

NEET

SOLVED PAPER 2018

- Oxygen is **not** produced during photosynthesis by
 - Cycas*
 - Nostoc*
 - Green sulphur bacteria
 - Chara*
- Double fertilisation is
 - fusion of two male gametes with one egg
 - fusion of one male gamete with two polar nuclei
 - fusion of two male gametes of pollen tube with two different eggs
 - syngamy and triple fusion
- Which one of the following plants shows a very close relationship with a species of moth, where none of the two can complete its life cycle without the other?
 - Banana
 - Yucca*
 - Hydrilla*
 - Viola*
- Pollen grains can be stored for several years in liquid nitrogen having temperature of
 - -196°C
 - -80°C
 - -120°C
 - -160°C
- Which one of the following elements is responsible for maintaining turgor in cells?
 - Potassium
 - Sodium
 - Magnesium
 - Calcium
- What is the role of NAD^+ in cellular respiration?
 - It is a nucleotide source of ATP synthesis
 - It functions as an electron carrier
 - It functions as an enzyme
 - It is the final electron acceptor for anaerobic respiration
- In which of the following forms is iron absorbed by plants?
 - Free element
 - Ferrous
 - Ferric
 - Both ferric and ferrous
- Which of the following is commonly used as a vector for introducing a DNA fragment in human lymphocytes?
 - λ phage
 - Ti*-plasmid
 - Retrovirus
 - pBR 322
- Use of bioresources by multinational companies and organisations without authorisation from the concerned country and its people is called
 - biodegradation
 - biopiracy
 - bio-infringement
 - bioexploitation
- In India, the organisation responsible for assessing the safety of introducing genetically modified organisms for public use is
 - Research Committee on Genetic Manipulation (RCGM)
 - Council for Scientific and Industrial Research (CSIR)
 - Indian Council of Medical Research (ICMR)
 - Genetic Engineering Appraisal Committee (GEAC)
- The correct order of steps in Polymerase Chain Reaction (PCR) is
 - Denaturation, Extension, Annealing
 - Annealing, Extension, Denaturation
 - Extension, Denaturation, Annealing
 - Denaturation, Annealing, Extension
- Select the **correct** match
 - TH Morgan – Transduction
 - $F_2 \times$ Recessive parent – Dihybrid cross
 - Ribozyme – Nucleic acid
 - G Mendel – Transformation
- A 'new' variety of rice was patented by a foreign company, though such varieties have been present in India for a long time. This is related to
 - Lerma Rojo
 - Sharbati Sonora
 - Co-667
 - Basmati

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- 14.** Which one of the following pairs is **wrongly** matched?
- (a) XO type sex-determination – Grasshopper
(b) ABO blood grouping – Codominance
(c) Starch synthesis in pea – Multiple alleles
(d) TH Morgan – Linkage
- 15.** Select the **correct** statement.
- (a) Spliceosomes take part in translation
(b) Punnett square was developed by a British scientist
(c) Franklin Stahl coined the term 'linkage'
(d) Transduction was discovered by S. Altman.
- 16.** The experimental proof for semiconservative replication of DNA was first shown in a
- (a) plant (b) bacterium
(c) fungus (d) virus
- 17.** Which one of the following flowers only once in its lifetime?
- (a) Mango (b) Jackfruit
(c) Bamboo species (d) Papaya
- 18.** Offsets are produced by
- (a) parthenocarpy (b) mitotic divisions
(c) meiotic divisions (d) parthenogenesis
- 19.** Select the **correct** match.
- (a) Matthew Meselson and F. Stahl : *Pisum sativum*
(b) Alfred Hershey and Martha Chase : TMV
(c) Alec Jeffreys : *Streptococcus pneumoniae*
(d) Francois Jacob and Jacques Monod : *Lac operon*
- 20.** Which of the following has proved helpful in preserving pollen as fossils?
- (a) Oil content (b) Cellulosic intine
(c) Pollenkitt (d) Sporopollenin
- 21.** Natality refers to
- (a) number of individuals leaving the habitat
(b) birth rate
(c) death rate
(d) number of individuals entering a habitat
- 22.** World Ozone Day is celebrated on
- (a) 16th September (b) 21st April
(c) 5th June (d) 22nd April
- 23.** Which of the following is a secondary pollutant?
- (a) SO₂ (b) CO₂
(c) CO (d) O₃
- 24.** Niche is
- (a) the range of temperature that the organism needs to live
(b) the physical space where an organism lives
(c) all the biological factors in the organism's environment
(d) the functional role played by an organism where it lives
- 25.** What type of ecological pyramid would be obtained with the following data?
- Secondary consumer : 120 g
Primary consumer : 60 g
Primary producer : 10 g
- (a) Upright pyramid of numbers
(b) Pyramid of energy
(c) Inverted pyramid of biomass
(d) Upright pyramid of biomass
- 26.** In stratosphere, which one of the following elements acts as a catalyst in degradation of ozone and release of molecular oxygen?
- (a) Fe (b) Cl
(c) Carbon (d) Oxygen
- 27.** Which two functional groups are characteristic of sugars?
- (a) Carbonyl and phosphate
(b) Carbonyl and methyl
(c) Hydroxyl and methyl
(d) Carbonyl and hydroxyl
- 28.** Which among the following is **not** a prokaryote?
- (a) *Nostoc* (b) *Mycobacterium*
(c) *Saccharomyces* (d) *Oscillatoria*
- 29.** The Golgi complex participates in
- (a) respiration in bacteria
(b) formation of secretory vesicles
(c) fatty acid breakdown
(d) activation of amino acid
- 30.** Which of the following is not a product of light reaction of photosynthesis?
- (a) NADPH (b) NADH
(c) ATP (d) Oxygen

31. Which of the following is true for nucleolus?
 (a) It takes part in spindle formation
 (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

32. Stomatal movement is **not** affected by
 (a) O₂ concentration (b) Light
 (c) Temperature (d) CO₂ concentration

33. The stage during which separation of the paired homologous chromosomes begins is
 (a) diakinesis (b) diplotene
 (c) pachytene (d) zygotene

34. Stomata in grass leaf are
 (a) rectangular (b) kidney-shaped
 (c) dumb-bell-shaped (d) barrel-shaped

35. Secondary xylem and phloem in dicot stem are produced by
 (a) phellogen (b) vascular cambium
 (c) apical meristems (d) axillary meristems

36. Pneumatophores occur in
 (a) carnivorous plants
 (b) free-floating hydrophytes
 (c) halophytes
 (d) submerged hydrophytes

37. Casparian strips occur in
 (a) cortex (b) pericycle
 (c) epidermis (d) endodermis

38. Plants having little or no secondary growth are
 (a) conifers
 (b) deciduous angiosperms
 (c) grasses
 (d) cycads

39. Sweet potato is a modified
 (a) tap root (b) adventitious root
 (c) stem (d) rhizome

40. Which one of the following statements is **correct**?
 (a) Horsetails are gymnosperms
 (b) *Selaginella* is heterosporous, while *Salvinia* is homosporous
 (c) Ovules are not enclosed by ovary wall in gymnosperms
 (d) Stems are usually unbranched in both *Cycas* and *Cedrus*.

41. Select the **wrong** statement.
 (a) Pseudopodia are locomotory and feeding structures in sporozoans
 (b) Mushrooms belong to Basidiomycetes
 (c) Cell wall is present in members of Fungi and Plantae
 (d) Mitochondria are the powerhouse of the cell in all kingdoms except Monera

42. After karyogamy followed by meiosis, spores are produced exogenously in
 (a) *Agaricus* (b) *Alternaria*
 (c) *Neurospora* (d) *Saccharomyces*

43. Match the items given in Column I with those in Column II and select the **correct** option given below

Column-I		Column-II	
1. Herbarium	i.	It is a place having a collection of preserved plants and animals.	
2. Key	ii.	A list that enumerates methodically all the species found in an area with brief description aiding identification.	
3. Museum	iii.	It is a place where dried and pressed plant specimens mounted on sheets are kept.	
4. Catalogue	iv.	A booklet containing a list of characters and their alternates which are helpful in identification of various taxa.	

- | | | | | |
|-----|-----|----|-----|----|
| | 1 | 2 | 3 | 4 |
| (a) | ii | iv | iii | i |
| (b) | iii | ii | i | iv |
| (c) | i | iv | iii | ii |
| (d) | iii | iv | i | ii |

44. Winged pollen grains are present in
 (a) mango (b) *Cycas*
 (c) mustard (d) *Pinus*

45. Which one is **wrongly** matched?
 (a) Gemma cups – *Marchantia*
 (b) Biflagellate zoospores – Brown algae
 (c) Uniflagellate gametes – *Polysiphonia*
 (d) Unicellular organism – *Chlorella*

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- 46.** Which one of the following options correctly represents the lung conditions in asthma and emphysema, respectively?
- Increased respiratory surface; Inflammation of bronchioles
 - Increased number of bronchioles; Increased respiratory surface
 - Inflammation of bronchioles; Decreased respiratory surface
 - Decreased respiratory surface; Inflammation of bronchioles

- 47.** Match the items given in Column I with those in Column II and select the **correct** option given below

Column I	Column II
1. Tricuspid valve	i. Between left atrium and left ventricle
2. Bicuspid valve	ii. Between right ventricle and pulmonary artery
3. Semilunar valve	iii. Between right atrium and right ventricle

- | | | | | | |
|---------|----|-----|--------|-----|-----|
| 1 | 2 | 3 | 1 | 2 | 3 |
| (a) i | ii | iii | (b) i | iii | ii |
| (c) iii | i | ii | (d) ii | i | iii |

- 48.** Match the items given in Column I with those in Column II and select the **correct** option given below

Column I	Column II
1. Tidal volume	i. 2500–3000 mL
2. Inspiratory reserve volume	ii. 1100–1200 mL
3. Expiratory reserve volume	iii. 500–550 mL
4. Residual volume	iv. 1000–1100 mL

- | | | | |
|---------|-----|----|-----|
| 1 | 2 | 3 | 4 |
| (a) i | iv | ii | iii |
| (b) iii | i | iv | ii |
| (c) iii | ii | i | iv |
| (d) iv | iii | ii | i |

- 49.** The transparent lens in the human eye is held in its place by
- smooth muscles attached to the iris
 - ligaments attached to the iris
 - ligaments attached to the ciliary body
 - smooth muscles attached to the ciliary body

- 50.** Which of the following is an amino acid derived hormone?

- Estradiol
- Ecdysone
- Epinephrine
- Estriol

- 51.** Which of the following hormones can play a significant role in osteoporosis?

- Estrogen and parathyroid hormone
- Progesterone and aldosterone
- Aldosterone and prolactin
- Parathyroid hormone and prolactin

- 52.** Which of the following structures or regions is **incorrectly** paired with its function?

- Hypothalamus Production of releasing hormones and regulation of temperature, hunger and thirst.
- Limbic system Consists of fibre tracts that interconnect different regions of brain; controls movement.
- Medulla oblongata Controls respiration and cardiovascular reflexes.
- Corpus callosum Band of fibres connecting left and right cerebral hemispheres.

- 53.** The amnion of mammalian embryo is derived from

- mesoderm and trophoblast
- endoderm and mesoderm
- ectoderm and mesoderm
- ectoderm and endoderm

- 54.** Hormones secreted by the placenta to maintain pregnancy are

- hCG, hPL, progesterones, estrogens
- hCG, hPL, estrogens, relaxin, oxytocin
- hCG, hPL, progesterones, prolactin
- hCG, progesterones, estrogens, glucocorticoids

- 55.** The difference between spermiogenesis and spermiation is

- In spermiogenesis, spermatozoa from Sertoli cells are released into the cavity of seminiferous tubules, while in spermiation spermatozoa are formed
- In spermiogenesis, spermatozoa are formed, while in spermiation spermatids are formed
- In spermiogenesis, spermatids are formed, while in spermiation spermatozoa are formed
- In spermiogenesis, spermatozoa are formed, while in spermiation spermatozoa are released from Sertoli cells into the cavity of seminiferous tubules

56. The contraceptive 'SAHELI'
- is an IUD
 - increases the concentration of estrogen and prevents ovulation in females
 - blocks estrogen receptors in the uterus, preventing eggs from getting implanted
 - is a post-coital contraceptive

57. Ciliates differ from all other protozoans in
- using pseudopodia for capturing prey
 - having a contractile vacuole for removing excess water
 - using flagella for locomotion
 - having two types of nuclei

58. Identify the vertebrate group of animals characterised by crop and gizzard in its digestive system.

- Aves
- Reptilia
- Amphibia
- Osteichthyes

59. Which of the following features is used to identify a male cockroach from a female cockroach?

- Forewings with darker tegmina
- Presence of caudal styles
- Presence of a boat-shaped sternum on the 9th abdominal segment
- Presence of anal cerci

60. Which one of these animals is **not** a homeotherm?

- Camelus*
- Chelone*
- Macropus*
- Psittacula*

61. Which one of the following animals does **not** undergo metamorphosis?

- Moth
- Tunicate
- Earthworm
- Starfish

62. Which of the following organisms are known as chief producers in the oceans?

- Cyanobacteria
- Diatoms
- Dinoflagellates
- Euglenoids

63. Which one of the following population interactions is widely used in medical science for the production of antibiotics?

- Parasitism
- Mutualism
- Commensalism
- Amensalism

64. All of the following are included in *ex-situ* conservation except

- botanical gardens
- sacred groves
- wildlife safari parks
- seed banks

65. Match the items given in Column I with those in Column II and select the correct option given below.

Column-I		Column-II	
1. Eutrophication		i. UV-B radiation	
2. Sanitary landfill		ii. Deforestation	
3. Snow blindness		iii. Nutrient enrichment	
4. Jhum cultivation		iv. Waste disposal	

- | | | | | | | | | | |
|-----|-----|----|----|----|-----|---|-----|----|-----|
| | 1 | 2 | 3 | 4 | | 1 | 2 | 3 | 4 |
| (a) | iii | iv | i | ii | (b) | i | iii | iv | ii |
| (c) | ii | i | ii | iv | (d) | i | ii | iv | iii |

66. In a growing population of a country,

- reproductive and pre-reproductive individuals are equal in number
- reproductive individuals are less than the post-reproductive individuals
- pre-reproductive individuals are more than the reproductive individuals
- pre-reproductive individuals are less than the reproductive individuals

67. Which part of poppy plant is used to obtain the drug Smack?

- Roots
- Latex
- Flowers
- Leaves

68. All of the following are parts of an operon except

- an enhancer
- structural genes
- an operator
- a promoter

69. A woman has an X-linked condition on one of her X chromosomes. This chromosome can be inherited by

- only grand children
- only sons
- only daughters
- Both (b) and (c)

70. According to Hugo de Vries, the mechanism of evolution is

- phenotypic variations
- saltation
- multiple step mutations
- minor mutations

71. AGGTATCGCAT is a sequence from the coding strand of a gene. What will be the corresponding sequence of the transcribed mRNA?

- ACCUAUGC GAU
- UGGTUTCGCAT
- AGGUAUCGCAU
- UCCAUAGCGUA

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- 72.** Match the items given in Column I with those in Column II and select the **correct** option given below.

Column-I			Column-II		
1. Proliferative phase			i. Breakdown of endometrial lining		
2. Secretory phase			ii. Follicular phase		
3. Menstruation			iii. Luteal phase		
	1	2	3		1
(a)	ii	iii	i	(b)	i
(c)	iii	ii	i	(d)	iii
					i
					ii

- 73.** Match the items given in Column I with those in Column II and select the **correct** option given below

Column-I				Column-II			
1. Glycosuria				i. Accumulation of uric acid in joints.			
2. Gout				ii. Mass of crystallised salts within the kidney.			
3. Renal calculi				iii. Inflammation in glomeruli			
4. Glomerular nephritis				iv. Presence of glucose in urine.			
	1	2	3	4		1	2
(a)	ii	iii	i	iv	(b)	i	ii
(c)	iii	i	iv	i	(d)	iv	i
						ii	iii
						iii	iv

- 74.** Match the items given in Column I with those in Column II and select the **correct** option given below

Column-I (Function)				Column-II (Part of Excretory System)			
1. Ultrafiltration				i. Henle's loop			
2. Concentration of urine				ii. Ureter			
3. Transport of urine				iii. Urinary bladder			
4. Storage of urine				iv. Malpighian corpuscle			
				v. Proximal convoluted tubule			
	1	2	3	4		1	2
(a)	v	iv	i	ii	(b)	iv	i
(c)	iv	v	ii	iii	(d)	v	iv
						i	ii
						iii	iii

- 75.** Which of the following gastric cells indirectly help in erythropoiesis?

- (a) Goblet cells (b) Mucous cells
(c) Chief cells (d) Parietal cells

- 76.** Match the items given in Column I with those in Column II and select the **correct** option given below

Column-I			Column-II		
1. Fibrinogen			i. Osmotic balance		
2. Globulin			ii. Blood clotting		
3. Albumin			iii. Defence mechanism		
	1	2	3		1
(a)	i	iii	ii	(b)	i
(c)	iii	ii	i	(d)	ii
					iii
					i

- 77.** Which of the following is an occupational respiratory disorder?

- (a) Botulism
(b) Silicosis
(c) Anthracis
(d) Emphysema

- 78.** Calcium is important in skeletal muscle contraction because it

- (a) detaches the myosin head from the actin filament
(b) activates the myosin ATPase by binding to it
(c) binds to troponin to remove the masking of active sites on actin for myosin
(d) prevents the formation of bonds between the myosin cross bridges and the actin filament

- 79.** Nissl bodies are mainly composed of

- (a) nucleic acids and SER
(b) DNA and RNA
(c) proteins and lipids
(d) free ribosomes and RER

- 80.** Which one of these statements is **incorrect**?

- (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

- 81.** Select the **incorrect** match.

- (a) Submetacentric chromosomes – L-shaped chromosomes
(b) Allosomes – Sex chromosomes
(c) Lampbrush chromosomes – Diplotene bivalents
(d) Polytene chromosomes – Oocytes of amphibians

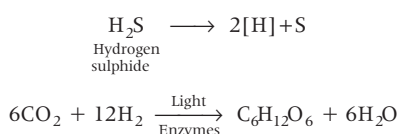
- 82.** Which one of the following terms describe human dentition?
 (a) Pleurodont, Monophyodont, Homodont
 (b) Thecodont, Diphyodont, Heterodont
 (c) Thecodont, Diphyodont, Homodont
 (d) Pleurodont, Diphyodont, Heterodont
- 83.** Which one of the following events does **not** occur in rough endoplasmic reticulum?
 (a) Cleavage of signal peptide
 (b) Protein glycosylation
 (c) Protein folding
 (d) Phospholipid synthesis
- 84.** Many ribosomes may associate with a single mRNA to form multiple copies of a polypeptide simultaneously. Such strings of ribosomes are termed as
 (a) plastidome (b) polyhedral bodies
 (c) polysome (d) nucleosome
- 85.** In which disease does mosquito transmitted pathogen cause chronic inflammation of lymphatic vessels?
 (a) Ringworm disease (b) Ascariasis
 (c) Elephantiasis (d) Amoebiasis
- 86.** Which of the following is **not** an autoimmune disease?
 (a) Alzheimer's disease (b) Rheumatoid arthritis
 (c) Psoriasis (d) Vitiligo
- 87.** Among the following sets of examples for divergent evolution, select the **incorrect** option. :
 (a) Brain of bat, man and cheetah
 (b) Heart of bat, man and cheetah
 (c) Forelimbs of man, bat and cheetah
 (d) Eye of *Octopus*, bat and man
- 88.** Conversion of milk to curd improves its nutritional value by increasing the amount of
 (a) vitamin-B₁₂ (b) vitamin-A
 (c) vitamin-D (d) vitamin-E
- 89.** The similarity of bone structure in the forelimbs of many vertebrates is an example of
 (a) convergent evolution
 (b) analogy
 (c) homology
 (d) adaptive radiation
- 90.** Which of the following characteristics represents 'Inheritance of blood groups' in humans?
 1. Dominance
 2. Codominance
 3. Multiple allele
 4. Incomplete dominance
 5. Polygenic inheritance
 (a) 2, 4 and 5 (b) 1, 2 and 3
 (c) 2, 3 and 5 (d) 1, 3 and 5

Answers

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

Answer with Explanations

1. (c) **Green sulphur bacteria** are anaerobic bacteria. They do not evolve oxygen during photosynthesis. Such type of photosynthesis is known as anoxygenic photosynthesis. They do not use water as a source of reducing power. Instead, hydrogen is obtained from hydrogen sulphide.



Concept Enhancer Green sulphur bacteria, e.g. *Chlorobium limicola*, possesses bacteriopheophytin as photosynthetic pigment.

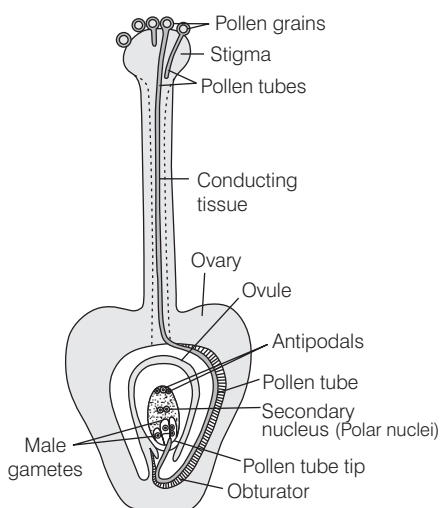
Cycas is a gymnosperm, *Nostoc* is a blue-green algae and *Chara* is a green algae. All of these produce oxygen during photosynthesis.

2. (d) **Double fertilisation** is the fusion of two male gametes to two different cells of the same female gametophyte. It consists of following two events

- Syngamy** Fusion of the egg nucleus with one male gamete is called syngamy.
- Triple fusion** It is the fusion of second male gamete and central cell.

Concept Enhancer Syngamy results in the formation of diploid ($2n$) zygote. Triple fusion involves three nuclei, i.e. one of male gamete and two polar nuclei.

It gives rise to a triploid ($3n$) endosperm.



Fertilisation in an angiosperm through porogamy

3. (b) *Yucca gloriosa* has developed an obligate symbiotic relationship with *Pronuba yuccasella* moth. The moth cannot complete its life cycle with the association of *Yucca* flowers and in turn *Yucca* has no other pollinator.

Hydrilla is a hydrophilous plant while *Viola* is an entomophilous plant. **Bananas** are usually parthenocarpic fruits. Therefore, they do not require pollination.

Concept Enhancer The female moth visits the *Yucca* flowers at night and collects pollen in the form of balls. The moth, then inserts its ovipositor into ovary of the flower to lay eggs. The temperature of the ovary is suitable for hatching of *Pronuba's* eggs and works as an incubator. After that, it climbs to the top of the style and pushes the pollen ball into stylar canal. Thus, pollination occurs. Some seeds are eaten by larvae which escape after piercing the ovary wall.

4. (a) Pollen grains can be stored for several years in liquid nitrogen having a temperature of -196°C . Pollen grains can be later used in plant breeding programmes.

5. (a) Among the given elements, potassium (K^+) is responsible for maintaining turgor pressure in cell because it regulates the proton pumps involved in opening and closing of stomata. Magnesium (Mg^{2+}) is a constituent of chlorophyll pigment which helps in photosynthesis in green plants. Calcium (Ca^{2+}) provides selective permeability to the cell membrane. All of these, i.e. K^+ , Ca^{2+} and Mg^{2+} are essential elements.

Sodium (Na^+) is involved in membrane permeability. It is a non-essential element.

6. (b) NAD^+ functions as an **electron carrier** in cellular respiration. NAD is an oxidising agent which accept electrons and then transfer them to the Electron Transport System (ETS). As a result, 3ATP molecules are formed.
7. (c) According to NCERT, plants absorb iron mostly in the form of **ferric** (Fe^{3+}) ions. However, plants in acidic soil can absorb iron in **ferrous** (Fe^{2+}) as well as **ferric** (Fe^{3+}) form. It is an important constituent of proteins involved in the transfer of electrons like ferredoxin and cytochromes. It is reversibly oxidised from Fe^{2+} to Fe^{3+} during electron transfer. It activates catalase enzyme. It is essential for the formation of chlorophyll.

8. (c) Usually a **retrovirus** is used as a vector for introducing a DNA fragment in human cells. They are used as vector in gene therapy to introduce the desired gene so as to replace the functioning of a defected gene. e.g. Severe Combined Immune Deficiency (SCID) is caused due to defect in the gene for the enzyme adenosine deaminase.

In gene therapy against it, lymphocytes are extracted from the bone marrow of the patient. These are grown in a culture outside the body. A functional ADA cDNA, using a retroviral vector, is then introduced into these lymphocytes. These are re-injected into the patient's bone marrow.

λ -**phage** allows cloning of DNA fragments upto 23 Kb lengths. **Ti-plasmid** is usually used for plants. **pBR-322** is an artificial cloning vector, usually used for bacteria.

9. (b) **Biopiracy** is referred to the use of bioresources by multinational companies and other organisations without proper authorisation from the countries and people concerned without compensatory payment. Bio-infringement is the commission of a prohibited act with respect to a patented invention without permission from the patent holder. Bio-exploitation means taking advantage of biological resources of other country without permission. Biodegradation is biological breakdown of organic material by bacteria, fungi, etc.

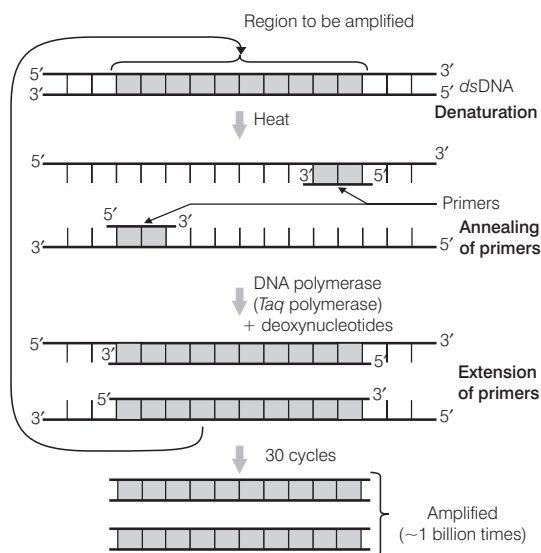
10. (d) In India, **Genetic Engineering Approval Committee**, i.e., **GEAC** (NCERT) is responsible for assessing the safety of introducing genetically modified organisms for public use. GEAC comes under the Ministry of Environment and Forests (MOE & F) while the **Review Committee on Genetic Manipulation** (RCGM) comes under Department of Biotechnology.

The **Council of Scientific and Industrial Research** (CSIR) is the largest research and development organisation in India. **The Indian Council of Medical Research** (ICMR) is the apex body in India for the formulation, coordination and promotion of biomedical research.

The name of GEAC is changed to Genetic Engineering Appraisal Committee from Genetic Engineering Approval Committee in 2010.

11. (d) The Polymerase Chain Reaction (PCR) involves three basic steps; denaturation, annealing and extension. In the **denaturation** step, DNA is heated at high temperature (94°C to 96°C) to separate the two strands. In the next step (**annealing**), the two oligo-nucleotide primers anneal to each single-stranded template DNA.

This step is carried out at a lower temperature (40°C to 60°C). The final step is **extension**, wherein *Taq* DNA polymerase synthesises the DNA region between the primers, using dNTPs (deoxynucleoside triphosphates) and Mg^{2+} ions.



Polymerase Chain Reaction (PCR) : Each cycle has three steps : (i) Denaturation; (ii) Primer annealing; and (iii) Extension of primers

12. (c) **Ribozymes** are RNA molecules having enzymatic activity, i.e. they are capable of catalysing specific biochemical reactions. Hence, they are nucleic acids with enzymatic function. **TH Morgan** is known as the 'Father of Experimental Genetics'. He worked on linkage, crossing over, linkage maps, etc. In **dihybrid cross**, two allelic pairs are used for crossing. **Mendel** is considered as the 'Father of Genetics'. He proposed the laws of inheritance.
13. (d) In 1997, an American company got patent rights on Basmati rice through the US Patent and Trademark office. This 'new' variety of Basmati had actually been derived from Indian farmer's varieties. This 'new' variety was produced by crossing Indian Basmati with semi-dwarf varieties. **Lerma Rojo** and **Sharbati Sonora** are high yielding varieties of wheat. **Co-667** is a variety of soyabean.
14. (c) In the given pairs, option (c) is wrongly matched. Starch synthesis in pea is an example of pleiotropy. A pleiotropic gene is a single gene which produces many or multiple unrelated phenotypes. Rest of the pairs are correctly matched. **Concept Enhancer** The gene for starch synthesis in pea seeds has two alleles B and b. In BB genotype, large starch grains are produced. After

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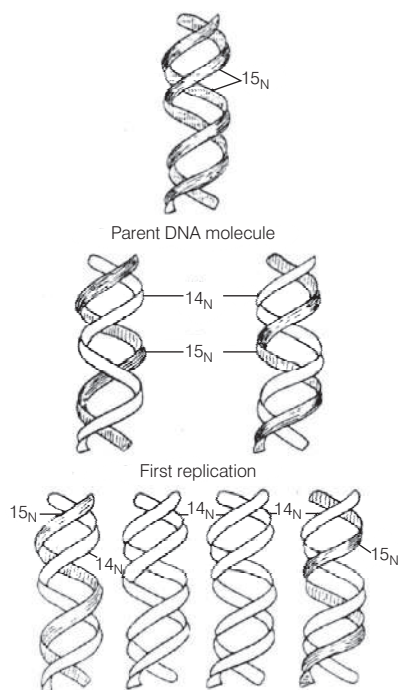
maturation the seeds are round. In bb homozygous condition, smaller starch grains are produced and mature seeds are wrinkled. Bb heterozygotes form round seeds so that B seems to be dominant allele. However, Bb seeds have starch grains of intermediate size, showing incomplete dominance.

15. (b) **Punnett Square** is a checker-board used to show the result of a cross between two organisms. The checker board was devised by a British geneticist, **Reginald Punnett** (1927). It depicts both genotypes and phenotypes of the progeny.

Franklin Stahl with **Matthew Meselson** proved the semi-conservative replication of DNA. **Spliceosome** is formed during post-transcriptional changes in eukaryotes. It is a complex, formed between 5' end (GU) and 3' end (AG) of intron to remove it.

Transduction is a method of sexual reproduction in bacteria. It involves the transfer of foreign genes by means of viruses. It was discovered by **Zinder** and his teacher **Lederberg** (1952) in *Salmonella typhimurium*.

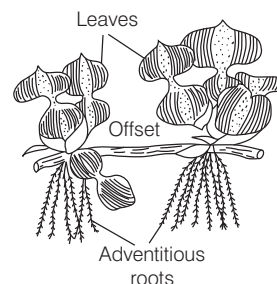
16. (b) The experimental proof for semiconservative replication of DNA was first shown in a bacterium, *Escherichia coli*. It was discovered by Meselson and Stahl (1958).



Interpretation of results of experiment of Meselson and Stahl (1958) to prove semi-conservative replication of DNA

In this mode of replication, one strand of parent DNA is conserved in the progeny while the second is freshly synthesised. Meselson and Stahl proved this by using heavy isotope of Nitrogen (N^{15}).

17. (c) **Bamboo** plants are perennial, monocarpic plants. They flower only once in their lifetime, usually after 50–100 years. They produce large number of fruits and die. **Mango, Jackfruit** and **Papaya** are polycarpic plants, i.e. they flower repeatedly at regular intervals every year.
18. (b) **Offsets** are produced by **mitotic divisions**. They are one internode long runners that occur in some aquatic plants. Breaking of offsets helps in vegetative propagation. They give rise to new plants, e.g. *Eichhornia*. **Meiotic divisions** occur in only germ cells. **Parthenocarpy** is the development of seedless fruits. **Parthenogenesis** can be defined as the development of an egg into a complete individual without fertilisation.

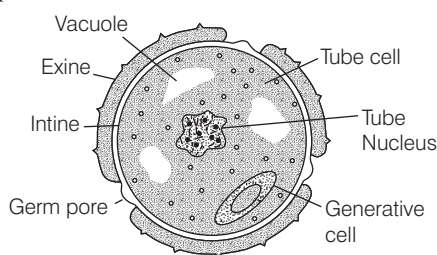


Offset of water hyacinth (*Eichhornia*)

19. (d) **Jacob and Monod** (1916) discovered the **lac operon**. An operon is a part of genetic material or DNA which acts as a single regulated unit. It possesses one or more structural genes, an operator gene, a promoter gene, a regulator gene, a repressor gene and an inducer or corepressor. **Matthew Meselson** and **F Stahl** discovered the semi-conservative mode of DNA replication in *E. coli*. **Alfred Hershey** and **Martha Chase** use T_2 Bacteriophage in their experiments to infect *E. coli* and proved that DNA is the genetic material. **Alec Jeffreys** (1984) invented the DNA fingerprinting technique. This technique determines nucleotide sequences of certain areas of DNA which are unique to each individual.
20. (d) Sporopollenin has proved helpful in preserving pollen as fossils. The covering of pollen grain, sporoderm is consist of two layers, viz., exine and intine. **Exine** is made of a highly resistant fatty substance called **sporopollenin**.

It could not be degraded by any enzyme. It is not affected by high temperature, strong acid or strong alkali. Thus, it keeps the pollen grains well-preserved as fossils.

Pollenkitt is a yellowish, viscous, sticky and oily layer that covers exine of some insect pollinated pollen grains. Intine of pollen grains is made up of pectin and cellulose.



A mature pollen grain of an angiosperm

21. (b) **Natality is birth rate.** It refers to the number of births during a given period in the population that are added to the initial density.

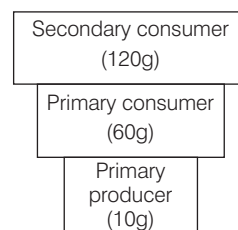
Death rate is termed as mortality. It refers to the number of deaths in the population during a given period. **Immigration** is the number of individuals of the same species that have come into the habitat, on the other hand **emigration** is the number of individuals of the population who left the habitat.

22. (a) 'World Ozone Day' is celebrated on 16th September to control O₃ depletion. Ozone layer is a fragile shield of gas that protects earth from harmful UV-rays.

On 21st April the Civil Service Day and National Yellow Bat Day is celebrated. **5th June** of every year is celebrated as World Environment Day. Earth Day is an annual event, celebrated on **22nd April** of every year.

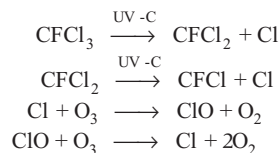
23. (d) **Ozone (O₃)** is a secondary pollutant as it is formed by the reaction amongst the primary pollutants. On the other hand, **SO₂** is a primary pollutant. These pollutants persist in the environment in the form they are passed into it. **CO** is qualitative pollutant. It is considered as pollutant only when its concentration reaches beyond a threshold value in the environment. **CO₂** is a quantitative as well as a primary pollutant.
24. (d) **Niche** is an ecological component of habitat which is delimited by functioning of an organism. A species may live in more than one niche in different stages of its life cycle.

25. (c) An inverted pyramid of biomass will be obtained from the given data. The biomass is continuously decreasing from secondary consumer (120 g) to primary consumer (60 g) to primary producer (10 g). Therefore, upright pyramid of biomass cannot be obtained. The data is given in the form of biomass, therefore pyramid of number and energy cannot be obtained. Further, pyramid of energy is always upright.



Inverted pyramid of biomass

26. (b) In stratosphere, Cl acts as a catalyst in the degradation of ozone and release of molecular oxygen. It is released by action of UV rays on chlorofluorocarbon. Chlorine reacts with ozone in a series of chain reaction, converting it into oxygen. One active chlorine can destroy 5000 molecules of ozone in one month.



Iron (Fe), carbon (C) and oxygen (O) are not Ozone Depleting Substances (ODS).

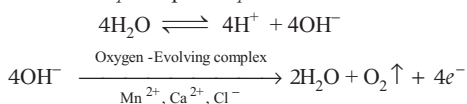
27. (d) **Sugars** are chemically carbohydrates. They are polyhydroxy aldoses, ketoses and their condensation products. Aldoses bear a terminal aldehyde or —CHO group while ketoses have an internal ketone or —CO group. Thus, they possess two functional groups, i.e. carbonyl and hydroxyl.
28. (c) Among the given options, *Saccharomyces* is a fungus, i.e. it is a eukaryote. They possess a well defined nucleus and other cell organelles. *Nostoc* and *Oscillatoria* are cyanobacteria while *Mycobacterium* is a true bacterium. Cyanobacteria and bacteria both are prokaryotes as they lack a well-defined nucleus and other cell organelles.
29. (b) **Golgi complex** participates in the formation of secretory vesicles. It is a cytoplasmic structure found in eukaryotic cells. It is made up of four parts; cisternae, tubules, vesicles and vacuoles.

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The forming face or cisternae receives vesicles from endoplasmic reticulum. Their contents pass through various cisternae with the help of coated vesicles and intercisternal connectives. They ultimately reach the maturing face where they are budded off as, coated secretory or Golgian vesicles or vacuoles.

In **bacteria**, respiration occurs with the help of mesosomes. The **breakdown of fatty acid** occurs in peroxisomes and mitochondria. **Activation of amino acid** is an important step of protein synthesis and it occurs in cytoplasm. In this process, amino acids get attached to *t*RNA molecules.

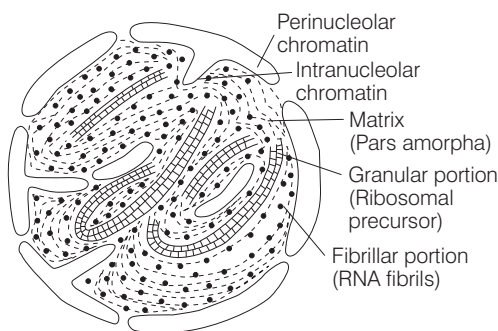
30. (b) During light reaction of photosynthesis NADPH, ATP and oxygen are formed. **Oxygen** is liberated by the photolysis of water.



The electrons released during photolysis of water are picked up by P_{680} photocentre of PS-II. On receiving light energy photocentre expels an electron which passes over a series of carriers. As a result assimilatory power, i.e. **ATP** and **NADPH** is produced. **NADH** is formed during respiration.

31. (d) Nucleolus is a naked, round or slightly irregular structure in nucleus. It lacks a membrane and its contents are in direct contact with the nucleoplasm. It is a site for active **ribosomal RNA (rRNA) synthesis**.

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

32. (a) Stomatal movement is not affected by **O₂ concentration**. Stomata are tiny pore complexes found in the epidermis of leaves and other soft

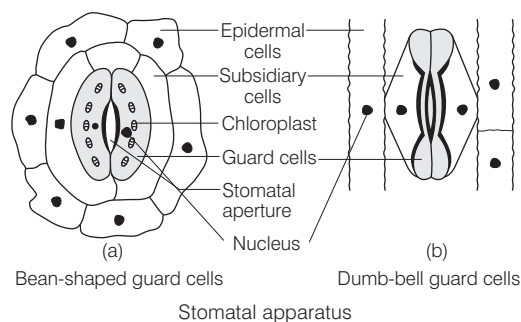
aerial parts. They are meant for the gaseous exchange but are also the main source of transpiration. Stomatal movements are affected by many factors like **light, temperature** and **CO₂ concentration**. In the majority of plants, the stomata are open in light and close in darkness. Normally high temperature above 30°C reduces stomatal opening in many species. Low CO₂ concentration usually induces opening of stomata while high CO₂ concentration closes the same.

33. (b) The separation of the paired homologous chromosomes begins in **diplotene stage**. In this phase, the dissolution of synaptonemal complex begins. The recombined homologous chromosomes of the bivalents separate from each other except at the sites of crossovers.

Zygotene is the second state of prophase I of meiosis. It is associated with the formation of synapsis. Next stage is **pachytene** during which crossing over occurs between non-sister chromatids of the homologous chromosomes. **Diakinesis** is the final stage of meiotic prophase-I. This is marked by terminalisation of chiasmata.

34. (c) Epidermis of all green aerial parts of plants contain minute opening called stomata. It is surrounded by guard cells and neighbouring subsidiary cells collectively termed as stomatal apparatus.

Kidney-shaped or bean-shaped guard cells are present in dicots only, while in monocots like grasses, these cells are dumb-bell shaped. Guard cells differ from rest of the cells in shape, size and thickenings.



35. (b) Secondary vascular tissues, i.e., secondary xylem and phloem are formed by the **vascular cambium**. It is produced by two types of meristems; fascicular or intrafascicular and interfascicular cambium. Intrafascicular cambium is a primary meristem which occurs as strips in vascular bundles.

It divides to form secondary phloem on outer side and secondary xylem on the inner side. Interfascicular cambium arises secondarily from the cells of medullary rays.

Phellogen or **cork cambium** is produced in the outer cortical cells of dicot stems. It is helpful in increasing the girth. **Apical meristems** are present at the tips of stem, root and their branches. They are responsible for increase in length of the plant. **Axillary meristem** is found in axillary buds. These cells are left behind from shoot apical meristem during the formation of leaves and elongation of stems.

36. (c) Pneumatophores are breathing or respiratory roots which are found in **halophytes** like mangroves. Halophytes grow in saline swamps, therefore respiratory roots come out of water and pick up oxygen for respiration. Excess CO₂ is also given out. It occurs through small pores, called lenticles.

Carnivorous plants, free-floating hydrophytes and submerged hydrophytes do not possess pneumatophores.

37. (d) Casparian strips are found in **endodermis** of roots. It is a band of thickening which runs along the radial and tangential walls of endodermal cells. It is made up of suberin and lignin. Casparian strips prevent plasmolysis of endodermal cells.

Cortex is found below epiblema. It is made up of thin-walled parenchymal cells. **Epidermis** is the outermost layer made up of thin-walled flattened and slightly elongated parenchymal cells. **Pericycle** is found below endodermis and it is made of parenchymatous cells.

38. (c) Secondary growth occurs due to the presence of vascular cambium. **Grasses** are monocot and lacks vascular cambium. Therefore, they do not show secondary growth.

Deciduous angiosperms are usually woody dicot plants and show secondary growth. **Conifers** and **cycads** are gymnosperms and usually show anomalous secondary growth.

39. (b) Sweet potato is a **modified adventitious root** which is meant for storage of food. It does not assume a definite shape and occurs singly. **Tap roots** develop from the radicle of the embryo. They gradually become narrow towards the tip. **Stem** is usually the above-ground erect ascending part of the plant body. It bears leaves and flowers. **Rhizome** is modified underground stem, e.g., *Zingiber officinale*.

40. (c) In **gymnosperms**, ovules are not enclosed by ovary wall. Seeds do not occur inside a fruit. They are naked. **Horsetail** is the common name of *Equisetum*. Pteridophytes like *Selaginella* and *Salvinia* are heterosporous and possess two types of spores, i.e. microspores and megaspores. *Cycas* has an unbranched columnar stem while *Cedrus* possess branched stem.

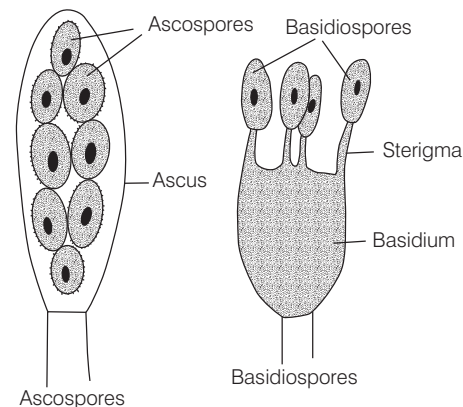
Therefore, only statement (c) is correct.

41. (a) **Sporozoans** are endoparasites. They lack locomotory organelles like cilia, flagella, pseudopodia, etc., e.g. *Plasmodium*. Pseudopodia are found in amoeboid protozoans, e.g., *Amoeba*, *Entamoeba*, etc. Therefore, statement (a) is wrong while rest of the statements are correct.

42. (a) *Agaricus* Meiospores are produced exogenously after karyogamy and meiosis. It belongs to Basidiomycetes.

Alternaria belongs to the Deuteromycetes class of fungi. The fungi of this class lack sexual reproduction. Therefore, sexual spores are not formed.

Neurospora and *Saccharomyces* belong to Ascomycetes class of fungi. They produce ascospores as meiospores. Their ascospores are produced endogenously.



43. (d) **Herbarium** is a place where dried and pressed plant specimens, mounted on sheets are kept systematically. It is a repository or store house for future use. **Key** is a booklet containing list of characters and their alternates which are helpful in identification of various taxa-class, order, family, genus and species.

Museum is an institution where artistic and educational materials are exhibited to the public. The materials available for observation and study are called a collection.

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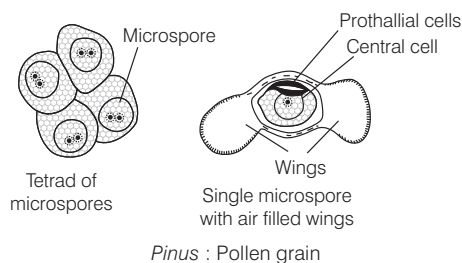
Catalogue is a list or register that enumerates methodically all the species found in a particular place. It often possesses brief description of species that aids in identification.

Therefore, option (d) is correct.

44. (d) Winged pollen grains are present in *Pinus*.

These wings are spirally arranged microsporophylls that arise from the lateral side and help in pollination.

The sperms (pollen grains) of *Cycas* are top-shaped. The pollen grains of **mango** are spheroidal, while that of **mustard** are prolate to subspheroidal.



Concept Enhancer In *Pinus*, the pollination is anemophilus. Pollen remains suspended in the air for a long time due to wings. It appears as yellow dust. This is popularly called as phenomenon of 'sulphur shower'.

45. (c) *Polysiphonia* is a red algae. In its sexual reproduction it is of oogamous type. The male sex organ, spermatangium produces non-flagellate male gametes.

In **Brown algae**, sexual reproduction varies from isogamy, anisogamy to oogamy. In isogamy and anisogamy both the gametes are motile while in oogamy only male gametes are motile. These motile gametes have two unequal laterally attached flagella.

Chlorella is a unicellular organism. It is green algae belonging to class Chlorophyta. In *Marchantia*, gemma cups are found on its dorsal surface. It contains gametes which help in vegetative propagation.

46. (c) **Asthma** is inflammation of bronchioles. Its symptoms include wheezing, coughing and difficulty in breathing mainly during expiration.

Emphysema is an inflation or abnormal distension of the bronchioles or alveolar sacs of the lungs. Many of the septa between the alveoli are destroyed and much of the elastic tissue of the lungs is replaced by connective tissue. As a result alveolar septa collapse and the surface area get greatly reduced.

47. (c) The atrioventricular opening between the left atrium and left ventricle is guarded by the **bicuspid valve**. It is also called as mitral valve. The right atrioventricular opening is guarded by the **tricuspid valve**. It has three flaps.

Semilunar valve is found in right ventricle and pulmonary artery.

Therefore, option (c) is correct.

48. (b) **Tidal Volume (TV)** is the volume of air inspired or expired during normal breath. It is about 500–550 mL.

Inspiratory Reserve Volume (IRV) is the extra amount of air that can be inspired directly after a normal inspiration. It is about 2500–3000 mL.

Expiratory Reserve Volume (ERV) is the extra amount of air that can be expired forcibly after a normal expiration. It is about 1000–1100 mL.

Residual Volume (RV) is the volume of air which remains still in the lung after the most forceful expiration. It is about 1100–1200 mL.

Therefore, option (b) is correct.

49. (c) The lens in the human eye is held in place by the **suspensory ligaments** attached to the ciliary body. The function of other components are as follows

- The smooth muscles attached to the ciliary body helps to control the shape of lens.
- Smooth muscles of iris help in regulating the diameter of pupil.
- Pactinate ligament attached to iris is involved in the drainage of aqueous humor because it contains spaces between the fibres.

50. (c) Among the following, **epinephrine** is an amino acid derived hormone. It is a catecholamine which is produced in the chromaffin cells of adrenal medulla from amino acids tyrosine. On the other hand, estradiol and estrone are steroid hormone that are involved in the regulation of estrous and menstrual cycles.

Ecdysone is also a steroid hormone that controls moulting in insects.

51. (a) **Estrogen and parathyroid hormone** can play significant role in osteoporosis. It is caused due to the deficiency of estrogen and excessive activity of parathormones. Estrogen helps to promote the activity of osteoblast (helps in the formation of bone cells) and inhibits osteoclast (destruct the bones). On the other hand, parathormone promotes the mobilisation of calcium from bones into blood hence causes demineralisation.

The other listed hormones also contribute to osteoporosis but their effects are insignificant or very less. *e.g.*, low level of progesterone and aldosterone causes bone loss whereas raised level of prolactin have been linked with osteoporosis.

52. (b) **Limbic system** consists of four major components namely hippocampus, amygdala, septal nuclei and mammillary bodies. It controls the emotional behaviour, food habits and sex behaviour of an organism. It is not involved in controlling movements.

The rest three options are correctly paired with their functions.

53. (c) Amnion of mammalian embryo is derived from **ectoderm** and **mesoderm**. It is one of the extraembryonic membrane which is formed by the amniogenic cells of ectodermal origin on inner side and somatopleuric extraembryonic mesoderm on outer side. This membrane acts as a shock absorber for the foetus, regulates foetal body temperature and prevents desiccation.

The origin of other extraembryonic membranes is as follows

- **Chorion** Trophoectoderm and mesoderm.
- **Allantois and Yolk sac** Outer mesoderm and inner endoderm.

54. (a) The hormones secreted by the placenta to maintain pregnancy are **hCG, hPL, progestogens** and **estrogens**. Placenta is the intimate connection between the foetus and uterine wall of the mother to exchange the materials. It has endocrine function and secretes the following hormones

- (i) **Human Chorionic Gonadotropins** (hCG) It stimulates and maintains the corpus luteum to secrete progesterone until the end of pregnancy.
- (ii) **Human Placental Lactogen** (hPL) It is also known Human Chorionic Somatomam- motropin (HCS), it stimulates the growth of mammary glands during pregnancy.
- (iii) **Progesterone and estrogen** support foetal growth, maintain pregnancy, inhibit uterine contractions, etc.

On the other hand, the sources of other hormones are as follows

- **Oxytocin** Secreted by posterior lobe of pituitary gland during foetal ejection reflex.
- **Glucocorticoid** Secreted by adrenal gland of foetus to induce foetal ejection reflex.
- **Relaxin** Secreted by corpus luteum to increase flexibility of pubis symphysis.
- **Prolactin** Secreted by anterior lobe of pituitary, helps in the secretion of milk.

55. (d) **Spermiogenesis** is the process of transformation of spermatids (n) into spermatozoa (n) or sperms. It involves the differentiation phase in which one spermatid develops into one spermatozoan.

Spermiation involves the release of sperms from seminiferous tubules through Sertoli cells.

56. (c) The contraceptive 'SAHELI' **blocks estrogen receptors in the uterus** preventing eggs from getting implanted. It is a type of mini pill that contains a monosteroidal preparation centchroman. It is taken once in a week after an initial intake of twice a week dose for 3 months. This non-hormonal preparation contains progestin only and no estrogen. It modulates the estrogen receptors selectively and has high contraceptive value.

57. (d) Ciliates differ from all other protozoans in **having two types of nuclei**.

These two nuclei are usually of different size, *i.e.* one is meganucleus and the other is micronucleus. The former controls metabolism whereas the latter is concerned with reproductions, *e.g. paramecium*.

In other protozoans, like *Amoeba*, single nucleus is present which is involved in metabolism and reproduction.

Other options are incorrect because Ciliates use filtre feeding mechanism for obtaining food.

Like other protozoans, they also possess contractile vacuoles.

Ciliates use cilia for locomotion.

58. (a) Crop and gizzard are found in the digestive tract of **birds** (Aves).

Crop helps in storage and softening of food particles whereas gizzard (muscular stomach) helps in its crushing and churning.

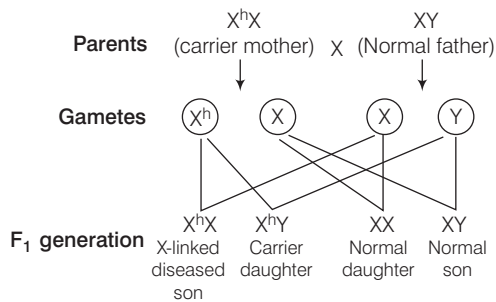
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- 59. (b)** In male cockroach, the 9th sternite bears a pair of small and spine-like unjointed **caudal or anal styles** which are absent in female cockroach. The anal styles are believed to function as motion detector.
Besides this, the other three characters, *i.e.* anal cerci, boat-shaped sternum on 9th abdominal segment and forewings with darker tegmina are found in both male and female cockroaches.
- 60. (b)** Among the given animals *Chelone* is not a homeotherm. It is green sea turtle belonging to class–Reptilia which are ectotherms or cold-blooded and their internal body temperature varies according to the ambient environment.
In contrast, *Camelus* and *Macropus* belonging to class–Mammalia and *Psittacula* belonging to class–Aves are homeotherms. They can maintain constant body temperature irrespective of surrounding temperature.
- 61. (c)** All the given animals except **earthworm** undergoes metamorphosis. Earthworm exhibits direct development where no larval stage is involved.
Metamorphosis is usually seen in animals exhibiting indirect development, involving a larval stage which later transformed into an adult.
Larval form of **moth** is caterpillar and that of **tunicates** is tadpole.
In **starfish**, bipinnaria larva occurs.
- 62. (b)** **Diatoms** are chief producers in the oceans and they contribute 40% of marine primary productivity. They constitute a major group of unicellular eukaryotic microalgae and are among the most common types of phytoplanktons.
The other given organisms also exhibit autotrophic mode of nutrition.
- 63. (d)** **Amensalism** is widely used in medical science for the production of antibiotics.
It involves, the secretion of chemicals called allochemicals by one microbial group to harm other microbes, *e.g.*, *Penicillium* secretes chemicals to inhibit the growth of *Staphylococcus* bacteria. These chemicals can be used in medical science for the production of antibiotics.
On the other hand, no such chemicals are secreted in parasitism, mutualism and commensalism.
- 64. (b)** **Sacred groves** is a mode of *in situ* conservation in which forest fragments of varying size are protected by religious communities. It helps to protect the biota of that area on site.
On the other hand, botanical gardens, seed banks and wildlife safari parks are the examples of *ex situ* conservation in which the biota is protected outside its natural habitat.
- 65. (a)** **Eutrophication** is the nutrient enrichment of water bodies containing excessive population of phytoplanktons.
Sanitary landfill is a method of solid waste disposal in which the waste material is buried in the pits dug on the ground and later they get covered by soil.
Snow blindness is caused due to UV-B radiations exposure. These radiations can reach the earth surface due to the depletion of ozone layer.
In **Jhum cultivation**, land is cultivated temporarily and then abandoned so that, it can revert to its natural vegetation. It is a long term process and usually leads to deforestation.
- 66. (c)** In a growing population, younger population (or pre-reproductive individuals) size is larger than that of reproductive individuals. Such population is represented by a triangular-shaped age pyramid.
Whereas, the equal number of reproductive and pre-reproductive individuals represents a stable population and the age pyramid is bell-shaped.
Less number of pre-reproductive individuals than reproductive individuals represents declining population and age pyramid appears urn-shaped. The similar case is seen when reproductive individuals are less than the post-reproductive individuals.
- 67. (b)** The latex of poppy plant *Papaver somniferum* is used to obtain 'Smack'. It is a white crystalline, odourless, bitter compound. It acts as a depressant and slows down the body functions.
- 68. (a)** Except **enhancer**, all the given components are parts of an operon. Enhancer sequences are present in eukaryotes that, when bound by specific proteins or transcription factors, enhance the transcription of an associated gene.
On the other hand, operon is a regulatory unit of DNA containing a cluster of genes in prokaryotes.

The **promoter** of operon is the site where RNA polymerase binds. The **operator** acts as on-off switch to control transcription. The **structural genes** code for enzymes involved in metabolic pathway.

69. (d) In the given problem, woman is the carrier of X-linked condition and she can transmit the carrier allele to both **her son** and **daughter**. The resulting son will become diseased because X-linked disorder always affect males due to the presence of single X-chromosome.

The daughter offspring will become carrier but not diseased because females are affected by X-linked disorder in homozygous recessive condition, i.e. two recessive alleles are required.



Hence, 50% son are diseased and 50% are normal. Similarly, 50% daughter are carrier and 50% are normal.

70. (b) According to Hugo de Vries, the mechanism of evolution is **saltation**. Hugo de Vries (1901) proposed mutation theory of evolution and stated that evolution is a jerky process in which new species are evolved due to discontinuous sudden variations or saltation. These are the single step large mutations occurring in population.
71. (c) Coding strand is the one that codes for *mRNA*. It has same nucleotide sequence as that of *mRNA* except thymine (T) is replaced by uracil (U) in *mRNA*. Hence, the corresponding sequence of transcribed *mRNA* by template or non-coding strand (complementary to RNA) is AGGUAUCGAU.
72. (a) During **proliferative phase**, the follicles start growing in size under the influence of Follicle stimulating Hormone (FSH). Hence, this phase is also called follicular phase.

During **secretory phase**, corpus luteum secretes progesterone that helps to thicken the endometrial lining. Due to the persistence of corpus luteum, this phase is also called luteal phase.

Menstruation or bleeding occurs due to the breakdown of endometrial lining in the absence of pregnancy. During this phase, corpus luteum regresses and progesterone level decreases.

73. (d) Increased level of glucose in blood which may be caused due to untreated diabetes mellitus results in **glycosuria**. In this condition, glucose is present in the urine.

Gout is a form of arthritis characterised by severe pain and tenderness in joints. It is caused due to the accumulation of uric acid crystals in joints.

Renal calculi or **kidney stones** are small masses of crystalline salts within the kidneys. These stones can be of calcium, uric acid, struvite (magnesium ammonium phosphate), etc.

Glomerular nephritis is the inflammation of filtering unit, i.e. glomerulus of kidney. It is also known as **Bright's disease**. It may cause haematuria (blood in urine) and proteinuria (proteins in blood).

74. (b) **Ultrafiltration** or **Glomerular filtration** is carried out in the glomerular capillaries found in Malpighian corpuscle. This process is carried out under high pressure.

Henle's loop continuously absorbs the water from glomerular filtrate, because of the hyperosmolarity created by counter-current mechanism. This helps in the **concentration of urine** and hence, it becomes hypertonic.

Ureter are narrow, tubular structures that convey or **transport urine** from kidney to urinary bladder.

Urinary bladder is pear-shaped, muscular, sac-like structure that temporarily **stores urine**.

75. (d) **Parietal cells** (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.

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The functions of other cells are as follows

- Mucous or Goblet cells secrete mucus that lines the stomach and protects it from the acid present in stomach.
 - Chief cells secrete gastric digestive enzymes as proenzymes or zymogens.
- 76. (d) Fibrinogen** is a soluble plasma protein that is stimulated by thrombin and gets converted into insoluble form fibrin. The latter helps in the formation of blood clot to seal the wound and stop bleeding.
- 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.
- 77. (b) Silicosis** is an occupational respiratory disorder which is caused due to excessive inhalation of silica dust. It usually affects the workers of grinding or stone breaking industries. The long-term exposure can cause lung fibrosis (or stiffening), leading to breathing difficulties.
- Anthraxis** or **Anthrax** is a bacterial infection caused by *Bacillus anthracis*.
- Botulism** is food poisoning infection caused by *Clostridium botulinum*. Its symptoms include diarrhoea, vomiting, abdominal distention, etc.
- Emphysema** is a lung disease, that damages the air sacs and causes shortness of breathe. It may be caused by smoking, deficiency of enzymes alpha-1-antitrypsin and air pollution.
- 78. (c)** Calcium plays a key regulatory role in muscle contraction. Ca^{2+} ions bind to troponin and changes its shape and position. This in turn, alter the shape and position of tropomyosin and hence, the active sites on F-actin are exposed. Due to this, myosin cross-bridges are able to bind to these active sites and muscle contraction occurs.
- 79. (d)** Nissl granules are found in the cell-body of neurons. These granules are composed of **Rough Endoplasmic Reticulum** (RER) that bears free ribosomes. The latter acts as the site of protein synthesis. These granules were named after its discoverer **Franz Nissl**.
- 80. (d)** Oxidative phosphorylation is the process of ATP formation due to the transfer of electrons from NADH or FADH_2 to oxygen molecule (O_2) by a series of electron carriers. This process occurs in the **inner mitochondrial membrane** because of its less permeability, presence of ETC proteins and ATP synthase.
- The rest three statements are correct.
- 81. (d) Polytene chromosomes** are giant chromosomes that are quite common in the salivary glands of insects therefore they are popularly called as salivary chromosomes.
- The **Lampbrush chromosomes** are highly elongated special kind of synapsed mid-prophase or diplotene chromosome that are bivalents. **Sex chromosomes** are also called as allosomes. They determine the sex of an organism.
- Submetacentric chromosomes** have a submedian centromere. They appear L-shaped during metaphase.
- Therefore, except option (d), all are correctly matched.
- 82. (b)** The terms, **thecodont**, **diphyodont** and **heterodont** describe human dentition. In men, two types of teeth are found, milk or deciduous teeth and permanent teeth. Thus, they have **diphyodont teeth**. The teeth are **thecodont**, i.e. they remain embedded in the sockets of the jaw bones. Men have four types of teeth; incisors, canine, premolars and molars, i.e., **heterodont teeth**.
- 83. (d) Phospholipid synthesis** does not occur in RER. It occurs inside Smooth Endoplasmic Reticulum (SER). A **signal peptide** is a short peptide present at the N-terminus of the newly synthesised proteins. It targets them to the ER and is then cleaved off. RER synthesises **proteins**. It bears enzymes for modifying polypeptides synthesised by attached ribosomes, e.g. **glycosylation**.
- 84. (c) Polysome** is a string of ribosomes associated with a single mRNA. Polysome helps to produce a number of copies of the same polypeptide.
- Nucleosome** is the unit of eukaryotic DNA that consists of a DNA segment wrapped around a core of eight histone proteins. Nucleosome chain gives a 'beads on string' appearance under electron microscope. **Plastidome** refer to all the plastids of a cell which work as a functional unit.

Polyhedral bodies or carboxysomes are present in several groups of autotrophic bacteria that assimilate inorganic carbon *via* Calvin cycle, e.g. Cyanobacteria.

85. (c) **Elephantiasis** is a helminthic disease caused by *Wuchereria bancrofti*. The infestation is transmitted by female *Culex* mosquitoes from one individual to the others. The worms live in the lymphatic system.

Ascariasis is caused by *Ascaris lumbricoides*. It is an endoparasite of the small intestine of human beings.

Amoebiasis is caused by *Entamoeba histolytica*. It lives in the large intestine of humans. **Ringworm** is a fungal skin disease.

86. (a) **Alzheimer's disease** is not an autoimmune disease. It is caused due to the destruction of vast number of neurons in the *Hippocampus*. It occurs due to a combination of genetic factors, environmental or lifestyle factors and the ageing process.

There is loss of neurotransmitter acetylcholine. Individuals with this disease have trouble remembering recent events.

Rheumatoid arthritis, vitiligo and psoriasis all are autoimmune diseases. In **rheumatoid arthritis**, antibodies are produced against the synovial membrane and cartilage. **Vitiligo causes** white patches on skin while **psoriasis** causes itch-skin.

87. (d) **Divergent evolution** results in homologous structures. These organs have the same fundamental structure but are different in functions. Structural homology is seen in brain, heart and forelimbs of man, bat and cheetah.

Eyes of Octopus, bat and man are examples of analogous organs which show **convergent evolution**. Therefore, option (d) is incorrect.

88. (a) Conversion of milk to curd improves its nutritional value by increasing the amount of **vitamin-B₁₂**.

Vitamin-A is found in milk, carrot, tomato, etc. Skin can synthesise **vitamin-D** in the presence of sunlight. **Vitamin-E** is found in wheat, green leafy vegetables, etc.

89. (c) The similarity of bone structure in the forelimbs of many vertebrates is an example of **homology**. The homologous organs have the same fundamental structure but are adapted to perform different functions, e.g. forelimbs of man, cheetah, whale and bat.

Analogous organs show **convergent evolution**. These organs have similar functions but are different in their structural details and origin. Development of different functional structures from a common ancestral form is called **adaptive radiation**.

90. (b) **Dominance, codominance and multiple alleles** are the characteristics that represent 'inheritance of blood groups' in humans. ABO blood groups are determined by the gene I. There are **multi ple** (three) **alleles**; I^A , I^B and I^O of this gene. Allele I^A and I^B are **dominant** over I^O . However, when I^A and I^B alleles are present together, they show **codominance**. Therefore, option (b) is correct.