

Chapterwise Collection of Most Difficult Biology Questions asked in last 15 Years' NEET/AIPMT

BIOLOGY

1. The Living World

- The living organisms can be unexceptionally distinguished from the non-living things on the basis of their ability for [CBSE-AIPMT 2007]
 (a) responsiveness to touch
 - (b) interaction with the environment and progressive evolution
 - (c) reproduction
 - (d) growth and movement
- **2.** How many organisms in the list given below are autotrophs?

Lactobacillus, Nostoc, Chara, Nitrosomonas, Nitrobacter, Streptomyces, Saccharomyces, Trypanosoma, Porphyra, Wolffia. [CBSE-AIPMT 2012] (a) Four (b) Five (c) Six (d) Three

- Nomenclature is governed by certain universal rules. Which one of the following is contrary to the rules of nomenclature? [NEET 2016, Phase I]
 - (a) The first word in a biological name represents the genus name and the second is a specific epithet
 - (b) The names are written in Latin and are Italicised
 - (c) When written by hand, the names are to be underlined
 - (d) Biological names can be written in any language
- 4. Study the four statements (I-IV) given below and select the two correct ones out of them. [NEET 2016, Phase II]
 - I. Definition of biological species was given by Ernst Mayr.
 - II. Photoperiod does not affect reproduction in plants.
 - III. Binomial nomenclature system was given by RH Whittaker.
 - IV. In unicellular organisms, reproduction is synonymous with growth.

The two correct statements are

(a) II and III (b) III and IV (c) I and IV (d) I and II

- 5. Carbohydrates the most abundant biomolecules on earth, are produced by [CBSE-AIPMT 2005]
 (a) all bacteria, fungi and algae
 (b) fungi, algae and green plant cells
 (c) some bacteria, algae and green plant cells
 (d) viruses, fungi and bacteria
- 6. The label of a herbarium sheet does not carry information on [NEET 2016, Phase II]
 (a) date of collection
 (b) name of collector
 (c) local names
 (d) height of the plant
- 7. Which one of the following is not a correct statement? [NEET 2013]
 - (a) Herbarium houses dried, pressed and preserved plant specimens
 - (b) Botanical gardens have collection of living plants for reference
 - (c) A museum has collection of photographs of plants and animals
 - (d) Key is a taxonomic aid for identification of specimens

2. Kingdom–Monera and Viruses

- 8. Viroids differ from viruses in having [NEET 2017]
 (a) DNA molecules with protein coat
 (b) DNA molecules without protein coat
 - (c) RNA molecules with protein coat
 - (d) RNA molecules without protein coat
 - (d) find molecules without protein coat
- **9.** Select the wrong statement. [CBSE-AIPMT 2015] (a) The viroids were discovered by DJ Ivanowski
 - (b) WM Stanley showed that viruses could be crystallised
 - (c) The term 'Contagium vivum fluidum' was coined by MW Beijerinck
 - (d) Mosaic disease in tobacco and AIDS in human being are caused by viruses



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- 10. Which of the following statements is wrong for viroids? [NEET 2016, Phase I]
 - (a) They are smaller than viruses
 - (b) They cause infections
 - (c) Their RNA is of high molecular weight
 - (d) They lack a protein coat
- **11.** Which of the following statements is not true for retroviruses? [CBSE-AIPMT 2004]
 - (a) DNA is not present at any stage in the life cycle of retroviruses
 - (b) Retroviruses carry gene for RNA dependent DNA polymerase
 - (c) The genetic material in mature retroviruses is RNA
 - (d) Retroviruses are causative agents for certain kinds of cancer in man
- **12.** Which statement is wrong for viruses?

 (a) All are parasites

 [CBSE-AIPMT 2012]
 - (b) All of them have helical symmetry
 - (c) They have ability to synthesise nucleic acids and proteins
 - (d) Antibiotics have no effect on them
- **13.** Barophilic prokaryotes [CBSE-AIPMT 2005]
 - (a) grow slowly in highly alkaline frozen lakes at high altitudes
 - (b) occur in water containing high concentrations of barium hydroxide
 - (c) grow and multiply in very deep marine sediments
 - (d) readily grown and divide in sea water enriched in any soluble salt of barium
- 14. Which one of the following statements about Mycoplasma is wrong? [CBSE-AIPMT 2007]
 - (a) They are also called PPLO
 - (b) They are pleomorphic(c) They are sensitive to penicillin
 - (d) They cause disease in plants

3. Kingdom–Protista

- **15.** Select the wrong statement. [NEET 2016, Phase II] (a) The walls of diatoms are easily destructible
 - (b) 'Diatomaceous earth' is formed by the cell walls of diatoms
 - (c) Diatoms are chief producers in the oceans
 - (d) Diatoms are microscopic and float passively in water
- 16. Auxospores and hormocysts are formed respectively by [CBSE-AIPMT 2005]
 (a) several diatoms and a few cyanobacteria
 - (b) several cyanobacteria and several diatoms
 - (c) some diatoms and several cyanobacteria
 - (d) some cyanobacteria and many diatoms
- **17.** In which group of organisms the cell walls form two thin overlapping shells which fit together?

[CBSE-AIPMT 2015]

(b) Euglenoids(d) Slime moulds

(a) Chrysophytes	
(c) Dinoflagellates	

MODULE 3

18. When a freshwater protozoan possessing a contractile vacuole is placed in a glass containing marine water, the vacuole will [CBSE-AIPMT 2004]
(a) increase in number
(b) disappear
(c) increase in size
(d) decrease in size

4. Kingdom-Fungi

19. Cellulose is the major component of cell walls of

	[CBSE-AIPMT 2008]
(a) Pythium	(b) Xanthomonas
(c) Pseudomonas	(d) Saccharomyces

20. Which one of the following has haplontic life cycle? [CBSE-AIPMT 2009]
(a) Funaria
(b) Polvtrichum

(a) i unana	$(0) \cap Oyunchun$
(c) Ustilago	(d) Wheat

- 21. Choose the wrong statement. [CBSE-AIPMT 2015]
 (a) *Penicillium* is multicellular and produces antibiotics
 (b) *Neurospora* is used in the study of biochemical genetics
 (c) Morels and truffles are poisonous mushrooms
 (d) Yeast is unicellular and useful in fermentation
- 22. Which pair of the following belongs to Basidiomycetes? [CBSE-AIPMT 2007]
 (a) Bird's nest fungi and puff balls
 (b) Puff balls and *Claviceps*(c) *Peziza* and stink horns
 - (d) Morchella and mushrooms
- 23. Trichoderma harzianum has proved a useful microorganism for [CBSE-AIPMT 2008] (a) bioremediation of contaminated soils (b) reclamation of wastelands
 - (c) gene transfer in higher plants
 - (d) biological control of soil-borne plant pathogens
- **24.** Ergot of rye is caused by a species of [CBSE-AIPMT 2007] (a) *Phytophthora* (b) *Uncinula* (c) *Ustilago* (d) *Claviceps*
- **25.** Which of the following environmental conditions are essential for optimum growth of *Mucor* on a piece of bread? [CBSE-AIPMT 2006]
 - I. Temperature of about 25°C
 - II. Temperature of about 5°C
 - III. Relative humidity of about 5%
 - IV. Relative humidity of about 95%
 - V. A shady place
 - VI. A brightly illuminated place

Choose the answer from the following options. (a) I, IV and V (b) II, IV and V (c) II, III and VI (d) II, III and V

5. Plant Kingdom

26.	2. Zygotic meiosis is the characteristic of		[NEET 2017]
	(a) Marchantia	(b) <i>Fucus</i>	
	(c) Funaria	(d) Chlamydomor	nas

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- **27.** Life cycle of *Ectocarpus* and *Fucus* respectively are [NEET 2017]
 - (a) haplontic, diplontic(b) diplontic, haplodiplontic(c) haplodiplontic, diplontic(d) haplodiplontic, haplontic
- **28.** Which one of the following statements is wrong ? [NEET 2016, Phase II]
 - (a) Algae increase the level of dissolved oxygen in the immediate environment
 - (b) Algin is obtained from red algae and carrageenan from brown algae
 - (c) Agar-agar is obtained from *Gelidium* and *Gracilaria* (d) *Laminaria* and *Sargassum* are used as food
- 29. Which one is a wrong statement? [CBSE-AIPMT 2015]
 - (a) Archegonia are found in bryophytes, pteridophytes and gymnosperms
 - (b) *Mucor* has biflagellate zoospores
 - (c) Haploid endosperm is typical feature of gymnosperms
 - (d) Brown algae have chlorophyll-a and c, and fucoxanthin
- **30.** Select the wrong statement. [NEET 2013]
 - (a) Isogametes are similar in structure, function and behaviour
 - (b) Anisogametes differ either in structure, function and behaviour
 - (c) In Oomycetes, female gamete is smaller and motile, while male gamete is larger and non-motile
 - (d) *Chlamydomonas* exhibits both isogamy and anisogamy and *Fucus* shows oogamy
- 31. Male and female gametophytes are independent and free-living in [CBSE-AIPMT 2010]

 (a) mustard
 (b) castor
 (c) Pinus
 (d) Sphagnum
- Which one of the following is a vascular cryptogam? [CBSE-AIPMT 2009]
 (a) Equisetum
 (b) Ginkgo
 - (c) Marchantia (d) Cedrus
- **33.** Ectophloic siphonostele is found in [CBSE-AIPMT 2005] (a) *Adiantum* and Cucurbitaceae
 - (b) Osmunda and Equisetum
 - (c) Marsilea and Botrychium
 - (d) Dicksonia and maiden hair fern
- **34.** Select the correct statement. [NEET 2016, Phase I]
 - (a) Salvinia, Ginkgo and Pinus all are gymnosperms
 - (b) Sequoia is one of the tallest trees
 - (c) The leaves of gymnosperms are not well-adapted to extremes of climate
 - (d) Gymnosperms are both homosporous and heterosporous $% \left({{{\mathbf{r}}_{\mathbf{r}}}} \right)$
- **35.** The gametophyte is not an independent, free-living generation in [CBSE-AIPMT 2011] (a) Adiantum
 - (b) Marchantia
 - (D) IVIAICIIA (a) Diava
 - (c) Pinus
 - (d) Polytrichum

- **36.** Read the following statements and answer the question which follows them
 - I. In liverworts, mosses and ferns gametophytes are free-living.
 - II. Gymnosperms and some ferns are heterosporous.
 - III. Sexual reproduction in *Fucus, Volvox* and *Albugo* are oogamous.
 - IV. The sporophyte in liverworts is more elaborate than that in mosses.

How many of the above	ve statements a	are correct?
(a) One	(b) Two	[NEET 2013]
(c) Three	(d) Four	

37. Select one of the following pairs of important features distinguishing *Gnetum* from *Cycas* and *Pinus* and showing affinities with angiosperms. [CBSE-AIPMT 2008]

- (a) Absence of resin duct and leaf venation(b) Presence of vessel elements and absence of archegonia
- (c) Perianth and two integuments
- (d) Embryo development and apical meristem
- **38.** Flagellated male gametes are present in all the three of which one of the following sets?
 (a) Anthoceros, Funaria and Spirogyra [CBSE-AIPMT 2007]
 (b) Zygnema, Saprolegnia and Hydrilla
 (c) Fucus, Marselia and Calotropis
 (d) Riccia, Dryopteris and Cycas
- **39.** Male gametophyte with least number of cells is present in
 [CBSE-AIPMT 2014]

 (a) Pteris
 (b) Funaria
 (c) Lilium
 (d) Pinus
- 40. Replum is present in the ovary of flower of [CBSE-AIPMT 2008]
 (a) lemon
 (b) mustard
 (c) sunflower
 (d) pea
- **41.** Match items in Column I with those in Column II.

Column I	Column II
A. Peritrichous flagellation	1. Ginkgo
B. Living fossil	2. Macrocystis
C. Rhizophore	3. Escherichia coli
D. Smallest flowering plant	4. Selaginella
E. Largest perennial alga	5. Wolffia

Select the correct answer from the following.

Codes				
А	В	С	D	Е
3	1	4	5	2
2	1	3	4	5
5	3	2	5	1
1	2	5	3	2
	des A 3 2 5 1	des A B 3 1 2 1 5 3 1 2	des A B C 3 1 4 2 1 3 5 3 2 1 2 5	des A B C D 3 1 4 5 2 1 3 4 5 3 2 5 1 2 5 3

[CBSE-AIPMT 2005]

6. Animal Kingdom

- **42.** Which one of the following statements about all the four *Spongilla*, leech, dolphin and penguin is correct? [CBSE-AIPMT 2010]
 - (a) Penguin is homeothermic, while the remaining three are poikilothermic
 - (b) Leech is a freshwater form, while all others are marine
 - (c) *Spongilla* has special collared cells called choanocytes, not found in the remaining three
 - (d) All are bilaterally symmetrical
- **43.** Ascaris is characterised by the [CBSE-AIPMT 2008] (a) absence of true coelom but presence of metamerism
 - (b) presence of neither true coelom nor metamerism
 - (c) presence of true coelom but absence of metamerism
 - (d) presence of true coelom and metamerism (metamerisation)
- **44.** Which of the following is correctly stated as it happens in common cockroach? [CBSE-AIPMT 2011]
 - (a) Oxygen is transported by haemoglobin in blood
 - (b) Nitrogenous excretory product is urea
 - (c) The food is grinded by mandibles and gizzard
 - (d) Malpighian tubules are excretory organs projecting out from the colon
- 45. A jawless fish, which lays eggs in freshwater and whose ammocoete larvae after metamorphosis return to the ocean is [CBSE-AIPMT 2015]
 (a) Eptatretus
 (b) Myxine
 (c) Neomyxine
 (d) Petromyzon
- **46.** In which one of the following, the genus name, its two characters and its phylum are not correctly matched, whereas the remaining three are correct? [CBSE-AIPMT 2012]

Genus name		Two characters	Phylum
(a)	Pila	(i) Body segmented (ii) Mouth with radula	Mollusca
(b)	Asterias	(i) Spiny-skinned (ii) Water vascular system	Echinodermata
(C)	Sycon	(i) Pore bearing (ii) Canal system	Porifera
(d)	Periplaneta	(i) Jointed appendages	Arthropoda

47. Which one of the following groups of animals is correctly matched with its one characteristic feature without even a single exception? [CBSE-AIPMT 2011]

(a)	Chordata	—	Possess a mouth provided with an
			upper and a lower jaw
(b)	Chondrichthyes	—	Possess cartilaginous
			endoskeleton
(C)	Mammalia	_	Give birth to young ones
(d)	Reptilia	_	Possess 3-chambered heart with
			one incompletely divided ventricle

48. In which one of the following, the genus name, its two characters and its class/phylum are correctly matched? [CBSE-AIPMT 2011]

	Genus	Two characters	Class/Phylum
(a)	Salamandra	(i) A tympanum represents ear(ii) Fertilisation is external	Amphibia
(b)	Pteropus	(i) Skin possesses hair(ii) Oviparous	Mammalia
(C)	Aurelia	(i) Cnidoblast(ii) Organ level of organisation	Coelenterata
(d)	Ascaris	(i) Body segmented(ii) Males and females distinct	Annelida

49. Which one of the following groups of three animals each is correctly matched with their one characteristic morphological feature?

			[CBSE-AIPMT 2008]
	Animals		Morphological Feature
(a)	Liver fluke, sea anemone,		Bilateral symmetry
(b)	sea cucumber Centipede, prawn, sea		Jointed appendages
(C)	urchin Scorpion, spider, cockroach		Ventral solid central
(d)	Cockroach, locust, Taenia	_	Metameric segmentation

50. Which of the following pairs are correctly matched? [CBSE-AIPMT 2007]

Animals	Morphological features			
I. Crocodile — Four-chambered heart				
II. Sea urchin—	Parapodia			
III. Obelia —	Metagenesis			
IV. Lemur —	Thecodont			
(a) I, III and IV	(b) II, III and IV			
(c) I and IV	(d) I and II			

- 51. In Arthropoda, head and thorax are often fused to form cephalothorax, but in which one of the following classes, is the body divided into head, thorax and abdomen? [CBSE-AIPMT 2004](a) Insecta
 - (b) Myriapoda
 - (c) Crustacea
 - (d) Arachnida and Crustacea
- **52.** What will you look for to identify the sex of the following? [CBSE-AIPMT 2011]
 - (a) Male frog
 (b) Female cockroach
 (c) Male shark
 (d) Female Ascaris
 A copulatory pad on the first digit of the hindlimb
 Anal cerci
 Claspers borne on pelvic fins
 Sharply-curved posterior end

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- **53.** In which one of the following sets of animals do all the four give birth to young ones? [CBSE-AIPMT 2006]
 - (a) Lion, bat, whale, ostrich
 - (b) Platypus, penguin, bat, hippopotamus
 - (c) Shrew, bat, cat, kiwi
 - (d) Kangaroo, hedgehog, dolphin, loris
- **54.** From the following statements select the wrong one. [CBSE-AIPMT 2005]
 - (a) Millipedes have two pairs of appendages in each segment of the body
 - (b) Prawn has two pairs of antennae
 - (c) Animals belonging to phylum-Porifera are exclusively marine
 - (d) Nematocysts are characteristic of the phylum-Cnidaria

7. Morphology of Flowering Plants

- **55.** In China rose, the flowers are [NEET 2013] (a) actinomorphic, hypogynous with twisted aestivation
 - (b) actinomorphic, epigynous with valvate aestivation
 - (c) zygomorphic, hypogynous with imbricate aestivation
 - (d) zygomorphic, epigynous with twisted aestivation
- **56.** How many plants among *Indigofera*, *Sesbania*, Salvia, Allium, Aloe, mustard, groundnut, radish, gram and turnip have stamens with different lengths in their flowers? [NEET 2016, Phase II] (a) Three (b) Four (c) Five (d) Six
- **57.** Among China rose, mustard, brinjal, potato, guava, cucumber, onion and tulip, how many plants have superior ovary? [CBSE-AIPMT 2015] (a) Five (b) Six (c) Three (d) Four
- **58.** How many plants in the list given below have composite fruits that develop from an inflorescence?

Walnut, Poppy, Radish, I	Fig, Pineapple, Apple,
Tomato, Mulberry	[CBSE-AIPMT 2012]
(a) Four	(b) Five
(c) Two	(d) Three

- **59.** Among bitter gourd, mustard, brinjal, pumpkin, China rose, lupin, cucumber, sunnhemp, gram, guava, bean, chilli, plum, Petunia, tomato, rose, Withania, potato, onion, Aloe and tulip, how many plants have hypogynous flower? [NEET 2013] (a) Six (b) Ten (c) Fifteen (d) Eighteen
- **60.** The correct floral formula of chilli is

[CBSE-AIPMT 2011] (a) $\oplus \ Q \vec{k}_{(5)} C_{(5)} A_5 G_{(2)}$ (b) $\oplus \ Q \vec{k}_{(5)} C_{(5)} A_{(5)} G_2$ (c) $\oplus \ Q \vec{k}_5 C_5 A_{(5)} G_2$ (d) $\oplus \ Q \vec{k}_{(5)} C_5 A_5 G_{(2)}$

- **61.** Pineapple (ananas) fruit develops from (a) a multipistillate syncarpous flower [CBSE-AIPMT 2006] (b) a cluster of compactly borne flowers on a common axis (c) a multilocular monocarpellary flower (d) a unilocular polycarpellary flower
- **62.** An example of a seed with endosperm, perisperm and caruncle is [CBSE-AIPMT 2009] (b) coffee (a) cotton (c) lily (d) castor
- **63.** Which one of the following statements is correct? [CBSE-AIPMT 2011] (a) Seeds of orchids have oil rich endosperm

 - (b) Placentation in primrose is basal
 - (c) Flower of tulip is a modified shoot
 - (d) In tomato, fruit is a capsule
- **64.** Perisperm differs from endosperm in [NEET 2013] (a) being a haploid tissue
 - (b) having no reserve food
 - (c) being a diploid tissue

(d) its formation by fusion of secondary nucleus with several sperms

8. Anatomy of Flowering Plants

65. Palisade parenchyma is absent in leaves of

i ansauc pareneny	
	[CBSE-AIPMT 2009]
(a) Sorghum	(b) mustard
(c) soybean	(d) gram

- 66. Tracheids differ from other tracheary elements in [CBSE-AIPMT 2014] (a) having Casparian strips (b) being imperforate
- (d) being lignified (c) lacking nucleus **67.** Water containing cavities in vascular bundles are found in [CBSE-AIPMT 2012] (a) sunflower (b) maize (c) Cycas (d) Pinus
- **68.** Passage cells are thin-walled cells found in [CBSE-AIPMT 2007]
 - (a) endodermis of roots facilitating rapid transport of water from cortex to pericycle
 - (b) phloem elements that serve as entry points for substances for transport to other plant parts
 - (c) testa of seeds to enable emergence of growing embryonic axis during seed germination
 - (d) central region of style through which the pollen tube grows towards the ovary

69. The balloon-shaped structures called tyloses

[NEET 2016, Phase II]

- (a) originate in the lumen of vessels
- (b) characterise the sapwood
- (c) are extensions of xylem parenchyma cells into vessels
- (d) are linked to the ascent of sap through xylem vessels



9. Structural Organisation in Animals

- **70.** Choose the correctly matched pair. [CBSE-AIPMT 2014]
 - (a) Inner lining of salivary ducts-Ciliated epithelium
 - (b) Moist surface of buccal cavity-Glandular epithelium
 - (c) Tubular parts of nephrons-Cuboidal epithelium
 - (d) Inner surface of bronchioles-Squamous epithelium
- **71.** The function of the gap junction is to

[CBSE-AIPMT 2015]

- (a) performing cementing to keep neighbouring cells together
- (b) facilitate communication between adjoining cells by connecting the cytoplasm for rapid transfer of ions, small molecules and some large molecules
- (c) separate two cells from each other
- (d) stop substance from leaking across a tissue

72. Choose the correctly matched pair. [CBSE-AIPMT 2014] (a) Tendon–Specialised connective tissue

- (b) Adipose tissue Dense connective tissue
- (c) Areolar tissue Loose connective tissue
- (d) Cartilage–Loose connective tissue
- 73. Which type of white blood cells are concerned with the release of histamine and the natural anticoagulant heparin? [CBSE-AIPMT 2008]
 (a) Neutrophils (b) Basophils (c) Eosinophils (d) Monocytes
- 74. Which type of tissue correctly matches with its location? [NEET 2016, Phase I]

	Tissue	Location
(a)	Areolar tissue	Tendons
(b)	Transitional epithelium	Tip of nose
(C)	Cuboidal epithelium	Lining of stomach
(d)	Smooth muscle	Wall of intestine

- 75. Which one of the following correctly describes the location of some body parts in the earthworm *Pheretima*? [CBSE-AIPMT 2009]
 - (a) Two pairs of accessory glands in 16th -18th segments
 - (b) Four pairs of spermathecae in 4th -7th segments
 - (c) One pair of ovaries attached at intersegmental septum of 14th and 15th segments
 - (d) Two pairs of testis in 10th and 11th segments
- 76. Select the correct route for the passage of sperms in male frogs. [NEET 2017]
 - (a) Testes \rightarrow Bidder's canal \rightarrow Kidney \rightarrow Vasa efferentia \rightarrow Urinogenital duct \rightarrow Cloaca
 - (b) Testes \rightarrow Vasa efferentia \rightarrow Kidney \rightarrow Seminal vesicle \rightarrow Urinogenital duct \rightarrow Cloaca
 - (c) Testes \rightarrow Vasa efferentia \rightarrow Bidder's canal \rightarrow Ureter \rightarrow Cloaca
 - (d) Testes \rightarrow Vasa efferentia \rightarrow Kidney \rightarrow Bidder's canal \rightarrow Urinogenital duct \rightarrow Cloaca

10. Cell: The Unit of Life

- 77. A major breakthrough in the studies of cells came with the development of electron microscope. This is because [CBSE-AIPMT 2006]
 - (a) the resolving power of the electron microscope is 200-350 nm as compared to 0.1-0.2 for the light microscope
 - (b) electron beam can pass through thick materials, whereas light microscopy required thin sections
 - (c) the electron microscope is more powerful than the light microscope as it uses a beam of electrons which has wavelength much longer than that of photons
 - (d) the resolution power of the electron microscope is much higher than that of the light microscope
- 78. A student wishes to study the cell structure under a light microscope having 10X eyepiece and 45X objective. He should illuminate the object by which one of the following colours of light so as to get the best possible resolution? [CBSE-AIPMT 2005]

 (a) Blue
 (b) Green
 (c) Yellow
 (d) Red
- **79.** Which one of the following does not differ in *E.coli* and *Chlamydomonas* ? [CBSE-AIPMT 2012]
 - (a) Ribosomes(b) Chromosomal organisation(c) Cell wall(d) Cell membrane
- 80. What is true about ribosomes? [CBSE-AIPMT 2012](a) The prokaryotic ribosomes are 80S, where S stands for sedimentation coefficient
 - (b) These are composed of ribonucleic acid and proteins
 - (c) These are found only in eukaryotic cells
 - (d) These are self-splicing introns of some RNAs
- 81. Keeping in view the 'fluid mosaic model' for the structure of cell membrane, which one of the following statements is correct with respect to the movement of lipids and proteins from one lipid monolayer to the other (described as flip-flop movement)? [CBSE-AIPMT 2008]
 (a) Both lipids and proteins can flip-flop
 - (b) While lipids can rarely flip-flop, proteins cannot
 - (c) While proteins can flip-flop, lipids cannot
 - (d) Neither lipids, nor proteins can flip-flop
- **82.** Cellular organelles with membranes are

[CBSE-AIPMT 2015]

- (a) nuclei, ribosomes and mitochondria
 (b) chromosomes, ribosomes and endoplasmic reticulum
 (c) endoplasmic reticulum, ribosomes and nuclei
 (d) lysosomes, Golgi apparatus and mitochondria
- **83.** Which of the following statements regarding mitochondrial membrane is not correct?

[CBSE-AIPMT 2006]

(a) The enzymes of the electron transfer chain are embedded in the outer membrane

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- (b) The inner membrane is highly convoluted forming a series of infoldings
- (c) The outer membrane resembles a sieve
- (d) The outer membrane is permeable to all kinds of molecules
- 84. The two subunits of ribosome remain united at a critical ion level of [CBSE-AIPMT 2008] (b) manganese (a) copper (c) magnesium (d) calcium
- **85.** Which one of the following also acts as a catalyst in a bacterial cell? [CBSE-AIPMT 2011] (a) sn RNA (b) hnRNA (c) 23S rRNA (d) 5S rRNA
- **86.** Flagella of prokaryotic and eukaryotic cells differ in [CBSE-AIPMT 2004]
 - (a) type of movement and placement in cell
 - (b) location in cell and mode of functioning
 - (c) microtubular organisation and type of movement
 - (d) microtubular organisation and function
- **87.** Which of the following is true for nucleolus?
 - (a) It takes part in spindle formation [CBSE-AIPMT 2006]
 - (b) It is a membrane-bound structure
 - (c) Larger nucleoli are present in dividing cells
 - (d) It is a site for active ribosomal RNA synthesis

11. Biomolecules

- **88.** About 98 per cent of the mass of every living organism is composed of just six elements including carbon, hydrogen, nitrogen, oxygen and [CBSE-AIPMT 2007] (a) phosphorus and sulphur (b) sulphur and magnesium
 - (c) magnesium and sodium (c) calcium and phosphorus
- **89.** Which one of the following statements is wrong? [NEET 2016, Phase I]
 - (a) Cellulose is a polysaccharide
 - (b) Uracil is a pyrimidine
 - (c) Glycine is a sulphur containing amino acid
 - (d) Sucrose is a disaccharide
- 90. The chitinous exoskeleton of arthropods is formed by the polymerisation of [CBSE-AIPMT 2015]
 - (a) keratin sulphate and chondroitin sulphate
 - (b) D-glucosamine
 - (c) N-acetyl glucosamine
 - (d) lipoglycans

91. Macromolecule chitin is

- (a) nitrogen containing polysaccharide
- (b) phosphorus containing polysaccharide
- (c) sulphur containing polysaccharide
- (d) simple polysaccharide

92. Which one of the following structural formula of two organic compounds is correctly identified along with its related function? [CBSE-AIPMT 2011]



- (a) A Triglyceride Major source of energy
- (b) B Uracil A component of DNA
- A component of cell membrane (c) A — Lecithin (d) B — Adenine
 - A nucleotide that makes up nucleic acids
- **93.** A phosphoglyceride is always made up of [NEET 2013]
 - (a) only a saturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached
 - (b) only an unsaturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached
 - (c) a saturated or unsaturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached
 - (d) a saturated or unsaturated fatty acid esterified to a phosphate group, which is also attached to a glycerol molecule
- **94.** Given below is the diagrammatic representation of one of the categories of small molecular weight organic compounds in the living tissues. Identify the category shown and the one blank component X in it.



Component

Guanine

[CBSE-AIPMT 2012]

Category	
(a) Cholesterol	
(b) Amino acid	

[NEET 2013]

- NH_2 (c) Nucleotide (d) Nucleoside
 - Adenine Uracil

MODULE 3

- **95.** Enzymes, vitamins and hormones can be classified into a single category of biological chemicals, because all of these [CBSE-AIPMT 2005]
 - (a) help in regulating metabolism
 - (b) are exclusively synthesised in the body of a living organism as at present
 - (c) are conjugated proteins
 - (d) enhance oxidative metabolism
- **96.** Which of the following statements regarding enzyme inhibition is correct? [CBSE-AIPMT 2005] (a) Competitive inhibition is seen when a substrate competes
 - with an enzyme for binding to an inhibitor protein
 - (b) Competitive inhibition is seen when the substrate and the inhibitor compete for the active site on the enzyme
 - (c) Non-competitive inhibition of an enzyme can be overcome by adding large amount of substrate
 - (d) Non-competitive inhibitors often bind to the enzyme irreversibly
- **97.** Which of the following describes the given graph correctly? [NEET 2016, Phase II]



- (a) Endothermic reaction with energy *A* in the presence of enzyme and *B* in the absence of enzyme
- (b) Exothermic reaction with energy *A* in the presence of enzyme and *B* in the absence of enzyme
- (c) Endothermic reaction with energy *A* in the absence of enzyme and *B* in the presence of enzyme
- (d) Exothermic reaction with energy *A* in the absence of enzyme and *B* in the presence of enzyme
- **98.** Select the option which is not correct with respect to enzyme action. [CBSE-AIPMT 2014]
 - (a) Substrate binds with enzyme as its active site(b) Addition of a lot of succinate does not reverse the
 - inhibition of succinic dehydrogenase by malonate (c) A non-competitive inhibitor binds the enzyme at a site
 - distinct from that which binds the substrate
 - (d) Malonate is a competitive inhibitor of succinic dehydrogenase

12. Cell Cycle and Cell Division

MODULE 3

99. 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? [CBSE-AIPMT 2014]
(a) G₀ and G₁ (b) G₁ and S (c) Only G₂ (d) G₂ and M

100. Given below is a schematic breakup of the phases/stages of cell cycle



Which one of the following is the correct indication of the stage/phase in the cell cycle? [CBSE-AIPMT 2009]

(a) B-Metaphase

(a)

(b)

(C)

(d)

- (b) C-Karyokinesis
- (c) D–Synthetic phase
- (d) A–Cytokinesis
- 101. Which one of the following precedes reformation of the nuclear envelope during M-phase of the cell cycle? [CBSE-AIPMT 2004]
 - (a) Decondensation from chromosomes and reassembly of the nuclear lamina
 - (b) Transcription from chromosomes and reassembly of the nuclear lamina
 - (c) Formation of the contractile ring and formation of the phragmoplast
 - (d) Formation of the contractile ring and transcription from chromosomes

102. A stage in cell division is shown in the figure. Select the answer which gives correct identification of the stage with its characteristic mentioned. [NEET 2013]



- Nuclear envelope reforms, Golgi complex reforms
- phase Chromosomes move away from equatorial plate, Golgi complex not present
- Cytokinesis Cell plate formed, mitochondria distributed between two daughter cells
- Telophase Endoplasmic reticulum and nucleolus not reformed yet

103. Match the stages of meiosis in Column I to their characteristic features in Column II and select the correct option using the codes given below.

[NEET 2016, Phase II]

C	Colun	nn I		Column II			
A. Pad	chyter	ne	1.	Pairing of homologous chromosomes			
B. Metaphase-I			2.	Terminalisation of chiasmata			
C. Dia	kinesi	is	3.	3. Crossing-over takes place			
D. Zyg	gotene	Э	4.	Chromosomes align at equatorial plate			
Codes	6						
A (a) 3 (c) 2	B 4 4	C 2 3	D 1 1	A B C D (b) 1 4 2 3 (d) 4 3 2 1			

104. When cell has stalled DNA replication fork, which checkpoint should be predominantly activated? [NEET 2016, Phase II]

(a) G₁/S
(b) G₂/M
(c) M
(d) Both G₂/M and M

13. Transport in Plants

105. Two cells *A* and *B* are contiguous. Cell *A* has osmotic pressure 10 atm, turgor pressure 7 atm and diffusion pressure deficit 3 atm. Cell *B* has osmotic pressure 8 atm, turgor pressure 3 atm and diffusion pressure deficit 5 atm. The result will be [CBSE-AIPMT 2007]

(a) movement of water from cell B to A

- (b) no movement of water
- (c) equilibrium between the two
- (d) movement of water from cell A to B
- **106.** Which of the following facilitates opening of stomatal aperture? [NEET 2017]
 - (a) Contraction of outer wall of guard cells
 - (b) Decrease in turgidity of guard cells
 - (c) Radial orientation of cellulose microfibrils in the cell wall of guard cells
 - (d) Longitudinal orientation of cellulose microfibrils in the cell wall of guard cells
- **107.** Water vapour comes out from the plant leaf through the stomatal opening. Through the same stomatal opening carbon dioxide diffuses into the plant during photosynthesis. Reason out the above statements using the following options.

[NEET 2016, Phase I]

- (a) Both processes can happen together because the diffusion coefficient of water and CO₂ is different
- (b) The above processes happen only during night-time
- (c) One process occurs during daytime and the other at night
- (d) Both processes cannot happen simultaneously

- 108. A column of water within xylem vessels of tall trees does not break under its weight because of(a) dissolved sugars in water [CBSE-AIPMT 2015]
 - (b) tensile strength of water
 - (c) lignification of xylem vessels
 - (d) positive root pressure
- 109. A few drops of sap were collected by cutting across a plant stem by a suitable method. The sap was tested chemically.
 Which one of the following test results indicates that it is phloem sap? [NEET 2016, Phase II]
 (a) Acidic
 (b) Alkaline
 (c) Low refractive index
 (d) The absence of sugar
- **110.** The translocation of organic solutes in sieve tube members is supported by
 [CBSE-AIPMT 2006]

 (a) P-proteins
 [CBSE-AIPMT 2006]
 - (b) mass flow involving a carrier and ATP
 - (c) cytoplasmic streaming
 - (d) root pressure and transpiration pull

14. Mineral Nutrition

- 111. In which of the following, all three are macronutrients? [NEET 2016, Phase I]
 (a) Iron, copper, molybdenum
 (b) Molybdenum, magnesium, manganese
 (c) Nitrogen, nickel, phosphorus
 - (c) Mitrogen, nicker, phosphore
 - (d) Boron, zinc, manganese
- **112.** The deficiencies of micronutrients not only affect growth of plants but also vital functions such as photosynthetic and mitochondrial electron flow. Among the list given below, which group of three elements shall affect most, both photosynthetic and mitochondrial electron transport?

	[CBSE-AIPMT 2005]
(a) Co, Ni, Mo	(b) Ca, K, Na
(c) Mn, Co, Ca	(d) Cu, Mn, Fe

- **113.** Which one of the following elements in plants is not remobilised?
 [CBSE-AIPMT 2011]

 (a) Calcium
 (b) Potassium

 (c) Sulphur
 (d) Phosphorus
- 114. Which one of the following is correctly matched?
 (a) Passive transport of nutrients ATP [CBSE-AIPMT 2012]
 (b) Apoplast Plasmodesmata
 (c) Potassium Readily immobilisation
 (d) Bakane of rice seedlings F Skoog
- 115. Which one of the following helps in the absorption of phosphorus from soil by plants?[CBSE-AIPMT 2011]
 (a) Rhizobium
 (b) Frankia
 (c) Anabaena
 (d) Glomus



NEET Test Drive

- **116.** Nitrogen-fixation in root nodules of *Alnus* is brought about by [CBSE-AIPMT 2009, 08] (a) Bradyrhizobium (b) Clostridium (c) Frankia (d) Azorhizobium
- **117.** Which of the following is a flowering plant with nodules containing filamentous nitrogen-fixing microorganisms? [CBSE-AIPMT 2007] (a) Casuarina equisetifolia (b) Crotalaria juncea (c) Cycas revoluta (d) Cicer arietinum

15. Photosynthesis in Higher Plants

118. Plants adapted to low light intensity have

[CBSE-AIPMT 2004]

- (a) larger photosynthetic unit size than the sun plants
- (b) higher rate of CO₂ fixation than the sun plants
- (c) more extended root system
- (d) leaves modified to spines
- **119.** Emerson's enhancement effect and red drop have been instrumental in the discovery of

[NEET 2016, Phase I]

- (a) two photosystems operating simultaneously
- (b) photophosphorylation and cyclic electron transport
- (c) oxidative phosphorylation
- (d) photophosphorylation and non-cyclic electron transport

120. In photosystem-I, the first electron acceptor is

	[CBSE-AIPMT 2006]
(a) cytochrome	(b) plastocyanin
(c) an iron-sulphur protein	(d) ferredoxin

121. Anoxygenic photosynthesis is the characteristic of [CBSE-AIPMT 2014]

(a) Rhodospirillum	(b) Spirogyra
(c) Chlamydomonas	(d) Ulva

- **122.** PGA as the first CO₂-fixation product was discovered [CBSE-AIPMT 2010] in the photosynthesis of (a) bryophyte (b) gymnosperm (c) angiosperm (d) alga
- **123.** The oxygen evolved during photosynthesis comes from water molecules. Which one of the following pairs of elements involved in this reaction? [NEET 2016, Phase I]
 - (a) Manganese and chlorine
 - (b) Manganese and potassium
 - (c) Magnesium and molybdenum
 - (d) Magnesium and chlorine

124. During photorespiration, the oxygen consuming reactions occur in the [CBSE-AIPMT 2006]

- (a) stroma of chloroplasts and peroxisomes
- (b) grana of chloroplasts and peroxisomes
- (c) stroma of chloroplasts
- (d) stroma of chloroplasts and mitochondria

MODULE 3

- **125.** As compared to a C_3 -plant, how many additional molecules of ATP are needed for the net production of one molecule of hexose sugar by C₄-plants? [CBSE-AIPMT 2005] (b) 6 (a) 2 (c) 12 (d) zero
- **126.** Photosynthesis in C_4 -plants is relatively less

limited by atmospheric CO₂ levels because [CBSE-AIPMT 2005]

- (a) effective pumping of CO₂ into bundle sheath cells
- (b) RuBisCO in C₄-plants has higher affinity for CO₂
- (c) four carbon acids are the primary initial CO₂-fixation products
- (d) the primary fixation of CO2 is mediated via PEP carboxylase
- **127.** With reference to factors affecting the rate of photosynthesis, which of the following statements is not correct? [NEET 2017]
 - (a) Light saturation for CO2-fixation occurs at 10% of full sunlight
 - (b) Increasing atmospheric CO₂ concentration upto 0.05% can enhance CO₂-fixation rate
 - (c) C₃-plants respond to higher temperature with enhanced photosynthesis, while C₄-plants have much lower temperature optimum
 - (d) Tomato is a greenhouse crop, which can be grown in CO₂ enriched atmosphere for higher yield

16. Respiration in Plants

- **128.** In which one of the following processes CO_2 is not released? [CBSE-AIPMT 2014]
 - (a) Aerobic respiration in plants
 - (b) Aerobic respiration in animals
 - (c) Alcoholic fermentation
 - (d) Lactate fermentation
- **129.** How many ATP molecules could maximally be generated from one molecule of glucose, if the complete oxidation of one mole of glucose to CO₂ and H₂O yields 686 kcal and the useful chemical energy available in the high energy phosphate bond of one [CBSE-AIPMT 2006] mole of ATP is 12 kcal? (a) 30 (b) 57 (c) 1 (d) 2
- **130.** The chemiosmotic coupling hypothesis of oxidative phosphorylation proposes that Adenosine Triphosphate (ATP) is formed because

[CBSE-AIPMT 2008]

- (a) high energy bonds are formed in mitochondrial proteins
- (b) ADP is pumped out of the matrix into the intermembrane space
- (c) a proton gradient forms across the inner membrane
- (d) there is a change in the permeability of the inner mitochondrial membrane toward Adenosine Diphosphate (ADP)

The **NEET** Edge ~ Biology

- **131.** What is the role of NAD⁺ in cellular respiration?
 - (a) It is a nucleotide source of ATP synthesis [NEET 2018]
 - (b) It functions as an electron carrier
 - (c) It functions as an enzyme
 - (d) It is the final electron acceptor for anaerobic respiration
- **132.** All enzymes of TCA cycle are located in the mitochondrial matrix except one which is located in inner mitochondrial membranes in eukaryotes and in cytosol in prokaryotes. This enzyme is [CBSE-AIPMT 2007]
 - (a) lactate dehydrogenase
 - (b) isocitrate dehydrogenase
 - (c) malate dehydrogenase
 - (d) succinate dehydrogenase

133. Which statement is wrong for Krebs' cycle?

- (a) There are three points in the cycle where NAD⁺ is reduced to NADH + H^+
- (b) There is one point in the cycle where FAD⁺ is reduced to FADH₂
- (c) During conversion of succinyl Co-A to succinic acid, a molecule of GTP is synthesised
- (d) The cycle starts with condensation of acetyl group (acetyl Co-A) with pyruvic acid to yield citric acid
- **134.** The three boxes in this diagram represent the three major biosynthetic pathways in aerobic respiration. Arrows represent net reactants or [NEET 2013] products



Arrows numbered 4, 8 and 12 can all be (a) NADH (b) ATP (d) FAD⁺ or FADH₂ $(c) H_2O$

135. Which one of these statements is incorrect?

[NEET 2018]

[NEET 2017]

- (a) Glycolysis operates as long as it is supplied with NAD that can pick up hydrogen atoms
- (b) Glycolysis occurs in cytosol
- (c) Enzymes of TCA cycle are present in mitochondrial matrix
- (d) Oxidative phosphorylation takes place in outer mitochondrial membrane

17. Plant Growth and Development

- **136.** Dr. F Went noted that if coleoptile tips were removed and placed on agar for one hour, the agar would produce a bending when placed on one side of freshly cut coleoptile stumps. Of what significance is this experiment? [CBSE-AIPMT 2014] (a) It made possible the isolation and exact identification of
 - auxin

- (b) It is the basis for quantitative determination of small amounts of growth-promoting substances (c) It supports the hypothesis that IAA is auxin (d) It demonstrated polar movement of auxins
- **137.** During seed germination, its stored food is mobilised by [NEET 2013] (a) ethylene (b) cytokinin (c) ABA (d) gibberellin
- **138.** Which one of the following acids is a derivative of carotenoids? [CBSE-AIPMT 2009] (a) Indole-butyric acid (b) Indole-3-acetic acid (c) Gibberellic acid (d) Abscisic acid
- **139.** Importance of day length in flowering of plants was first shown in [CBSE-AIPMT 2008] (d) Petunia (a) Lemna (b) tobacco (c) cotton
- **140.** Phytochrome is a [NEET 2016, Phase II] (a) flavoprotein (b) glycoprotein (c) lipoprotein (d) chromoprotein
- **141.** Anthesis is a phenomenon which refers to (a) reception of pollen by stigma [CBSE-AIPMT 2004] (b) formation of pollen (c) development of anther (d) opening of flower bud
- **142.** One set of a plant was grown at 12 hr day and 12 hr night period cycles and it flowered while in the other set, night phase was interrupted by flash of light and it did not produce flower. Under which one of the following categories will you place this plant? [CBSE-AIPMT 2004] (b) Darkness neutral (a) Long-day (c) Day neutral (d) Short-day
- **143.** An enzyme that can stimulate germination of barley seeds is [CBSE-AIPMT 2006] (a) lipase (b) protease (c) invertase (d) α-amylase

18. Digestion and Absorption

- **144.** Which cells of 'Crypts of Lieberkuhn' secrete antibacterial lysozyme ? [NEET 2017] (a) Argentaffin cells (b) Paneth cells (c) Zymogen cells (d) Kupffer cells
- **145.** Which of the following gastric cells indirectly help in erythropoiesis? [NEET 2018] (a) Goblet cells (b) Mucous cells (c) Chief cells (d) Parietal cells
- **146.** If for some reason our goblet cells are nonfunctional, this will adversely affect the (a) production of somatostatin [CBSE-AIPMT 2010] (b) secretion of sebum from the sebaceous glands (c) maturation of sperms
 - (d) smooth movement of food down the intestine

- **147.** The initial step in the digestion of milk in humans is carried out by [CBSE-AIPMT 2014, 11]
 (a) lipase (b) trypsin (c) rennin (d) pepsin
- **148.** Which one of the following is the correct matching of the site of action on the given substrate, the enzyme acting upon it and the end product?

[CBSE-AIPMT 2004]

- (a) Duodenum : Triglycerides trypsin monoglycerides
- (b) Small intestine : Starch $\alpha\text{-amylase}$ disaccharide (maltose)
- (c) Small intestine : Proteins pepsin amino acids
- (d) Stomach : Fats, Lipase micelles
- **149.** Select the correct match of the digested products in humans given in Column I with their absorption site and mechanism in Column II. [NEET 2013]

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

- **150.** Which one of the following statements is true regarding digestion and absorption of food in humans? [CBSE-AIPMT 2009]
 - (a) Oxyntic cells in our stomach secrete the proenzyme pepsinogen
 - (b) Fructose and amino acids are absorbed through intestinal mucosa with the help of carrier ions like $\rm Na^+$
 - (c) Chylomicrons are small lipoprotein particles that are transported from intestine into blood capillaries
 - (d) About 60% of starch is hydrolysed by salivary amylase in our mouth
- **151.** The richest sources of vitamin $-B_{12}$ are
 - (a) goat's liver and Spirulina
 - (b) chocolate and green gram
 - (c) rice and hen's egg
 - (d) carrot and chicken's breast
- **152.** Which group of three of the following five statements (A–E) contains all three correct statements regarding beri-beri ? [CBSE-AIPMT 2005]
 - A. A crippling disease prevalent among the native population of sub-Sahara Africa.
 - B. A deficiency disease caused by lack of thiamine (vitamin- B_1).
 - C. A nutritional disorder in infants and young children when the diet is persistently deficient in essential protein.

- D. Occurs in those countries where the staple diet is polished rice.
- E. The symptoms are pain from neuritis, paralysis, muscle wasting, progressive oedema, mental deterioration and finally heart failure.
 (a) A, B and D
 (b) B, C and E
 (c) A, C and E
 (d) B, D and E
- 153. Which one of the following is a fat- soluble vitamin and its related deficiency disease?
 (a) Ascorbic acid Scurvy [CBSE-AIPMT 2007]
 (b) Retinol Xerophthalmia
 (c) Cobalamine Beri-beri
 (d) Calciferol Pellagra

19. Breathing and Exchange of Gases

154. The figure shows a diagrammatic view of human respiratory system with labels *A*, *B*, *C* and *D*. Select the option, which gives correct identification and main function and/or characteristic. [NEET 2013]



- (a) A–Trachea–Long tube supported by complete cartilaginous rings for conducting inspired air
- (b) *B*–Pleural membrane–Surrounds ribs on both sides to provide cushion against rubbing
- (c) C–Alveoli–Thin-walled vascular bag-like structures for the exchange of gases
- (d) D–Lower end of lungs–Diaphragm pulls it down during inspiration
- **155.** Lungs do not collapse between breaths and some air always remains in the lungs which can never be expelled because

 [NEET 2016, Phase II]
 - (a) there is a negative pressure in the lungs
 - (b) there is a negative intrapleural pressure pulling at the lung walls
 - (c) there is a positive intrapleural pressure.
 - (d) pressure in the lungs is higher than the atmospheric pressure
- 156. Reduction in the pH of blood will [NEET 2016, Phase I]
 - (a) reduce the blood supply to the brain
 - (b) decrease the affinity of haemoglobin with oxygen
 - (c) release bicarbonate ions by the liver
 - (d) reduce the rate of heartbeat

[[]CBSE-AIPMT 2008]

157. Listed below are four respiratory capacities (1 - 4) and four jumbled respiratory volumes of a normal human adult

К	lespiratory Capacities	Respiratory Volume
1.	Residual volume	2500 mL
2.	Vital capacity	3500 mL
3.	Inspiratory reserve volume	1200 mL
4.	Inspiratory capacity	4500 mL

Which one of the following is the correct matching of two capacities and volumes? [CBSE-AIPMT 2010] (a) (2) 2500 mL, (3) 4500 mL (b) (3) 1200 mL, (4) 2500 mL (c) (4) 3500 mL, (1) 1200 mL (d) (1) 4500 mL, (2) 3500 mL

158. What is the vital capacity of our lungs?

[CBSE-AIPMT 2008]

- (a) Inspiratory reserve volume plus tidal volume
- (b) Total lung capacity minus expiratory reserve volume
- (c) Inspiratory reserve volume plus expiratory reserve volume(d) Total lung capacity minus residual volume
- **159.** Blood analysis of a patient reveals an unusually
 - high quantity of carboxyhaemoglobin content. Which of the following conclusions is most likely to be correct? [CBSE-AIPMT 2004]
 - (a) The patient has been inhaling polluted air containing unusually high content of carbon disulphide
 - (b) The patient has been inhaling polluted air containing unusually high content of chloroform
 - (c) The patient has been inhaling polluted air containing unusually high content of carbon dioxide
 - (d) The patient has been inhaling polluted air containing unusually high content of carbon monoxide

20. Body Fluids and Circulation

160. Which one of the following animals has two separate circulatory pathways? [CBSE-AIPMT 2015](a) Frog(b) Lizard

(a) mog	
(c) Whale	(d) Shark

- **161.** The most popularly known blood grouping is the ABO grouping. It is named ABO and not ABC because 'O' in it refers to having **[CBSE-AIPMT 2009]** (a) other antigens besides A and B on RBCs
 - (b) overdominance of this type on the genes for A and B types
 - (c) one antibody only—either anti-A or anti-B on the RBCs
 - (d) no antigens A and B on RBCs
- 162. Match the items given in Column I with those in Column II and select the correct option given below. [NEET 2018]

	Column I		Column II
Α.	Fibrinogen	1.	Osmotic balance
В.	Globulin	2.	Blood clotting
C.	Albumin	3.	Defence mechanism

Codes

А	В	С	A	В	С
(a) 1	3	2	(b) 1	2	3
(c) 3	2	1	(d) 2	3	1

- **163.** You are required to draw blood from a patient and to keep it in a test tube for analysis of blood corpuscles and plasma. You are also provided with the following four types of test tubes. Which of them will you not use for the purpose? [CBSE-AIPMT 2004] (a) Test tube containing calcium bicarbonate
 - (b) Chilled test tube
 - (c) Test tube containing heparin
 - (d) Test tube containing sodium oxalate
- 164. Blood pressure in the pulmonary artery is

 (a) more than that in the carotid
 (b) more than that in the pulmonary vein
 (c) less than that in the vena cava
 (d) same as that in the aorta
- 165. Figure shows schematic plan of blood circulation in human with labels A-D. Identify the correct label with given function. [NEET 2013]



- (a) A–Pulmonary vein–takes impure blood from body parts, $pO_2 = 60 \text{ mm Hg}$
- (b) *B*–Pulmonary artery–takes blood from heart to lungs, $pO_2 = 90 \text{ mm Hg}$
- (c) C–Vena cava–takes blood from body parts to right auricle, $pCO_2 = 45 \text{ mm Hg}$
- (d) D–Dorsal aorta–takes blood from heart to body parts, $pO_2 = 95 \text{ mm Hg}$
- **166.** If due to some injury the chordae tendinae of the tricuspid valve of the human heart is partially non-functional, what will be the immediate effect? [CBSE-AIPMT 2010]
 - (a) The flow of blood into the aorta will be slowed down
 - (b) The 'pacemaker' will stop working
 - (c) The blood will tend to flow back into the left atrium
 - (d) The flow of blood into the pulmonary artery will be reduced
- 167. If you suspect major deficiency of antibodies in a person, to which of the following would you look for confirmatory evidence? [CBSE-AIPMT 2007]
 (a) Serum albumins (b) Serum globulins

(a) oorann albannino	(b) Obraini globallina
(c) Fibrinogen in the plasma	(d) Haemocytes

21. Excretory Products and Their Elimination

- **168.** Which one of the following pairs of items correctly belongs to the category of organs mentioned [CBSE-AIPMT 2008] against it?
 - (a) Thorn of Bougainvillea and tendrils Analogous organs of Cucurbita
 - (b) Nictitating membrane and blind --- Vestigial organs spot in human eye
 - (c) Nephridia of earthworm and Excretory organs Malpighian tubules of cockroach
 - (d) Wings of honeybee and wings of Homologous organs crow
- **169.** Consider the following four statements about certain desert animals such as kangaroo rat.
 - I. They have dark colour and high rate of reproduction and excrete solid urine.
 - II. They do not drink water, breathe at a slow rate to conserve water and have their body covered with thick hairs.
 - III. They feed on dry seeds and do not require drinking water.
 - IV. They excrete very concentrated urine and do not use water to regulate body temperature.

Which two of the above statements for such animals are true? [CBSE-AIPMT 2008] (b) II and II (a) III and IV (c) III and I (d) I and II

170. Figure shows human urinary system with structures labelled A-D. Select option, which correctly identifies them and gives their characteristics and/or functions. [NEET 2013]



- (a) A-Adrenal gland-located at the anterior part of kidney. Secrete catecholamines, which stimulate glycogen breakdown
- (b) B-Pelvis-broad funnel-shaped space inner to hilum, directly connected to loops of Henle
- (c) C-Medulla-inner zone of kidney and contains complete nephrons
- (d) D-Cortex—outer part of kidney and do not contain any part of nephrons

171. Which one of the following correctly explains the function of a specific part of a human nephron? [CBSE-AIPMT 2011]

- Most reabsorption of the major (a) Henle's loop substances from the glomerular filtrate
- (b) Distal convoluted Reabsorption of ions into the surrounding blood capillaries tubule
- Carries the blood away from the (c) Afferent arteriole glomerulus towards renal vein
- (d) Podocytes Create minute spaces (slit pores) for the filtration of blood into the Bowman's capsule
- **172.** Which one of the following statements in regard to the excretion by the human kidneys is correct?

[CBSE-AIPMT 2010]

- (a) Descending limb of loop of Henle is impermeable to water
- (b) Distal convoluted tubule is incapable of reabsorbing HCO₂
- (c) Nearly 99% of the glomerular filtrate is reabsorbed by the renal tubules
- (d) Ascending limb of loop of Henle is impermeable to electrolytes

173. If Henle's loop were absent from mammalian nephron, which of the following is to be expected? (a) The urine will be more concentrated [CBSE-AIPMT 2003]

- (b) The urine will be more dilute
- (c) There will be no urine formation
- (d) There will be hardly any change in the quality and quantity of urine formed

174. Which of the following statements is correct?

- [NEET 2017] (a) The ascending limb of loop of Henle is impermeable to
- water (b) The descending limb of loop of Henle is impermeable to water
- (c) The ascending limb of loop of Henle is permeable to water
- (d) The descending limb of loop of Henle is permeable to
- electrolytes
- **175.** Which one of the following statements is correct with respect to kidney function regulation? [CBSE-AIPMT 2011]
 - (a) Exposure to cold temperature stimulates ADH release
 - (b) An increase in glomerular blood flow stimulates formation of angiotensin-II
 - (c) During summer when body loses lot of water by evaporation, the release of ADH is suppressed (d) When someone drinks lot of water ADH release is stopped
- **176.** A patient suffering from cholera is given saline drip because [CBSE-AIPMT 2000, 1996] (a) Cl⁻ ions are important component of blood plasma
 - (b) Na⁺ions help to retain water in the body
 - (c) Na⁺ions are important in transport of substances across membrane
 - (d) Cl⁻ ions help in the formation of HCl in stomach for digestion

22.	L	ocomotio	n and Mover	ient
177.	W a m	hich one of the body part and oves it?	e following is the con the kind of muscle t [C	rrect pairing of tissue that BSE-AIPMT 2009]
	(a (b (c (c	 Heart wall Biceps of uppe Abdominal wall Iris 	 Involuntary u r arm — Smooth mus — Smooth mus — Involuntary s 	nstriated muscle cle fibres cle mooth muscle
178.	(a) (b) (c) (d)	umber of cervia) more than that o) less than that of) same as that of) more than that o	cal vertebrae in cam f rabbit [C rabbit whale f horse	nel is BSE-AIPMT 1990]
179.	· O tr re ex	ut of 'X' pairs o ue ribs. Select presents value planation.	of ribs in humans or the option that corr s of X and Y and pr	nly 'Y' pairs are ectly covides their [NEET 2017]
	(a)) X = 12, Y = 7	True ribs are attached overtebral column and v sternum	dorsally to entrally to the
	(b)) X = 12, Y = 5	True ribs are attached overtebral column and s two ends	dorsally to ternum on the
	(C)	X = 24, Y = 7	True ribs are dorsally a vertebral column, but a side	ttached to re free on ventral
	(d) X = 24, Y = 12	True ribs are dorsally a vertebral column, but a side	ttached to re free on ventral
180.	Tl jo	ne characterist int in humans	ics and an example is	of a synovial [NEET 2013]
		Characteristic	S	Examples
	(a)	Fluid cartilage bet movements	ween two bones, limited	Knee joints
	(b)	Fluid-filled betwee	en two joints, provides	Skull bones
	(C)	Fluid-filled synovia bones	al cavity between two	Joint between atlas and axis
	(d)	Lymph-filled betw	ween two bones,	Gliding joint between carpals

181. Which of the following pairs is correctly matched?

limited movement

[CBSE-AIPMT 2005]

(a) Hinge joint	—	Between vertebrae	
(b) Gliding joint		Between zygapophyses	of
		the successive vertebrae	
(c) Cartilaginous joint		Skull bones	
(d) Fibrous joint		Between phalanges	

182. Osteoporosis, an age-related disease of skeletal system, may occur due to [NEET 2016, Phase II] (a) immune disorder affecting neuromuscular junction leading to fatigue

- (b) high concentration of Ca²⁺ and Na⁺
- (c) decreased level of oestrogen
- (d) accumulation of uric acid leading to inflammation of joints
- **183.** Select the correct statement regarding the specific disorder of muscular or skeletal system.

[CBSE-AIPMT 2012]

- (a) Muscular dystrophy-Age related shortening of muscles (b) Osteoporosis–Decrease in bone mass and higher chances of fractures with advancing age
- (c) Myasthenia gravis-Autoimmune disorder which inhibits sliding of myosin filaments
- (d) Gout-Inflammation of joints due to extra deposition of calcium
- **184.** Select the correct statement with respect to locomotion in humans. [NEET 2013]
 - (a) A decreased level of progesterone causes osteoporosis in old people
 - (b) Accumulation of uric acid crystals in joints causes their inflammation
 - (c) The vertebral column has 10 thoracic vertebrae
 - (d) The joint between adjacent vertebrae is a fibrous joint

23. Neural Control and Coordination

185. Which one of the following statements is correct?

[CBSE-AIPMT 2006]

- (a) Neurons regulate endocrine activity, but not vice-versa (b) Endocrine glands regulate neural activity and nervous system regulates endocrine glands
- (c) Neither hormones control neural activity nor the neurons control endocrine activity
- (d) Endocrine glands regulate neural activity, but not vice-versa
- **186.** How do parasympathetic neural signals affect the working of the heart? [CBSE-AIPMT 2014]
 - (a) Reduce both heart rate and cardiac output
 - (b) Heart rate is increased without affecting the cardiac output
 - (c) Both heart rate and cardiac output increase
 - (d) Heart rate decreases but cardiac output increases
- **187.** When a neuron is in resting state, i.e. not conducting any impulse, the axonal membrane is [CBSE-AIPMT 2011]
 - (a) equally permeable to both Na^+ and K^+ ions
 - (b) impermeable to both Na⁺ and K⁺ ions
 - (c) comparatively more permeable to K⁺ ions and nearly impermeable to Na+ ions
 - (d) comparatively more permeable to Na⁺ ions and nearly impermeable to K⁺ ions

188. During the propagation of a nerve impulse, the action potential results from the movement of [CBSE-AIPMT 2008]

(a) K⁺ ions from extracellular fluid to intracellular fluid (b) Na⁺ ions from intracellular fluid to extracellular fluid (c) K⁺ ions from intracellular fluid to extracellular fluid (d) Na⁺ ions from extracellular fluid to intracellular fluid



MODULE 3)

489

- **189.** During the transmission of nerve impulse through a nerve fibre, the potential on the inner side of the plasma membrane has which type of electric charge? [CBSE-AIPMT 2007] (a) First negative, then positive and again back to negative
 - (b) First positive, then negative and continue to be negative
 - (c) First negative, then positive and continue to be positive
 - (d) First positive, then negative and again back to positive
- **190.** In the resting state of the neural membrane, diffusion due to concentration gradients, if allowed, would drive [CBSE-AIPMT 2004] (a) K⁺ into the cell (b) K⁺ and Na⁺ out of the cell (c) Na⁺ into the cell (d) Na⁺ out of the cell
- **191.** An action potential in the nerve fibre is produced when positive and negative charges on the outside and the inside of the axon membrane are reversed, because [CBSE-AIPMT 2000]
 - (a) more potassium ions enter the axon as compared to sodium ions leaving it
 - (b) more sodium ions enter the axon as compared to potassium ions leaving it
 - (c) all potassium ions leave the axon
 - (d) all sodium ions enter the axon
- **192.** A diagram showing axon terminal and synapse is given. Identify correctly at least two of A-D.

[NEET 2013]



- (a) A-Receptor, C-Synaptic vesicles (b) B-Synaptic connection, $D-K^+$ (c) A-Neurotransmitter, B-Synaptic cleft $D-Ca^{2+}$ (d) C-Neurotransmitter,
- **193.** Destruction of the anterior horn cells of the spinal cord would result in loss of [CBSE-AIPMT 2015]
 - (a) sensory impulses
 - (b) voluntary motor impulses
 - (c) commissural impulses
 - (d) integrating impulses

194. In mammalian eye, the 'fovea' is the centre of the visual field, where [CBSE-AIPMT 2015]

- (a) high density of cones occurs, but has no rods
- (b) the optic nerve leaves the eye
- (c) only rods are present
- (d) more rods than cones are found

195. Parts *A*, *B*, *C* and *D* of the human eyes are shown in the diagram. Select the option, which gives correct identification along with its functions/ characteristics. [NEET 2013]



- (a) A-Retina-Contains photoreceptors-Rods and cones
- (b) B-Blind spot-Has only a few rods and cones
- (c) C-Aqueous chamber-Reflects the light, which does not pass through the lens
- (d) D-Choroiditis-anterior part forms ciliary body
- **196.** Which one of the following is the correct difference between rod cells and cone cells of our retina?

		Rod cells	Cone cells
(a)	Visual acuity	High	Low
(b)	Visual pigment contained	lodopsin	Rhodopsin
(C)	Overall function	Vision in poor light	Colour vision and detailed vision in bright light
(d)	Distribution	More concentrated in centre of retina	Evenly distributed all over retina

- **197.** In a man, abducens nerve is injured. Which one of the following functions will be affected? [CBSE-AIPMT 2005]
 - (a) Movement of the eyeball
 - (b) Swallowing
 - (c) Movement of the tongue
 - (d) Movement of the neck
- **198.** Cornea transplantation is outstandingly successful [CBSE-AIPMT 1996] because
 - (a) cornea is easy to preserve
 - (b) cornea is not linked up with blood vascular and immune systems
 - (c) the technique involved is very simple
 - (d) cornea is easily available
- **199.** Choose the correct statement. [NEET 2016, Phase II]
 - (a) Nociceptors respond to changes in pressure
 - (b) Meissner's corpuscles are thermoreceptors
 - (c) Photoreceptors in the human eye are depolarised during darkness and become hyperpolarised in response to the liaht stimulus
 - (d) Receptors do not produce graded potentials

MODULE 3

24. Chemical Coordination and Integration

200. GnRH, a hypothalamic hormone, needed in

- reproduction, acts on [NEET 2017] (a) anterior pituitary gland and stimulates secretion of LH and oxytocin
- (b) anterior pituitary gland and stimulates secretion of LH and FSH
- (c) posterior pituitary gland and stimulates secretion of oxytocin and FSH
- (d) posterior pituitary gland and stimulates secretion of LH and relaxin
- **201.** Hypersecretion of growth hormone in adults does not cause further increase in height because [NEET 2017]
 - (a) growth hormone becomes inactive in adults
 - (b) epiphyseal plates close after adolescence
 - (c) bones loose their sensitivity to growth hormone in adults
 - (d) muscle fibres do not grow in size after birth
- **202.** Identify the hormone with its correct matching of source and function. [CBSE-AIPMT 2014] (a) Oxytocin-Posterior pituitary, growth and maintenance of
 - mammary glands
 - (b) Melatonin-Pineal gland, regulates the normal rhythm of sleep-wake cycle
 - (c) Progesterone-Corpus luteum, stimulation of growth and activities of female secondary sex organs
 - (d) Atrial natriuretic factor-Ventricular wall increases the blood pressure
- **203.** The amino acid, tryptophan is the precursor for the synthesis of [NEET 2016, Phase I]
 - (a) thyroxine and tri-iodothyronine
 - (b) oestrogen and progesterone
 - (c) cortisol and cortisone
 - (d) melatonin and serotonin
- **204.** A pregnant female delivers a baby, who suffers from stunted growth, mental retardation, low intelligence quotient and abnormal skin. This is the result of [NEET 2013] (a) deficiency of iodine in diet

 - (b) low secretion of growth hormone
 - (c) cancer of the thyroid gland
 - (d) oversecretion of pars distalis
- **205.** A health disorder that results from the deficiency of thyroxine in adults and characterised by

[CBSE-AIPMT 2009]

- I. a low metabolic rate
- II. increase in body weight
- III. tendency to retain water in tissues is
 - (a) hypothyroidism (b) simple goitre (d) cretinism
 - (c) myxoedema

- **206.** Which of the following endocrine glands stores its secretion in the extracellular space before [CBSE-AIPMT 1995] discharging into the blood? (a) Pancreas (b) Adrenal (c) Testis (d) Thyroid
- **207.** A person is having problems with calcium and phosphorus metabolism in his body. Which one of the following glands may not be functioning properly? [CBSE-AIPMT 2007] (a) Parathyroid (b) Parotid (c) Pancreas (d) Thyroid
- **208.** A person entering an empty room suddenly finds a snake right in front on opening the door. Which one of the following is likely to happen in his neurohormonal control system? [CBSE-AIPMT 2012]
 - (a) Sympathetic nervous system is activated releasing epinephrine and norepinephrine from adrenal medulla
 - (b) Neurotransmitters diffuse rapidly across the cleft and transmit a nerve impulse
 - (c) Hypothalamus activates the parasympathetic division of brain
 - (d) Sympathetic nervous system is activated releasing epinephrine and norepinephrine from adrenal cortex
- **209.** Feeling the tremors of an earthquake, a scared resident of seventh floor of a multistoryed building starts climbing down the stairs rapidly. Which hormone initiated this action? [CBSE-AIPMT 2007] (a) Thyroxine (b) Adrenaline (c) Glucagon (d) Gastrin
- **210.** Which one of the following pairs of hormones are the examples of those that can easily pass through the cell membrane of the target cell and bind to a receptor inside it (mostly in the nucleus)?

[CBSE-AIPMT 2012]

- (a) Insulin and glucagon (b) Thyroxine and insulin (c) Somatostatin and oxytocin (d) Cortisol and testosterone
- **211.** According to the accepted concept of hormone action, if receptor molecules are removed from target organs, then the target organ will [CBSE-AIPMT 1995]
 - (a) not respond to the hormone
 - (b) continue to respond to hormone without any difference
 - (c) continue to respond to the hormone but in the opposite wav
 - (d) continue to respond to the hormone but will require higher concentration
- **212.** Which of the following radioactive isotopes is used in the detection of thyroid cancer?

[CBSE-AIPMT 2002, 1995	
------------------------	--

(a) lodine-131 (b) Carbon-14 (d) Phosphorus-32 (c) Uranium-238

MODULE 3

213. Select the answer which correctly matches the endocrine gland with the hormone it secretes and its function/deficiency symptom. [NEET 2013]

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

214. Match the source gland with its respective hormone as well as the function. [CBSE-AIPMT 2011]

	Source gland	Hormone	Function
(a)	Posterior pituitary	Vasopressin	Stimulates reabsorption of water in the distal tubules in the nephron
(b)	Corpus luteum	Oestrogen	Supports pregnancy
(C)	Thyroid	Thyroxine	Regulates blood calcium level
(d)	Anterior pituitary	Oxytocin	Contraction of uterus muscles during childbirth

215. Given ahead is an incomplete table about certain hormones, their source glands and one major effect of each on the body in humans. Identify the correct option for the three blanks *A*, *B* and *C*

[CBSE-AIPMT 2	011]
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Gland		Secretion	Effect on body	
A		Oestrogen	Maintenance of secondary sexual characters	
Alpha cells of islets of Langerhans		В	Raises blood sugar level	
Anterior pituitary		С	Oversecretion leads to gigantism	
(a) (b) (c)	A Placenta Ovary Placenta	B Insulin Insulin Glucagon	C Vasopressin Calcitonin Calcitonin	
(d)	Ovary	Glucagon	Growth hormone	

25. Reproduction in Organisms

216. Match Column I with Column II and select the correct option using the codes given below.

			[NEET 2016, Phase II]
	Column I		Column I
Α.	Pistils fused together	1.	Gametogenesis
В.	Formation of gametes	2.	Pistillate
C.	Hyphae of higher ascomycetes	З.	Syncarpous
D.	Unisexual female flower	4.	Dikaryotic

(MODULE 3)

•

Codes

	A (a) 4 (c) 1	B 3 2	C 2 4	D 1 3			(b) (d)	A 2 3	B 1 1	C 4 4	D 3 2	
217.	 Why is vivipary an undesirable character for annual crop plants? [CBSE-AIPMT 2005] (a) It reduces the vigour of the plant (b) It adversely affects the fertility of the plant (c) The seeds exhibit long dormancy (d) The seeds cannot be stored under normal conditions for the next season 											
218.	Which match (a) Off (b) Rh (c) Bir (d) Cc	of the ed? de of fset izome nary fis nidia	rep	ollow	ing _]	pair	s is V B S P	Exa Vater anar arga	t cor [CB mple hyac na ssum illium	srec SE-A	tly AIPM	(T 2015]
219.	 Which one of the following statements is not correct? [NEET 2016, Phase II] (a) Offsprings produced by the asexual reproduction are called clone (b) Microscopic, motile asexual reproductive structures are called zoospores (c) In potato, banana and ginger, the plantlets arise from the internodes present in the modified stem (d) Water hyacinth, growing in the standing water, 											
220.	In which one pair both the plants can be vegetatively propagated by leaf pieces? (a) Agave and Kalanchoe (b) Bryophyllum and Kalanchoe (c) Asparagus and Bryophyllum (d) Chrysanthemum and Agave								[T 2005]			
221.	 Select the wrong statement. [NEET 2013] (a) Isogametes are similar in structure, function and behaviour (b) Anisogametes differ either in structure, function and behaviour (c) In Oomycetes, female gamete is smaller and motile, while male gamete is larger and non-motile (d) <i>Chlamydomonas</i> exhibits both isogamy and anisogamy and <i>Eucus</i> shows occamy 							CT 2013] haviour l , while amy				
222.	In ooga (a) a sm gam (b) a lar gam	amy, nall no ete ge no ete	feri n-mo	tilisa otile fe otile fe	tion emale emale	inv e gar e gar	rolv mete mete	es e and e and	[CB d a la d a si	SE- A arge mall	MIPM motil motil	I T 2004] e male le male

- (c) a large non-motile female gamete and a small non-motile male gamete
- (d) a large motile female gamete and a small non-motile male gamete

26. Sexual Reproduction in Flowering Plants

223. Which one of the following statements is not true? [NEET 2016, Phase I]

- (a) Exine of pollen grains is made up of sporopollenin
- (b) Pollen grains of many species cause severe allergies(c) Stored pollen in liquid nitrogen can be used in the crop
- breeding programmes
- (d) Tapetum helps in the dehiscence of anther

224. Which one of the following statements is correct?

- (a) Hard outer layer of pollen is called intine [NEET 2013](b) Sporogenous tissue is haploid
 - (c) Endothecium produces the microspores
 - (d) Tapetum nourishes the developing pollen

225. Which of the following statements is not correct? [NEET 2016, Phase I]

- (a) Insects that consume pollen or nectar without bringing about pollination are called pollen nectar robbers
- (b) Pollen germination and pollen tube growth are regulated by chemical components of pollen interacting with those of the pistil
- (c) Some reptiles have also been reported as pollinators in some plant species
- (d) Pollen grains of many species can germinate on the stigma of a flower, but only one pollen tube of the same species grows into the style
- 226. How many pollen grains will be formed after meiotic division in 10 microspore mother cells? [CBSE-AIPMT 1996]

			-
(a) 10	(b) 20	(c) 40	(d) 80

227. In an angiosperm, how many microspore mother cells are required to produce 100 pollen grains? [CBSE-AIPMT 1995]

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

228. Which type of association is found in between entomophilous flower and pollinating agent? [CBSE-AIPMT 2002]

(a) Mutualism	(b) Commensalism
(c) Cooperation	(d) Coevolution

- 229. Flowers showing ornithophily show few characteristics like [CBSE-AIPMT 1999]
 - (a) blue flower with nectaries at base of corolla
 - (b) red sweet scented flower with nectaries
 - (c) bright red flower into thick inflorescence
 - (d) white flowers with fragrance

230. In majority of angiosperms, [NEET 2016, Phase II]

- (a) egg has a filiform apparatus
- (b) there are numerous antipodal cells
- (c) reduction division occurs in the megaspore mother cells
- (d) a small central cell is present in the embryo sac

- **231.** Double fertilisation leading to initiation of endosperm in angiosperms requires [CBSE-AIPMT 2000]
 - (a) fusion of one polar nucleus and the second male gamete only
 - (b) fusion of two polar nuclei and the second male gamete
 - (c) fusion of four or more polar nuclei and the second male gamete only
 - (d) all of the above kinds of fusion in different angiosperms
- 232. The scutellum observed in a grain of wheat or maize is comparable to which part of the seed in other monocotyledons? [CBSE-AIPMT 2010, 06]
 (a) Cotyledon (b) Endosperm
 (c) Aleurone layer (d) Plumule
- **233.** Generative cell was destroyed by laser but a normal pollen tube was still formed because
 - (a) vegetative cell is not damaged [CBSE-AIPMT 1989]
 - (b) contents of killed generative cell stimulate pollen growth
 - (c) laser beam stimulates growth of pollen tube
 - (d) the region of emergence of pollen tube is not harmed
- 234. What would be the number of chromosomes in the cells of the aleuron layer in a plant species with 8 chromosomes in its synergids? [CBSE-AIPMT 2006]
 (a) 24 (b) 32 (c) 8 (d) 16
- **235.** Number of meiotic divisions required to produce 200/400 seeds of pea would be [CBSE-AIPMT 1993] (a) 200/400 (b) 400/800 (c) 300/600 (d) 250/500
- 236. Ovule is straight with funiculus, embryo sac, chalaza and micropyle lying on one straight line. It is [CBSE-AIPMT 1993]
 (a) orthotropous (b) anatropous
 - (c) campylotropous (d) amphitropous

27. Human Reproduction

- **237.** Which of the following depicts the correct pathway of transport of sperms? [NEET 2016, Phase II]
 - (a) Rete testis \rightarrow Efferent ductules \rightarrow Epididymis \rightarrow Vas deferens
 - (b) Rete testis \rightarrow Epididymis \rightarrow Efferent ductules \rightarrow Vas deferens
 - (c) Rete testis \rightarrow Vas deferens \rightarrow Efferent ductules \rightarrow Epididymis
 - (d) Efferent ductules \rightarrow Rete testis \rightarrow Vas deferens \rightarrow Epididymis
- **238.** Which one of the following statements is false in respect of viability of mammalian sperm?
 - (a) Sperm is viable for only up to 24 hrs [CBSE-AIPMT 2012]
 - (b) Survival of sperm depends on the pH of the medium and is more active in alkaline medium
 - (c) Viability of sperm is determined by its motility
 - (d) Sperms must be concentrated in a thick suspension

- 494
- 239. Changes in GnRH pulse frequency in females is controlled by circulating levels of [NEET 2016, Phase I](a) oestrogen and inhibin(b) progesterone only
 - (c) progesterone and inhibin (d) oestrogen and progesterone
- **240.** Select the incorrect statement. [NEET 2016, Phase I] (a) LH and FSH trigger ovulation in ovary
 - (b) LH and FSH decrease gradually during the follicular phase
 - (c) LH triggers secretion of androgens from the Leydig cells
 - (d) FSH stimulates the Sertoli cells which help in
 - spermiogenesis

241. What is the correct sequence of sperm formation? [NEET 2013]

- (a) Spermatid, Spermatocyte, Spermatogonia, Spermatozoa
- (b) Spermatogonia, Spermatocyte, Spermatozoa, Spermatid
- (c) Spermatogonia, Spermatozoa, Spermatocyte, Spermatid
- (d) Spermatogonia, Spermatocyte, Spermatid, Spermatozoa
- **242.** Which one of the following is the correct matching of the events occurring during menstrual cycle?

[CBSE-AIPMT 2009]

- (a) Ovulation LH and FSH attain peak level and sharp fall in the secretion of progesterone
 (b) Proliferative – Bapid regeneration of myometrium
- b) Proliferative Rapid regeneration of myometrium phase and maturation of Graafian follicle
- (c) Development of Secretory phase and increased secretion of progesterone
- (d) Menstruation Breakdown of myometrium and ovum not fertilised
- 243. Which one of the following statements is incorrect about menstruation? [CBSE-AIPMT 2008]
 - (a) During normal menstruation, about 40 mL blood is lost
 - (b) The menstrual fluid can easily clot
 - (c) At menopause in the female, there is especially abrupt increase in gonadotropic hormones
 - (d) The beginning of the cycle of menstruation is called menarche
- 244. Fertilisation in humans is practically feasible only if [NEET 2016, Phase I]
 - (a) the ovum and sperms are transported simultaneously to ampullary isthmic junction of the Fallopian tube
 - (b) the ovum and sperms are transported simultaneously to ampullary-isthmic junction of the cervix
 - (c) the sperms are transported into cervix within 48 hrs of release of ovum in uterus
 - (d) the sperms are transported into vagina just after the release of ovum in Fallopian tube
- **245.** If mammalian ovum fails to get fertilised, which one of the following is unlikely? [CBSE-AIPMT 2005]
 - (a) Corpus luteum will disintegrate
 - (b) Oestrogen secretion further decreases
 - (c) Primary follicle starts developing
 - (d) Progesterone secretion rapidly declines

246. Extrusion of second polar body from egg nucleus occurs [CBSE-AIPMT 1993]

(a) after entry of sperm but before completion of fertilisation(b) after completion of fertilisation

- (c) before entry of sperm
- (d) without any relation of sperm entry
- 247. Which one of the following statements about morula in humans is correct? [CBSE-AIPMT 2010](a) It has almost equal quantity of cytoplasm as an uncleaved zygote but much more DNA
 - (b) It has far less cytoplasm as well as less DNA than in an uncleaved zygote
 - (c) It has more or less equal quantity of cytoplasm and DNA
 - (d) It has more cytoplasm and more DNA than in an uncleaved zygote
- **248.** Termination of gastrulation is indicated by
 - (a) obliteration of blastocoel
 - (b) obliteration of archenteron
 - (c) closure of blastopore
 - (d) closure of neural tube
- 249. Ectopic pregnancies are referred to as
 (a) pregnancies with genetic abnormality [CBSE-AIPMT 2015]
 (b) implantation of embryo at site other than uterus
 (c) implantation of defective embryo in the uterus
 (d) pregnancies terminated due to the hormonal imbalance
- **250.** Select the correct option describing gonadotropin activity in a normal pregnant female.

[CBSE-AIPMT 2014, 12]

- (a) High level of FSH and LH stimulates the thickening of endometrium
- (b) High level of FSH and LH facilitates implantation of the embryo
- (c) High level of hCG stimulates the synthesis of oestrogen and progesterone
- (d) High level of hCG stimulates the thickening of endometrium
- 251. Which one of the following is not the function of placenta? It [NEET 2013]
 - (a) facilitates supply of oxygen and nutrients to embryo
 - (b) secretes oestrogen
 - (c) facilitates removal of carbon dioxide and waste material from embryo
 - (d) secretes oxytocin during parturition
- 252. The first movements of the foetus and appearance of hair on its head are usually observed during which month of pregnancy? [CBSE-AIPMT 2010](a) Fourth month
 - (b) Fifth month
 - (c) Sixth month
 - (d) Third month

253. Match Column I with Column II and select the correct option using the codes given below.

			[IIIII avio, I huse ii]
	Column I		Column II
А.	Mons pubis	1.	Embryo formation
В.	Antrum	2.	Sperm
C.	Trophectoderm	З.	Female external genitalia
D.	Nebenkern	4.	Graafian follicle

Codes

А	В	С	D		А	В	С	D
(a) 3	4	2	1	(b)	3	4	1	2
(c) 3	1	4	2	(d)	1	4	3	2

28. Reproductive Health

254. Match the following column I (sexually transmitted diseases) with their column II (causative agent) and select the correct option. [NEET 2017]

Column IColumn IIA. Gonorrhoea1. HIVB. Syphilis2. NeisseriaC. Genital warts3. TreponemaD. AIDS4. Human papilloma viCodes	١.	Colum	21							
 A. Gonorrhoea B. Syphilis C. Genital warts D. AIDS Codes 1. HIV 2. Neisseria 3. Treponema 4. Human papilloma vi 	١.					Column II				
B. Syphilis 2. Neisseria C. Genital warts 3. Treponema D. AIDS 4. Human papilloma via Codes		Gonorrh	ioea		1.	HIV				
C. Genital warts 3. <i>Treponema</i> D. AIDS 4. Human papilloma vii Codes	5.	. Syphilis 2.				Neisseria				
D. AIDS 4. Human papilloma vii Codes	C. Genital warts					Treponema				
Codes).	AIDS	IDS 4. Human papilloma virus							
	2	odes								
A B C D A B C		A E	С	[\supset	A B C D				
(a) 2 3 4 1 (b) 3 4 1	а	u) 2 3	4	1	1	(b) 3 4 1 2				
(c) 4 2 3 1 (d) 4 3 2) 4 2	3	1	1	(d) 4 3 2 1				

- **255.** In India, human population is heavily weighed towards the younger age groups as a result of [CBSE-AIPMT 1995]
 - (a) short lifespan of many individuals and low birth rate
 - (b) long lifespan of many individuals and low birth rate
 - (c) short lifespan of many individuals and high birth rate
 - (d) long lifespan of many individuals and high birth rate
- **256.** Which of the following approaches does not give the defined action of contraceptive? [NEET 2016, Phase I]

(a)	Intrauterine devices	 Increase phagocytosis of sperms, suppress sperm motility and fertilising capacity of sperms
(b)	Hormonal contraceptives	 Prevent/ retard entry of sperms, prevent ovulation and fertilisation
(C)	Vasectomy	 Prevents spermatogenesis
(d)	Barrier methods	 Prevent fertilisation

- **257.** Consider the statements given below regarding contraception and answer as directed thereafter. [CBSE-AIPMT 2008]
 - I. Medical Termination of Pregnancy (MTP) during first trimester is generally safe.

- II. Generally chances of conception are nil until mother breastfeeds the infant up to two years.
- III. Intrauterine devices like copper-T are effective contraceptives.
- IV. Contraception pills may be taken up to one week after coitus to prevent contraception.

Which two of the above statements are correct? (a) | and ||| (b) | and || (c) || and ||| (d) ||| and |V

258. Given below are four methods (A-D) and their modes of action (1-4) in achieving contraception. Select their correct matching from the four options that follows. [CBSE-AIPMT 2008]

		Met	hod		Mode of Action						
A	A. The pill				1. Prevents sperms reaching cervix						
E	B. Condom			2.	2. Prevents implantation						
0	C. Vasectomy				3. Prevents ovulation						
C	D. Copper-T				Semen contains no sperms						
Со	des										
	А	В	С	D	A B C D						
(a)	3	4	1	2	(b) 2 3 1 4						

259. In context of amniocentesis, which of the following statements is incorrect? [NEET 2016, Phase I](a) It is used for prenatal sex-determination

(d) 4 1 2 3

- (b) It can be used for the detection of Down syndrome
- (c) It can be used for the detection of cleft palate
- (d) It is usually done when a woman is between 14-16 weeks pregnant
- 260. In case of a couple, where the male is having a very low sperm count, which technique will be suitable for fertilisation? [NEET 2017]
 - (a) Intrauterine transfer

(c) 3 1 4 2

- (b) Gamete intracytoplasmic Fallopian transfer
- (c) Artificial insemination
- (d) Intracytoplasmic sperm Injection
- **261.** In vitro fertilisation is a technique that involves transfer of which one of the following into the Fallopian tube? [CBSE-AIPMT 2010]
 - (a) Embryo only, up to 8 cell stage
 - (b) Either zygote or early embryo up to 8 cell stage
 - (c) Embryo of 32 cell stage
 - (d) Only zygote
- **262.** A childless couple can be assisted to have a child through a technique called GIFT. The full form of this technique is [CBSE-AIPMT 2015] (a) Gamete Inseminated Fallopian Transfer
 - (b) Gamete Intra Fallopian Transfer
 - (c) Gamete Internal Fertilisation and Transfer
 - (d) Germ Cell Internal Fallopian Transfer
 - (d) Germ Ceir Internal Falloplan mansier

- **263.** Test tube baby means a baby born when
 - [CBSE-AIPMT 2003]
 - (a) the ovum is fertilised externally and thereafter implanted in the uterus
 - (b) it develops from a non-fertilised egg
 - (c) it is developed in a test tube
 - (d) it is developed through tissue culture method

264. Certain characteristic demographic features of developing countries are [CBSE-AIPMT 2004]

- (a) high fertility, low or rapidly falling mortality rate, rapid population growth and a very young age distribution
- (b) high fertility, high density, rapidly rising mortality rate and a very young age distribution
- (c) high infant mortality, low fertility, uneven population growth and a very young age distribution
- (d) high mortality, high density, uneven population growth and a very old age distribution

29. Principles of Inheritance and Variation

265. Which one of the following cannot be explained on the basis of Mendel's law of dominance?

[CBSE-AIPMT 2010]

- (a) The discrete unit controlling a particular character is called a factor
- (b) Out of one pair of factors one is dominant and the other recessive
- (c) Alleles do not show any blending and both the characters recover as such in $\rm F_2$ -generation
- (d) Factors occur in pairs
- **266.** In a test cross involving F_1 dihybrid flies, more parental type offsprings were produced than the recombinant type offspring. This indicates

[NEET 2016, Phase I]

- (a) chromosomes failed to separate during meiosis
- (b) the two genes are linked and present on the same chromosome
- (c) both of the characters are controlled by more than one gene
- (d) the two genes are located on two different chromosomes
- 267. Two genes R and Y are located very close on the chromosomal linkage map of maize plant. When RRYY and rryy genotypes are hybridised, then F₂ segregation will show [CBSE-AIPMT 2007]
 (a) higher number of the recombinant types
 - (b) segregation in the expected 9 : 3 : 3 : 1 ratio
 - (c) segregation in 3 : 1 ratio
 - (d) higher number of the parental types
- 268. In a dihybrid cross AABB × aabb, F₂ progeny of AABB, AABb, AaBB and AaBb occurs in the ratio of [CBSE-AIPMT 1994] (a) 1:1:1:1 (b) 9:3:3:1 (c) 1:2:2:1 (d) 1:2:2:4

269. Match the terms in Column I with their description in Column II and choose the correct option. [NEET 2016, Phase I]

C	Colun	nn I			Column II						
A. Dom	1.	Mar cha	Many genes govern a single character								
B. Codominance					In a one	In a heterozygous organism, only one allele expresses itself				only	
C. Pleio	3.	In a heterozygous organism, both alleles express themselves fully				ooth Iy					
D. Polygenic inheritance					A si cha	ingle	ers	e influ	ences	many	/
Codes											
А	В	С	D			А	В	С	D		
(a) 2	3	4	1		(b)	4	1	2	3		
(c) 4	3	1	2		(d)	2	1	4	3		

270. A tall true breeding garden pea plant is crossed with a dwarf true breeding garden pea plant. When the F_1 plants were selfed, the resulting genotypes were in the ratio of **[NEET 2016, Phase I]** (a) 1 : 2 : 1 :: Tall heterozygous : Tall homozygous : Dwarf (b) 3 : 1 :: Tall : Dwarf (c) 3 : 1 :: Dwarf : Tall

(d) 1 : 2 : 1 :: Tall homozygous : Tall heterozygous : Dwarf

- 271. The genotypes of a husband and wife are I^AI^B and I^Ai. Among the blood types of their children, how many different genotypes and phenotypes are possible? [NEET 2017]
 (a) 3 genotypes ; 3 phenotypes
 (b) 3 genotypes ; 4 phenotypes
 (c) 4 genotypes ; 3 phenotypes
 (d) 4 genotypes ; 4 phenotypes
- 272. ABO blood groups in humans are controlled by the gene I. It has three alleles I^A, I^B and i. Since there are three different alleles, six different genotypes are possible. How many phenotypes can occur? [CBSE-AIPMT 2010]
 (a) Three
 (b) One
 (c) Four
 (d) Two
- **273.** Which one of the following conditions correctly describes the manner of determining the sex in the given example? [CBSE-AIPMT 2011]
 - (a) XO type of sex chromosomes determines male sex in grasshopper
 - (b) XO condition in humans as found in Turner syndrome, determines female sex
 - (c) Homozygous sex chromosomes (XX) produce male in Drosophila
 - (d) Homozygous sex chromosomes (ZZ) determine female sex in birds

274. A fruitfly heterozygous for sex-linked genes is mated with normal female fruitfly. Male specific chromosome will enter egg cell in the proportion [CBSE-AIPMT 1997]

(a) 1 : 1 (b) 2 : 1 (c) 3 : 1 (d) 7 : 1

The **NEET** Edge ~ Biology

- **275.** Which of the following statements is not true of two genes that show 50% recombination frequency? (a) The genes may be on different chromosomes [NEET 2013] (b) The genes are tightly linked (c) The genes show independent assortment (d) If the genes are present on the same chromosome, they undergo more than one crossovers in every meiosis **276.** The linkage map of X-chromosome of fruitfly has 66 units, with yellow body gene (y) at one end and bobbed hair gene (b) at the other end. The recombination frequency between these two genes (y and b) should be [CBSE-AIPMT 2003] $(a) \le 50\%$ (b) 100% (c) 66% (d) > 50%**277.** There are three genes a, b, c. Percentage of crossing over between a and b is 20%, b and c is 28% and a and c is 8%. What is the sequence of genes on chromosome? [CBSE-AIPMT 2002] (a) b, a, c (b) a, b, c (c) a, c, b (d) None of these **278.** Which of the following is suitable for experiment on linkage? [CBSE-AIPMT 1993] (a) $aaBB \times aaBB$ (b) $AABB \times aabb$ (c) $AaBb \times AaBb$ (d) $AAbb \times AaBB$ **279.** Mr. Kapoor has Bb autosomal gene pair and d allele sex-linked. What shall be the proportion of Bd in sperms? [CBSE-AIPMT 1993] (a) 0 (b) 1/2 (c) 1/4 (d) 1/8 **280.** A male human is heterozygous for autosomal genes A and B and is also hemizygous for haemophilic gene h. What proportion of his sperms will be abh?
 - (a) $\frac{1}{8}$ (b) $\frac{1}{32}$ (c) $\frac{1}{16}$ (d) $\frac{1}{4}$
- 281. A man with a certain disease marries a normal woman. They have eight children (3 daughters and 5 sons). All the daughters suffer from their father's disease but none of the sons is affected. Which of the following modes of inheritance do you suggest for this disease? [CBSE-AIPMT 1996, 2002]
 (a) Sex-linked recessive (b) Sex-linked dominant (c) Autosomal dominant (d) Sex-limited recessive
- 282. Pick out the correct statements. [NEET 2016, Phase I]
 - I. Haemophilia is a sex-linked recessive disease.
 - II. Down's syndrome is due to aneuploidy.
 - III. Phenylketonuria is an autosomal recessive gene disorder.
 - IV. Sickle-cell anaemia is an X-linked recessive gene disorder.
 - (a) II and IV are correct(b) I, III and IV are correct(c) I, II and III are correct(d) I and IV are correct

- 283. Down's syndrome is caused by an extra copy of chromosome number 21. What percentage of offspring produced by an affected mother and a normal father would be affected by this disorder?
 (a) 50%
 (b) 25%
 [CBSE-AIPMT 2003]
 (c) 100%
 (d) 75%
- **284.** A woman with albinic father marries an albinic man. The proportion of her progeny is [CBSE-AIPMT 1994] (a) 2 normal : 1 albinic
 - (b) all normal
 - (c) all albinic
 - (d) 1 normal : 1 albinic
- 285. In the following human pedigree, the filled symbols represent the affected individuals. Identify the type of given pedigree. [CBSE-AIPMT 2015]



(a) Autosomal dominant (c) Autosomal recessive (b) X-linked recessive (d) X-linked dominant

- 286. A colourblind man marries a woman with normal sight who has no history of colour blindness in her family. What is the probability of their grandson being colourblind? [CBSE-AIPMT 2015]

 (a) 0.5
 (b) 1
 (c) Nil
 (d) 0.25
- 287. A man whose father was colourblind marries a woman, who had a colourblind mother and normal father. What percentage of male children of this couple will be colourblind? [CBSE-AIPMT 2014]
 (a) 25% (b) 0%
 (c) 50% (d) 75%
- **288.** Study the pedigree chart given below.



What does it show?

- (a) Inheritance of a sex-linked inborn error of metabolism like phenylketonuria
- (b) Inheritance of a condition like phenylketonuria as an autosomal recessive trait
- (c) The pedigree chart is wrong as this is not possible
- (d) Inheritance of a recessive sex-linked disease like haemophilia



[CBSE-AIPMT 2009]

289. If both parents are carriers for thalassemia, which is an autosomal recessive disorder, what are the chances of pregnancy resulting in an affected child? [NEET 2013]

(a) No chance (b) 50% (c) 25% (d) 100%

- 290. Blue eye colour is recessive to brown eye colour. A brown eyed man whose mother was blue eyed marries a blue eyed woman. The children shall be [CBSE-AIPMT 1991]
 (a) both blue eyed and brown eyed 1 : 1
 - (b) all brown eyed
 - (c) all blue eyed
 - (d) blue eyed and brown eyed 3 : 1
- 291. Both husband and wife have normal vision though their fathers were colourblind. The probability of their daughter becoming colourblind is

 (a) 0%
 (b) 25%
 [CBSE-AIPMT 1990]
 (c) 50%
 (d) 75%

30. Molecular Basis of Inheritance

292. A molecule that can act as a genetic material must fulfil the traits given below, except

[NEET 2016, Phase II]

- (a) it should be able to express itself in the form of 'Mendelian characters'
- (b) it should be able to generate its replica
- (c) it should be unstable structurally and chemically
- (d) it should provide the scope for slow changes that are required for evolution
- 293. During transcription, holoenzyme RNA polymerase binds to a DNA sequence and the DNA assumes a saddle-like structure at that point. What is that sequence called? [CBSE-AIPMT 2005]
 (a) CAAT box
 (b) GGTT box
 (c) AAAT box
 (d) TATA box
- 294. During transcription, the nucleotide sequence of the DNA strand that is being coded is ATACG, then the nucleotide sequence in the *m*RNA would be [CBSE-AIPMT 2004]
 (a) TATGC (b) TCTGG (c) UAUGC (d) UATGG
- 295. If there are 999 bases in an RNA that codes for a protein with 333 amino acids and the base at position 901 is deleted such that the length of the RNA becomes 998 bases, how many codons will be altered ? [NEET 2017] (a) 1 (b) 11 (c) 33 (d) 333
- 296. What would happen if in a gene encoding a polypeptide of 50 amino acids, 25th codon (UAU) is mutated to UAA? [CBSE-AIPMT 2003]
 - (a) A polypeptide of 49 amino acids will be formed
 - (b) A polypeptide of 25 amino acids will be formed
 - (c) A polypeptide of 24 amino acids will be formed
 - (d) Two polypeptides of 24 and 25 amino acids will be formed

- **297.** Select the two statements out of the four (I-IV) given below about *lac* operon.
 - I. Glucose or galactose may bind with the repressor and inactivate it.
 - II. In the absence of lactose, the repressor binds with the operator region.
 - III. The *z*-gene codes for permease.
 - IV. This was elucidated by Francis Jacob and Jacques Monod.

The correct statements	are	[CBSE-AIPMT 2010]
(a) I and III	(b) I and I	V
(c) II and IV	(d) I and II	

- 298. Which of the following is not required for any of the techniques of DNA fingerprinting available at present? [NEET 2016, Phase I]

 (a) Zinc finger analysis
 (b) Restriction enzymes
 (c) DNA-DNA hybridisation
 (d) Polymerase chain reaction
- **299.** Which one of the following is wrongly matched?
 - [CBSE-AIPMT 2014]
 - (a) Transcription–Writing information from DNA to t RNA
 - (b) Translation–Using information in mRNA to make protein (c) Repressor protein–Binds to operator to stop enzyme
 - synthesis
 - (d) Operon-Structural genes, operator and promoter

31. Evolution

- 300. Following are the two statements regarding the origin of life. [NEET 2016, Phase I]
 - I. The earliest organisms that appeared on the Earth were non-green and presumably anaerobes.
 - II. The first autotrophic organisms were the chemoautotrophs that never released oxygen.

Of the above statements, which one of the following options is correct? (a) II is correct but I is false (b) Both I and II are correct (c) Both I and II are false (d) I is correct but II is false

- **301.** Which of the following is the correct sequence of events in the origin of life? [NEET 2016, Phase II]
 - I. Formation of protobionts.
 - II. Synthesis of organic monomers.
 - III. Synthesis of organic polymers.
 - IV. Formation of DNA-based genetic systems.

(a) I–II–III–IV (b) I–III–II–IV (c) II–III–I–IV (d) II–III–IV–I

302. The process by which organisms with different evolutionary history evolve similar phenotypic adaptations in response to a common environmental challenge, is called [NEET 2013]
(a) natural selection (b) convergent evolution (c) non-random evolution (d) adaptive radiation

303. Which one of the following options gives one correct example each of convergent evolution and divergent evolution? [CBSE-AIPMT 2012]

	Convergent evolution	Divergent evolution
(a)	Eyes of <i>Octopus</i> and mammals	Bones of forelimbs of vertebrates
(b)	Thorns of <i>Bougainvillea</i> and tendrils of <i>Cucurbita</i>	Wings of butterflies and birds
(C)	Bones of forelimbs of vertebrates	Wings of butterflies and birds
(d)	Thorns of <i>Bougainvillea</i> and tendrils of <i>Cucurbita</i>	Eyes of <i>Octopus</i> and mammals

304. Age of fossils in the past was generally determined by radio-carbon method and other methods involving radioactive elements found in the rocks. More precise methods, which were used recently and led to the revision of the evolutionary periods for different groups of organisms, include

[CBSE-AIPMT 2004]

- (a) study of carbohydrates/proteins in fossils
- (b) study of the conditions of fossilisation
- (c) Electron Spin Resonance (ESR) and fossil DNA
- (d) study of carbohydrates/proteins in rocks
- **305.** The age of the fossil of *Dryopithecus* on the geological time scale is [CBSE-AIPMT 1998]

(a) 5×10^6 yr back	(b) 25×10^{6} yr back
(c) 50×10^6 yr back	(d) 75×10^6 yr back

- **306.** The eyes of *Octopus* and eyes of cat show different patterns of structure, yet they perform similar function. This is an example of [NEET 2013]
 - (a) homologous organs that have evolved due to convergent evolution
 - (b) homologous organs that have evolved due to divergent evolution
 - (c) analogous organs that have evolved due to convergent evolution
 - (d) analogous organs that have evolved due to divergent evolution
- **307.** In general, in the developmental history of a mammalian heart, it is observed that it passes through a two-chambered fish-like heart, three-chambered frog-like heart and finally to four-chambered stage. To which hypothesis can this above cited statement be approximated?

[CBSE-AIPMT 1998]

(a) Hardy-Weinberg law	(b) Lamarck's principle
(c) Biogenetic law	(d) Mendelian principles

(a) Llordy Mainhard Lour

308. In recent years, DNA sequences (nucleotide sequence) of mtDNA and Y-chromosomes were considered for the study of human evolution, because [CBSE-AIPMT 2003] (a) they can be studied from the samples of fossil remains

- (b) they are small and therefore, easy to study
- (c) they are uniparental in origin and do not take part in recombination
- (d) their structure is known in greater detail
- **309.** Which one of the following sequences was proposed by Darwin and Wallace for organic evolution?

[CBSE-AIPMT 2003]

- (a) Variations, natural selection, overproduction, constancy of population size
- (b) Overproduction, variations, constancy of population size, natural selection
- (c) Variations, constancy of population size, overproduction, natural selection
- (d) Overproduction, constancy of population size, variations, natural selection

310. Darwin's theory of pangenesis shows similarity with theory of inheritance of acquired characters then what will be correct according to it?

[CBSE-AIPMT 2001]

- (a) Useful organs become strong and developed while useless organs become extinct. These organs help in struggle for survival
- (b) Size of organs increases with ageing
- (c) Development of organs is due to will power
- (d) There should be some physical basis of inheritance
- **311.** Using imprints from a plate with complete medium and carrying bacterial colonies, you can select streptomycin resistant mutants and prove that such mutations do not originate as adaptation. These imprints need to be used [CBSE-AIPMT 2005] (a) on plates with and without streptomycin
 - (b) on plates with minimal medium
 - (c) only on plates with streptomycin
 - (d) only on plates without streptomycin
- **312.** In the case of peppered moth (*Biston betularia*), the black-coloured form became dominant over the light-coloured form in England during industrial revolution. This is an example of [CBSE-AIPMT 2009] (a) natural selection whereby the darker forms were selected
 - (b) appearance of the darker coloured individuals due to very poor sunlight
 - (c) protective mimicry
 - (d) inheritance of darker colour character acquired due to the darker environment

313. Industrial melanism as observed in peppered moth proves that [CBSE-AIPMT 2007]

- (a) the true black melanic forms arise by a recurring random mutation
- (b) the melanic form of the moth has no selective advantage over lighter form in industrial area
- (c) the lighter form moth has no selective advantage either in polluted industrial area or non-polluted area
- (d) melanism is a pollution generated feature

314. Which one of the following statements is correct? [CBSE-AIPMT 2007]

- (a) Stem cells are specialised cells
- (b) There is no evidence of the existence of gills during embryogenesis of mammals
- (c) All plant and animal cells are totipotent
- (d) Ontogeny repeats phylogeny

32. Human Health and Diseases

315. Common cold differs from pneumonia in that

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[CBSE-AIPMT 2012]
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- (a) pneumonia is a communicable disease, whereas the common cold is a nutritional deficiency disease
- (b) pneumonia can be prevented by a live attenuated bacterial vaccine, whereas the common cold has no effective vaccine
- (c) pneumonia is caused by a virus, while the common cold is caused by the bacterium *Haemophilus influenzae*
- (d) pneumonia pathogen infects alveoli whereas the common cold affects nose and respiratory passage but not the lungs

316. In which one of the following options the two examples are correctly matched with their particular type of immunity? [CBSE-AIPMT 2012]

	Examples	Type of immunity
(a	Polymorphonuclear leukocytes and monocytes	Cellular barriers
(b	Anti-tetanus and anti-snake bite injections	Active immunity
(C) Saliva in mouth and tears in eyes	Physical barriers
(d) Mucous coating of epithelium lining the urinogenital tract and the HCl in stomach	Physiological barriers

317. Which one of the following statements is correct with respect to immunity? [CBSE-AIPMT 2012]

- (a) Preformed antibodies need to be injected to treat the bite by a viper snake
- (b) The antibodies against smallpox pathogen are produced by T-lymphocytes
- (c) Antibodies are protein molecules, each of which has four light chains
- (d) Rejection of a kidney graft is the function of B-lymphocytes
- **318.** Consider the following four statements (I-IV) regarding kidney transplant and select the two correct ones out of these.
 - I. Even if a kidney transplant is proper, the recipient may need to take immunosuppressants for a long time.
 - II. The cell-mediated immune response is responsible for the graft rejection.
 - III. The B-lymphocytes are responsible for the rejection of graft.

IV. The acceptance or rejection of a kidney transplant depends on specific interferons.

The two correct statements are[CBSE-AIPMT 2010](a) II and III(b) III and IV(c) I and III(d) I and II

319. Match the disease in Column I with the appropriate items (pathogen/prevention/treatment) in Column II. [CBSE-AIPMT 2008]

		Colum	n I	Column II					
_	А.	Amoet	oiasis	1.	Treponema pallidum				
_	В.	Diphth	eria	2.	Use only sterilised food and water				
	C.	Choler	а	З.	3. DPT vaccine				
	D.	Syphili	S	4.	Use oral rehydration therapy				
Co	de	5							
	А	В	С	D	A B C D				
(a)	1	2	3	4	(b) 2 4 1 3				
(c)	2	1	3	4	(d) 2 3 4 1				

- **320.** Which of the following statements is not true for cancer cells in relation to mutations?
 - [NEET 2016, Phase I]
 - (a) Mutations destroy telomerase inhibitor
 - (b) Mutations inactivate the cell control
 - (c) Mutations inhibit the production of telomerase
 - (d) Mutations in proto-oncogenes accelerate the cell cycle
- **321.** Which one of the following statements is correct? [CBSE-AIPMT 2009]
 - (a) Patients, who had undergone surgery are given cannabinoids to relieve pain
 - (b) Benign tumours show the property of metastasis
 - (c) Heroin accelerates body functions
 - (d) Malignant tumours may exhibit metastasis

[CBSE-AIPMT 2003]

- (a) malignant tumours of the colon
- (b) benign tumours of the connective tissue
- (c) malignant tumours of the connective tissue
- (d) malignant tumours of the skin or mucous membrane
- **323.** Which of the following symptoms indicate radiation sickness? [CBSE-AIPMT 1997]
 - (a) Red and ulcerated skin

322. Carcinoma refers to

- (b) Nausea and anaemia
- (c) Nausea and loss of hair
- (d) Ulcerated skin, nausea and loss of hair
- **324.** Which of the following is correct regarding AIDS causative agent HIV? [NEET 2016, Phase II]
 - (a) HIV is enveloped virus containing one molecule of single-stranded RNA and one molecule of reverse transcriptase
 - (b) HIV is enveloped virus that contains two identical molecules of single-stranded RNA and two molecules of reverse transcriptase
 - (c) HIV is unenveloped retrovirus
 - (d) HIV does not escape but attacks the acquired immune response

The **NEET** Edge ~ Biology

- **325.** At which stage of HIV infection does one usually show symptoms of AIDS? [CBSE-AIPMT 2014, 11] (a) Within 15 days of sexual contact with an infected person (b) When the infected retrovirus enters host cells (c) When HIV damages large number of helper T-lymphocytes (d) When the viral DNA is produced by reverse transcriptase **326.** Retroviruses are implicated as a cause for cancer in humans because they [CBSE-AIPMT 1996] (a) carry gene for reverse transcriptase (b) may carry cellular proto-oncogenes in their genome (c) may carry v-oncogenes in their genome (d) carry single-stranded RNA as their genetic material **327.** Which one of the following is the correct statement regarding the particular psychotropic drug specified? [CBSE-AIPMT 2008] (a) Hashish causes alter thought perceptions and hallucinations (b) Opium stimulates nervous system and causes hallucinations (c) Morphine leads to delusions and disturbed emotions (d) Barbiturates cause relaxation and temporary euphoria **328.** Which one of the following is not correctly
- **328.** Which one of the following is not correctly matched? [CBSE-AIPMT 2004]
 - (a) Glossina palpalis
 Sleeping sickness
 (b) Culex pipiens
 Filariasis
 - (b) Culex pipiens
 (c) Aedes aegypti
 Filariasis
 Yellow fever
 - (d) Anopheles culicifacies Leishmaniasis
- **329.** A person showing unpredictable moods, outbursts of emotion, quarrelsome behaviour and conflicts with others, is suffering from [CBSE-AIPMT 2006]
 - (a) schizophrenia
 - (b) Borderline Personality Disorder (BPD)
 - (c) mood disorders
 - (d) addictive disorders

33. Strategies for Enhancement in Food Production

- **330.** Consider the following four statements (I-IV) and select the option which includes all the correct ones only.
 - I. Single cell *Spirulina* can produce large quantities of food rich in protein, minerals, vitamins, etc.
 - II. Body weight-wise the microorganism *Methylophilus methylotrophus* may be able to produce several times more proteins than the cows per day.
 - III. Common button mushrooms are a very rich source of vitamin-C.
 - IV. A rice variety has been developed which is very rich in calcium. [CBSE-AIPMT 2012]

- (a) Statements III and IV (b) Statements I, III and IV (c) Statements II, III and IV (d) Statements I and II
- 331. Consider the following statements (I-IV) about organic farming. [CBSE-AIPMT 2011]
 - I. Utilises genetically modified crops like *Bt* cotton.II. Uses only naturally produced inputs like compost.
 - III. Does not use pesticides and urea.
 - IV. Produces vegetables rich in vitamins and minerals.

Which of the above statements are correct? (a) II, III and IV (b) III and IV (c) II and III (d) I and II

- **332.** Consider the following four measures (I-IV) that could be taken to successfully grow chickpea in an area where bacterial blight disease is common.
 - I. Spray with Bordeaux mixture.
 - II. Control of the insect vector of the disease pathogen.
 - III. Use of only disease-free seeds.
 - IV. Use of varieties resistant to the disease.

Which two of the above	measures can control the
disease?	[CBSE-AIPMT 2008]
(a) III and IV	(b) I and IV
(c) II and III	(d) I and II

- **333.** Farmers in a particular region were concerned that premature yellowing of leaves of a pulse crop might cause decrease in the yield. Which treatment could be most beneficial to obtain maximum seed yield? [CBSE-AIPMT 2006]
 - (a) Frequent irrigation of the crop
 - (b) Treatment of the plants with cytokinins along with a small dose of nitrogenous fertiliser
 - (c) Removal of all yellow leaves and spraying the remaining green leaves with 2,4,5-trichlorophenoxy acetic acid
 - (d) Application of iron and magnesium to promote synthesis of chlorophyll
- **334.** Of the world's top five crops (in terms of annual production) [CBSE-AIPMT 1997]
 - (a) three belong to Poaceae (Gramineae), one to Leguminosae, one to Solanaceae
 - (b) four belong to Poaceae, one to Leguminosae
 - (c) four belong to Poaceae, one to Solanaceae
 - (d) all five belong to Poaceae

335. In crop improvement programme, haploids are important because they
 [CBSE-AIPMT 1989]

- (a) require one half of nutrients
- (b) are helpful in study of meiosis
- (c) grow better under adverse conditions
- (d) form perfect homozygous

- **336.** In cloning of cattle, a fertilised egg is taken out of the mother's womb and [CBSE-AIPMT 2007]
 - (a) in the eight cell stage, cells are separated and cultured until small embryos are formed which are implanted into the womb of other cows
 - (b) in the eight cell stage, the individual cells are separated under electrical field for further development in culture media
 - (c) from this, up to eight identical twins can be produced
 - (d) the egg is divided into 4 pairs of cells which are implanted into the womb of other cows
- **337.** One of the most important reason why wild plants should thrive is that these are good sources of
 - (a) unsaturated edible oils
 - (b) highly nutritive animals feed
 - (c) genes for resistance to diseases and pests
 - (d) rare and highly sought after fruits of medical importance
- **338.** Which one of the following pairs is mismatched?

(a) Pila globosa	 Pearl	[CBSE-AIPMT 2007]
(b) Apis indica	 Honey	
(c) Kenia lacca	 Lac	

- (d) Bombyx mori Silk
- **339.** The long-term prospects for a truly human civilisation depend in a large measure on
 - [CBSE-AIPMT 1996]

[CBSE-AIPMT 2000]

(a) the ability of humanity to moderate its fecundity

- (b) increasing the food production
- (c) colonisation of under populated areas
- (d) control of human diseases

34. Microbes in Human Welfare

340. Which of the following is wrongly matched in the given table? [NEET 2016, Phase I]

	Microbe	Product	Application
(a)	Monascus purpureus	Statins	Lowering of blood cholesterol
(b)	Streptococcus	Streptokinase	Removal of clot from blood vessel
(C)	Clostridium butylicum	Lipase	Removal of oil stains
(d)	Trichoderma polysporum	Cyclosporin-A	Immunosuppressive drug

341. Select the correct statement from the following. [CBSE-AIPMT 2010]

- (a) Biogas is produced by the activity of aerobic bacteria on animal waste
- (b) *Methanobacterium* is an aerobic bacterium found in rumen of cattle

(c) Biogas, commonly called gobar gas, is pure methane(d) Activated sludge-sediment in settlement tanks of sewage treatment plant is a right source of aerobic bacteria

342. Match Column I with Column II and select the correct option using the codes given below. [NEET 2016, Phase II]

	Col	umn	I		Col	umr	n II		
А.	Citric	acid		1.	Trici	hode	erma		
В.	Cyclosporin		2.	Clos	strid	ium			
C.	Statins		З.	Asp	ergii	llus			
D.	Butyric acid			4.	Mor	nasc	us		
Code	es								
A	νВ	С	D			А	В	С	D
(a) 3	3 1	2	4		(b)	3	1	4	2
(c) 1	4	2	3		(d)	3	4	1	2

- **343.** Biological control component is central to advanced agricultural production. Which of the following is used as a third generation pesticide?
 - [CBSE-AIPMT 1998]
 - (b) Pheromones

(a) Pathogens

- (c) Insect repellents
- (d) Insect hormone analogues
- **344.** One of the major difficulties in the biological control of insect pests is the [CBSE-AIPMT 1995]
 - (a) practical difficulty of introducing the predator to specific areas
 - (b) method is less effective as compared with the use of insecticides
 - (c) predator does not always survive when transferred to a new environment
 - (d) the predator develops a preference to other diets and may itself become a pest
- **345.** Which of the following plants are used as green manure in crop fields and in sandy soils?

[CBSE-AIPMT 2003]

- (a) Saccharum munja and Lantana camara
- (b) Dichanthium annulatum and Azolla nilotica
- (c) Crotalaria juncea and Alhagi comelorum
- (d) Calotropis procera and Phyllanthus niruri

346. Which one of the following statements is correct? [CBSE-AIPMT 2007]

- (a) Extensive use of chemical fertilisers may lead to eutrophication of nearby water bodies
- (b) Both *Azotobacter* and *Rhizobium* fix atmospheric nitrogen in root nodules of plants
- (c) Cyanobacteria such as Anabaena and Nostoc are important mobilisers of phosphates and potassium for plant nutrition in soil
- (d) At present it is not possible to grow maize without chemical fertilisers



35. Biotechnology: Principles and Processes

347. Genetic engineering is possible, because

(a) the phenomenon of transduction in bacteria is well-understood

- (b) we can see DNA by electron microscope
- (c) We can cut DNA at specific sites by endonucleases like DNase-I
- (d) restriction endonucleases purified from bacteria can be used in vitro

[CBSE-AIPMT 1998]

- **348.** A mutant strain of T_4 -bacteriophage R-II, fails to lyse the *E. coli* but when two strains R-II^x and R-II^y are mixed then they lyse the *E. coli*. What may be the possible reason? [CBSE-AIPMT 2002]
 - (a) Bacteriophage transforms in wild
 - (b) It is not mutated
 - (c) Both strains have similar cistrons
 - (d) Both strains have different cistrons
- **349.** What is the criterion for DNA fragment movement on agarose gel during gel electrophoresis? [NEET 2017] (a) The larger the fragment size, the farther it moves
 - (b) The smaller the fragment size, the farther it moves
 - (c) Positively charged fragments move to farther end
 - (d) Negatively charged fragments do not move
- **350.** The DNA fragments separated on an agarose gel can be visualised after staining with [NEET 2017] (a) bromophenol blue (b) acetocarmine (c) aniline blue (d) ethidium bromide
- **351.** Which vector can clone only a small fragment of DNA? [CBSE-AIPMT 2014]
 - (a) Bacterial artificial chromosome
 - (b) Yeast artificial chromosome
 - (c) Plasmid
 - (d) Cosmid
- **352.** The colonies of recombinant bacteria appear white in contrast to blue colonies of non-recombinant bacteria because of [NEET 2013]
 - (a) non-recombinant bacteria containing β -galactosidase
 - (b) insertional inactivation of α -galactosidase in non-recombinant bacteria
 - (c) insertional inactivation of α-galactosidase in recombinant bacteria
 - (d) inactivation of glycosidase enzyme in recombinant bacteria

353. PCR and restriction fragment length polymorphism are the methods for [CBSE-AIPMT 2012] (a) study of enzymes (b) genetic transformation

- (a) study of enzymes (c) DNA sequencing
- (d) genetic fingerprinting

- **354.** Plasmids are suitable vectors for gene cloning because [CBSE-AIPMT 2000]
 - (a) these are small circular DNA molecules which can integrate with host chromosomal DNA
 - (b) these are small circular DNA molecules with their own replication origin site
 - (c) these can shuttle between prokaryotic and eukaryotic cells
 - (d) these often carry antibiotic resistance genes
- **355.** The given figure is the diagrammatic representation of the *E. coli* vector pBR322. Which one of the given options correctly identifies its certain component(s)?

[CBSE-AIPMT 2012]



- (a) ori-original restriction enzyme
- (b) rop-reduced osmotic pressure
- (c) Hind III, Eco RI-selectable markers
- (d) amp^{*R*}, tet^{*R*}–antibiotic resistance genes
- **356.** Which one is a true statement regarding DNA polymerase used in PCR? [CBSE-AIPMT 2012]
 - (a) It is used to ligate introduced DNA in recipient cells
 - (b) It serves as a selectable marker
 - (c) It is isolated from a virus
 - (d) It remains active at high temperature
- **357.** The genetic defect-Adenosine Deaminase (ADA) deficincy may be cured permanently by

[CBSE-AIPMT 2009]

- (a) periodic infusion of genetically engineered lymphocytes having functional ADA cDNA
- (b) administering adenosine deaminase activators
- (c) introducing bone marrow cells producing ADA into cells at early embryonic stages
- (d) enzyme replacement therapy
- **358.** Stirred-tank bioreactors have been designed for [CBSE-AIPMT 2010]
 - (a) addition of preservatives to the product
 - (b) purification of the product
 - (c) ensuring anaerobic conditions in the culture vessel
 - (d) availability of oxygen throughout the process

36. Biotechnology and Its Applications

359. Production of a human protein in bacteria by genetic engineering is possible because

[CBSE-AIPMT 2005]

- (a) bacterial cell can carry out the RNA splicing reactions
- (b) the human chromosome can replicate in bacterial cell
- (c) the mechanism of gene regulation is identical in humans and bacteria
- (d) the genetic code is universal

360. An improved variety of transgenic basmati rice [CBSE-AIPMT 2010]

- (a) does not require chemical fertilisers and growth hormones
- (b) gives high yield and is rich in vitamin-A
- (c) is completely resistant to all insect pests and diseases of paddy
- (d) gives high yield but has no characteristic aroma

361. Genetic engineering has been successfully used for producing [CBSE-AIPMT 2010]

- (a) transgenic mice for testing safety of polio vaccine before use in humans
- (b) transgenic models for studying new treatments for certain cardiac diseases
- (c) transgenic cow-Rosie which produces high fat milk for making ghee
- (d) animals like bulls for farm work as they have super power

362. The introduction of *t*DNA into plants involves [CBSE-AIPMT 2015]

(a) infection of the plant by Agrobacterium tumefaciens

- (b) altering the pH of soil, heat-shocking the plants
- (c) exposing the plants to cold for a brief period (d) allowing the plant roots to stand in water

363. Commonly used vectors for human genome

sequencing are	[CBSE-AIPMT 2014]
(a) T-DNA	(b) BAC and YAC
(c) Expression vectors	(d) T/A cloning vectors

37. Organisms and Population

364. Which one of the following pairs is mismatched? [CBSE-AIPMT 2005]

(a)	Savanna	_	Acacia trees
(b)	Prairie		Epiphytes
(C)	Tundra	—	Permafrost

(d) Coniferous forest Evergreen trees

365. What is a keystone species? [CBSE-AIPMT 2004]

- (a) A species which makes up only a small proportion of the total biomass of a community, yet has a huge impact on the community's organisation and survival
- (b) A common species that has plenty of biomass, yet has a fairly low impact on the community's organisation
- (c) A rare species that has minimal impact on the biomass and on other species in the community
- (d) A dominant species that constitutes a large proportion of the biomass and which affects many other species

366. The figure given below is a diagrammatic representation of response of organisms to abiotic factors. What do (A), (B) and (C) represent respectively? [CBSE-AIPMT 2010]



- (b) Regulator
- (c) Partial regulator Regulator Conformer
- (d) Regulator Conformer Partial regulator
- **367.** Which one of the following processes during decomposition is correctly described? [NEET 2013] (a) Fragmentation-Carried out by organisms such as earthworm
 - (b) Humification-Leads to the accumulation of a dark coloured substance humus, which undergoes microbial action at a verv fast rate
 - (c) Catabolism–Last step in the decomposition under fully anaerobic condition
 - (d) Leaching–Water soluble inorganic nutrients rise to the top layers of soil

368. The table below gives the populations (in thousands) of ten species (A- J) in four areas (I-IV) consisting of the number of habitats given within brackets against each. Study the table and answer the question which follows.

Area and number of			Spe (ii	ecies a n thous	nd the sands)	ir pop in the	ulatio area	ns s		
habitats	А	В	С	D	Е	F	G	н	I	J
l (11)	2.3	1.2	0.52	6.0	_	3.1	1.1	9.0	—	10.3
ll (11)	10.2	_	0.62		1.5	3.0	_	8.2	1.1	11.2
III (13)	11.3	0.9	0.48	2.4	1.4	4.2	0.8	8.4	2.2	4.1
IV (12)	3.2	10.2	11.1	4.8	0.4	3.3	0.8	7.3	11.3	2.1

Which area out of I to IV shows maximum species diversity? [CBSE-AIPMT 2008] (a) II (b) III (c) IV (d) |

369. Consider the following four conditions (I-IV) and select a correct pair of them as adaptation to environment in desert lizards. [CBSE-AIPMT 2011]

Conditions

- I. Burrowing in soil to escape high temperature.
- II. Losing heat rapidly from the body during high temperature.
- III. Bask in sun when temperature is low.

The **NEET** Edge ~ Biology

- IV. Insulating body due to thick fatty dermis.(a) III and IV(b) I and III(c) II and IV(d) I and II
- **370.** Which of the following pairs is correctly matched? [CBSE-AIPMT 2005]
 - (a) Uricotelism–Aquatic habitat
 - (b) Parasitism Intraspecific relationship
 - (c) Excessive perspiration-Xeric adaptation
 - (d) Stream-lined body-Aquatic adaptation
- **371.** Gause's principle of competitive exclusion states that [NEET 2016, Phase I]
 - (a) competition for the same resources excludes species having different food preferences
 - (b) no two species can occupy the same niche indefinitely for the same limiting resources
 - (c) larger organisms exclude smaller ones through competition
 - (d) more abundant species will exclude the less abundant species through competition
- **372.** Competition for light, nutrients and space is most severe between [CBSE-AIPMT 1988]
 - (a) closely related organisms growing in different niches
 - (b) closely related organisms growing in the same area/niche
 - (c) distantly related organisms growing in the same habitat
 - (d) distantly related organisms growing in different niches
- **373.** Asymptote in a logistic growth curve is obtained, when [NEET 2017]

(a) The value of 'r' approaches zero (b) K = N(c) K > N(d) K < N

374. When does the growth rate of a population following the logistic model equal zero? The logistic model is given as dN/dt = rN(1-N/K)

[NEET 2016, Phase I]

- (a) when N nears the carrying capacity of the habitat
- (b) when *N/K* equals zero
- (c) when death rate is greater than birth rate
- (d) when N/K is exactly one
- **375.** The population of an insect species shows an explosive increase in numbers during rainy season followed by its disappearance at the end of the season. What does this show? [CBSE-AIPMT 2007] (a) S-shaped or sigmoid growth of this insect
 - (a) S-snaped or sigmoid growth of this insect
 - (b) The food plants mature and die at the end of the rainy season
 - (c) Its population growth curve is of J-type
 - (d) The population of its predators increases enormously

376. What type of human population is represented by the following age pyramid? [CBSE-AIPMT 2011]



(c) Declining population

(b) Stable population(d) Expanding population

377. A country with a high rate of population growth took measures to reduce it. The figure below shows age sex pyramids of populations *A* and *B* twenty years apart. Select the correct interpretation about them. [CBSE-AIPMT 2009]



- (a) 'A' is more recent and shows slight reduction in the growth rate
- (b) 'B' is earlier pyramid and shows stabilised growth rate
- (c) 'B' is more recent showing that population is very young
- (d) 'A' is the earlier pyramid and no change has occurred in the growth rate

38. Ecosystem

- **378.** Consider the following statements concerning food chains. [CBSE-AIPMT 2008]
 - I. Removal of 80% tigers from an area resulted in greatly increased growth of vegetation.
 - II. Removal of most of the carnivores resulted in an increased population of deers.
 - III. The length of food chains is generally limited to 3-4 trophic levels due to energy loss.
 - IV. The length of food chains may vary from 2 to 8 trophic levels.

Which of the two above statements are correct? (a) I and II (b) II and III (c) III aqnd IV (d) I and IV

379. Identify the likely orgnaisms A, B, C and D in the food web shown below. [CBSE-AIPMT 2012]



380. Given below is an imaginary pyramid of numbers. What could be one of the possibilities about certain organisms at some of the different levels?

Rat

Cat

[CBSE-AIPMT 2012]

Pigeon



(a) Level PC is insects and level SC is small insectivorous birds

- (b) Level PP is phytoplanktons in sea and whale on top level $\ensuremath{\mathsf{TC}}$
- (c) Level one $\ensuremath{\mathsf{PP}}$ is peepal trees and the level SC is sheep
- (d) Level PC is rats and level SC is cats
- **381.** In Grass–Deer–Tiger food chain, grass biomass is one tonne. The tiger biomass shall be

	0	[C]	BSE-AIPMT 1	994]
(a) 100 kg	(b) 10 kg	(c) 200 kg	(d) 1 kg	

(MODULE 3)

(d) Squirrel

- **382.** In which of the following both pairs have correct combination? [CBSE-AIPMT 2015]
 - (a) Gaseous nutrient cycle Sedimentary nutrient cycle

(b)

(b)

(C)

(d)

Carbon and nitrogenSulphur and phosphorus

- Gaseous nutrient cycle Carbon and sulphur Sedimentary nutrient cycle – Nitrogen and phosp
 - Nitrogen and phosphorus
 Nitrogen and sulphur
- (c) Gaseous nutrient cycle Sedimentary nutrient cycle
- Carbon and phosphorus
 Sulphur and phosphorus
 Carbon and nitrogen
- (d) Gaseous nutrient cycle Sedimentary nutrient cycle
- 383. Given below is a simplified model of phosphorus cycling in a terrestrial ecosystem with four blanks (*A-D*). Identify the blanks. [CBSE-AIPMT 2014]



- Producers Litter fall Rock minerals Detritus
- **384.** During ecological succession, [CBSE-AIPMT 2015] (a) the gradual and predictable change in species composition occur in a given area
 - (b) the establishment of a new biotic community is very fast in its primary phase
 - (c) the numbers and types of animals remain constant
 - (d) the changes lead to a community that is in near equilibrium with the environment and is called pioneer community

385. The correct sequence of plants in a hydrosere is [CBSE-AIPMT 2009]

(a) Oak \rightarrow Lantana \rightarrow Scirpus \rightarrow Pistia \rightarrow Hydrilla \rightarrow Volvox (b) Volvox \rightarrow Hydrilla \rightarrow Pistia \rightarrow Scirpus \rightarrow Lantana \rightarrow Oak (c) Pistia \rightarrow Volvox \rightarrow Scirpus \rightarrow Hydrilla \rightarrow Oak \rightarrow Lantana

- (d) Oak \rightarrow Lantana \rightarrow Volvox \rightarrow Hydrilla \rightarrow Pistia \rightarrow Scirpus
- 386. If the forest cover is reduced to half, what is most likely to happen on a long basis? [CBSE-AIPMT 1996](a) Tribals living in these areas will starve to death
 - (b) Cattle in these and adjoining areas will die due to lack of fodder
 - (c) Large areas will become deserts
 - (d) Crop breeding programmes will suffer due to a reduced availability of variety of germplasm

387. Match the following and select the correct option. [CBSE-AIPMT 2014]

	Column I		Column II
Α.	Earthworm	1.	Pioneer species
В.	Succession	2.	Detritivore
C.	Ecosystem service	3.	Natality
D.	Population growth	4.	Pollination

Codes

А	В	С	D	А	В	С	D
(a) 1	2	3	4	(b) 4	1	3	2
(c) 3	2	4	1	(d) 2	1	4	3

39. Biodiversity and Conservation

- **388.** Which one of the following pairs of organisms are exotic species introduced in India?[CBSE-AIPMT 2007]
 - (a) Ficus religiosa, Lantana camara
 - (b) *Lantana camara*, water hyacinth
 - (c) Water hyacinth, *Prosopis cineraria*
 - (d) Nile perch, Ficus religiosa

389. Which one of the following expanded forms of the following acronyms is correct? [CBSE-AIPMT 2011]

- (a) UNEP United Nations Environmental Policy
- (b) EPA Environmental Pollution Agency
- (c) IUCN International Union for Conservation of Nature and Natural Resources
- (d) IPCC International Panel for Climate Change

390. Select the correct statement about biodiversity.

- [CBSE-AIPMT 2012] (a) The desert areas of Rajasthan and Gujarat have a very
- high level of desert animal species as well as numerous rare animals
- (b) Large scale planting of *Bt* cotton has no adverse effect on biodiversity
- (c) Western Ghats have a very high degree of species richness and endemism
- (d) Conservation of biodiversity is just a fad pursued by the developed countries

391. Identify the odd combination of the habitat and the particular animal concerned. [CBSE-AIPMT 2007]

(a) Dachigam National Park	 — Snow leopard
(b) Sunderbans	 Bengal tiger
(c) Periyar	 — Elephant
(d) Rann of Kutch	 Wild ass

- (d) Kann of Kutch Wild ass
- **392.** A number of natural reserves have been created to conserve specific wildlife species. Identify the correct combination from the following.
 - (a) Gir forest Tiger [CBSE-AIPMT 1996]
 (b) Kaziranga Elephants
 (c) Rann of Kutch Wild ass
 - (d) Manas Wildlife Sanctuary Musk deer
- **393.** Which of the following is the correct matching pair of a sanctuary and its main protected wild animal? [CBSE-AIPMT 1995]

(a) Gir	— Lion	(b) Sariska	— Tiger
(c) Sunderban	— Rhino	(d) Kaziranga	— Musk deer

- Population

394. Which of the following is correctly matched?

(d) Stratification

			[NEET 2016, Phase II]
a)	Aerenchyma		Opuntia
(b)	Age pyramid	—	Biome
(c)	Parthenium hysterophorus		Threat to biodiversity

40. Environmental Issues

- **395.** A scrubber in the exhaust of a chemical industrial plant removes [CBSE-AIPMT 2014]
 - (a) gases like sulphur dioxide
 - (b) particulate matter of the size 5 micrometer or above
 - (c) gases like ozone and methane
 - (d) particulate matter of the size 2.5 micrometer or less
- **396.** Steps taken by the Government of India to control air pollution include [CBSE-AIPMT 2009]
 - (a) compulsory mixing of 20% ethyl alcohol with petrol and 20% biodiesel with diesel
 - (b) compulsory PUC (Pollution Under Control) certification of petrol driven vehicles, which tests for carbon monoxide and hydrocarbons
 - (c) permission to use only pure diesel with a maximum of 500 ppm sulphur as fuel for vehicles
 - (d) use of non-polluting Compressed Natural Gas (CNG) only as fuel by all buses and trucks
- **397.** Acid rains are produced by [CBSE-AIPMT 1988]
 - (a) excess NO_2 and SO_2 from burning fossil fuels
 - (b) excess production of NH_3 by industry and coal gas
 - (c) excess release of carbon monoxide by incomplete combustion
 - (d) excess formation of CO_2 by combustion and animal respiration
- **398.** A lake near a village suffered heavy mortality of fishes within a few days. Consider the following reasons for this
 - I. Lots of urea and phosphate fertiliser were used in the crops in the vicinity.
 - II. The area was sprayed with DDT by an aircraft.
 - III. The lake water turned green and stinky.
 - IV. Phytoplankton populations in the lake declined initially thereby greatly reducing photosynthesis.

Which two of the above were the main causes of
fish mortality in the lake?[CBSE-AIPMT 2008](a) II and III(b) III and IV(c) I and III(d) I and II

- 399. In which one of the following, the BOD (Biochemical Oxygen Demand) of Sewage (S), Distillery Effluent (DE), Paper Mill Effluent (PE) and Sugar Mill Effluent (SE) have been arranged in ascending order? [CBSE-AIPMT 2007]
 (a) SE < S < PE < DE
 (b) SE < PE < S < DE
 (c) PE < S < SE < DE
 (d) S < CDE < CDE
 - (d) S < DE < PE < SE

400 .	Lead concentration	in	blood	is	considered	alarming	ŗ
	if it is				[CBSE-A	JPMT 2004]
	(a) 20 μg/100 mL		(b)	30	µg/100 mL		

(a) 20 μg/100 mL	(b) 30 µg/100 mL
(c) 4-6 µg/100 mL	(d) 10 µg/100 mL



1. (b) 11. (a) 21. (c) 31. (d) 41. (a) 51. (a) 61. (b) 71. (b) 81. (b) 91. (a)	 (c) (b) (a) (a) (c) (c) (c) (c) (c) (c) (c) (d) (c) (d) (c) 	3. (d) 13. (c) 23. (d) 33. (b) 43. (b) 53. (d) 63. (c) 73. (b) 83. (a) 93. (c)	4. (c) 14. (c) 24. (d) 34. (b) 44. (c) 54. (b) 64. (b) 74. (d) 84. (c) 94. (d)	5. (c) 15. (a) 25. (a) 35. (c) 45. (d) 55. (a) 65. (a) 75. (d) 85. (c) 95. (a)	6. (d) 16. (a) 26. (d) 36. (c) 46. (a) 56. (b) 66. (b) 76. (d) 86. (c) 96. (b)	7. (c) 17. (a) 27. (c) 37. (b) 47. (b) 57. (b) 67. (b) 77. (d) 87. (d) 97. (b)	8. (d) 18. (b) 28. (b) 38. (d) 48. (a) 58. (d) 68. (a) 78. (a) 88. (a) 98. (b)	9. (a) 19. (a) 29. (b) 39. (c) 49. (c) 59. (c) 69. (c) 79. (d) 89. (c) 99. (d)	10. (c) 20. (c) 30. (c) 40. (b) 50. (a) 60. (a) 70. (c) 80. (b) 90. (c) 100. (c)
101. (a) 111. (c) 121. (a) 131. (b) 141. (d) 151. (a) 161. (d) 171. (d) 181. (b) 191. (b)	102. (a) 112. (d) 122. (d) 132. (d) 142. (d) 152. (d) 162. (d) 172. (c) 182. (c) 192. (a)	103. (a) 113. (a) 123. (a) 133. (d) 143. (d) 153. (b) 163. (a) 173. (b) 183. (b) 193. (b)	104. (a) 114. (c) 124. (a) 134. (b) 144. (b) 154. (c) 164. (b) 174. (a) 184. (b) 194. (a)	105. (d) 115. (d) 125. (c) 135. (d) 145. (d) 155. (b) 165. (c) 175. (d) 185. (a) 195. (a)	106. (c) 116. (c) 126. (d) 136. (b) 146. (d) 156. (b) 166. (d) 176. (b) 186. (a) 196. (c)	107. (a) 117. (a) 127. (c) 137. (d) 147. (d) 157. (c) 167. (b) 177. (d) 187. (c) 197. (a)	108. (b) 118. (a) 128. (d) 138. (d) 148. (b) 158. (d) 168. (c) 178. (a) 198. (b)	109. (b) 119. (a) 129. (b) 139. (b) 149. (a) 159. (d) 169. (a) 179. (a) 189. (a) 199. (c)	110. (b) 120. (c) 130. (c) 140. (d) 150. (c) 160. (c) 170. (a) 180. (c) 190. (c) 200. (b)
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1. The Living World

- All living organisms interact with their environment and show progressive evolution. They can sense and respond to environmental uses. On the other hand, reproduction, growth and movement cannot be all inclusive defining properties of living organisms.
- 2. Autotrophs are the organisms which are capable of synthesising their food themselves from organic and inorganic substances. The autotrophs from the list are *Nostoc, Chara, Nitrosomonas, Nitrobacter, Porphyra* and *Wolffia.*
- **3.** Biological names originate from Latin language and are printed in italics. Nomenclature is the science of providing distinct and proper name to the organisms.
- 4. Statements I and IV are correct. The correct forms of II and III are as follows
 - II. Photoperiod does affect the reproduction in plants.
 - III. Binomial nomenclature was given by Carolus Linnaeus.
- 5. Carbohydrates, the most abundant biomolecules on earth are produced by bacteria, algae and green plants. Some photosynthetic bacteria such as 'Rhodopseudomonas' can prepare carbohydrates. But during this type of food synthesis, O₂ is not evolved because in this case hydrogen donor is other than H₂O. Algae (green and blue-green) and all green plant cells prepare their food (carbohydrate) through photosynthesis. Here, hydrogen ions are donated by water molecules by the process of photolysis of water, i.e. O₂ is released during this type of food synthesis.
- 6. Herbarium does not have information on height of the plant. It is a collection of plants that usually have been dried, pressed, preserved plant on sheets and are arranged in accordance with any accepted system of classification for future reference and study.
- Statement (c) is incorrect. It is corrected as, museums have collection of preserved plant and animal specimens for study and reference. Specimens are preserved in the containers in preservative solutions.

EXPLANATIONS

Herbarium is a storehouse of collected plant specimens that are dried, pressed and preserved on sheets. Botanical gardens have collection of living plants for reference. Key is a taxonomic aid for the identification of plants and animals based on the similarities and dissimilarities.

2. Kingdom–Monera and Viruses

- 8. Viroids differ from viruses in having RNA molecules without protein coat. Viruses on the other hand possess DNA or RNA with a protein coat as their genetic material. Viruses can infect a wide range of organisms including plants, animals or bacteria, while viroids infect only plants.
- All statements are correct except the statement (a), which can be corrected as Viroids were discovered by TO Diener in 1971 as a new infectious agent that was smaller than virus.
- **10.** Statement (c) is wrong about viroids. Viroids are infectious, non-protein coding, highly structured with small circular RNAs, which have the ability to replicate autonomously. These contain RNA of low molecular weight and induce diseases in higher plants only.
- **11.** The statement (a) is not true for retroviruses. Retroviruses are so named because they contain enzyme reverse transcriptase or RNA dependent DNA polymerase. The genetic material of these viruses is RNA. It differs from other RNA viruses in working pattern of first synthesis of DNA *via* reverse transcription, e.g. Rous Sarcoma Virus, HIV, etc.
- **12.** All the viruses do not possess helical symmetry. Two types of symmetry are recognised in viruses, which correspond to the two primary shapes, rod and spherical. Rod-shaped viruses have helical symmetry and spherical viruses have icosahedral symmetry.
- **13.** Barophilic prokaryotes grow and multiply in very deep marine sediments. These are generally found in deep sea floors where pressure is more than 38 MPa.
- 14. Penicillin is an antibiotic which acts on cell wall and *Mycoplasma* lacks cell wall. Thus, *Mycoplasma* is not sensitive

to penicillin. *Mycoplasma* are inhibited by metabolic inhibitors like chloramphenicol and tetracycline.

3. Kingdom–Protista

- **15.** Statement (a) is wrong. Diatoms are single-celled plant-like protists that produce intricately structured cell walls made of nano(–) silica particles (SiO₂) which are indestructible. Rest of the options are correct.
- 16. Auxospores and hormocysts are formed by several diatoms and a few cyanobacteria, respectively. Bacillariophyceae members (diatoms) are microscopic, eukaryotic, unicellular or colonial coccoid algae. These algae sexually reproduce by the formation of auxospores in most cases. Bozi (1914) and Fermi (1930) reported that short sections of living cells at the tips of the trichomes of Wertiella lanosa become invested by a thick, lamellated, pigmented sheath. Such mullticellular spore-like structures, function as perennating bodies. They are specially modified hormogones and are called hormospores or hormocysts.
- **17.** Chrysophytes are placed under the kingdom–Protista. This group includes diatoms and golden algae (desmids). Most of them are photosynthetic. In diatoms, the cell walls form two thin overlapping cell wall plates, which fit together as in a soap box.
- **18.** Freshwater protozoans live in hypotonic environment so, for regulation of excess of water which comes in the protoplasm through the process of endosmosis, contractile vacuoles have developed. When these protozoans are placed in marine water, i.e. hypertonic water, the contractile vacuoles disappear because the process of endosmosis does not occur and thus, water does not come in the protoplasm.

4. Kingdom-Fungi

19. Cellulose is a major component of cell wall of *Pythium* fungi. It belongs to Oomycetes (e.g. *Pythium*) and Hyphochytridiomycetes. Fungal cell wall contains 80–90% carbohydrates, the remainder being proteins and lipids. The typical feature of fungal cell wall is the presence of chitin.



- **20.** *Ustilago* has haplontic life cycle. In their sexual phase, only zygospore is diploid structure, which divides by meiotic cell divisions to produce haploid zoospores. All others are haploid, such a sexual cycle is termed as haploid or haplontic.
- All statements are correct except statement (c), which can be corrected as Morels and truffles are edible and are members of Ascomycetes in kingdom–Fungi. They are also known as sac fungi.
- **22.** Bird's nest fungi (Nidulariales) and puff ball fungi (Lycoperdales) belong to Basidiomycetes. The common example of class—Basidiomycetes are smut, rusts, the mushrooms, the toad stools, the puff balls and the pore fungi.
- **23.** *Trichoderma harzianum* are found in damp soils. They have an inhibitory effect on the growth of the mycelium of *Pythium*. They serve to suppress fungi causing damping off disease of the seedlings and thereby influence favourably the growth of crops.
- **24.** The fungus *Claviceps purpurea* is responsible for ergot disease of rye which lowers the yield of rye plant. It belongs to Ascomycota division.
- **25.** *Mucor* shows the best growth on a piece of bread at a temperature of about 25°C, relative humidity of about 95% in a moist and shady place. *Mucor* is a saprophytic fungus belonging to the order–Mucorales and family–Mucoraceae and grows on decaying dung and on some food stuffs having higher moisture contents.

5. Plant Kingdom

26. Zygotic meiosis is represented in the haplontic life cycle of many algae including *Chlamydomonas.* In such a life cycle, all cells are haploid except zygote. This is because meiosis occurs in the zygote itself resulting into four haploid cells that give rise to haploid plants.



(MODULE 3)



Haplodiplontic life cycle of Ectocarpus

In *Ectocarpus*, sporic meiosis occurs and haploid biflagellate meiozoospores are formed. They germinate to produce gametophytic thalli. The gametophytes liberate gametes, which fuse to form diploid zygote, which gives rise to a diploid plant.

- 28. Only option (b) is wrong and all other options are correct. Algin extracted from brown algae, e.g. Laminaria, etc., is a hydrocolloid used in shaving creams, jellies, flameproof plastic, etc. Carrageenan is extracted from red algae like Chondrus and used as emulsifier and clearing agent.
- **29.** The statement (b) is wrong. *Mucor* (fungus) belongs to the class—Zygomycetes. The members of Zygomycetes bear non-motile, non-flagellated gametes.
- **30.** Statement (c) is wrong as, Oomycetes include water moulds, white rusts and downy mildews. In these, female gamete is large and non-motile, whereas, male gamete is small and motile. Isogametes are found in algae like *Ulothrix, Chlamydomonas, Spirogyra*, etc., which are similar in structure, function and behaviour. Anisogametes are found in *Chlamydomonas* in which one gamete is larger and non-motile and the other one is motile and smaller.

NEET Test Drive

Oogamy is the fusion of non-motile egg with motile sperm. The gametes differ both morphologically as well as physiologically. It occurs in *Chlamydomonas, Fucus, Chara, Volvox,* etc.

- **31.** In *Sphagnum*, male and female gametophytes are independent and free-living. In bryophytes, the most conspicuous phase in life cycle is the gametophyte. It is independent and concerned with reproduction.
- **32.** Pteridophytes are also called vascular cryptogams as these have a well-developed vascular system but are non-flowering plants, e.g. *Equisetum*.
- **33.** In the ectophloic siphonostele, the xylem surrounds pith and this xylem is surrounded by phloem, pericycle and endodermis, respectively, e.g. *Osmunda* and *Equisetum*.



Ectophloic siphonostele

34. The statement (b) is correct. *Sequoia* is one of the tallest tree species, known as red wood tree. It is a

gymnospermic plant. Salvinia is an angiosperm, but Ginkgo and Pinus are gymnosperms.

and *Pinus* are gymnosperms. Gymnosperms are well-adapted to extremes of climate and are heterosporous.

They produce two types of spores, i.e. microspores and megaspores.

- **35.** In gymnosperms (e.g. *Pinus, Cycas*, etc.), the male and female gametophytes do not have an independent free-living existence. They remain within the sporangia retained on the sporophytes.
- **36.** Statements I, II and III are correct. Statement IV is incorrect and can be corrected as the sporophyte in mosses is more elaborate than in liverworts. The sporophyte is dependent upon the gametophyte for nutrition.
- **37.** The presence of vessels in the xylem is an angiospermic character found in *Gnetum* which distinguishes it from *Cycas* and *Pinus*.

The NEET Edge ~ Biology

Gnetum resembles angiosperms in many other aspects also like

- (i) The leaves in *Gnetum* have reticulate venation that is an angiospermic character.
- (ii) In *Gnetum*, female gametophyte is only partly cellular before fertilisation and becomes completely cellular only after fertilisation. Some of the free nuclei act as eggs as there are no archegonia.

The short apices in *Gnetum* and angiosperms show a distinct tunica and corpus configuration.

The cortex of stem of *Pinus* is transversed by large resin ducts or canals. Each duct or canal is lined by a layer of thin-walled parenchymatous glandular secretory cells constituting epithelium. The epithelial cells secrete resin into canal. Resin is the chief source of turpentine.

- **38.** Flagellated male gametes are present in *Riccia, Dryopteris* and *Cycas.* These need a film of water to reach archegonia and fertilise the egg cell.
- **39.** *Lilium* (angiosperm) possesses the male gametophyte with least number of cells.

The number of cells in male gametophyte shows the pattern of reduction from bryophytes to angiosperms. In angiosperms, it is reduced to about 2-3 celled and called as pollen grains.

The number of cells in male gametophyte decreases in the following order

Funaria > Pteris > Pinus > Lilium

40. Replum is present in the ovary of flowers of mustard. The gynoecium in family—Cruciferae (Brassicaceae) is bicarpellary, syncarpous, ovary superior, unilocular with parietal placentation. At maturity, ovary becomes bilocular due to the formation of false septum (replum), e.g. mustard.

In family–Asteraceae (Compositae), the gynoecium is bicarpellary syncarpous, ovary inferior, unilocular, one ovule in each locule, basal placentation and stigma branched, e.g. sunflower.

In family–Fabaceae (Leguminosae), the gynoecium is monocarpellary, unilocular with superior ovary and marginal placentation, e.g. pea.

41. Column I Column II Peritrichous Escherichia coli flagella (flagella (a bacterium) all over the body) Living fossil Ginkgo biloba (maiden hair tree) Rhizophore Selaginella (a pteridophyte) (a form of aerial adventitious roots) Smallest Wolffia flowering plant Largest perennial Macrocystis algae

6. Animal Kingdom

42. The statement (c) is correct.

- Spongilla have choanocyte cells. These are absent in leech, dolphin and penguin. These distinctive cells line the interior body walls of sponges. These cells have a central flagellum that is surrounded by a collar of microvilli. Choanocytes are versatile cells.
- **43.** Ascaris is characterised by the presence of neither true coelom nor metamerism. It is endoparasite of man. It inhabits the small intestine more frequently of children than of adults. The body is elongate, cylindrical and gradually tapering at both ends. There is present a fluid-filled cavity between body wall and visceral organs. This cavity is not true coelom as it is not lined by coelomic epithelium, has no relation with reproductive and excretory organs and develops from blastocoel. This body cavity is referred as pseudocoel.
- **44.** The statement (c) is correct with respect to common cockroach.

In cockroach, mandibles are a pair of hard, strong, large, dark-coloured, triangular structures which move in horizontal motion and crush food between them.

Gizzard or proventriculus has an outer layer of thick circular muscles and thick inner cuticle forming six highly chitinous plate called teeth. The gizzard acts as the grinding chamber and helps in grinding the food particles. Other statements do not hold true with respect to cockroach.

45. *Petromyzon* (the lamprey) belongs to the section Agnatha of the subphylum—Vertebrata. They have

long, greenish-brown, cylindrical body with smooth scaleless, slimy skin, jawless mouth, etc. They lay eggs in freshwater, but their ammocoete larvae after metamorphosis return to the ocean.

- 46. Option (a) is not correctly matched, because molluscs are bilaterally symmetrical, triploblastic, coelomate, soft-bodied animals. Their soft body is covered by a calcareous shell and is unsegmented with a distinct head, muscular foot and visceral hump, e.g. *Pila* (apple snail), *Sepia* (cuttle fish), *Pinctada* (pearl oyster), etc. Other options are correctly matched.
- **47.** The option (b) is correctly matched. The members of class–Chondrichthyes are marine animals with streamlined body and have cartilaginous endoskeleton without even single exception.

Chordata These possess a notochord, a hollow dorsal nerve cord, pharyngeal slits, an endostyle and a post anal tail for atleast some period of their life cycle.

Mammalia These are a clade of endothermic amniotes distinguished from reptiles and birds by the possession of hair, three middle ear bones, mammary glands and a neocortex.

Reptiles These are an evolutionary clade of animals, comprising today's turtles, crocodilians, snakes, lizards and tuatara, their extinct relatives and some of the extinct ancestors of mammals.

48. The option (a) is correctly matched. *Salamandra* (salamander) is a member of class–Amphibia. It has a tympanum representing the ear and fertilisation is external.

Pteropus are mammals, so they are viviparous. Aurelia has cellular-tissue grade of body organisation. Ascaris has unsegmented body and belongs to phylum–Aschelminthes.

Animal

49. Characteristic

worphological leature		
Bilateral symmetry		Liver fluke, <i>Taenia</i>
Jointed appendages	_	Prawn, cockroach,
		scorpion
Ventral solid central	—	Scorpion, spider,
nervous system		cockroach
Metameric	_	Annelids
segmentation		
Radial symmetry		Sea anemone

NEET Test Drive

- **50.** Exception in class–Reptilia, crocodile has four-chambered heart. In *Obelia*, the alternation of generations is called metagenesis in which an asexual polypoid generation appears to alternate regularly with a sexual medusoid generation. Thecodont dentition is found in mammals.
- 51. An arthropod body consists of head, thorax and abdomen, in some cases, head and thorax may be fused to form cephalothorax. Class—Insecta have body divided into head, thorax and abdomen.
- **52.** A clasper is a male anatomical structure found in some groups of animals and used in mating. Male cartilaginous fish-like shark have claspers formed from the posterior portion of their pelvic fin which serves as intermittent organs used to channel semen into the female's cloaca during mating.
- **53.** Kangaroo, hedgehog, dolphin and loris are all mammals. These give birth to young ones.
- **54.** Statement (b) is wrong regarding prawn. It does not have two pairs of antennae instead it has one pair of antennues.

7. Morphology of Flowering Plants

55. Actinomorphic (star-shaped) can be divided into 3 or more identical sections, which are related to each other by rotation about the centre of the flower, e.g. China rose. Zygomorphic flowers can be divided by only a single plane into two mirror image halves, e.g. orchids.

Valvate aestivation The sepals or petals in a whorl just touch one another at the margin, e.g. *Calotropis*.

Twisted aestivation One margin of the appendage overlaps that of the next one, e.g. China rose. In imbricate aestivation, the margins of sepals or petals overlap but not necessarily in specific direction, e.g. *Cassia*.

The flowers containing superior ovary are called hypogynous flowers. The other floral whorls like androecium, petals and sepals arise successively below ovary.

56. Only *Salvia*, mustard, radish and turnip have stamens of different length in their flowers.

Hence, correct answer is (b). Mustard, turnip, radish belong to Brassicaceae.

57. A superior ovary is an ovary attached to the receptacle above the attachment of other floral parts. In this case, the flower is said to be hypogynous, e.g. China rose, mustard, brinjal, potato, onion and tulip.

Guava and cucumber have inferior ovaries or epigynous flowers.

So, out of 8 given names, 6 have superior ovaries.

58. Fig, pineapple and mulberry are composite fruits.

Plant	Botanical name	Fruit	Inflorescence
Fig	Ficus carica	Syconus	Hypanthodium
Pineapple	Annanas sativus	Sorosis	Spike
Mulberry	Morus	Sorosis	Catkin
	sp.		

- **59.** All the given plants except bitter gourd, pumpkin, cucumber, guava, plum and rose are hypogynous flowers, i.e. 15. Hypogynous flowers have gynoecium present above all other floral parts and with superior ovary.
- **60.** Floral formula of chilli (*Capsicum* annum) is $\bigoplus q K_{(5)}C_{(5)}A_5G_{(2)}$.

It belongs to family–Solanaceae. In this family, flower is actinomorphic, complete and bisexual, calyx has five sepals which are gamosepalous showing valvate aestivation, corolla has five petals which are gamopetalous showing valvate aestivation, androecium has five free stamens (polyandrous) but epipetalous, gynoecium is bicarpellary, syncarpous, bilocular with superior ovary having axile placentation.

- **61.** The fruit of *Ananas comosus* (pineapple or ananas) is sorosis, (a type of multiple fruits), developing from spike, spadix or catkin. In this type, the flowers associate by their succulent tepals, the axis bearing them grows and becomes fleshy or woody. Thus, the whole inflorescence turns into a compact fruit.
- **62.** The seeds of castor (*Ricinus communis*, family–Euphorbiaceae) are endospermic dicot seeds. They possess endosperm which acts as the food storage tissue of seed. They also possess perisperm and caruncle. Perisperm is persistent nucellus also found in *Nymphaea*. The caruncle is fleshy outgrowth near hilum of the seeds.

63. The correct statement is (c), because flower is highly condensed and modified shoot meant for sexual reproduction (Dr. Goethe; 1790). During the course of evolution, the nodes of the axis of shoot came in contact so that internodes got reduced and leaves get modified and specialised to form four essential whorls of flower.

The other statements can be corrected as

Seeds of orchids lack endosperm. Placentation in primrose is free central placentation. In tomato, fruit is a berry.

64. The main difference between perisperm and endosperm is that perisperm is present in seeds as persistent nucellus and endosperm is present in developing embryo as its reserved food which is completely consumed by it during development.

8. Anatomy of Flowering Plants

65. Palisade parenchyma is absent in leaves of *Sorghum* (family–Poaceae). It is a monocot plant. The mesophyll of monocot leaf is not differentiated into palisade and spongy parenchyma, all being thin-walled, chlorophyllous and irregularly compactly arranged with fewer intercellular spaces.

Palisade cells occur in dicotyledonous plants and also in few of the net-veined monocots. Mostly the members of families, the Araceae and Dioscoreaceae.

66. Tracheids differ from other tracheary elements in being imperforate. Tracheids and vessels both are called tracheary elements because their main function is conduction of sap. Tracheids are the specific cells which have pits to support upwards and lateral conduction of water sap.

Tracheids are comparatively short and single cell, while vessels have more than one cell and up to 10 cm long.

- **67.** The water containing cavities are found in the vascular bundles of maize. In this, vascular bundles are conjoint, collateral and closed. In this, vessels and xylem parenchyma cells dissolve forming a water containing schizolysigenous cavity called protoxylem cavity or lacuna or lysigenous cavity. Protoxylem cavity and protophloem may be absent in the smaller vascular bundles in maize.
- **68.** Some of the endodermal cells present opposite to the xylem patches are thin-walled and are called passage



cells or transfusion cells. In roots, endodermis is the innermost layer of cortex. Passage cells help in transfer of water and dissolved salts from cortex directly into the xylem and ultimately to the pericycle.

69. Tyloses are the extensions of xylem parenchyma cells into the vessel elements. These are the structures found in the woody tissues of dicot stems.



(a) In longitudinal section (b) In cross-section

9. Structural Organisation in Animals

70. Cuboidal epithelium is present in the tubular parts of nephron (PCT and DCT). It consists of short, cube-shaped cells with round nuclei located in the centre of the cell. These cells often forms microvilli to increase the absorptive surface area of the cell. Other correctly matched options are Inner lining of salivary ducts is lined by compound epithelium.

Moist surface of buccal cavity is lined by compound epithelium.

Inner surface of bronchioles is lined by ciliated epithelium.

- **71.** The function of gap junction is to facilitate communication between adjoining cells. These are specialised intercellular connection between a multitude of animal cell types. They directly connect the cytoplasm of two cells, which allow various molecules, ions and electrical impulses to directly pass through a regulated gate between cells.
- **72.** The option (c) is correctly matched pair. Areolar tissue is the body's loose connective tissue and provides flexibility and cushioning.

Adipose tissue is also loose connective tissue, while the tendon is a dense connective tissue, which connects the muscles with the bone.

Cartilage is a skeletal connective tissue. It has chondrocytes that produce a large amount of extracellular matrix composed of collagen fibre.

73. The basophils are probably like mast cells of connective tissue. They release heparin (a natural anticoagulant), histamine and serotonin. Their nucleus is usually three-lobed and their granules take basic stain strongly.

Monocytes are largest of all types of leucocytes. Their nucleus is bean-shaped. They are motile and phagocytic in nature and engulf bacteria and cellular debris. Generally, they change into macrophages after entering tissue spaces.

Eosinophils have two-lobed nucleus. They are non-phagocytic and help in dissolving blood clot. Their number increases in people with allergic conditions such as asthma or hay fever. Neutrophils are most numerous of all leucocytes. They eat harmful germs and are therefore, phagocytic in nature. Their nucleus is many lobed and stains weakly with both acid and basic stains.

74. Option (d) is correctly matched with its location.

The smooth muscle is present in the wall of intestine.

Columnar epithelium is present in the lining of stomach. Tendon is dense connective tissue and connects muscle to bone. Tip of nose consists of elastic cartilage.

- **75.** Option (d) correctly describes the location of some body parts in the earthworm. In earthworm, two pairs of testis are found in 10th and 11th segments, accessory glands in 17th and 19th segments, four pairs of spermatheca from 6th-9th segments and one pair of ovaries in 13th segment.
- **76.** In male frogs, germinal epithelium of seminiferous tubules produce sperms, which are transferred to kidney *via* vasa efferentia from the kidney, these enter into Bidder's canal, from where the sperms are carried to the transverse collecting tubules, longitudinal collecting tubule and then to urinogenital duct. The later carries the sperms to seminal vesical where, they are stored temporarily. From here, sperms are carried to cloaca and then these shed into water.

10. Cell: The Unit of Life

77. The resolution power of the electron microscope is much higher than that of the light microscope.

As an average, the resolving power of a light microscope is $0.25-0.3 \,\mu$ m while that of electron microscope is 2-10Å though theoretically, it is 0.25Å. The magnification range of light microscope is 2000-4000 while that of electron microscope is 100000-300000.

- **78.** Resolving power or resolution is the ability of the lens to distinguish fine details and structure. Specifically, it refers to the ability of the lenses to distinguish between two points which are a specified distance apart. Resolving power depends on two factors
 - (a) Wavelength of light used for illumination.
 - (b) Power of objective lenses.

Resolving power = $\frac{\text{Wavelength of light}}{2 \times \text{NA}}$

where, NA is numerical aperture.

Since, the limit of resolving power of a microscope is fixed by the structure of light, the shortest wavelength of visible light will give the maximum resolution. Among yellow, green, red and blue light colour, blue (500 nm) have shortest wavelength so, it will give best resolution.

- **79.** Cell membrane of prokaryotes is structurally similar to that of eukaryotes. So, it does not differ in *E. coli* and *Chlamydomonas*. Ribosomes, cell wall and chromosomal organisation differ in *E. coli* and *Chlamydomonas*.
- 80. The option (b) is true about ribosomes. They are large, non-membranous, RNA protein complexes which are necessary for protein synthesis. In prokaryotes, 70 S type of ribosomes are found while 80 S type of ribosomes are found in eukaryotes.
- **81.** Lipid molecules very rarely migrate from one lipid monolayer to other monolayer of lipid bimolecular layer.

Such a type of movement is called flip-flop or transbilayer movement and occurs once a month for any individual lipid molecule. But protein can never perform flip-flop movement.

82. Membrane bound organelles include lysosomes, endoplasmic reticulum, Golgi apparatus, mitochondria, chloroplasts, vacuoles and nucleus.



Non-membrane bound organelles include ribosomes, centrioles and microtubules.

83. Statement (a) is incorrect regarding mitochondria as enzymes of ETC are present in inner mitochondrial membrane.

Outer membrane contains enzymes involved in mitochondrial lipid synthesis and those enzymes that convert lipid substrates into other forms that are subsequently metabolised in the matrix. The outer membrane resembles a sieve that is permeable to all molecules of 10,000 daltons mole weight or less, including small proteins. The inner membrane is impermeable and highly convoluted, forming a series of infoldings, known as cristae in the matrix space.

- **84.** The two subunits of ribosomes remain united at a critical ion level of magnesium. It is constituent of chlorophyll, middle lamella and connected with phosphate transfer in respiration. It is concerned with binding of ribosomes, DNA and RNA synthesis.
- **85.** 23S *r*RNA in bacteria is the enzyme ribozyme for the formation of peptide bond. 23S *r*RNA is found in large subunit (70S) of ribosome of bacteria.
- 86. Flagella of prokaryotic and eukaryotic species differ in microtubular organisation and type of movement. In eukaryotes, the arrangement is (9 + 2) and specialised while in prokaryotes, the arrangement is (9 + 0) and is simple.
- 87. The option (d) is true for nucleolus. It is a site for active ribosomal RNA (rRNA) synthesis. It is a naked, round or slightly irregular structure in nucleus. It lacks a membrane and its contents are in direct contact with the nucleoplasm.
 Microtubules take part in the spindle formation. Mitochondria, vacuoles and plastids, etc., are membrane-bound structures. The dividing cells possess a large number of mitochondria.



Structure of nucleolus

(MODULE 3)

11. *Biomolecules*

- 88. About 98% of the mass of every living organism including bacterium and human beings is composed of just six elements, i.e. Carbon (C), Hydrogen (H), Nitrogen (N), Oxygen (O), Phosphorus (P) and Sulphur (S).
- 89. Statement (c) is wrong as, glycine is the simplest amino acid in which functional group 'R' is replaced by hydrogen atom (H). Cysteine and methionine are sulphur containing amino acids.
- **90.** The chitinous exoskeleton of arthropods is formed by the polymerisation of N-acetyl glucosamine, which is a derivative of glucose. It is also a characteristic component of the cell wall of fungi, the radulae of molluscs and the beaks and internal shells of cephalopods, which include squid and octopuses.
- Macromolecule chitin is a complex polysaccharide containing amino sugars and chemically modified sugars (e.g. glucosamine, N-acetyl galactosamine, etc).

Polysaccharides are long carbohydrate molecules of monosaccharide units joined together by glycosidic bonds. They have a general formula $C_x(H_2O)_y$. Chitin is the main component of the cell wall of fungi, the exoskeleton of arthropods, insects and radulae of molluscs, etc.

- **92.** Lecithin is a phospholipid composed of choline and inositol. It is found in all living cells as a major component of cell membrane.
- 93. Phosphoglyceride is always made up of two fatty acids, phosphoric acid and a trifunctional alcohol glycerol. The fatty acids are attached to the glycerol at the 1 and 2 position on glycerol through ester bonds. A fat is formed of two kinds of smaller molecules, i.e. glycerol and fatty acids. In making a fat-free fatty acid, molecules join to glycerol by an ester linkage. A fatty acid has a long carbon skeleton, usually 16 or 18 carbon atoms in length. If there are no double bonds between carbon atoms composing the chain, then as many hydrogen atoms as possible are bonded to the carbon skeleton. This is called saturated fatty acid. Unsaturated fatty acid has one or more double bonds.

94.



Nucleoside is made up of ribose sugar and nitrogenous base only. Uracil forms nucleoside with only ribose sugar. So, the option with category nucleoside component uracil is correct.

95. Enzymes, vitamins and hormones are classified into a single category of biological chemical because all these help in regulation of metabolism. Enzyme is a proteinaceous catalyst produced by a cell and responsible for the high rate and specificity of one or more intercellular or intracellular biochemical reactions.

Vitamin is an organic substance which is generally synthesised by plants (exception vitamin-D). The absence of a vitamin from the diet for sufficient time gives symptoms of a resulting deficiency disease.

Hormones are chemical messengers which on secretion bring about a specific and adaptive physiological response.

96. Statement (b) is correct regarding the enzyme inhibition. A competitive inhibitor competes with substrate molecule for occupying the active site of an enzyme. These inhibitors have structural resemblance with substrate molecules due to which they easily bind with active site of an enzyme and form an enzyme-inhibitor complex.

 $\begin{array}{c} E \\ (Enzyme) \end{array} + \begin{pmatrix} I \\ (Inhibitor) \end{array} \longrightarrow \begin{array}{c} EI \\ (Complex) \end{array}$ In non-competitive inhibition, there is no competition between the molecule for the active site of enzyme. The effect of inhibitor cannot be reversed by increasing the concentration of substrate, thus the inhibition is irreversible.

97. The graph shows the exothermic reaction *A* in the presence of enzyme as it lowers down the activation energy substantially.

The *B* graph shows this reaction in the absence of enzyme when activation energy is quite high. Thus, option (b) is correct.

The NEET Edge ~ Biology

98. Option (b) is not correct with respect to enzyme action because addition of a lot of succinate reverses the inhibition of succinic dehydrogenase by malonate. Inhibition of succinic dehydrogenase by malonate is an example of competitive inhibition.

Competitive inhibition occurs when enzyme and inhibitor both have more or less similar structure and are present in higher concentration.

Thus, both enzyme and inhibitor compete for the active site of enzyme resulting in the decrease of the enzymatic activity.

12. Cell Cycle and Cell Division

99. During the S or synthetic phase, the DNA content doubles, i.e. from 2C to 4C for all diploid cells.

The G_2 -phase follows the S-phase and is called second growth phase or pre-mitotic gap phase. In G_2 -phase, the synthesis of DNA stops therefore, the DNA level remains 4C if initial was 2C.

However, the formation of RNA and protein continues as they are required for the multiplication of cell organelles, spindle formation and cell growth. This amount becomes half (i.e.) 2C only during anaphase (in mitosis) when chromosomes separate.

- **100.** In the given figure, D is representing the S-phase (synthetic phase) of cell cycle. Cell cycle completes in two steps, i.e. interphase and M-phase. Interphase is completed in three successive stages G₁-phase (post-mitotic phase), S-phase (synthetic phase) and G₂-phase (pre-mitotic or post-synthetic phase).
- 101. At telophase stage of M-phase of cell cycle, nuclear membrane vesicles associate with the surface of individual chromosomes and fuse to reform the nuclear membranes, which partially enclose clusters of chromosomes before coalescing to reform the complete nuclear envelope. During this process, the nuclear pores reassemble and the dephosphorylated reassociate to form the nuclear lamina. One of the lamina proteins (lamina-B) remains with the nuclear membrane fragments throughout mitosis and may help nuclear reassembly. After the nucleus reforms, the chromosomes decondense and RNA synthesis resumes, causing the nucleolus to reappear.
- **102.** Telophase is the reverse of prophase. The chromosomes that have reached their respective poles decondense,

i.e. nuclear envelope reforms, Golgi complex reforms, etc. In late anaphase, centromeres split and chromatids separate and chromatids move to opposite poles. Cytokinesis is the process in which cell itself is divided into two daughter cells.

103. Various phases of meiosis and their characteristic features are Pachytene — Crossing over takes place

Metaphase-I —	Chromosomes align at
	equatorial plate
Diakinesis —	Terminalisation of
	chiasmata

- Zygotene Pairing of homologous chromosomes
- 104. Stalled forks activate checkpoint signaling and pause replication. Since, G₁/S checkpoint checks DNA damage, cells size prior to S-phase (i.e. DNA replication phase), this checkpoint would be activated by stalled DNA replication fork.

13. Transport in Plants

105. The difference between the diffusion pressure of a solution and that of its pure solvent at a particular temperature and pressure is called diffusion pressure deficit.

The water moves from lower DPD to higher DPD, i.e. from cell A to cell B. This is because when a cell is placed in pure water, the water enters into the cell as a result of the Diffusion Pressure Deficit (DPD) of cell sap.

DPD = OP - TP

- **106.** The radial orientation of cellulose microfibrils facilitates the opening of stomatal aperture. These are tiny pore complexes. Each stoma is surrounded by two specialised green epidermal cells called guard cells. Cellulose microfibrils are oriented radially rather than longitudinally, making it easier for the stoma to open, when turgor pressure inside the cell increases.
- **107.** Diffusion of water vapour and CO₂ are independent processes. Their diffusion depends on the difference in their partial pressure in the atmosphere as well as inside the cells of leaves.
- **108.** A column of water within xylem vessels of tall trees does not break under its weight because of high tensile strength of water, i.e. an ability to resist a pulling force. This high tensile property depends on cohesion, adhesion and surface tension property of water. Due

to these forces only, transpiration driven ascent of xylem sap occurs in tall trees of even 100 m height.

- **109.** The phloem sap is alkaline in nature. It continuously pumps protons from its companion cells to the other neighbouring cells during transport of sugars.
- **110.** According to mass flow hypothesis, the transport of organic solutes takes place from source to sink. This transport also depends on metabolic energy.

According to cytoplasmic streaming hypothesis (which was given by de Vries, 1885), the transport of organic solutes takes place by the combination of diffusion and cytoplasmic streaming. Cytoplasmic streaming carries organic solutes from one end to the other end of sieve tube.

P-proteins has a role as defence against phloem feeding insects and sealing of damaged sieve tubes.

Root pressure is a positive hydrostatic pressure developed in xylem vessels due to the metabolic activities of roots. Transpiration pull is a force developed due to transpiration.

14. Mineral Nutrition

- 111. None of the option is correct with respect to question. The option (c) seems to be more appropriate. None of the options consists of all three macronutrients, but option (c) have nitrogen and phosphorus which are macronutrients, but nickel is a micronutrients. Mo, Zn and B are micronutrients.
- **112.** Micronutrients are minerals obtained from the soil and present in plant tissues at concentrations usually less than $3 \mu mol g^{-1}$ dry matter. Cu (copper), Mn (manganese) and Fe (iron) are those micronutrients which affect both photosynthesis and mitochondrial electron transport. It is because they are the main constituents of various electron transport carrier proteins.
- **113.** Elements like calcium are a part of structural component of the cell (mainly cell wall) and hence, are not released. The deficiency symptoms tend to appear first in the young tissues whenever the elements are not demobilised.
- **114.** None of the options is correct. Option (c) is correctly matched. If statement be read as 'potassium readily mobilisation' instead of 'potassium readily



immobilisation'. Active transport of nutrients requires ATP. Symplast includes translocation through plasmodesmata. Bakane disease of rice was found by Hori (1918) to be caused due to *Gibberella fujikuroi*.

- **115.** *Glomus* helps in the absorption of phosphorus from soil by plants. It is a genus of Arbuscular Mycorrhizal (AM) fungi, which forms symbiotic relationship with plant roots. It is a longest genus of AM fungi.
- **116.** Nitrogen-fixation in root nodules of *Alnus* is brought about by *Frankia*. Nitrogen is the most critical element. Certain non-leguminous plants also form nodules to fix nitrogen. The best known example in temperate region is alder (*Alnus* sp). The bacterium involved in nodule formation is *Frankia* (Actinomycetes).

Clostridium is anaerobic, saprotrophic, free-living nitrogen-fixing bacterium. *Bradyrhizobium* sp are symbiont in

plants of *Paraspania* and soybean. The *Azorhizobium* forms both stem and root nodules in *Sesbania* (aquatic plant).

117. The *Casuarina* tree has nitrogen-fixing root nodules. It is a flowering plant. *Cicer arietinum* (gram) is a leguminous plant. *Cycas revoluta* is a gymnosperm. *Crotolaria juncea* is leguminous fibre yielding plant that harbors a filamentous actinomycete nitrogen-fixing organism called *Frankia*.

15. Photosynthesis in Higher Plants

118. Plants adapted to low light intensity have larger photosynthetic size than sun plants. These plants have lower photosynthetic rates and hence, lower growth rates.

These plants have larger leaves to use sunlight more efficiently. The leaves are thinner to catch more sunlight.

119. The enhancement effect has led to the discovery of two photosystems, i.e. PS-I and PS-II operating in photosynthesis. Emerson performed photosynthetic experiment on *Chlorella*. He provided monochromatic light of more than 680 nm and observed decrease in the rate of photosynthesis known as red drop.Later, he provided synchronised light of 680 nm and 700 nm and observed increase in the rate of photosynthesis.

120. In photosystem-I, the primary electron acceptor is probably a Fe-S protein. The reduced primary acceptor transfers the electrons to secondary electron acceptor (most probably P_{430}). The sequence of electron transfer is as follows

The reduced P_{430} passes its electrons to ferredoxin (Fd) present at outer surface of thylakoid membrane.

121. Anoxygenic photosynthesis (in which O₂ is not released) is seen in *Rhodospirillum* which is a purple non-sulphur bacterium. It helps an organism to trap light energy and stores it as chemical energy.

Other than this, anoxygenic photosynthesis commonly occurs in purple non-sulphur bacteria, green sulphur/non-sulphur bacteria and heliobacteria, etc. *Spirogyra*, *Chlamydomonas* and *Ulva* are algae which perform oxygenic photosynthesis.

- **122.** The PGA as the first product of photosynthesis was discovered in alga named *Chlorella* by Melvin Calvin. He made use of radioactive ¹⁴C in photosynthesis studies which had led to the discovery that the first CO₂ fixation product was a 3-carbon organic acid. The first product identified was 3-Phosphoglyceric Acid (PGA).
- **123.** In the presence of manganese, calcium and chloride ions, photolysis of water during photosynthesis evolves nascent oxygen as a byproduct. The hydrogen atoms of water molecules are used up for reducing carbon of CO_2 to produce glucose molecule ($C_6H_{12}O_6$).
- **124.** The first reaction of photorespiration occurs in the stroma of chloroplast. In this reaction, the RuBP (Ribulose 1-5 bisphosphate) consumes one oxygen molecule in the presence of enzyme RuBisCO.

In peroxisome, the glycolate transferred from chloroplast takes up O_2 and forms the glyoxylate whereas, the H_2O_2 released as byproduct.

125. In C_4 -plants, every CO_2 molecule has to be fixed twice, so these plants needed more energy for the synthesis of hexose sugar molecules than C_3 -plants in which CO_2 has to be fixed only once. 18 ATP molecules are required by C_3 -for the synthesis of one molecule of hexose sugar while 30 ATP molecules are needed by the C_4 -plants for the same. Thus, C_4 -plants have a need of 12 ATP molecules extra than $\ensuremath{\mathsf{C}_3}\xspace$ -plants for the synthesis of one molecule of hexose sugar.

126. The photosynthesis in C_4 -plants is relatively less limited by atmospheric CO_2 levels because, the primary fixation of CO_2 is mediated *via* PEP carboxylase enzyme. The fixation of CO_2 in C_4 -plants takes place in two places and by two different organic compounds. Phosphoenol Pyruvate (PEP) is found in mesophyll cells which primarily fixes atmospheric CO_2 into oxaloacetic acid (4C).

> RuBisCO is present in bundle sheath cells where final fixation of CO_2 in hexose sugars takes place. CO_2 is primarily fixed by PEP carboxylase because this enzyme has greater affinity to CO_2 than RuBisCO.

127. With reference to factors affecting the rate of photosynthesis, statement (c) is not correct. In C₄ -plants, the initial fixation of CO2 occurs in mesophyll cells. The primary acceptor of CO₂ is Phosphoenol Pyruvate (PEP). It combines with CO2, in the presence of enzyme PEP carboxylase to form the first stable product, i.e. Oxalo Acetic Acid (OAA), whereas C₃-plants lack PEP carboxylase enzyme. They possess RuBisCO enzyme. This enzyme can work as both carboxylase (fixation of CO_2) and oxygenase (fixation of O_2). RuBisCO has a much greater affinity for CO_2 than for O_2 and the binding is competitive. At higher temperature, its affinity for CO₂ decreases and it works as oxygenase.

Therefore, at higher temperature, photosynthesis decreases in C_3 -plants, while in C_4 -plants it increases.

16. Respiration in Plants

128. Lactate fermentation does not release any molecule of CO₂.



Lactic acid fermentation is process by which glucose, fructose and sucrose are converted into energy and the metabolite lactate. It is an anaerobic fermentation reaction that occurs in some bacteria and animal cells and allows glycolysis to continue by ensuring that NADH is returned to its oxidised state (NAD⁺).

- **129.** One mole of ATP liberates 12 kcal of energy, so 686 kcal will be liberated by 686 / 12 = 57.1 ATP molecules.
- **130.** The chemiosmotic coupling hypothesis of oxidative phosphorylation proposes that ATP is formed because a proton gradient forms across the inner membrane. The production of ATP with the help of energy liberated during oxidation of reduced coenzymes and terminal oxidation is called oxidative phosphorylation. Peter Mitchell (1961) gave a hypothesis known as chemiosmotic hypothesis for ATP synthesis. According to this, when electrons flow from dual proton-electron carrier to a non-hydrogen carrier, the H⁺ are released and expelled into the intermembrane space and thus, create a proton gradient with higher concentration of H⁺ in the intermembranous space than the matrix. Due to the proton motive force, the protons flow back and energy liberated during this backflow of protons activates ATPase present in F₁ head to synthesise ATP.
- **131.** NAD⁺ functions as an electron carrier in cellular respiration. NAD is an oxidising agent which accepts electrons and then transfers them to the Electron Transport System (ETS). As a result, 3ATP molecules are formed, by oxidation of one NAD⁺ molecule.
- **132.** Succinate dehydrogenase enzyme is present on inner membrane of mitochondria and catalyses the oxidation of succinate to fumarate in eukoryotes. This reaction occurs in cytosol in prokaryotic cells.
- **133.** Statement given in option (d) is wrong which can be corrected as

Krebs' cycle starts with the condensation of acetyl group with oxaloacetic acid and water to yield citric acid.

During conversion of succinic acid to fumaric acid, FAD^+ is reduced to $FADH_2$.

134. Pathway *A* is glycolysis, pathway *B* is the Krebs' cycle and pathway *C* is oxidative phosphorylation

Arrow	1	—	ADP or NAD ⁺
Arrow	2	—	Pyruvate
Arrow	3		NADH
Arrow	4		ATP
Arrow	5		ADP, NAD^+ or FAD
Arrow	6 and	7—	FADH ₂ and NADH
			(either one can be 6 or 7)
Arrow	8		ATP or CO ₂

Arrow 9 and 10— O_2 and ADP (either one can be 9 or 10) Arrow 11 and 12— H_2O and ATP (either one

can be 11 or 12)

135. Statement given in the option (d) is incorrect. Oxidative phosphorylation is the process of ATP formation due to the transfer of electrons from NADH or FADH₂ to oxygen molecule (O_2) by a series of electron carriers. This process occurs in the inner mitochondrial membrane because of its less permeability, the presence of ETC proteins and ATP synthase.

The rest three statements are correct.

17. Plant Growth and Development

- **136.** This experiment is significant for laying the basis of quantitative determination of growth promoting substances (auxin). Dr. F Went isolated auxin from *Avena* coleoptile tip. His experiment demonstrated the polar movement of auxins, i.e. it showed that the plants grow towards light in response to a signal generated in the tip of coleoptile by a plant hormone auxin.
- **137.** During seed germination, its stored food is mobilised by gibberellin hormone. It induces aleurone cells to secrete enzyme that breaks stored food in seed.

Cytokinins promote nutrient mobilisation which helps in the delay of leaf senescence. ABA plays an important role in seed development, maturation and dormancy. Ethylene induces fruit ripening and breaks seed dormancy.

138. Abscisic acid is a derivative of carotenoid. It is a terpenoid. Indole butyric acid and indole-3-acetic acid are auxins which are weak organic acids.

Gibberellic acid (gibberellin) is a terpene.

139. The importance of day length in flowering of plants was first shown in tobacco. It is called photoperiodism discovered by Garner and Allard (1920, 1922). They observed that maryland mammoth variety of tobacco could be made to flower only by reducing the light hours with artificial darkening.

> On the basis of photoperiodic response to flowering, plants have been divided into short day plants (tobacco), long day plants (e.g. wheat, hanbane), short-long day plants (e.g. *Campanula*),

long-short day plants (e.g. *Bryophyllum*) intermediate plants (e.g. wild kidney bean) and day-neutral plants (e.g. cotton).

- **140.** Phytochrome is a chromoprotein which exists in two forms, P_r (Phytochrome red) and P_{tr} (Phytochrome far-red). These are inter-convertible forms. When plants get red light this protein gets converted into P_{tr} from P_r and *vice-versa*. It controls the photoperiodism in all flowering plants.
- **141.** Anthesis is the opening of floral buds. Reception of pollen by stigma is called pollination. Formation of pollen is called microsporogenesis.
- **142.** The condition shows that the plant requires photoperiod shorter than the critical day length. This plant needs uninterrupted dark period for flowering. Therefore, it is a short-day plant and these do not flower if the dark period is interrupted with flashes of light.
- **143.** An enzyme that can stimulate germination of barlay seeds is α -amylase. Barley seeds are rich in carbohydrate (starch). The starch is hydrolysed by α -amylase to monosaccharide units at the time of the germination of seeds.

Lipase enzyme causes hydrolysis of fats. Protease enzyme is responsible for breakdown of proteins. Invertase enzyme is responsible for hydrolysis of sucrose.

18. Digestion and Absorption

144. The Paneth cells of Crypts of Lieberkuhn secrete antibacterial lysozyme. These are present in between the bases of villi of small intestine.



-Artery Crypts of Lieberkuhn Vein

A section of small intestinal mucosa showing villi and the Crypts of Lieberkuhn

Kupffer cells are phagocytic cells of liver. Zymogen cells produce inactive precursors of enzyme.

Argentaffin cells produce hormones. **145.** Parietal cells indirectly help in erythropoiesis. These cells also called

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oxyntic cells secrete hydrochloric acid and castle intrinsic factor. HCl converts iron (in diet) from ferric to ferrous form which can be easily absorbed and used during erythropoiesis (formation of RBCs).

Castle intrinsic factor helps in absorbing vitamin-B₁₂ and its deficiency causes pernicious anaemia.

- **146.** If goblet cells become non-functional, this will adversely affect smooth movement of food down the intestine due to the absence of mucin. These cells are something like a wine glass that are present in the columnar epithelium of the mammalian intestine and secrete mucin, a mucoprotein that forms mucus when in solution.
- 147. The initial step in digestion of milk in humans is carried out by pepsin. In calves, it is rennin. It is also present in small amounts in human infants but not adults. Pepsin acts on water soluble 'caseinogen (milk protein) to form soluble 'casein'. This combines with calcium salts to form insoluble calcium paracaseinate, which gets readily digested enzymatically.
- 148. Option (b) is the correct matching of the site of action on the given substrate, the enzyme acting on it and the end product. In small intestine, food meets with the pancreatic juice containing α-amylase, which converts starch into maltose, isomaltose and α-dextrins in small intestine.

Starch $\xrightarrow{\text{Pancreatic } \alpha \text{-amylase}}$ Maltose (disaccharide)

The pancreatic juice also contains proenzymes trypsinogen, chymotrypsinogen and procarboxypeptidase. The trypsinogen is converted to active trypsin in intestine by enterokinase of intestinal juice. The trypsin converts proteins into large peptides and the large peptides are converted to dipeptide and amino acids by carboxypeptidase.

149. Amino acids, monosaccharides like glucose, electrolytes like Na⁺ are absorbed into the blood by active transport. Fructose and some amino acids are absorbed with the help of the carrier ions like Na⁺ by facilitated transport.

Fatty acid and glycerol cannot be absorbed into the blood. They are first incorporated into small droplets called micelles, which move into the intestinal mucosa. **150.** Statement in option (c) is true regarding digestion and absorption of food in humans. Chylomicrons are lipoprotein particles synthesised by intestinal epithelial cells and consisting mainly of triglycerides. Chylomicrons are the form, in which dietary fat is transported in the circulatory system.

Oxyntic cells secrete HCI and CIF (Castle's Intrinsic Factor). Sodium pumps of cell membrane play a supportive role in absorption of fructose. Absorption of amino acids also involves active transport coupled with active sodium transport. Fructose is absorbed by facilitated diffusion.

- **151.** The richest sources of vitamin B₁₂ are goat's liver and *Spirulina*. Vitamin-B₁₂ (cyanocobalamin) is the only vitamin which is not found in vegetables. It is present in animal protein such as meat, liver, fish and *Spirulina* (single cell protein). It promotes DNA synthesis, maturation of RBCs and myelin formation.
- 152. The deficiency of vitamin-B₁ or thiamine causes the disease beri-beri. This disease occurs in those countries where the staple diet is polished rice. The symptoms of this disease are pain

from neuritis, paralysis, muscle wasting, progressive oedema, mental deterioration and finally heart failure.

153. Xerophthalmia is caused due to the deficiency of vitamin-A (retinol).

Retinol and calciferol are fat soluble vitamins but pellagra is not the deficiency disease of calciferol. Pellagra is caused due to the deficiency of Vitamin- B_3 .

19. Breathing and Exchange of Gases

- **154.** Option (c) gives correct identification and functions of lungs.
 - C Alveoli are thin-walled vascular bag-like structures for the exchange of gases.
 - A Trachea or windpipe is an air conducting tube through which transport of gases takes place. It has incomplete rings of hyaline cartilage.
 - B Pleural membrane is double-layered which reduces friction on the lung surface.
 D – Diaphragm is involved in the
 - D Diaphragm is involved in the inspiration and expiration process of breathing.
- **155.** Lungs do not collapse between breaths and some air always remains in the lungs which can be never expelled

because there is a negative intrapleural pressure pulling at the lung walls. Alveoli are basic functional unit of lungs. The outer alveolar wall surface has cells which secrete DPPC also called as lipid surfactant.

The surfactant expands the alveoli due to which the negative pressure inside the alveoli increases. This prevents the alveoli from collapsing. Since, in this question, both options (a) and (b) are correct and option (b) provides more appropriate explanation, therefore, it must be chosen.

- **156.** Reduction in the pH of blood, i.e. increase in acidity favours the dissociation of oxyhaemoglobin thereby giving up more O_2 . When this phenomenon occurs due to increase in CO_2 concentration, then it is called Bohr effect.
- **157.** Option (c) is correct matching of two capacities and its volumes.

Inspiratory Capacity (IC) is the maximum amount of air that can be inspired after a normal expiration, IC = TV + IRV. It is 3500 mL in adult male and 2400 mL in adult female.

Residual Volume (RV) is the amount of air remaining in the lungs after a forced exhalation. Its average value is 1200 mL and 1100 mL in adult male and female, respectively.

158. Vital capacity of our lungs is total lung capacity minus residual volume. It is about 4800 mL.

Total lung capacity is the sum of vital capacity and residual volume, i.e. vital capacity of our lungs is total lung capacity minus residual volume. Tidal volume is the amount of air which normally passes into and out of the lungs during each cycle of quite breathing. It is about 800 mL in adult person. Inspiratory reserve volume is the extra volume of air that can be inhaled into lungs during deepest possible inspiration.

159. The presence of high quantity of carboxyhaemoglobin in the blood reveals that person is exposed to inhalation of polluted air having high CO. Carbon monoxide forms a stable compound with haemoglobin called carboxyhaemoglobin as affinity of Hb for CO is 210 times greater than its affinity for O_2 . In this form, haemoglobin does not carry oxygen resulting in death due to hypoxia.

Hb + C	\rightarrow	HbCO
(Haemoglobin)	(Ca	rboxyhaemoglobin)



20. Body Fluids and Circulation

- **160.** Whale has two separate circulatory pathways. The circulatory system in which two distinct and separate circulatory pathways for blood flow are involved, is called double circulatory system (also, double-loop circulatory system). It occurs in mammals and birds. Whale is a mammal, so it shows above characteristic.
- **161.** Landsteiner divided human population into four groups based on the presence of antigens found in their RBCs. Each group represented a blood group. Thus, there are four types of blood groups A, B, AB and O. Blood group 'O' does not contain any antigen on RBCs, hence can be given to any person, that's why this blood group is called universal donor.
- **162.** Fibrinogen is a soluble plasma protein that is stimulated by thrombin and gets converted into insoluble form fibrin at the site of injury. The latter helps in the formation of blood clot to seal the wound and stop bleeding and further loss of blood from the injured part of body.

Globulins are simple proteins that form a large fraction of blood serum proteins involved in defence mechanism. There are four main types of globulins that are manufactured in liver, namely alpha-1, alpha-2, beta and gamma.

Albumin is a plasma protein that is manufactured by the liver. It helps in maintaining osmotic pressure which prevents the fluid-leakage out into the tissues from the bloodstream.

- **163.** Test tube containing calcium bicarbonate will not be used for the purpose. Clotting of collected blood can be prevented by coating the test tubes with silicon or adding chelating agents. Citrate, oxalate, heparin and EDTA are anticoagulants.
- **164.** Blood pressure in different blood vessels Artery > Arteriole > Capillary > Venule

> Vein (vena cava)
 So, blood pressure in the pulmonary

artery is more than that in the pulmonary vein. The pulmonary arteries have thicker

smooth muscle and connective tissue than the pulmonary veins to accommodate the higher pressure and high rate of blood flow. **165.** The correct labelling of parts with their respective functions is as follows

Pulmonary vein	-	Takes oxygenated blood from lung and carries it to left auricle
Dorsal aorta	-	Takes blood from heart to body parts, $pO_2 = 95 \text{ mm}$ Hg
Vena cava	-	Takes blood from body parts to right auricle $\rho CO_2 = 45 \text{ mm Hg}$
Pulmonary artery	-	Takes blood from heart to lungs, $pO_2 = 90 \text{ mm Hg}$

- **166.** If chordae tendinae of the tricuspid valve became partially non-functional due to the injury, then the flow of blood into the pulmonary artery will be reduced because chordae tendinae arise from papillary muscles and insert upon the flaps of tricuspid and bicuspid valves. The valves in the heart allow the flow of blood only in one direction, i.e. from the atria to the ventricles and from the ventricles to the pulmonary artery or aorta.
- **167.** Deficiency of antibodies can be confirmed by serum globulins as antibodies are also called immunoglobulins and constitute the gamma globulin part of blood proteins. These are secreted by activated B-cells or plasma cells.

21. Excretory Products and Their Elimination

168. In annelids like *Nereis*, earthworm, leech, etc., the tubular coiled structures called nephridia are excretory organs. In phylum–Arthropoda, insects centipedes, millipedes and arachnids possess Malpighian tubules as their principal excretory organ. Analogous organs have almost similar appearance and perform the same function, but develop in totally different groups and are totally different in their basic structure and developmental origin, e.g. wings of butterfly, birds, bats.

> The homologous organs have common origin, perform different type of functions and have different appearance, e.g. thorns of *Bougainvillea* and tendrils of *Cucurbita*.

> Vestigial organs are useless remnants, which might have been large and functional in the ancestors, e.g. nictitating membrane, vermiform appendix, etc.

169. Statements III and IV about kangaroo rat are true. Kangaroo rat is a desert rodent. Its body is covered by hairs. Its urine is more than 20 times concentrated as its plasma. This concentrated waste enables it to live in dry or desert environment where little water is available for him to drink.

Most of its water is metabolically produced from the oxidation of carbohydrates, fats and proteins in the seeds that it eats. The animal remains in cool burrow during daytime and the respiratory moisture condensed in nasal passages.

- **170.** A-Adrenal gland is correctly mentioned with its function. It is located at the anterior part of kidney and secretes catecholamines, which stimulate glycogen breakdown.
- **171.** Option (d) correctly explains function of human nephron. Podocytes or visceral epithelial cells are the cells in Bowman's capsule in the kidneys that wrap around the capillaries of glomerulus. They create minute pores (slit pores) for the filtration of blood into the Bowman's capsule.
- **172.** Statement in option (c) regarding kidney is correct. The plasma fluid that filters out from glomerular capillaries into Bowman's capsule of nephron is called glomerular filtrate. A comparison of the volume of the filtrate formed per day (180 L /day) with that of the urine released (1.5L), suggests that nearly 99% of the filtrate has to be reabsorbed by the renal tubules in a process called reabsorption.
- **173.** The main function of the Henle's loop is to absorb water from the tubular lumen, thus making the urine concentrated. If loop of Henle is absent, then the urine becomes more dilute.
- 174. Statement given in option (a) is correct. The ascending limb of loop of Henle is impermeable to water and permeable to K⁺, Cl⁻ and Na⁺ and partially permeable to urea. Due to this, sodium, potassium, calcium, magnesium and chloride are reabsorbed here, making the filtrate hypotonic.
- **175.** When someone drinks lot of water which is not required by body, the osmoregulation of the blood will decrease. The decrease in osmoregulation will inhibit the release of ADH.
- **176.** A patient suffering from cholera is given saline drip because Na⁺ ions are important in retaining water in the body.

519

NEET Test Drive

Severe diarrhoea, vomiting, watery stools are the chief symptoms of cholera. All these lead to dehydration. The toxin secreted by *Vibrio cholerae* causes a continuous activation of adenylate cyclase of intestinal epithelial cells.

The resultant high concentration of cAMP triggers continual secretion of CI^- , HCO_3^- and water into the lumen of the intestine. Administration of saline not only supports the sodium-potassium pump through which water in cell is restored, but glucose is also symported along with sodium.

22. Locomotion and Movement

- **177.** Pair given in option (d) is correct about body part and its muscle. Smooth muscles are plain, non-striated, involuntary or unstriped muscles due to the absence of striations. These occur in the walls of hollow internal organs, in capsules of lymph glands, spleen, etc., in iris and ciliary body of eyes, skin dermis, penis and other accessory genitalia, etc.
- **178.** Cervical vertebrae are seven in number, constant in most of the mammals. Whale, camel, giraffe, etc., have same number of cervical vertebrae. However, long neck in camel and giraffe is due to the more length of vertebrae.
- **179.** In the rib cage, the true ribs are those which are attached to the sternum in the front and vertebral column at back. These are 7 in numbers. Although, there are total 12 ribs in the rib cage. The 8th, 9th and 10th ribs are called false ribs. The 11th and 12th ribs are attached to the vertebral column and keep floating in the thoracic cavity, so are called floating ribs.
- **180.** Joint between atlas and axis is pivot joint, which is an example of synovial joint characterised by the presence of a fluid-filled synovial cavity between the articulating surface of the two bones. Knee joint (hinge joint) is a synovial joint characterised by the presence of fluid-filled synovial cavity between the articulating surfaces of the two bones.
- **181.** Gliding joint is present between zygapophyses of the successive vertebrae. This joint permits sliding movements of two bones over each other.
- **182.** Osteoporosis is an age related disease of skeletal system, which may occur due to decreased level of oestrogen.

(MODULE 3)

Oestrogen deficiency causes both the early and late forms of osteoporosis in post-menopausal women.

Osteoporosis is thinning or weakening of bones, which makes them fragile and more likely to break. Women have low oestrogen level when they are transitioning through menopause.

183. Osteoporosis is an age related disease, in which bones loose minerals and fibres from the matrix causing decreased bone mass and higher chances of fractures with advancing age. Major causative factors of osteoporosis are imbalance of hormones like calcitonin of thyroid, parathormone of parathyroids, sex hormones and deficiencies of calcium and vitamins. The disease may be classified as primary type 1, primary type 2 or secondary.

> The form of osteoporosis most common in women after menopause is referred to as primary type 1 or post-menopausal osteoporosis.

Secondary osteoporosis may arise at any age and affect men and women equally.

184. Inflammation of joints due to the accumulation of uric acid crystals is gout. Fibrous joints are formed by the flat skull bones, which fuse end-to-end with the help of dense fibrous connective tissues in the form of sutures to form cranium. The vertebral column is formed by 26 serially arranged units called vertebrae. The less secretion of progesterone causes abortion as it basically supports pregnancy.

23. Neural Control and Coordination

- **185.** The statement given in option (a) is correct. The autonomous nervous system regulates the secretion of glands, whereas the glands do not regulate the nervous system.
- **186.** The parasympathetic neural signals affect the working of the heart by reducing heart rate and cardiac input through the post-ganglionic fibres. These fibres are very short and are cholinergic in nature.
- 187. When a neuron is in resting state, i.e. not conducting any impulse, the axonal membrane is comparatively more permeable to K⁺ ions and nearly impermeable to Na⁺ ions. Neurons are excitable cells because their membranes are in a polarised state. Different types of selectively permeable

channels are present on the neural membrane.

- **188.** During the nerve impulse when a stimulus of adequate strength is applied to a polarised membrane, the permeability of the membrane to Na⁺ is increased at the point of stimulation. As a result, the sodium ion channels permit the influx of Na⁺ by diffusion into the intracellular fluid from extracellular fluid.
- **189.** During the transmission of nerve impulse through a nerve fibre, the potential on the inner side of the plasma membrane has first become negatively charged, then positive and again negatively charged by repolarisation.
- 190. In the resting nerve fibre, the cytoplasm inside the axon has a high concentration of K⁺ and a low concentration of Na⁺ in contrast to the fluid outside the axon. Thus, if diffusion occurs then through concentration gradient Na⁺ enters the fibre.
- **191.** When a nerve fibre is stimulated, its membrane becomes more permeable to sodium ions because of opening of ion gated channels for sodium ions. Hence, more sodium ions enter the axon than potassium ions leaving it. As a result, the positive and negative charges on the outside and inside of the membrane are reversed. The membrane with reversed polarity is called depolarised.
- **192.** *A* Receptor, *B* Synaptic cleft, *C* – Synaptic vesicles, *D* – Neurotransmitter
- **193.** Destruction of the anterior horn cells of the spinal cord would result in loss of voluntary motor impulses because the anterior horn cells which is the front column of grey matter in the spinal cord contains motor neurons that affect the axial muscle activity.
- **194.** In mammalian eye, the fovea is the centre of the visual field where high density of cones, but no rods occur. At the posterior pole of the eye lateral to the blind spot, there is a yellowish pigmented spot called macula lutea with a central pit called the fovea. It is a thinned-out portion of the retina where only the cones are densely packed. It is the point where the visual acuity (resolution) is the highest.
- **195.** *A*-Retina—Contains photoreceptors rods and cones. The daylight vision is the function of cones and twilight vision is related to rods.

B–Blind spot—Photoreceptor cells are not present in this part.

C-Aqueous chamber contains a thin watery fluid called aqueous humor. *D*-Sclera is the external layer of eye

having dense connective tissue. **196.** The rods contain the rhodopsin (visual purple) pigment and enable the animals to see in darkness. Therefore, present in large number in nocturnal animals. The cones contain the iodopsin (visual violet) pigment and chiefly concerned with distinction in colour and light vision

during daytime. **197.** Abducens (abducent) nerve is a cranial nerve which originates from the ventral surface of medulla oblongata. It innervates the lateral rectus muscle of eyeball. It is a motor nerve and controls the movements of the eyeball. Hence, if abducens nerve is injured in a man, movement of eyeball will be affected.

- **198.** Cornea transplantation is outstandingly successfull because it is non-vascular, i.e. no blood supply and is not linked with immune system.
- **199.** The photosensitive compounds (rhodopsin) in the human eye is composed of opsin (a protein) and retinal (an aldehyde of vitamin-A, i.e. retinol).

It is present in the rod cells (photoreceptors). Light induces dissociation of retinol, from opsin thus changing the structure of opsin. This creates potential differences in the photoreceptors and they become hyperpolarised.

However, during darkness rhodopsin is resynthesised from opsin and retinine to restore the dark vision and photoreceptors are depolarised.

The correct form of other statements are

- (a) Nociceptors are sensory nerve cells that respond to potentially damaging chemical or mechanical stimuli and send them to brain and spinal cord.
- (b) Meissner's receptors are tactile receptors receiving the stimuli of pressure.
- (d) Receptors always produce graded potentials.

24. Chemical Coordination and Integration

200. GnRH is a hypothalamic hormone. It stimulates the anterior lobe of pituitary gland to secrete LH and FSH. These two hormones play important role in menstrual cycle in human female. FSH is also involved in spermatogenesis in human males.

201. Chronic hypersecretion of Growth Hormone (GH) leads to gigantism or acromegaly depending on the age of the individual.

> If its hypersecretion occurs before the ossification of epiphyseal plates, it causes exaggerated and prolonged growth in long bones. It results in gigantism.

In adults, hypersecretion of GH leads to accromegaly. No increase in height occurs because of the ossified epiphyseal plate.

Epiphyseal plate is responsible for the growth of bone. It closes after adolescence.

202. The option (b) is correct matching of the source of endocrine hormone and its function. In animals, melatonin allows the regulation of circadian rhythms. Oxytocin is a neurohypophyseal hormone which stimulates the muscle contraction (smooth muscle) in the wall of uterus during childbirth.

Progesterone is a female hormone produced by the corpus luteum after ovulation in the Graafian follicles of ovary. This hormone maintains the wall of uterus throughout the pregnancy. ANF stimulates the secretion of Na and H_2O by the kidneys and helps in regulating blood pressure.

- **203.** Melatonin and serotonin are derivatives of tryptophan amino acid, while thyroxine and tri-iodothyronine are iodinated tyrosine amino acid derivatives. Tyrosine is an essential amino acid.
- **204.** Hypothyroidism during pregnancy causes defective development and maturation of the growing foetus leading to stunted growth. Low secretion of GH results in stunted growth resulting in pituitary dwarfism.
- **205.** Myxoedema (Gull's disease) occurs due to the deficiency of thyroxine in adults. It causes low BMR (by 30-40%), low body temperature, tendency to retain water in tissues, reduced heart rate, pulse rate, blood pressure and cardiac output, low sugar and iodine level in blood, muscular weakness and oedema (accumulation of interstitial fluid that causes the facial tissues to swell and look fluffy).

Decreased secretion of thyroxine hormone from thyroid gland causes hypothyroidism. Simple goitre is caused by lower intake of iodine through diet.

Cretinism occurs due to the hyposecretion of thyroxine during the growth years or birth.

- **206.** Thyroid gland secretes thyroxine. Thyroxine hormones are stored in the lumen of the follicle, the extracellular space.
- **207.** The parathormone secreted by parathyroid gland regulates the calcium and phosphate balance between the blood and other tissues.
- **208.** Epinephrine and norepinephrine are secreted by adrenal medulla (under the control of sympathetic nervous system) in response to stress of any kind or during emergency situations. These are also called emergency hormones. Thus, they would be released when the person enter an empty room and suddenly finds a snake.
- **209.** Adrenaline hormone is responsible for this action, as adrenaline hormone is known as 3F hormone, i.e. fright, flight and fight.
- **210.** Cortisol and testosterone are lipid soluble hormones, which can directly pass through the cell membrane of the target cell and bind with intracellular receptors.
- **211.** Hormones are released in normal blood circulation, but each hormone stimulates only a specific target organ to initiate a specific response. It is because of the presence of specific receptor protein only in the specific target cell. If these receptor molecules are removed from target organs, the organ will not respond to hormone.
- **212.** Radioactive iodine, i.e. lodine-131 is administered to patients suffering from thyroid cancer for its detection. lodine is integral part of thyroxine hormone.
- **213.** Lack of iodine in diet results in goitre. Oxytocin is produced by neurohypophysis, which stimulates uterus contraction during childbirth. Anterior pituitary secretes Growth Hormones (GH) whose oversecretion stimulates abnormal growth. Testosterone is secreted by Leydig cells of testes in males.
- **214.** Posterior pituitary stores and releases two hormones called oxytocin and vasopressin. Vasopressin acts mainly at the kidney and stimulates reabsorption of water and electrolytes by the distal tubules in the nephron and thereby reducing the loss of water through urine



NEET Test Drive

(diuresis). Hence, it is also called as Anti-Diuretic Hormone (ADH). Oestrogen is secreted by the ovarian follicles influenced by FSH. Oxytocin is produced by neurohypophysis, which stimulates uterus contraction during childbirth. Blood calcium level is regulated by parathyroid gland.

215. Ovary produces two steroid hormones, i.e. oestrogen and progesterone. Oestrogens produce wide ranging actions such as stimulation of growth and activities of female secondary sex organs, development of growing ovarian follicles, appearance of female secondary sex characters (e.g. high pitch of voice, etc.) mammary gland development. Oestrogens also regulate female sexual behaviour.

> Alpha cells of islets of Langerhans of the endocrine pancreas secrete a hormone called glucagon. It is a peptide hormone and plays an important role in maintaining the normal blood glucose levels. It acts mainly on the liver cells (hepatocytes) and stimulates glycogenolysis resulting in an increased blood sugar (hyperglycemia).

> The pars distalis region of pituitary, commonly called anterior pituitary, secretes Growth Hormone (GH). Over secretion of GH stimulates abnormal growth of the body leading to gigantism and low secretion of GH results in stunted growth resulting in dwarfism.

25. Reproduction in Organisms

216. Pistils fused together — Syncarpous Formation of gametes

— Gametogenesis Hyphae of higher ascomycete —Dikaryotic

Unisexual female flower—Pistillate

- **217.** Vivipary is an undesirable character for annual crop plants because germinated seeds cannot be stored under normal conditions for the next season. It is a condition, in which seeds germinate on plant itself.
- **218.** The pair in option (c) is not correctly matched. The plant body *Sargassum* is a diploid sporophyte. It does not multiply asexually by means of binary fission. Instead, it reproduces by vegetative means, i.e. fragmentation which is the only known method of vegetative reproduction in the free-floating species of *Sargassum*.



- **219.** Statement (c) is incorrect as in potato, banana and ginger new plantlets always arise from the nodes of the modified stem. Internodes are the area between the two nodes.
- **220.** Marginal notches in *Kalanchoe* and *Bryophyllum* possess adventitious buds in their leaves for vegetative propagation. Once these are detached from leaves, give rise to new individual plant.
- 221. The statement in option (c) is wrong. Oomycetes include water moulds, white rusts and downy mildews. In these, female gamete is larger and non-motile, whereas, male gamete is smaller and motile. Isogametes are found in algae like Ulothrix, Chlamydomonas, Spirogyra, etc., which are similar in structure, function and behaviour. Anisogametes are found in Chlamydomonas in which one gamete is larger and non-motile and the other one is motile and smaller. Oogamy is the fusion of non-motile egg with motile sperm. The gametes, differ both morphologically as well as physiologically. It occurs in Chlamydomonas, Fucus, Chara, Volvox, etc.

222. The option (b) is correct.

In oogamous type of sexual reproduction, the female gamete (ovum/egg) is big, passive while male gametes (spermatozoids) are smaller, active and motile. It is found in the members of fungi grouped in class Oomycetes.

26. Sexual Reproduction in Flowering Plants

223. The statement in option (d) is incorrect.

Tapetum is the inner layer of microsporangium (anther), which provides nourishment to developing pollen grain after meiotic cell division. Rest, all the statements are correct.

224. The statement in option (d) is true. Tapetum is the innermost layer of microsporangium. It nourishes the pollen grains. The inner wall of pollen grain is called intine. Endothecium is the wall around the microsporangium, which provides protection and helps in dehiscence of anther to release the pollen. Sporogenous tissue is diploid. The cells of this tissue undergo meiotic division to form microspore tetrads.

- **225.** The statement in option (d) is incorrect. Pollen grains of different species are incompatible, so they fail to germinate. Only the pollen of the same species germinate and can form pollen tube, which grows and finally dispatches male gamete to embryo sac. Rest, all the statements are correct.
- **226.** 40 pollen grains will be formed after meiotic division in 10 microspore mother cells. One microspore mother cell forms four pollen grains after meiotic division. So, 10 microspore mother cells will form 40 pollen grains.
- 227. In angiosperms, each Microspore Mother Cell (MMC) undergoes meiosis to produce four microspores which develop into pollen grains. Thus, to produce 100 pollen grains, 25 microspore mother cells are required.
- **228.** Mutualism type of association is found in between entomophilous flower and pollinating agent. The plant uses its pollinator to ensure cross-pollination, while pollinator uses the plant as food.
- **229.** Flowers showing ornithophily have sweet scented, red coloured flowers with nectaries. Ornithophily is an allogamy performed by birds, such as long beaked small birds (sun birds, humming birds), crow, parrot, bulbul, etc. Ornithophilous flowers are large and showy cup-shaped with abundant nectar or edible part, e.g. *Bombax, Agave*, etc.
- **230.** In most of the angiosperms, the reduction division occurs in megaspore mother cell to produce 4 cells. Out of these, 3 degenerate and one remains which forms functional megaspore. This divides mitotically and forms embryo sac which contains following structures.



Degenerating megaspores Functional megaspore

- (i) One egg cell with 2 synergids forming an egg apparatus.
- (ii) There are 3 antipodal cells.
- (iii) There are two central cells which are seen as secondary nucleus (2*n*).

Egg does not have filiform apparatus. It is the synergids, which have special cellular thickenings at the micropylar tip which is called filiform apparatus. This guides pollen tube into the synergids.

The NEET Edge ~ Biology

- **231.** In angiosperms, the endosperm is a special tissue, which is formed as a result of triple fusion. In triple fusion, the second male gamete fuses with secondary nucleus (diploid nucleus formed by fusion of two polar nuclei) to form triploid primary endosperm nucleus.
- **232.** In wheat or maize (family–Poaceae), the scutellum is thought to be a modified cotyledon or seed leaf. It contains reserve food material for germinating seeds.
- **233.** Pollen grain or microspore divides mitotically forming a larger tube or vegetative cell and a small generative cell. Since, vegetative cell gives rise to pollen tube and generative cell divides to form two male gametes, thus if a generative cell is destroyed by laser, a normal pollen tube will still form through the vegetative cell which is there undestroyed.
- **234.** Synergids are two, short-lived, haploid cells lying close to the egg in mature embryo sac of flowering plant ovule. While, the endosperm is a triploid tissue formed after triple fusion. Thus, if the synergids have 8 chromosomes, the aleurone layer (part of endosperm) will have just triple of that of chromosomes in the synergids, i.e. 24 chromosomes.
- **235.** 200 seeds of pea would be produced from 200 pollen grains and 200 embryo sacs. 200 pollen grains will be formed by 50 microspore mother cells, while 200 embryo sacs will be formed by 200 megaspore mother cells. Similarly, 400 seeds of pea would be produced from 400 pollen grains and 400 embryo sacs. 400 pollen grains will be formed by 100 Microspore Mother Cells (MMCs) and 400 embryo sacs fromed by 400 Megaspore Mother Cells (MMCs). Thus, number of meiotic divisions required to produce 200/400 seeds would be 250/500.
- **236.** Orthotropous or atropous is the erect ovule in which the body of ovule lies straight and upright over the funicle. Hilum, chalaza and micropyle occur on one straight line, e.g. family Polygonaceae and Piperaceae.

27. Human Reproduction

237. The pathway given in option (a) dipicts correct pathway of transport of sperm. The sperms are produced in the seminiferous tubules. The rete testis is connected to these tubules at one end and transfers sperms to vasa efferentia

(small tubular structures between rete testis and epididymis).

The sperms reach to epididymis through vasa efferentia where they are temporarily stored for maturation and then transferred to seminal vesicle through vas deferens.

Thus, the correct route is

Rete testis \rightarrow Efferent ductules \rightarrow Epididymis \rightarrow vas deferens.

- **238.** Statement given in the option (a) is false with respect to viability of mammalian sperm. Viability of a sperm means the capability of a sperm, to fertilise an egg. Sperms are viable for 24 h to 48 h, whereas the ovum is viable for only 24 h.
- **239.** High levels of oestrogen and progesterone give negative feedback to hypothalamus for the release of GnRH. Thus, inhibiting the gonadotropin release.
- **240.** The statement in option (b) is incorrect. In follicular phase of menstrual cycle, LH and FSH increase gradually and stimulate follicular development as well as secretion of oestrogens by the growing follicles.
- **241.** Spermatogonia \rightarrow Spermatocyte \rightarrow Spermatid \rightarrow Spermatozoa

Spermatogonium is present on the inside wall of seminiferous tubule, which undergoes mitotic division and increases their number. Spermatocytes are some of the spermatogonia, which periodically undergo meiosis. The secondary spermatocytes undergo the second meiotic division to produce four, equal haploid spermatids. The spermatids are transformed into spermatozoa (sperm).

- **242.** In secretory phase during ovulation, the follicle breaks and collapse under the continuous influence of Luteinising Hormone (LH). It begins to enlarge and forms a yellowish structure, called the corpus luteum. The corpus luteum plays an important role in the preparation of the endometrium for the implantation of the fertilised egg by secreting oestrogens and progesterone.
- 243. The statement in option (b) is incorrect. Rest, all the statements are correct. During normal menstruation, approximately 40 mL of blood and an additional 35 mL of serous fluid are lost. The menstrual fluid is normally non-clotting because a fibrinolysin is released along with necrotic endometrial material.
- **244.** Fertilisation in humans, is practically feasible only if the sperm and ovum are

transported simultaneously at ampullary-isthmic junction of Fallopian tube.

- **245.** If mammalian ovum fails to get fertilised, the oestrogen secretion does not decrease further, while corpus luteum will disintegrate. Primary follicle starts developing and progesterone secretion rapidly declines.
- **246.** The sperm entry stimulates the secondary oocyte to undergo meiotic-II division, which produces the ovum and second polar body.
- **247.** Cleavage divisions are mitotic division, in which the single-celled zygote is converted into a multicellular morula. But during cleavage divisions, there is no growth of resultant daughter cells /blastomeres. So, the DNA content will increase, but there is no increase or insignificant increase in amount of protoplasm.
- **248.** Termination of gastrulation is indicated by obliteration of blastocoel. The three embryonic membranes are formed during this stage. These are ectoderm, mesoderm and endoderm. These layers give rise to different organs of developing foetus.
- **249.** Ectopic pregnancy develops when an embryo implants somewhere else, other than the uterus, such as in one of Fallopian tube. It is also known as eccysis or tubal pregnancy.
- **250.** hCG (human Chorionic Gonadotropin) secretion occurs about 48-72 hours after implantation. Its level increases and excess of hCG leaks into urine, which is the indication of pregnancy.

This hormone like LH stimulates the corpus luteum to secrete high levels of progesterone and some oestrogen to maintain pregnancy. These steroids are required to maintain the development of placenta, initiate the development of mammary glands and inhibit ovulation.

- **251.** Pituitary secretes oxytocin during parturition. The functions of placenta are supply of oxygen and nutrients to embryo. It also secretes oestrogen, facilitates removal of carbon dioxide and waste materials from embryo.
- **252.** The first movement of the foetus and appearance of hair on its head are usually observed during fifth month of pregnancy.

During development of foetus in human by week 20, hair begins to grow including eyebrows and eyelashes, fingerprints develop. Finger nails and toe nails grow. Firm hand grip. Between



16 and 20 weeks, the first movements of the foetus are observed.

253. The correct matches are Mona pubis–Female external genitalia Antrum–Graafian follicle Trophectoderm–Embryo development Nebenkern–Sperm

28. Reproductive Health

254.	Gonorrhoea	Neisseria
	Syphilis	Treponema
	Genital warts	Human papilloma virus
	AIDS	HIV

- **255.** In India, human population is heavily weighed towards the younger age group as a result of high birth rate and short lifespan of individuals.
- **256.** The option (c) does not define action of contraceptive because in vasectomy, a small part of the vas deferens is removed or tied up through a small incision on the scrotum in males. Vasectomy blocks the gamete transport and does not affect spermatogenesis.
- **257.** Option (a) with statements I and III are correct. Intrauterine devices like copper-T are effective contraceptives for birth control. It suppresses sperm motility and the fertilising capacity of the sperm. Medical termination of pregnancy or induced abortion is voluntary or intentional termination of pregnancy before full term of foetus. It is comparatively safe up to 12 weeks (the first trimester) of pregnancy.
- **258.** The contraceptive pills are hormones either in combination or progesterone only that primarily prevent release of egg. It is convenient and highly effective, significant non-contraceptive health benefits such as protection against ovarian and endometrial cancers.

Condom is thin rubber sheath for penis that collects semen. It is easy to use, effective and inexpensive.

Vasectomy is the cutting and tying off the ductus deferens so, that sperm connot enter the ejaculate.

Copper-T is small plastic device placed in the uterus that prevents fertilisation or implantation.

MODULE 3)

259. Cleft palate is a developmental abnormality which may occur in the developing foetus and so it can be detected by sonography, not by amniocentesis.

Amniocentesis is being misused for foetal sex-determination test so, it is banned in India.

- **260.** Assisted Reproductive Technologies (ARTs) is a general term referred to the method used to achieve pregnancy by artificial means or partial artificial means and is primarily used in infertility treatment. Artificial insemination is a type of ARTs.
- **261.** *In vitro* fertilisation (IVF) or test tube baby technique involves fertilising one or more eggs outside the body and then transferring the fertilised eggs known as pre-embryos back into the uterus.

Zygote Intra Fallopian Transfer (ZIFT) is an example of IVF. In this, the zygote or early embryos up to 8 blastomeres are transferred into the Fallopian tube. If the embryo has more than 8 blastomeres then it is transferred into uterus this is known as IUT.

- **262.** The full form of GIFT is Gamete Intra Fallopian Transfer. This method is used in females who cannot produce ova, but can provide suitable environment for fertilisation and further development of embryo in the oviducts. In such cases, ovum from the donor female is surgically removed and is then introduced into the Fallopian tube of such females. Such women then accept sperms from her husband during copulation.
- **263.** The test tube baby means a baby born when the ovum is fertilised externally and thereafter implanted in the uterus. Patrick Stepote and Robert Edward first time developed test tube baby technique in 1978. In these cases, where normal fertilisation is not possible, ovum from the female and the sperm from the male are mated *in vitro*. The zygote, later on is implanted in the uterus where further development into baby take place.
- **264.** The characteristic demographic features of developing countries is high fertility, low or rapidly falling mortality rate, rapid population growth and a very young age distribution. In India, it is all due to the reproductive and child health care programmes operating throughout the country.

29. Principles of Inheritance and Variation

265. Out of the given statements, statement (c) is incorrect because the law of dominance does not occur universally. After Mendel several cases were recorded by scientists, where a clear deviation from law of dominance was seen.

Such a deviation may be seen in the form of incomplete dominance or blending inheritance and codominance.

- **266.** When two genes in a dihybrid cross are situated on the same chromosome, the proportion of parental gene combinations are much higher than the non-parental or recombinant type as linked genes are inherited together in offspring.
- **267.** Higher number of the parental types formed when RRYY and rryy genotypes are hybridised, giving the condition that R and Y genes are closely linked. Law of independent assortment is not applicable when the genes of different character occupy the same homologous chromosomes, i.e. are linked gene.
- **268.** In a dihybrid cross, the genotypic ratio can be represented as follows— assuming a cross between AABB and aabb

AABB	×	aabb	- Parents
AB	\downarrow	ab	— Gametes
[AaBb		$-F_1$ -generation
Selfing	g ↓		$-F_2$ -generation
	∕ 1BB		— 1 AABB
$1 \text{ AA} \leftarrow$	— 2 Bb)	— 2 AABb
1 bb	∑ 1 A	abb	
	/ 1 BE	3	— 2AaBB
2 Aa <	, 2B	b	— 4AaBb
	∖ 1b	b	— 2Aabb
	/ 1B	В	— 1 aaBB
1 aa <	— 2B	b	— 2aaBb
	∖ 1bb)	— aabb

So, the ratio of AABB, AABb, AaBB and AaBb will be 1:2:2:4 in F_2 -generation.

 269. Dominance—Expression of only one allele in a heterozygous organism
 Codominance—Side by side full expression of both alleles. F₁ resembles both parents

> Pleiotropy—Single gene can exhibit multiple phenotypic expression, e.g. phenylketonuria

524

Polygenic inheritance—Many genes govern a single character, *e.g.* human skin colour.

270. Parents – TT × tt (Tall) Tt (Dwarf) F₁-generation (Heterozygous tall)



Phenotypic ratio = 3:1[Tall:Dwarf]Genotypic ratio $\Rightarrow 1:2:1$

(Homozygous tall : Heterozygous tall : Dwarf)
 271. A cross between two individuals, one with AB blood group and other with A blood group will produce four genotypes and three phenotypes.

Parents	N	lale	Female
Phenotype		AB	А
Genotype	I	А <mark>В</mark>	l ^A i
Gametes	ľ	^A , I ^B	l ^A , i
	l ^A l ^A i	× (A) (^A i (A)	Ι ^Β Ι ^Α Ι ^Β (AB) Ι ^Β i (B)
0 11			

Offsprings genotypes : $4(|^{A}|^{A}, |^{A}|^{B}, |^{A} i, |^{B} i)$ Phenotypes : 3 (A, B, AB)

- **272.** The ABO blood group system has at least 6 genotypes. On the basis of the presence or absence of antigens and antibodies, four blood groups (phenotypes) have been differentiated—A, B, AB and O blood groups. In ABO blood group system, inheritance of grouping is controlled by a single autosomal gene on chromosome 9 with three major alleles A, B and O (I^A, I^B and I^O).
- **273.** Grasshopper is an example of XO type of sex-determination in which the males have only one X-chromosome besides the autosomes, whereas females have a pair of X-chromosomes.
- **274.** Genes which are present on sex chromosomes are called sex-linked genes. Male *Drosophila* contains XY sex chromosome, while female contains XX-chromosomes.

During gamete formation, male produces 50% male specific gametes and 50% female specific gametes while female produces only one type of gametes, i.e. female specific. As male produces two types of gametes in equal proportion. There is an equal opportunity to getting a male or female offspring.

275. Out of the given statements (b) is not true because the tightly linked genes on chromosomes show 100% parental types and 0% recombinants. Two genes that undergo independent assortment indicated by a recombinant frequency of 50% are either on non-homologous chromosomes or located far apart in a single chromosome.

As the distance between two genes increases, crossover frequency increases.

- **276.** The actual distance between two genes is said to be equivalent to the percentage of crossing over between these two genes. Since, the two genes lie at the ends of the chromosome, there are 100% chances of their segregation during crossing over.
- **277.** According to the given question, the sequence of genes on chromosome are b, a, c.



- **278.** AABB × aabb is suitable for experiment on linkage. Linkage may be defined as the tendency of two genes of the same chromosome to remain together in the process of inheritance.
- **279.** Mr. Kapoor will have the genotype Bb, d, so 1/4th of the sperms will have Bd.
- **280.** The genotype of human male in question must be Aa Bb X^hY.

Hence, $2 \times 2 \times 2 = 8$ types of gametes would be formed, AB X^h, ABY, aB X^h. aBY, Ab X^h, AbY, ab X^h, abY

Hence, 1/8 proportion of his sperms would be abh.

- **281.** Daughters have two X-chromosomes one of them is from father and other comes from mother, in this case, all the daughters are suffering from the fathers disease hence, X-chromosome of father must be carrying a dominant trait, i.e. inheritance pattern is sex-linked dominant.
- **282.** Statement given in option (c) is correct. Sickle-cell anaemia is an autosomal recessive gene disorder in which sickle-celled RBCs are formed instead of normal ones. They carry very less

content of O_2 as their haemoglobin is malformed. The person suffering from this disease show symptoms of anaemia.

- 283. In the given question, 50% of offsprings would be affected by this disorder because Down's syndrome is the result of trisomy, in which chromosome pair number 21st contains an extra copy of chromosome (2A + 1). Affected mother will produce 50% normal egg cells and rest 50% eggs are of abnormal type.
- **284.** Daughter of an albinic father will be carrier of this disease, when such woman gets married to an albinic man, 50% of her progeny will be normal and 50% will be albinic.
- **285.** The given pedigree shows the autosomal recessive disorder. In this disorder, the individual inherits two mutated genes, one from each parent. This disorder is usually passed on by two carriers. Health is rarely affected, but individuals have one mutated gene (recessive gene) and one normal gene (dominant gene) for the condition. The carrier individuals have a 25% chance of having an unaffected child with normal genes, 50% chance of having an unaffected child with a 25% chance of having an affected child with a 25% chance of having an unaffected child with a 25% chance of having an unaffected child with a 25% chance of having an unaffected child with a 25% chance of having an unaffected child with a 25% chance of having an unaffected child with a 25% chance of having an unaffected child with a 25% chance of having an unaffected child with a 25% chance of having an unaffected child with a 25% chance of having an unaffected child with a 25% chance of having an unaffected child with a 25% chance of having an unaffected child with a 25% chance of having an unaffected child with a 25% chance of having an unaffected child with a 25% chance of having an unaffected child with a 25% chance of having an unaffected child with a 25% chance of having an unaffected child with a 25% chance of having an affected child with a 25% chance of having an a 45% chance of having an affected child with a 25% chance of having an affected child with a 25% chance of having an affected child with a 25% chance of having an affected child with a 25% chance of having an affected child with a 25% chance of having an affected child with a 25% chance of having an affected child with a 25% chance of having an affected child with a 25% chance of having an affected child with a 25% chance of having an affected child with a 25% chance of having an affected child with a 25% chance of having an 25% chanc
- **286.** When a colourblind man (X^CY) marries to a woman with normal sight (XX) who has no family history of colour blindness, all of their sons will be normal pure and all of their daughters will be carriers as shown below



So in the next generation, the children of all of their son will be normal in all conditions (except the case in which the wife involved is not carrier neither colourblind). For carrier daughters.

 (i) If they many to a normal man 50% of their grandsons will become colourblind as

525



Colourblind son

 (ii) If carrier daughter marries to a colourblind man 50% of their grandson will be colourblind along with 50% of the grand daughter while rest 50% of the grand daughters will be carriers as



So, in both the above cases, the result shows 50% of grand sons will be colourblind which in terms of overall progenies (son + daughters) comes as 25% thus confirming the probability as 0.25.

287. As colour blindness is a sex-linked recessive genetic disorder, for it is present at X-chromosome. Thus, according the gene to the situation given in the question, a man whose father was colourblind (will be, i.e. XY normal) marries a woman whose mother was colourblind and father was normal (i.e. this woman will be a carrier) according to the cross given below



daughter son

Thus, when marriage will happen between a normal man and a carrier woman, in that case percentage of a male child to be colourblind is 25% (this

(MODULE 3)



- **288.** The statement in option (d) is correct. In the given pedigree chart, squares are representing males and circles females. In F₁-generation, 1-male and 1-female are diseased and in next generation only male is diseased. This shows the inheritance of a recessive sex-linked disease like haemophilia.
- **289.** In the given question, since both parents carry a haemoglobinopathy trait of thalassemia the risk is 25% for each pregnancy for an affected child.

R	r
RR	Rr
Rr	rr
	R RR Rr

RR-Unaffected (25%)

Rr-Carrier (50%)

rr-Affected (25%)

So, the chances of pregnancy resulting in an affected child is 25%.

290. A brown eyed man, whose mother was blue eyed must have the genotype Bb where B represents brown eye colour and b represents blue eye colour. When a man of such genotype marries a blue eyed woman, the children shall be



291. In this case, when the fathers of both husband and wife were colourblind and they have normal vision, husband have normal vision, while wife is carrier of this disease. Daughter of such parents will be carrier but there is no chance of her to be colourblind.

30. Molecular Basis of Inheritance

292. The statement given in option (c) is an exception to the genetic molecule's characteristics. It should be stable structurally and chemically.

The criteria that a molecule must fulfil to act as a genetic material are as following

- (i) It should be able to replicate.
- (ii) It should be chemically and structurally stable.
- (iii) It should provide the scope for slow changes, i.e. mutations which are required for evolution.
- (iv) It should be able to express itself in the form of 'Mendelian characters'.
- **293.** TATA box is present in eukaryotic promoter region. It has a resemblance with Pribnow box of prokaryotes. TATA box was identified by Dr. Hogness and so, it is also called as Hogness box. It is a 7 bp long region located 20 bp upstream to the start point.

During the process of transcription, the RNA polymerase (a holoenzyme which has a core unit and a sigma factor for proper initiation of transcription) binds to TATA box due to which DNA assumes a saddle-like structure at this place.

294. If DNA has ATACG nucleotide sequence then the *m*RNA would contain UAUGC sequence. The formation of *m*RNA from DNA is termed as transcription. This process takes place in the nucleus (eukaryotes) or in the cytoplasm (prokaryotes).

The base sequence of *m*RNA is complementary copy of the template DNA strand.

295. 33 codons will be altered if the 901st base is deleted and RNA has only 998 bases instead of 999 bases.

Total bases present in RNA = 999 Bases left after deletion of 901st base in

RNA = 999 – 901 = 98 Number of codon present in 98 = 33 (Approximately as three codons code for one amino acid).

- **296.** UAA is the 'stop' codon hence, polypeptide chain will not grow after 24th amino acid. In the absence of new initiating codon, rest of codons will not be able to translate.
- **297.** Statements II and IV are true about *lac* operon. In prokaryotes, a hypothesis was given in 1961 to explain the protein synthesis regulation. This hypothesis was given by F Jacob and J Monod and for this they were awarded Nobel Prize in 1965, the hypothesis was known by the name of Operon Model.

The operator gene is the segment of DNA, which exercise a control overtranscriptions. In the absence of lactose, the repressor binds with the operator gene.

- **298.** Zinc finger analysis is not required for any of the techniques of DNA fingerprinting available. It is a small protein structural motif that is characterised by the coordination of one or more Zn ions in order to stabilise the folds.
- **299.** Statement (a) is wrongly matched. It is because transcription is a process of *m*RNA synthesis from a DNA template. It involves three main events, i.e. initiation (binding of RNA polymerase to as DNA), elongation (development of a short stretch of DNA) and termination (recognition of the transcription termination sequence and the release of RNA polymerase).

31. Evolution

300. The statement given in option (b) is correct. The earliest organisms that appeared on Earth were anaerobic chemoautotrophs.

Chemoautotrophs were the first autotrophic organisms. They were unable to perform photolysis of water and never released oxygen, instead they used H_2S and produced sulphur as a byproduct, e.g. sulphur bacteria.

301. Option (c) is correct regarding the sequential manner of events of origin of life is as follows Synthesis of organic monomers

↓ Synthesis of organic polymers

Formation of protobionts

Formation of DNA based genetic systems

302. The process by which organisms with different evolutionary history evolve similar phenotypic adaptations in response to a common environmental challenge is called convergent evolution. It occurs in unrelated group of organisms. The process of evolution of different species in a given geographical area starting from a point and literally radiating to other areas of geography is called adaptive radiation. Natural selection is the basis of evolution.

303. The correct example of convergent and divergent evolution is given in option

(a). Convergent evolution involves the independent development of similar structures in organisms that are not directly related. It is represented by analogous organs, e.g. eyes of *Octopus* and mammals, wings of insects and birds. In divergent evolution, same basic organ becomes adapted by specialisation to perform different functions.

It is represented by homologous organs, e.g. bones of forelimbs of vertebrates (like seal's flipper, bat's wing, cat's paw, horse's front leg and human hand), thorns of *Bougainvillea* and tendrils of *Cucurbita*.

- **304.** Electron Spin Resonance (ESR) measures number of charges occupying deep traps in crystal band gap. The basic principle of ESR is same as those for luminescence, i.e. electrons become trapped and stored as a result of ionising radiations, e.g. dating of tooth enamel.
- **305.** The age of the fossil of *Dryopithecus* on the geological time scale is 25×10^6 years back, i.e. about 20-25 million years ago. *Dryopithecus* had the combined characters of great apes, old world monkeys and man. The main structural characteristics of *Dryopithecus* are broad jaws, large canines, semi-erect walking, 5 cusped molars and the absence of brow ridges.
- **306.** The eyes of *Octopus* and eyes of cat are examples of analogous organs, though they are different in structure but similar in function. The analogous organs are not anatomically similar structures though they perform similar functions. Hence, analogous structures are a result of convergent evolution, i.e. different structures evolving for the same function and hence, having similarity.

Homologous organs develop along different directions due to the adaptations to various needs. This is divergent evolution and the structures are homologous.

- **307.** Biogenetic law was propounded by Ernst Haeckel in 1866. According to this, during its early development, an animal passes through ancestral adult stages.
- **308.** In the recent years, DNA sequences of *mt*DNA and Y-chromosomes were considered for the study of human evolution because they are uniparental

in origin and do not take part in recombinations. Wilson and Sarich choose mitochondrial DNA (*mt*DNA) for the study of maternal line inheritance. While, Y-chromosomes were considered for the study of human evolution particularly male domain.

- **309.** The sequence of organic evolution proposed by Darwin and Wallace is variations, constancy of population size, overproduction and natural selection. Though living organisms tend to multiply geometrically, the number of individuals of a species tend to remain constant over a long period of time. Out of heterogenous population (due to the variation), best adapted individuals are selected by nature.
- **310.** According to both the views, Darwin's theory and pangenesis something is passed from parent to offspring which causes development of specific characters, i.e. all that has been acquired by the organism during its lifetime is preserved by generation and transmitted to offsprings in the form of pangenesis or gemmules.
- **311.** Plates having streptomycin allow to propagate only those bacteria which are resistant to the antibiotic. While, those plates in which streptomycin is absent, both resistant and non-resistant bacteria can grow normally.
- **312.** The given case is an example of natural selection. As a result of struggle for existence only those organisms could survive, which have favourable variations to adapt to the environmental conditions. With so many variations in population of species, the struggle for existence results in survival of the fittest. In this case, the darker peppered moths were naturally selected.

The survival of the fittest is the result of selection and proliferation of only those organisms, which were most suitably adapted to the environment and most successful in mating, i.e. natural selection.

313. Industrial melanism as observed in peppered moth proves that the true black melanic forms arise by a recurring random mutation.

Industrial melanism is a term used to describe the evolutionary process in which darker individuals come to predominate over lighter individuals since the industrial revolution as a result of natural selection. In 1848, a black form of the moth was recorded in Manchester and by 1895, 98% of the peppered moth population in



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Manchester was black. This black 'melanic' forms arose by a recurring random mutation, but its phenotypic appearance had a strong selective advantage in industrial areas.

314. The statement given in option (d) is correct. Recapitulation theory or biogenetic law states that ontogeny (development of embryo) is recapitulation of phylogeny (ancestral sequence) of embryonic development of organisms.

32. Human Health and Diseases

315. Common cold differs from pneumonia in that pneumonic pathogen infects alveoli whereas the common cold affects nose, respiratory passage but not lungs. Pneumonia is caused by the bacteria *Diplococcus pneumoniae* which infects the alveoli of lungs. It generally spreads through the sputum of patient. Fever, cold and difficulty in breathing are some common symptoms of pneumonia. It can be treated by the antibiotics.

Common cold is caused by a variety of viruses, most commonly by rhinovirus (RNA virus). It spreads through droplet infection. It affects the upper respiratory tract but not the lungs. Nasal and bronchial irritation, sneezing and coughing are some common symptoms of cold.

- **316.** Option (a) correctly match the example of immunity and lymphocyte. Phagocytosis is an important feature of cellular innate immunity, performed by cells called phagocytes that engulf or eat pathogens or foreign particles. Common examples of these phagocytes are monocytes, macrophages, neutrophil granulocytes (often referred to as polymorphonuclear leukocytes or PMN or PML, because of the varying shapes of nucleus), tissue dendritic cells, mast cells, etc. Anti-tetanus and anti-snake bite injections are examples of passive immunity.
- **317.** Statement (a) is correct with respect to immunity. In artificially acquired passive immunity, preformed antibody in an immune serum of some other animal is introduced into the body, as the antivenum used to treat snake bites. In this case, the body does not produce any antibodies. Antibody is a protein molecule having two light chains and two heavy chains. B-cells recognise

and bind antigens and may differentiate to memory cells or plasma cells (produce antibody). T-cells cause transplant rejection.

- **318.** Both statements I and II are correct. The correct form of statement III is B-lymphocytes are not responsible for the rejection of graft. IV is the acceptance or rejection of a kidney transplant does not depend on specific interferons. Interferons are antiviral proteins.
- **319.** Amoebiasis is caused by protozoan called *Entamoeba histolytica*. Prevention of infection is entirely a matter of hygiene, both personal as well as municipal. Their prevention include use of properly cooked food and sterilised water.

Diphtheria is caused by bacterium named *Corynebacterium diphtheriae*. The symptoms are fever, sore throat, severe damage to heart, nerve cell and adrenal glands. The DPT vaccine is used for diphtheria, pertussis and tetanus.

Cholera is caused by bacterium named *Vibrio cholerae*, a Gram negative bacterium. It spreads by faecal contamination. The dehydration and loss of mineral salts can cause death. It is treated by the use of oral rehydration therapy.

Syphilis is caused by *Treponema pallidum*, a spirochaete and spread by sexual contact and is a STD.

- **320.** Cancerous cells have high telomerase activity. The maintenance of telomere stability is required for the long term proliferation of tumours. This makes telomerase a target not only for cancer diagnosis but also for the development of novel anti-cancer therapeutic agents, e.g. telomerase inhibitors are used in cancer treatment.
- **321.** Statement given in option (d) is correct. Malignant tumour first grows slowly. No symptoms are noticed. This stage is called the latent stage. The tumour later grows quickly. The cancer cells go beyond adjacent tissue and enter the blood and lymph. Once this happens, they migrate to many other sites in the body where the cancer cells continue to divide. It is called as metastasis. Only malignant tumours are properly designated as cancer.
- **322.** Carcinoma refers to malignant tumours of skin and mucous membrane. It is a malignant or metastatic tumour. It can extend to the neighbouring cells, this

process is called as metastasis. These tumours are generally located in epithelial tissue and glands, e.g. breast cancer, skin cancer, stomach cancer, lung cancer, pancreas cancer, etc.

- **323.** The symptom given in option (d) indicates radiation sickness. Even lower doses of radiations cause serious damages like skin burns, nausea, loss of hairs and nails, change in blood cell count, prolonged exposure causes formation of tumours, cancer. High dose (lethal radiation exposer) may cause instant death.
- **324.** Statement (b) is correct. The correct form of other statements are
 - (a) HIV is a virus containing ssRNA and reverse transcriptase enzyme enveloped inside protein coat.
 - (c) HIV is enveloped retrovirus.
 - (d) HIV escapes the immune cells and attacks helper T-cells of immune system.
- 325. HIV infection does usually show symptoms of AIDS when HIV damages large number of helper T-lymphocytes. T-lymphocyte receptors can recognise only antigen that bound to cell membrane proteins. These lymphocytes mediate CMI (Cell-Mediated Immunity).
 B-lymphocytes are the major effector molecules of humoral immunity.
 Erythrocytes are red blood cells.
 Thrombocytes or platelets secrete factors that are involved in vascular repair.
- **326.** Retroviruses are implicated as a cause of cancer in humans because they may carry cellular proto-oncogenes in their genome, when these proto-oncogenes get converted into oncogenes due to some physical, chemical or biological agents, they cause cancer.
- **327.** The statement given in option (a) is correct regarding psychotropic drug. Charas is the dried resinous extract from the flowering tops and leaves of *Cannabis sativa*. In some countries, it is called hashish. It is a hallucinogen, which alters a person's thoughts, feelings and perceptions.
- **328.** Pair given in option (d) is not correctly matched. Leishmaniasis or kala-azar is caused by a protozoan, *Leishmania donovani*. It is spread by sandfly. It is also known as dum-dum fever. Its control includes eradication of vector and use of antibiotics.
- **329.** Schizophrenia is a group of severe mental disorders that have common symptoms as hallucinations, delusions,



blunted emotions, disordered thinking. It can be caused by excessive dopamine production, alternation of neuropeptide and decreased frontal lobe activities. Recovery is possible with regular use of chloropromazine along with psychosocial therapy.

33. Strategies for Enhancement in Food Production

- **330.** Out of the given statements, (I) and (II) are correct as single cell *Spirulina* can produce large quantities of food rich in protein, minerals, vitamins, etc. And body weight-wise the microorganism *Methylophilus methylotrophus* may be able to produce several times more proteins than cows per day.
- **331.** Out of the given statements, (II) and (III) are correct as organic farming is the form of agriculture that relies on techniques such as crop rotation, green manure, compost and biological pest control to maintain soil productivity and control pest on a farm. Organic farming excludes or strictly limits the use of manufactured chemical fertilisers, pesticides (which include herbicides, insecticides and fungicides), plant growth regulators such as hormones, food additives and genetically modified organisms.
- **332.** Bacterial blight of chickpea is caused by bacterium *Xanthomonas campestris*. The stems and the leaves of infected plant give blighted or burnt up appearance.

Control measures include roguing, 3-year crop rotation, disease-free seeds, spray of copper fungicides (Bordeaux mixture) and antibiotics besides sowing disease resistant varieties.

333. If a pulse crop possesses premature yellowing of leaves and decreases in yield, an application of magnesium and iron to promote synthesis of chlorophyll may become most beneficial to overcome the problem and to obtain maximum seed yield.

Magnesium is an important part of ring structure of chlorophyll molecule and its deficiency causes chlorosis and premature leaf abscission.

In iron deficiency also, the leaves become chlorotic because iron is required for the synthesis of some of the chlorophyll protein complexes in the chloroplast.

334. Top five crops of today are wheat–*Triticum aestivum* (Poaceae),

corn-Zea mays (Poaceae), rice-Oryza sativa (Poaceae), potato-Solanum tuberosum (Solanaceae) and barley-Hordeum vulgare (Poaceae).

- **335.** Haploids are important in crop improvement programme because they produce a pureline and form perfect homozygous.
- **336.** The statement in option (a) is correct. During cloning of a cattle, a fertilised egg is taken out of the mother's womb and in the eight cell stage, cells are separated and cultured until small embryos are formed which are implanted into the womb of other cows.
- **337.** Wild plants have to survive without getting any protection and for this, they evolve various strategies/characters which are exploited by plant breeders like disease resistance.
- **338.** Out of the given options, option (a) is mismatched because pearl is obtained from pearl oyster (*Pinctada vulgaris*) while, honey from *Apis indica*, lac from *Kenia lacca* and silk from *Bombyx mori*.
- **339.** The long term prospects for a truly human civilisation depend on a large measure on control of human disease.

34. Microbes in Human Welfare

- **340.** Option (c) is wrongly matched as, lipase is obtained from *Candida albicans*. Butyric acid is produced by fermentive activity of the bacteria called *Clostridium butylicum*. It does not produce lipase.
- 341. Out of the given statements, option (d) is correct because activated sludge is a process dealing with the treatment of sewage and industrial waste waters. Atmospheric air or pure oxygen is introduced to a mixture of primary treated or screened sewage (or industrial waste water) combined with organisms to develop a biological flock, which reduces the organic content of the sewage. Sediment in settlement tanks of sewage treatment, plant is a rich source of aerobic bacteria because small amounts are used as inoculum in secondary treatment or biological treatment stage of sewage treatment.
- **342.** Option (b) is correct. The correct matches are as follows

Citric acid —	Aspergillus
Cyclosporin—	Trichoderma
Statins —	Monascus
Butyric acid-	Clostridium

- **343.** Insect hormones, i.e. pheromones are third generation pesticides. Pheromones are the chemical substances which when released into an animal's surroundings, influence the behaviour or development of other individuals of the same species. Inorganic substances, oils, plant extracts used as insecticides are called first generation pesticides and synthetic organic compounds as second generation pesticides.
- **344.** The major difficulties in the biological control of insects–pest is that the predator develops a preference to other diets and may itself become a pest. Biological control mainly refers to the introduction of living organisms which destroy other harmful organisms.
- **345.** *Crotalaria juncea* (sunnhemp) and *Alhagi camelorum* are among the plants which are used as green manures in India. These green manures help the soil to become enriched through increase in water holding capacities and fertility.
- **346.** Out of the given statements, option (a) is correct as eutrophication is caused by runoff water from fertilised fields, sub-urban lawns, feed lots and detergent rich sewage. It is the phenomenon of nutrient enrichment of a water body which enhances the growth of water weeds and depletes dissolved oxygen.

35. *Biotechnology* : *Principles and Processes*

- **347.** Genetic engineering is possible because restriction endonuclease purified from bacteria can be used *in vitro*. It is the manipulation of genetic material of an organism using enzyme restriction endonuclease. Nathans and Smith (1970) isolated the first restriction endonuclease. Jackson, Symons and Paul Berg (1972) successfully generated recombinant DNA molecules *in vitro*.
- **348.** The possible reason is that both strains have different cistron because the enzymes required for lysing *E. coli* could not be synthesised by the mutant strain. Two different strains had cistrons for synthesising different enzymes which acted together.
- **349.** Gel electrophoresis is used for the separation of molecules of similar electric charge on the basis of their size. Hence, smaller the DNA fragment size the farther it moves.



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Agarose gel matrix functions as sieve. Smaller DNA fragments easily move and larger fragments take time to move in gel matrix.

350. The DNA fragments separated on an agarose gel can be visualised after staining with ethidium bromide. It is intercalating agent and a fluorescent agent. The stained DNA fragments are seen as bright orange coloured bands under UV-light.

Intercalation is the insertion of molecules between the planar bases of DNA. This process is used as a method for analysing DNA. Intercalation occurs, when ligands of an appropriate size and chemical nature fit themselves in between base pairs of DNA. These ligands are mostly polycyclic, aromatic and planar and therefore often make good nucleic acid stains. Intensively studied DNA intercalator include ethidium bromide, proflavine, etc.

- **351.** Plasmid is a small fragment of DNA (about 10 Kbp size) that is physically separate from and can replicate freely of chromosomal DNA within a cell. It can clone small DNA fragments. Cosmid –45 Kbp
 BAC –300-350 Kbp
 YAC –1 Mbp (1,000 Kbp-2,500 Kbp)
- **352.** The colonies of recombinant bacteria appear white in contrast to blue colonies of non-recombinant bacteria because of insertional inactivation of alpha galactosidase in recombinant bacteria. Alpha galactosidase is a glycoside hydrolase enzyme that hydrolyses the terminal alpha galactosyl moieties from glycolipids and glycoprotein. It is encoded by the GLA gene. β -galactosidase is an exoglycosidic bond formed between a galactose and its organic moiety.
- **353.** PCR and RFLP are methods used for genetic fingerprinting. As Restriction Fragment Length Polymorphism (RFLP) is the basis of genetic (or DNA) fingerprinting and is useful in identifying individuals from their semen, blood or tissues or any other DNA sample and resolution of parenthood disputes.

Polymerase Chain Reaction (PCR) is also useful in genetic fingerprinting as it can amplify the DNA sample even if available in a very small amount.

354. Plasmids are suitable vectors for gene cloning because these are small circular DNA molecules with their own replication origin site. These carry a

(MODULE 3)

signal situated at their replication origin which determines how many copies are to be made and this number can be artificially increased for cloning a given gene.

- **355.** amp^{*R*} and tet^{*R*} are the antibiotic resistance genes. *Ori* represents the site of origin of replication, *rop* represents the proteins that take part in the replication of plasmid. *Hind* III, *Eco* RI are the recognition sites of restriction endonucleases.
- **356.** Polymerase Chain Reaction (PCR) is used to amplify a DNA segment or to synthesise *in vitro* the multiple copies of gene (or DNA) of interest, using two sets of primers and the enzyme DNA polymerase. This enzyme is isolated from a bacterium *Thermus aquaticus* and it remains active during the high temperature but high temperature induced denaturation of double-stranded DNA.
- **357.** Severe Combined Immuno Deficiency (SCID) caused by Adenosine Deaminase Deficiency (ADA) is the first genetic disorder to be treated with gene therapy. T-cell directed gene transfer was useful in the treatment of ADA-SCID, whereas the retroviral-mediated gene transfer to haematopoietic stem cells was insufficient for achievement of clinical benefits.
- **358.** The most common type of aerobic bioreactor in use today is the stirred tank bioreactor, which may feature a specific internal configuration designed to provide a specific circulation pattern. The stirred tank bioreactor have been designed for availability of oxygen throughout the processes.

36. Biotechnology and Its Applications

- **359.** Production of human protein in bacteria by genetic engineering is possible because the genetic code is universal as a codon codes for the same amino acid in all the living organisms.
- **360.** An improved variety of transgenic basmati rice gives high yields and is rich in vitamin-A. It is named golden rice (transgenic basmati rice). It is a variety of *Oryza sativa* produced through genetic engineering to biosynthesise beta-carotene, a precursor of provitamin-A in the edible parts of rice. The research that led to golden rice was conducted with the goal of helping children who suffer from vitamin-A deficiency in poor countries.

Golden rice has been bred to be especially disease-resistant, resulting in better crop yields.

361. Genetic engineering has been successfully used for producing transgenic mice which are being developed for use in testing the safety of vaccines before they are used on humans. Transgenic mice are being used for testing toxicity of drugs. Transgenic animals are made to carry genes, which make them more sensitive to toxic substances than non-transgenic animals.

They are then exposed to the toxic substances and the effects studied. Toxicity testing in such animals will allow us to obtain results in less time.

- **362.** Agrobacterium tumefaciens, a pathogen of several dicot plants is able to deliver a piece of DNA known as *t* DNA to transform normal plant cells into a tumour and direct these tumour cells to produce the chemicals required by the pathogen.
- **363.** Commonly used vector for human genome sequencing are BAC (Bacterial Artificial Chromosome) and YAC. BAC is a DNA construct, based on a functional fertility plasmid (F plasmid) used for transforming and cloning in bacteria (*E. coli*) and YAC are genetically engineered chromosomes derived from the DNA of the yeast (*Saccharomyces cerevisiae*), which is then ligated into a bacterial plasma.

37. Organisms and Population

- 364. The pair given in option (b) is mismatched. Prairies contain tall grasses and shrubs, not the epiphytes.
 - Savanna *Acacia* trees Tundra *—* Permafrost

Coniferous forest — Evergreen trees

- **365.** The statement in option (a) is correct. Keystone species is a species which has much greater influence on community characteristics, relative to their low abundance or biomass removal of these cause serious disruption in functioning of community, e.g. in tropical forests, figs are keystone species.
- **366.** In the given diagrammatic representation of response of organisms to abiotic factors
 - (i) Regulator Some organisms are able to maintain homeostasis by physiological (sometimes behavioural also) means which

ensures constant body temperature, constant osmotic concentration, etc. They are known as regulators.

- (ii) Conformer Most animals and plants cannot maintain a constant internal environment. Their body temperature changes with the ambient temperature. These animals and plants are simply called conformer.
- (iii) Partial regulator During the course of evolution, the costs and benefits of maintaining a constant internal environment are taken into consideration. Some species have evolved the ability to regulate but only over a limited range of environmental conditions, beyond which they simply conform. They are partial regulators.
- **367.** Fragmentation is one of the steps during decomposition, in which detritus is converted into small fragments.

Humification leads to dark coloured amorphous substance called humus that is highly resistant to microbial action and undergoes decomposition at an extremely slow rate.

Catabolism is the set of metabolic pathways that breaks down complex molecules into smaller units to release energy.

Leaching refers to the loss of water soluble plant nutrients from the soil due to the rain and irrigation.

- **368.** Habitat is the place where an organism live. Population has been defined as a collective group of organisms of the same species occupying a particular place at a particular time. In the given table, the area IV has maximum species diversity, as there are 10 species (A-J) reside in 12 habitats, while in area III the 10 species reside in 13 habitats. So, exhibit less diversity than area IV.
- **369.** The pair given in option (b) correctly matched. The adaptation of lizard to its environment. Desert lizards bask in the sun and absorb heat when their body temperature drops below the comfort zone, but move into shade when the ambient temperature starts increasing. Some species are capable of burrowing into the soil to hide and escape from the above ground heat.
- **370.** The correct pair is in option (d), i.e. stream-lined body is an aquatic adaptation which helps these animals in swimming.

- **371.** Gause's principle of competitive exclusion states that no two species can occupy the same niche indefinitely for the same limiting resources.
- **372.** Niche word was used for the first time by Joseph Grinnel (1917). Niche means functional role of an organism in an ecosystem. Competition becomes most severe between the closely related organisms which share same niche.
- **373.** When K = N in a logistics growth curve, it is asymptote.

It means a population growing in a habitat with limited resources show initially a lag phase, followed by phase of acceleration and deceleration and finally an asymptote, i.e. when the population density (N) reaches the carrying capacity (K).



Population growth curve is logistic, when responses are limiting the growth, here, K is carrying capacity and N is population density.

374. In logistic growth model population, growth equation is described as

$$\frac{dN}{dt} = rN\left(\frac{K-N}{K}\right)$$

where, N = Population density at time t r = Intrinsic rate of natural increase K = Carrying capacity κ'

when,
$$\frac{N}{K} = 1$$
 then $\frac{K - N}{K} = 0$
Therefore, $\frac{dN}{dt} = 0$

- **375.** Its population growth curve is J-shaped in which density increases rapidly in exponential fashion and then stops abruptly as environmental resistance or another limiting factor becomes effective more or less suddenly.
- **376.** An age pyramid is a graphic representation of proportion of various age groups of a population with pre-reproductive at the base, reproductive in the middle and post-reproductive at the top. For human population, the age pyramids show age distribution of males and females in a combined diagram. The shape of the age pyramids reflects the growth status of the population. In a declining populations, the shape of pyramid is urn-shaped.

377. Interpretation (a) is correct for the given figures. As '*A*' is more recent and shows slight reduction in the growth rate.

38. Ecosystem

378. Statements II and III are correct. A simple food chain consists of producers, herbivores and carnivores. The length of food chain is generally limited to 3-4 trophic levels due to the energy loss. In grazing food chain, the producers (i.e. plants) are eaten by herbivores (i.e. rabbit, deer, cow, etc.) and the herbivores are eaten by carnivores. Therefore, the removal of most of the carnivores resulted in an increased population of deers.

Rest, statements I and IV are incorrect. There will be a decrease of vegetation when 80% tigers are removed from an area.

- **379.** In the given food web, option (a) is correct as producers utilise the radiant energy of sun which is transformed to chemical form during photosynthesis. Thus, green plants occupy the first trophic level. The herbivores constitute the secondary trophic level and the carnivores the third trophic level. Deer is herbivores, rabbit and rat are also herbivores but frog eats the grasshoppers. Also, deer is been eaten by lion.
- **380.** The given figure shows spindle-shaped pyramid of number in single tree ecosystem. Here, a single large sized tree provides food to a large number of herbivores which support a few carnivores and the later are eaten by small number of top carnivores. So, here PP is used for Primary Producer, i.e. single tree, PC is Primary Consumers, i.e. large number of insects, SC is Secondary Consumers, i.e. small insectivorous birds and TC is Top Consumers which may be eagles or falcon, etc.
- **381.** According to 10% law of Lindemann, if 1 tonne (1000 kg) biomass is present in grass, only 10% of it means 100 kg will go into deer and in tiger the biomass will be only 10 kg, i.e. 10% of deer's biomass.
- **382.** The biogeochemical cycles are of two types
 - (i) Gaseous cycles, in which the reservoir for the nutrient elements is in the atmosphere (air) or hydrosphere (water). The four most abundant elements in the living systems, i.e.





hydrogen, carbon, oxygen and nitrogen have predominantly gaseous cycles.

- (ii) Sedimentary cycles, the reservoir for the nutrient elements is in the sediments of the earth. Elements, such as phosphorus, sulphur, potassium and calcium have sedimentary cycles.
- **383.** *A* Detritus, *B* Rock mineral,
- C Producer, D Litter fall



- **384.** During ecological succession, the gradual and predictable change in species composition occurs in a given area. During this process, some species colonise an area and their populations become more numerous, whereas populations of other species decline and even disappear.
- **385.** The various stages in a hydrosere are well-studied in ponds, pools or lakes. The various stages of hydrosere are
 - (i) Phytoplankton stage, e.g. some blue-green algae, green algae (Volvox), diatoms and bacteria, etc.
 - (ii) Rooted submerged stage, e.g. Hydrilla, Vallisneria, etc.
 - (iii) Floating stage, e.g. Nelumbo, Nymphaea, etc. Some free-floating species are Pistia, Azolla, Lemna, etc.
 - (iv) **Red-swamp stage**, e.g. species of *Scirpus*, *Typha*, etc.
 - (v) **Sedge-meadow stage**, e.g. species of Cyperaceae and Gramineae.
 - (vi) **Woodland stage**, e.g. *Lantana, Salix, Populus*, etc.
 - (vii) Forest stage, e.g. Tropical rainforests, mixed forests of *Almus, Acer, Quercus* (oak), tropical deciduous forests.
- **386.** If the forest cover is reduced to half than it will lead to desertification (formation of desert) of that area in long term.
- **387.** The species that invade a base area in succession is called pioneer species and earthworm is a detritivore. Ecosystem services are the products of ecosystem process,

e.g. biodiversity maintenance, crop pollination, etc., and natality is the term used for population growth or birth rate in population ecology.

39. Biodiversity and Conservation

- **388.** Water hyacinth, *Prosopis cineraria* are exotic species introduced in India. A species of organism that is not native to a locality where it is flourishing and have been moved there from its natural range by humans or other agents is called exotic species.
- **389.** The expanded form of IUCN given in option (c) is correct. IUCN or IUCNNR (International Union for Conservation of Nature and Natural Resources) is now known as WCU (World Conservation Union). Its headquarter is at Gland, Switzerland. It studies the threat to biodiversity in all parts of the world by gathering information about the geographical distribution, population size and population changes of various taxa. It prepares a Red List or Red Data Book categorising different organisms belonging to different categories.
- **390.** Western Ghats occur along the Western coast of India in Maharashtra, Karnataka, Tamil Nadu and Kerala. There is high degree of endemism as well as richness of species of flowering plants, amphibians, reptiles, some mammals and butterflies.
- **391.** Odd combination of animal and its part is given in option (a). Dachigam National Park is situated near Dal Lake in Jammu and Kashmir. It is known for conservation of the most endangered Hangul or Kashmir stag in paramount.
- **392.** The correct combination is given in option (c). Rann of Kutch is situated in Gujarat and provides protection mainly to wild ass, whereas musk deers are mainly protected in Kedarnath sanctuary. Gir is famous for Asiatic lions. Kaziranga is famous for one-horned rhinoceros.
- **393.** Sariska is a wildlife sanctuary and is situated in Alwar, Rajasthan. Tiger is main protected animal in Sariska as it was selected as a Tiger Reserve in Project Tiger (1973). Gir is a National Park, associated with lions.
- **394.** Parthenium hysterophorus (carrot grass) is a threat to biodiversity. It is an alien species introduced inadvertantly for some economic use, turned invasive causing decline or extinction of the indigenous species.

The other options are wrong because

- (a) Aerenchyma is found in aquatic plants (*Vallisneria, Hydrilla*), but *Opuntia* is a xerophytic plant.
- (b) Biome is total sum of all ecosystem present in the planet earth whereas age pyramid is the graphical representation of age of organisms of one population at a specific time.
- (d) Stratification is related with different layers of vegetation in an ecosystem (like forest/grass land) and population is a term referred to a group of same kind of organisms which can freely interbreed.

40. Environmental Issues

- **395.** Scrubber is an electrostatic precipitator in which the dirty air is cleaned by capturing the gas like SO₂ and other oxides in water/lime spray (CaCO₃). The calcium in lime stone combines chemically with the sulphur to produce calcium sulphate (CaSO₄), which is separately collected.
- **396.** Government of India have taken many steps to control air pollution. Out of which one includes compulsory PUC (Pollution Under Control) certification of petrol driven vehicles, which test for carbon monoxide and hydrocarbons emissions of the vehicles.
- **397.** SO₂ and NO₂ are the gases responsible for acid rains. SO₂ mainly comes from burning of coal, fossil fuel in the form of smoke from industries.
- **398.** Reasons given in option (d) are responsible for fish mortality rate in lake. It is because lots of urea and phosphate fertiliser were used in the crops in the vicinity and the area was sprayed with DDT by an aircraft. Inorganic phosphorus and nitrogen are responsible for the growth of algae.

In polluted water, these increase due to which algae increase greatly at the surface of water forming water bloom. Due to the death of these algae their organic matter gets decomposed due to which oxygen gets depleted and aquatic animals die.

- **399.** The ascending order of BOD is Sewage (S) < Distillery Effluent (DE) < Paper Mill Effluent (PE) < Sugar Mill Effluent (SE).
- **400.** The concentration of lead in blood averages about $25 \,\mu\text{g} / 100 \,\text{mL}$. Increase to $70 \,\mu\text{g} / 100 \,\text{mL}$ is generally associated with clinical symptoms. Hence, a level of $30 \,\mu\text{g} / 100 \,\text{mL}$ is considered alarming. The chief sources of Pb to water are the effluents of lead and lead processing industries.