgiri and Komal.

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31. Large holed Swiss cheese is ripened with the help of CO₂ producing bacteria called
 (a) *Streptococcus thermophilus*
 (b) *Propionibacterium sharmanii*
 (c) *Penicillium roqueforti*
 (d) *Penicillium camemberti*.
32. Pebrine, a parasitic disease of silkworm is caused by
 (a) *Nosema apis* (b) *Acarapis woodi*
 (c) *Trichinella spiralis* (d) *Nosema bombycis*.
33. Match the column I with column II.
- | Column I | Column II |
|------------------------|-----------------------------------|
| A. Acetic acid | (i) <i>Spirulina</i> |
| B. Gluconic acid | (ii) <i>Canelida lipolytica</i> |
| C. Single cell protein | (iii) <i>Aspergillus niger</i> |
| D. Lipases | (iv) <i>Acetobacter aceti</i> |
| | (v) Pharmaceuticals |
| | (vi) <i>Fusarium graminearum</i> |
| | (vii) Alcohol fermentation |
| | (viii) <i>Geotrichum candidum</i> |
- (a) A-(i, v); B-(iii, vi); C-(ii, vii); D-(iv, viii)
 (b) A-(i, viii); B-(iii, vi); C-(i, vii); D-(iv, v)
 (c) A-(iv, vii); B-(iii, v); C-(i, vi); D-(ii, viii)
 (d) A-(i, vi); B-(iii, viii); C-(ii, v); D-(iv, vii)
34. The most common fungal partner of mycorrhiza belongs to the genus
 (a) *Azolla* (b) *Glomus*
 (c) *Frankia* (d) *Azotobacter*.
35. Fill the blank spaces in the table given below by selecting the correct option.

Crop	Variety	Resistance to Diseases
Wheat	A	Leaf and stripe rust
Brassica	Pusa Swamim	B
C	Pusa Shubhra	Black rot and curl blight black rot
Cowpea	Pusa Komal	D

- (a) A-Jaya; B-Hill bunt; C-Millets; D-Red rot
 (b) A-Himgiri; B-White rust; C-Cauliflower; D-Bacterial blight

- (c) A-Pusa Sadabahar; B-White rust; C-Chilli; D-Leaf curl
 (d) A-Himgiri; B-Hill bunt; C-Sugarcane; D-Brown rust

36. Rancidity of butter is due to the formation of
 (a) gluconic acid (b) butyric acid
 (c) lactic acid (d) citric acid.
37. Breeding of crops with higher level of vitamins and minerals or higher level of protein and healthier fat is called _____.
 (a) biofortification (b) re nutrition
 (c) bioremediation (d) combination
38. Match column I with column II. (There can be more than one match of column I in column II).

Column I	Column II
A. Inbreeding	(i) Gamma rays
B. Goat	(ii) Lincoln
C. Mutagens	(iii) <i>Triticale</i>
D. Exotic breed of sheep	(iv) <i>Capra capra</i>
E. Allopolyploid	(v) Homozygosity
	(vi) Ultra violet rays
	(vii) Corriedale
	(viii) Sodium azide

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

39. In U.S.A extensive growth of *Eichhornia crassipes* was checked by the application of
 (a) *Cercospora rodmanii*
 (b) *Trichoderma* sp.
 (c) *Puccinia chondrilla*
 (d) *Claviceps purpurea*.
40. Refer to the given statements.
 (i) Suspension culture grows slowly as compared to callus culture.
 (ii) Explants used in meristem culture are shoot tips and nodal segments.
 (iii) Haploids are sterile and have only one copy of each chromosome.
 (iv) Somaclones are genetically identical plants developed from any part of a plant by tissue culture.
 Which of the following statements are correct?
 (a) (i) and (ii) only (b) (i), (iii) and (iv)
 (c) (ii), (iii) and (iv) (d) (iv) only

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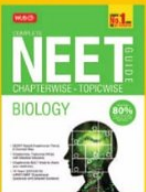
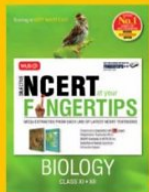
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