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NEET UG 2024

Mazin Mansoor

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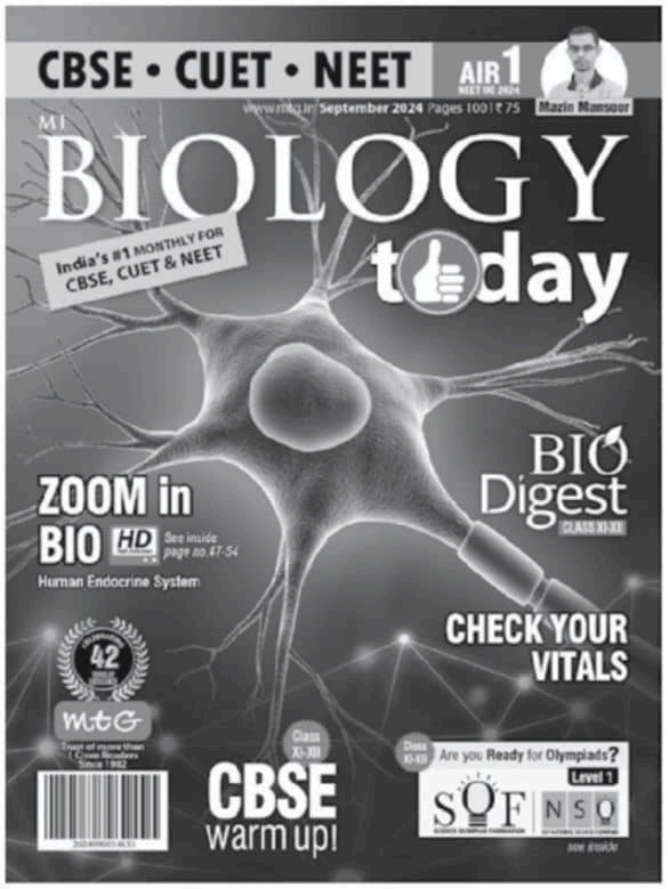

MT BIOLOGY today

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Editor : Anil Ahlawat

Contents

AIR 1

720/720

MAZIN MANSOOR

NEET Topper talks to you...

Our Interview with one of the NEET toppers, Mazin Mansoor will give you an insight how constant efforts can help to achieve extraordinary milestones and follow your dream. He is an inspiration to millions of other students. MTG wishes success to other aspirants for coming years ahead.

- **MTG : Can you please introduce yourself and tell us a bit about your background?**
  Mazin : I am from Bihar, Darbhanga. I live with my parents and 2 brothers.
- **MTG : What inspired you and how did you begin your preparation journey for NEET?**
  Mazin : Since class 9th, I started my preparation for NEET. In Class 11th, I came to Kota and joined Allen.
- **MTG : What exams have you appeared for and what status/rank you achieved in them? Any other Achievements?**
  Mazin : I have appeared for JEE Mains and secured 98.04 percentile.
- **MTG : Can you share your daily study routine during your preparation?**
  Mazin : I used to make list of topics which I had to complete on daily basis. I always ensured to complete particular syllabus, no matter what time it used to take.
- **MTG : Did you use MTG books during your preparation? Which MTG books contributed to your preparation for NEET?**
  Mazin : Yes, MTG books helped me a lot. I used to practice Previous years' questions from 34 years NEET. Objective NCERT at Your Fingertips also helped a lot as it has all NCERT based questions along with conceptual questions.

> *"I have used MTG books. I used to practice Previous years' questions from 34 years NEET. NCERT fingertips also helped a lot as it has all NCERT based questions. MCQs given in the NCERT Fingertips gave me a fair idea of what to expect in the exam."*

- **MTG : How important was practice in your preparation?**
  Mazin : Practice on daily basis is very important. Nothing should be left for last minute.
- **MTG : On which topics and chapters, you laid more stress in each subject?**
  Mazin : In physics, I laid more emphasis on optics and electrostatics. In chemistry, inorganic chemistry needs to be done on daily basis from beginning. Biology requires overall revision.
- **MTG : What was your revision strategy?**
  Mazin : I used to revise each topic again and again. Continuous practice helps in better understanding of concepts.
- **MTG : Did you use any mock tests or previous year papers from MTG? If so, how did they help you?**
  Mazin : I used to practice previous years' questions from MTG 34 years NEET.
- **MTG : How did you manage your time during the actual NEET exam?**
  Mazin : In my NEET exam, I solved chemistry first, then biology and finally physics. I solved paper in different rounds. In round 1, I attempted around 170 questions. Then in round 2, I did 10 questions. Finally, I filled OMR sheet and also rechecked my answers.

- **MTG : What role did your parents, teachers and mentors play in your preparation journey?**

  Mazin : My parents have major role in my success. My father is a doctor and has always been my role model. My mother is a homemaker and has always been very supportive. My teachers were also of great help as they were always there to solve all my doubts and queries.

- **MTG : What advice would you give to future NEET aspirants?**

  Mazin : Future NEET aspirants should maintain a revision notebook to avoid silly mistakes. NCERT books should be thoroughly revised especially biology.

- **MTG : What do you have to say about the quality of questions provided in MTG books?**

  Mazin : In MTG books, practice of chapterwise and topicwise questions help a lot in revision. In addition, few questions beyond NCERT also helped to solve conceptual question in NEET exam. Assertion-Reason and diagram based questions are of great help in NEET exam.

- **MTG : Would you like to recommend MTG books to the students who are in foundation classes and why?**

  Mazin : Foundation series starting from class 6 is highly recommended for all students as it helps in building strong concepts from beginning.

- **MTG : Had you not been selected then what would have been your future plans?**

  Mazin : It was always very clear that I want to be doctor only. If not selected this year, I would have dropped and started preparing again.

☺☺

Two of 17 NEET toppers from Delhi, 4 from Rajasthan

4 girls among 17 NEET-UG toppers

A change of mere five marks has brought cheer for many and caused heartbreak for others as there are candidates who have moved up or down by 8,000 ranks in NEET-UG for medical school admissions.

17 candidates with perfect 720 marks were declared toppers, against 61 when NTA released the merit list following SC's order.

Leading the 17 toppers with a perfect score of 720 is Delhi's Mridul Manya Anand, followed by UP's Ayush Naugraiya from EWS category. With multiple candidates getting perfect scores, NTA uses a tiebreaker system to rank them.

4 FEMALE TOPPERS

- **17** get perfect 720, **6** score 716, **77** candidates get 715
- 4 women in top 17, **22% females in top 100**
- Among 17 toppers, **3 from Maha**, 2 from UP, one each from Kerala, Chandigarh, TN, Bihar, Punjab & Bengal

While there was another Delhi candidate who scored 720, Rajasthan had four toppers, the highest.

There was also a huge sigh of relief from other examinees for whom there was a marginal difference in ranks. Along with the decrease in the number of toppers, in the revised results, the qualifying cutoffs and number of qualified candidates have also come down. The revised results were declared following a directive from Supreme Court after considering marks of a physics question, as there were two correct answers to a question.

Apart from 17 with the perfect 720, there were six who scored 716, and 77 with 715 marks, which forms the cohort of top 100 candidates. The revision of results also brought down the qualifying cutoffs — for the unreserved and economically weaker section the new cutoff range is 720-162, down from 164,while for OBC/SC/ST it is 161-127. With four girls scoring 720, the share of female toppers went up from 16% to 23%, and there were 22 among the top 100.

Forty-four of the 67 candidates who were earlier declared toppers had scored full marks because of the marks awarded for that particular physics question. The number of toppers was later reduced to 61 with NTA withdrawing grace marks awarded to six candidates to make up for loss of time at a few exam centres.

The total number of qualified candidates dropped by 415 to 13,15,853. There are 15 states and UTs which registered an increase in the number of qualified candidates, including Goa, Gujarat, Kerala, Uttarakhand and West Bengal. Category-wise, the number of qualifiers decreased for unreserved, EWS and OBC, while it increased for SC and ST.

NEET-UG is conducted by NTA for admissions to MBBS, BDS, Ayush and other related courses in govt and private institutions.

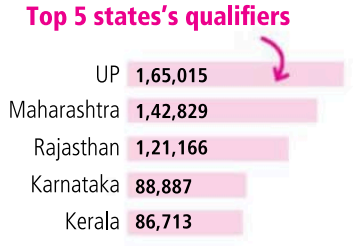
UP TOPS NEET-UG LIST

Candidates registered | 24,06,079

State-wise toppers

Rajasthan	4
Maharashtra	3
UP & Delhi	2
Kerala	1
Chandigarh	1
Tamil Nadu	1
Bihar	1
Punjab	1
West Bengal	1

Top 5 states's qualifiers



Unique Career in Demand

Explore the available Unique Career Options!

B.Sc. in Radiology and Imaging Technology

B.Sc. in Radiology and Imaging Technology is an undergraduate program of 3-year duration and 6 months of compulsory internship or in some universities it is of 4-year duration, divided into 3 years of academics and 1 year of internship. This program meticulously structured to impart in-depth advance knowledge of radiology and imaging methodologies and principles where students learn about various imaging modalities such as X-ray, MRI (Magnetic Resonance Imaging), CT (Computed Tomography), ultrasound, and nuclear medicine. They also delve into radiation safety and protection, patient positioning, image interpretation, and the use of imaging technology in diagnosing medical conditions. The course broadly emphasises the following key-areas human anatomy and physiology, radiation physics, pathology, radiodiagnosis, specialised diagnostic techniques, radiological technology and radiotherapy.

Eligibility

The eligibility criteria to get admission in this course are as follows:

- Candidate should have passed 10 + 2 from a recognised board of education with minimum of 50% aggregate in science stream (PCB/PCM/ PCBM) and english as one of the subject.

Or

- Candidate should have two years of diploma in Radiology and Imaging Technology after completing 10 + 2 or equivalent with minimum aggregate of 50% marks in physics, chemistry and biology.
- The lower age limit for candidates to be eligible for the course is 17 years at the time of admission.

Selection Criteria

- The admission criteria for B.Sc. Radiology and Imaging Technology varies from college to college. Most colleges accept admission directly on the basis of merit. However, some colleges conduct entrance exams. Candidates need to clear these exams to get admission in top colleges.
- Entrance exams conducted by various universities across India includes NPAT, CUET, CUCET and SET.

Job Perspectives

- B.Sc Radiology and Imaging Technology course offers a wide range of opportunities in the field of medicine. After completing the course, graduates have numerous career options in hospitals, clinics, and healthcare centres.
- Graduates can also opt for higher studies such as M.S., or PhD in relevant disciplines or choose the specialisation of their choices such as diagnostic radiology, cardiovascular radiology, radiation oncology, and pediatrics radiology.
- In various government and private sectors, the top job profiles include radiographers, imaging research manager, radiology technicians, area sales manager, medical advisor, marketing executive, medical image analysts, radiologists in hospitals, labs, and other institutions in the healthcare sector.
- Top recruiters that hire B.Sc Radiology and Imaging Technology graduates are AIIMS, Medanta, Fortis Hospital, Manipal Hospital, Columbia Asia, Apollo Hospitals, etc.

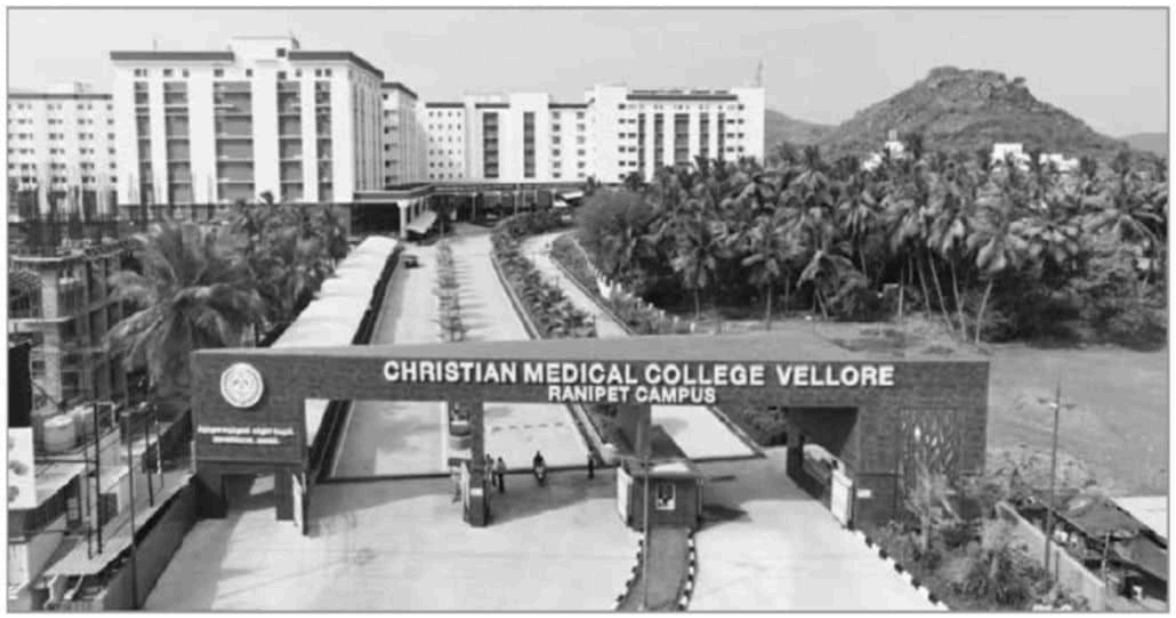
Best Colleges offering B.Sc. Radiology and Imaging Technology

S.No.	Name of the University/College	City/State
I.	**Christian Medical College**	**Vellore, Tamil Nadu**
II.	PGIMER	Chandigarh
III.	Mangalayatan University	Aligarh, Uttar Pradesh
IV.	JIPMER	Puducherry
V.	Amrita Vishwa Vidyapeetham	Faridabad, Haryana
VI.	CT University	Ludhiana, Punjab
VII.	Om Sai Paramedical School	Ambala, Haryana
VIII.	SGT University	Gurugram, Haryana

College Info

Christian Medical College, Vellore (Tamil Nadu)

Christian Medical College is established and maintained by the Christian Medical College Vellore Association, a registered society, formed by over 50 different Indian Christian churches and Christian organisations which run over 225 hospitals, health centres and dispensaries throughout India. The college has been ranked 3rd by NIRF in 2023. Under allied health sciences, the institution currently runs 20-degree courses, 10 diploma courses, 13 PG diploma courses, 3 fellowship courses and Masters in physiotherapy, hospital administration, clinical nutrition, nuclear medicine technology and bioethics.



Bachelor of Science in Radiology and Imaging Technology course is offered by the department of Radiology, under the auspices of The Tamil Nadu Dr. MGR Medical University. All modalities in Radiology are covered in a schedule over 3 years, with assessments every year. Classes are taken by dedicated teachers according to a schedule (radiographers, radiologists, physicists, sometimes doctors of other specialties). The department currently has 135 doctors and 184 radiographers. A common anatomy, physiology and ethics theory classes are held along with other paramedical students. During internship, students are encouraged to perform investigations under supervision.

Selection criteria

Candidates should have passed the higher secondary certificate examination (academic) conducted by the Tamil Nadu State Board or any other equivalent examination with the following subjects: english, physics, chemistry and biology (botany and zoology). Candidates should have completed the age of 17 years at the time of admission or should complete the said age on or before 31st December of the said year. Selection of candidates is based on merit.

Class XI

BIO

Digest

This article covers high yield facts of the given topic.

Structural Organistion in Animals

TISSUE

- In a complex multicellular organism, all functions like digestion, respiration, reproduction, etc., are carried out by different group of cells arranged in a well organised manner. Such a group of similar cells along with intercellular substances having similar origin and performing a specific function, constitute **tissue**.

EPITHELIAL TISSUE

- An epithelium or epithelial tissue is composed of one or more layers of cells covering the external and internal surfaces of various body parts. Epithelial tissue also forms glands.
- The epithelium lines the organs of the body cavity as well as ducts and passageways. The cells are compactly packed with little intercellular matrix.

Types of Epithelial Tissue

Simple

- Composed of a single layer of cells
- Functions as a lining for body cavities, ducts and tubes

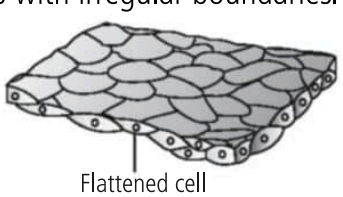
Compound

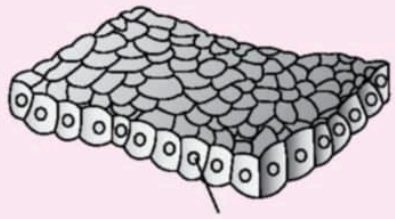
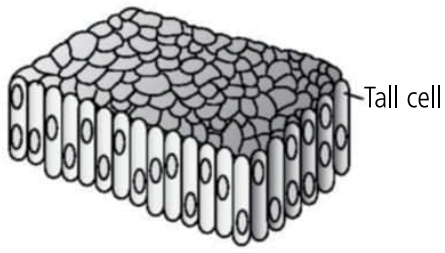
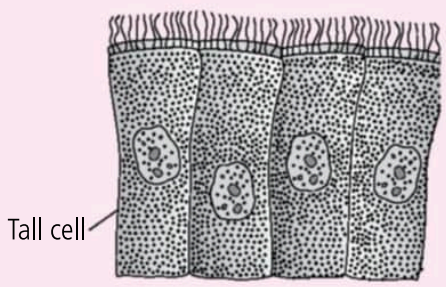
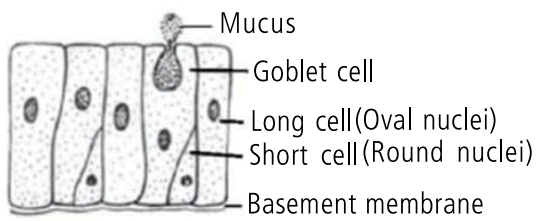
- Consists of two or more cell layers
- Protective in function

Simple epithelium

- On the basis of structural modification of the cells, simple epithelium is divided into different types.

Table : Structure, location and function of different types of simple epithelium

	Structure	Location	Main Function
(i)	**Simple squamous epithelium (pavement epithelium)** is composed of a single thin layer of flattened cells with irregular boundaries.  Flattened cell	It is present in the terminal bronchioles and alveoli of the lungs, wall of the Bowman's capsules and descending limbs of loop of Henle, blood vessels, lymph vessels, heart, coelomic cavities, and rete testis. It forms diffusion boundary.	Protection, excretion, gaseous exchange and secretion of coelomic fluid.

(ii)	**Simple cuboidal epithelium** is composed of a single layer of cube-like cells with round nuclei located in the centre of the cell. The cells of cuboidal epithelium often form microvilli on their free surface. This gives a brush-like appearance to their free border and hence called **brush bordered cuboidal epithelium**. Microvilli increase absorptive surface area.  Cube-like cell	It is present in the small salivary and pancreatic ducts, thyroid follicles, parts of membranous labyrinth, proximal and distal convoluted tubules of the nephrons of the kidneys, ovaries, seminiferous tubules of testes, ciliary bodies, choroid and iris of eyes.	Secretion and absorption.
(iii)	**Simple columnar epithelium** is made of tall and slender cells with their nuclei at the base. Certain cells of simple columnar epithelium contain mucus secreting **goblet cells.** The epithelium containing mucus cells, alongwith the under lying connective tissue is called **mucosa** or **mucous membrane**. In intestine this layer has microvilli and is called brush bordered columnar epithelium.  Tall cell	It lines the stomach, intestine, gall bladder and bile duct. It also forms the gastric glands, intestinal glands and pancreatic lobules (present in the pancreas) where it has secretory role and is called **glandular epithelium**.	Secretion, protection and absorption.
(iv)	**Simple ciliated epithelium** cells bear numerous delicate hair like outgrowths, the **cilia** on their free surface. It is of two types; ciliated columnar epithelium (columnar cells) and ciliated cuboidal epithelium (cuboidal cells).  Tall cell	**Ciliated columnar epithelium** lines the bronchioles, fallopian tubes (oviducts), ventricles of the brain and the central canal of the spinal cord, tympanic cavity of middle ear and auditory tube (Eustachian tube). **Ciliated cuboidal epithelium** occurs in certain parts of urinary tubules of the kidney.	It provides protection as well as movement of mucus, urine, eggs and cerebrospinal fluid in a particular direction.
(v)	**Pseudostratified epithelium** is composed of single layer of cells but the nuclei lie at different levels in different cells, thus it appears multilayered. Hence, it is called pseudostratified epithelium. It is of two types; pseudostratified columnar epithelium and pseudostratified columnar ciliated epithelium.  Mucus Goblet cell Long cell (Oval nuclei) Short cell (Round nuclei) Basement membrane	**Pseudostratified columnar epithelium** lines the large ducts of parotid salivary glands, urethra of the human male and olfactory mucosa. **Pseudostratified columnar ciliated epithelium** lines the trachea and large bronchi.	It provides protection, movement of secretions from glands, urine and semen in the male urethra and mucus loaded with dust particles and bacteria from the trachea towards the larynx.

Compound Epithelium

- Compound epithelium is made of more than one layer (multi-layered) of cells. It covers the dry surface of the skin, the moist surface of buccal cavity, pharynx, inner lining of ducts of salivary glands and of pancreatic ducts. Its main function is to provide protection against chemical and mechanical stresses and has limited role in secretion and absorption. These are of two types: transitional and stratified epithelium.

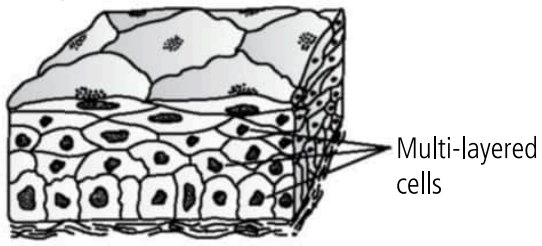


Fig.: Compound epithelium

- Based on structural modification, compound epithelium is of following types:
  (i) **Stratified squamous epithelium :** The cells in the deepest layer are columnar or cuboidal with oval nuclei. It is of two types, *i.e.*, keratinised stratified squamous epithelium (in skin epidermis) and non-keratinised stratified squamous epithelium (in pharynx, vagina, etc.).
  (ii) **Stratified cuboidal epithelium :** Its outer cells are cuboidal and basal cells are columnar. It lines the sweat gland ducts and larger salivary and pancreatic ducts.
  (iii) **Stratified columnar epithelium :** It has columnar cells in both superficial and basal layer. It lines mammary glands, ducts and parts of urethra.
  (iv) **Stratified ciliated columnar epithelium :** Its outer layer has ciliated columnar cells and the basal layer consists of columnar cells. It lines the larynx and upper part of the soft palate.
  (v) **Transitional epithelium :** It appears stratified and consists of fewer layers of less flattened surface cells with remarkable flexibility. It is found in ureters, urinary bladder and urethra.

Glandular Epithelium

- Some of the simple columnar or cuboidal epithelial cells get specialised for secretion and are called glandular epithelium.
- Based on complexity and mode of pouring secretion glandular epithelium is of following types:

On the basis of complexity

(i) **Unicellular glands** contain one cell. Goblet cells are mucus secreting unicellular glands of alimentary canal even though they do not contain ducts. Goblet cells are present in the epithelium of trachea and the digestive tube. The mucus secreted lubricates the apical surface of these tissues.

(ii) **Multicellular glands** are many celled glands and are usually situated in the deeper layers.

Mode of pouring of their secretion

(i) **Exocrine glands :** These glands pass their secretion through a duct onto body surfaces or into the cavities. They include the sweat, oil and salivary glands as well as liver, pancreas and many others.

(ii) **Endocrine glands :** These glands pour their products called hormones directly into fluid bathing the gland. Endocrine glands do not possess ducts or tubes and hence, called ductless gland. The pituitary, thyroid, and adrenal glands are examples of endocrine glands.

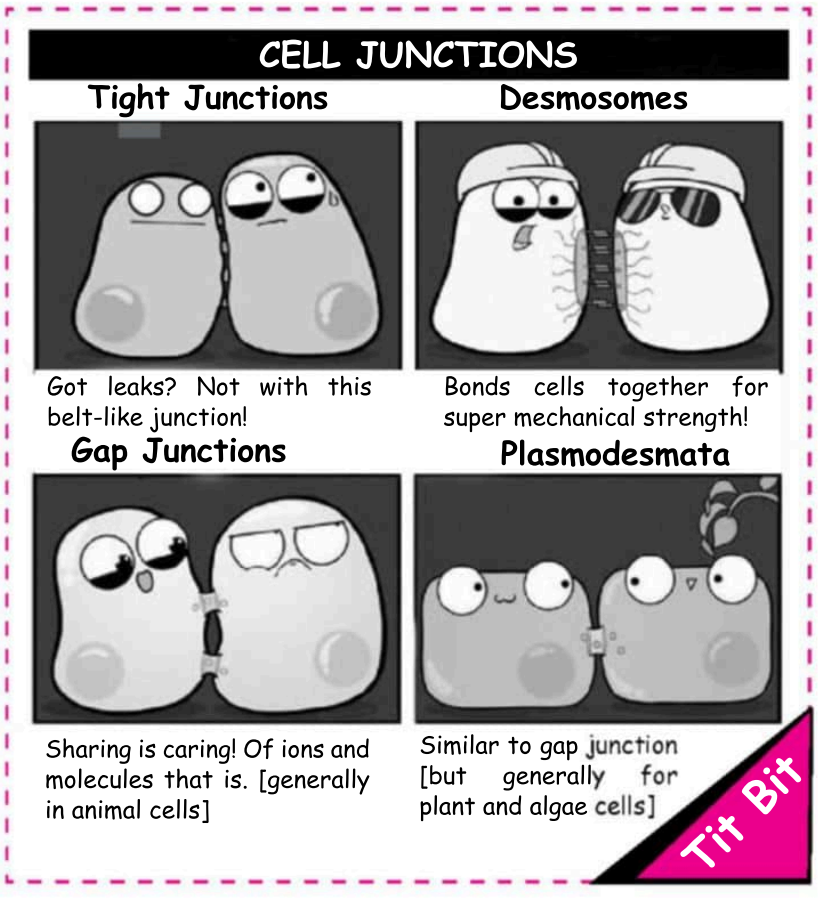
Specialised Junctions Between Epithelial Cells

- In animal tissues, special junctions provide both structural and functional links between its individual cells.
- Three types of cell junctions are found in the epithelium and other tissues. These are as follows:

(i) **Adhering junctions** – These junctions perform cementing function to keep neighbouring cells together.

(ii) **Tight junctions** – At some places plasma membrane of adjacent cells become fused to form tight junction. These structures are mostly found in columnar epithelium. These junctions help to stop substances from leaking across a tissue.

(iii) **Gap junctions** – At this junction cytoplasm of one cell is connected with cytoplasm of another cell through protein plate. It also allows small molecules or ions to pass one cell to another.



CONNECTIVE TISSUE

- Connective tissue is the most abundant and widely distributed tissue of the body. It provides the structural framework and support to the body.
- Three components called matrix (ground substance), cells and fibres form the connective tissue.
- **Matrix** or **ground substance** fills the spaces between cells and surrounds connective tissue fibres.
- **Cells** are of different types such as plasma cells, mesenchymal cells, neutrophils, lymphocytes, chromatophores, macrophages, mast cells, fibroblasts and adipocytes.
- **Fibres** are of three types: reticular, collagen and elastic fibres.

Types of Connective Tissue

- The connective tissue is classified into three types : (i) loose, (ii) dense and (iii) specialised connective tissue.

(i) **Loose connective tissue :** It has loosely arranged cells in a semi-fluid ground substance. It is further divided into 2 types:

(a) **Areolar tissue :** Consists of ground substance, the matrix, white, yellow and reticular fibres. It is present under the skin as subcutaneous tissue. The primary function of areolar tissue is to bind parts together.

(b) **Adipose tissue :** The adipose tissue consists of several spherical or oval adipose cells. These cells are often called **signet ring cells**. It is found in the subcutaneous tissue, around the heart, kidneys, eyeballs, mesenteries and omenta. It is chiefly a food reserve or 'fat depot' for storage.

(ii) **Dense connective tissue** contains tightly packed collagen fibres, making it stronger than loose connective tissue. It is of two types: dense irregular connective tissue and dense regular connective tissue.

(a) **Dense irregular connective tissue** has fibroblasts and many fibres (mostly collagen) that are oriented differently. It is present in the skin.

(b) **Dense regular connective tissue** has collagen fibres present in rows between many parallel bundles of fibres. It is further divided into **white fibrous tissue** which forms cords (tendons connect the skeletal muscle with the bones) and sheets; and **yellow elastic tissue** forms cords (ligaments join bones to bones) and sheets.

(iii) **Specialised connective tissue :** It includes cartilage, bone, vascular tissues (blood and lymph) and reticular tissues, each have unique cells and extracellular matrices that allows special functions.

(a) **Cartilage :** A typical cartilage consists of **cartilage cells** or **chondrocytes** and **ground substance** (matrix). Cartilage is present at the tip of nose, outer ear joints, between adjacent bones of the vertebral column. They are of three types:

– **Hyaline cartilage** forms articular surfaces at the joints of long bones such as knees, where it is called **articular cartilage**.

– **Fibrous cartilage** is of two types: white fibrous cartilage (strongest cartilage) and yellow elastic cartilage (makes organs flexible).

– **Calcified cartilage** the matrix contains granules of calcium carbonate, which makes cartilage hard and inelastic.

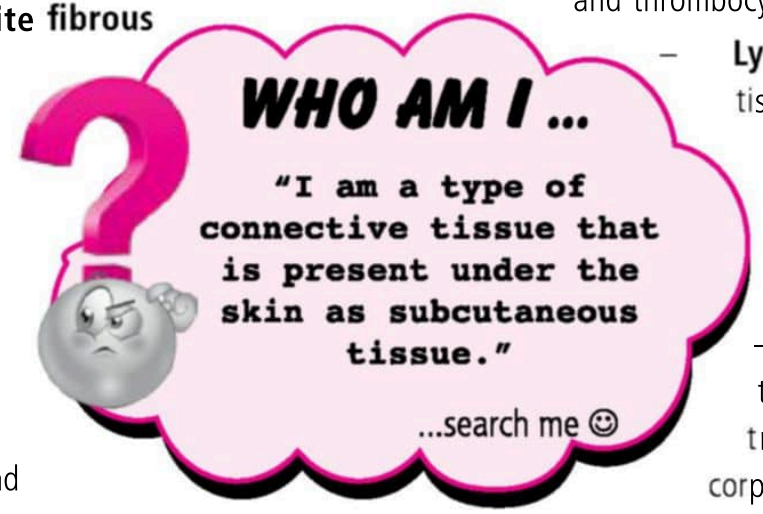
(b) **Bone**: Bone is a solid, rigid and hardest connective tissue in the body which gives support to various organs.

– It consists of four parts : periosteum, matrix, endosteum and bone marrow.

– On the basis of its texture, a bone is of two types : compact and spongy. **Compact bone** is hard, contains yellow bone marrow and present in the shaft of long bones while **spongy bone** is soft, contains red bone marrow and produces RBCs present at the epiphyses of long bones.

(c) **Vascular tissues** : Vascular tissues are mobile connective tissue that transport materials. They are of two types: blood and lymph.

– **Blood** is a reddish coloured, mobile fluid connective tissue that flows inside blood vessels by means of pumping activity of heart. Blood is composed of plasma and formed elements (blood corpuscles).Plasma is slightly alkaline, pale yellow but transparent and clear fluid. Formed elements or blood corpuscles are of three types: erythrocytes, leucocytes and thrombocytes (platelets).



– **Lymph** is a pale mobile connective tissue fluid made of lymph plasma and lymph corpuscles that flows in lymph vessels. Erythrocytes and platelets are absent in lymph.

– The main functions of connective tissue are attachment, storage, transport, formation of blood corpuscles, etc.

INTEXT PRACTICE QUESTIONS

1. **Where is brush-bordered cuboidal epithelium located?**
2. **What are the three type of cell junction found in epithelium and other tissues? Explain.**

MUSCULAR TISSUE

- The contractile structures of muscle cells are called **myofibrils**. Myofibrils are made of myofilaments.
- This tissue constitutes the muscles, made up of myocytes (muscle cells) which are in the form of contractile fibres varying in lengths, present in cytoplasm known as sarcoplasm.
- This tissue develops from the mesoderm of the embryo but the muscles of iris of eye and myoepithelial cells of the salivary, mammary and sweat glands arise from the ectoderm of the embryo.
- The special property of muscular tissue is **contractility** *i.e.*, the cells of muscular tissue can shorten considerably and return to the original relaxed state. The muscle cells contract in a definite direction.
- Another property of muscle is the electrical excitability. It is due to the energy stored in the electrical potential difference across the plasma membrane.
- The contractile structures of muscle cells are called **myofibrils**. Myofibrils are made of myofilaments.
- The three types of muscle tissue are skeletal (or striated), smooth and cardiac.

(i) **Skeletal muscle :** Fibres are long, cylindrical, unbranched and **striped**. This muscle type is mostly attached to bones. Striated muscles usually work under the control of animals's will and are called **voluntary muscles**.

(ii) **Smooth muscle :** Fibres are elongated and **spindle shaped**. Action of these muscles is controlled by autonomic nervous system. Hence are called involuntary muscles. These are also called **visceral muscles**.

(iii) **Cardiac muscle :** Fibres are long and **cylindrical structures** with definite sarcolemma. The fibres have some lateral branches, known as oblique bridges to form a contractile network. The myofibrils have transverse faint dark and light bands, which alternate with each other. They have dark **intercalated discs** at intervals. The intercalated discs function as boosters of contraction wave and permit wave of muscle contraction to be transmitted. Cardiac muscles are found in the wall of the heart. Cardiac muscle fibres are not under the control of the will and **never get fatigued**.

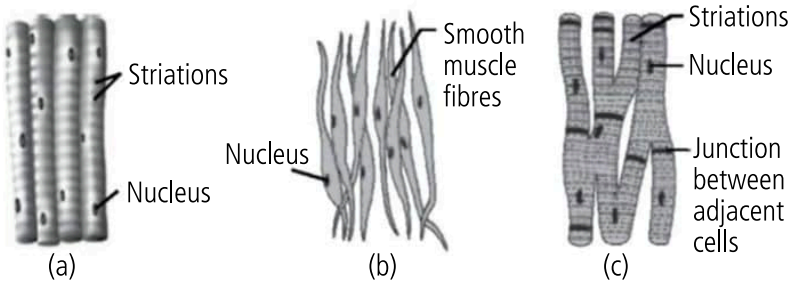


Fig.: Types of muscular tissue : (a) Skeletal muscle, (b) Smooth muscle, (c) Cardiac muscle

NERVOUS TISSUE

- It generally develops from the ectoderm but microgliocytes (glial cell type) arise from the mesoderm of the embryo.
- Nervous tissue controls body responsiveness to changing conditions.
- Special features of nervous tissue are **excitability** (ability to initiate nerve impulse in response to stimuli), **conductivity** (ability to transmit a nerve impulse), **connectivity** (nerve cell are interconnected) and **response** (in the form of sensation, secretion or contraction).
- **Neurons** are structural and functional unit of nervous system. Each neuron consists of a **cell body** or **cyton** and cell processes called **dendrites** and **axon**.

INTEXT PRACTICE QUESTIONS

3. **What do you understand by contractility in muscle tissue?**

EARTHWORM

- Earthworm is a reddish brown, cosmopolitan, terrestrial invertebrate that inhabits the upper layer of the moist soil. In the gardens, they can be traced by their faecal deposits known as **worm castings**. The common Indian earthworms are *Pheretima* and *Lumbricus*.

Morphology

- Earthworm has long cylindrical body showing bilateral symmetry, body is pointed in front and blunt behind.
- Body divided into 100-120 similar segments called **metameres** or **somites**.
- The first segment of body is termed as peristomium which

bears a sensory fleshy lobe, **prostomium** anteriorly. Peristomium encloses a crescent shaped mouth and anus is situated in the last or anal segment or pygidium.

- **Clitellum** (circular band of glandular tissue) is found from 14th to 16th segments. Due to its presence, body is differentiated into pre-clitellar, clitellar and post-clitellar regions.
- Except the first, last and clitellar segments, each segment bears a ring of tiny curved, chitinous structures called **setae** or **chaetae**.

Anatomy

- Body wall consists of cuticle, epidermis, muscular layer and parietal peritoneum.
- Coelom in earthworm is formed by splitting of embryonic mesoderm (schizocoelom). Coelomic fluid consists of phagocytes, circular cells, chloragogen cells (excretory) and mucocytes.
- Alimentary canal is complete and straight tube.
- **Mouth** leads to buccal cavity which extends from 1st to 3rd segment. **Oesophagus** extends from 5th to 7th segment and is dilated into gizzard in 8th-9th segment. **Stomach** extends from 9th to 14th segment.

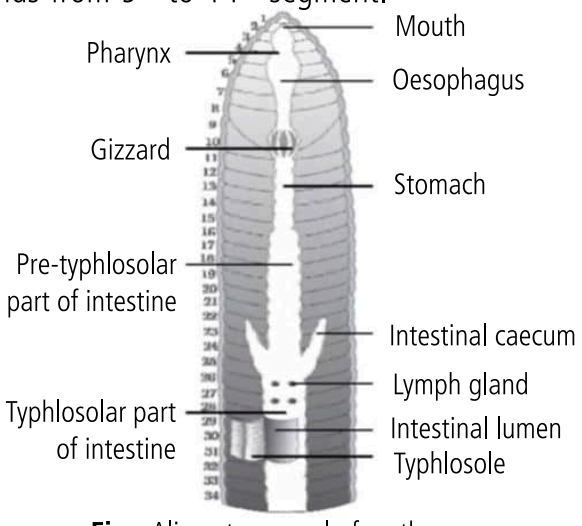
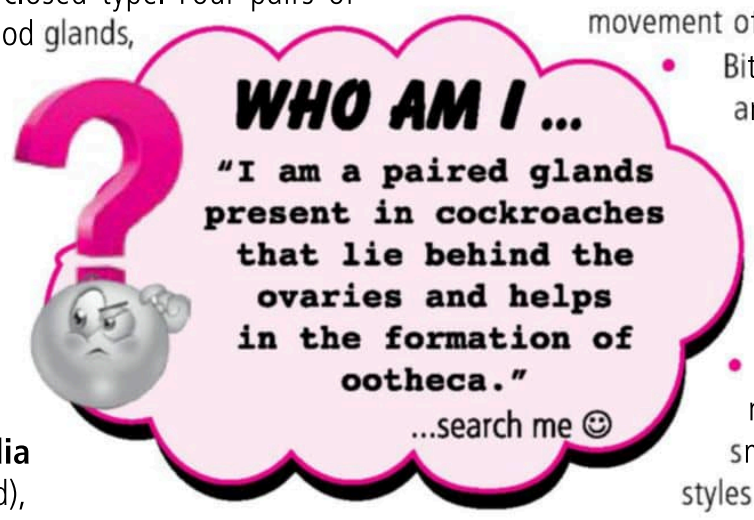


Fig.: Alimentary canal of earthworm

- **Intestine** is distinguished into pretyphlosolar region (15th-26th segment), typhlosolar region (from 27th segment upto 25th segments in front of anus) and post-typhlosolar region (in last 23rd to 25th segments).
- **Blood vascular system** is closed type. Four pairs of tubular hearts are present. Blood glands, present in segments 4th to 6th, produce blood corpuscles and haemoglobin.
- Earthworms are both **ammonotelic** and **ureotelic**.
- **Nephridia** perform the function of excretion and osmoregulation.
- According to their location nephridia are **septal nephridia** (occur in 15th segment onward), **pharyngeal nephridia** (occur in segments 4th, 5th and 6th) and **integumentary nephridia** (occur in all segments except first two).
- Nervous system is not very well developed. It is divided into central, peripheral and autonomic nervous system.
- Earthworms are **monoecious** but cannot fertilise their own eggs as they are **protandrous**.
- Male reproductive system includes testes, testes sacs, seminal vesicles, vasa deferentia, prostate glands and accessory glands.
- Two pairs of testes are present (one in 10th and other in 11th segment) that produce spermatozoa. They lie beneath the alimentary canal, on either side of nerve cord.
- Each testis sac of 10th and 11th segment encloses a testis and a spermiducal funnel.
- Female reproductive system consists of ovaries, oviducts and spermathecae.
- A pair of ovaries are attached to the posterior surface of septum present between 12th and 13th segments. They produce ova.
- Development is direct.



COCKROACH

- Cockroaches are brown or black bodied animals included in **Class Insecta** of **Phylum Arthropoda**. They are nocturnal omnivores, that live in damp places. They are the most common insects usually found in the houses. They are serious pests and vectors of diseases. The common species found in India is *Periplaneta americana*.

Morphology

- Adults are 34-53 mm long with their body segmented into three regions – **head**, **thorax** and **abdomen**.
- **Body** is elongated, bilaterally symmetrical and dorsoventrally flattened.
- Body is covered by chitinous brown coloured **exoskeleton** that provides support and rigidity. It has hardened plates called **sclerites** formed by cuticle (tergites dorsally and sternites ventrally). They are joined to each other by **articular (arthrodial) membrane** which allows movement of body and appendages.
- Biting and chewing type of mouth parts are present consisting of labrum, two mandibles, two maxillae, a labium and a hypopharynx.
- Thorax consists of three segments- **prothorax**, **mesothorax** and **metathorax**.
- Females can be distinguished from males externally due to presence of smaller wings and absence of anal styles.

Anatomy

- Alimentary canal is divided into 3 regions: foregut, midgut and hindgut.
- **Foregut** includes mouth that opens into pharynx and leads to narrow oesophagus which opens into **crop** (used for storing food). This is followed by **gizzard** that has 6 highly chitinous plates called teeth.
- **Midgut** is short and narrow. At the junction of foregut and midgut, 6-8 blind tubules called **hepatic caecae** are present which secrete digestive juice. At the junction of midgut and hindgut, thin filamentous 100-150 **Malpighian tubules** are present which remove excretory products from haemolymph.
- **Hindgut** is differentiated into ileum, colon and rectum. Rectum opens out through anus.
- Blood vascular system is of open type and vessels open into **haemocoel**.
- Visceral organs located in haemocoel are bathed in blood **(haemolymph)** which consists of colourless plasma and haemocytes.
- Heart of cockroach is **neurogenic** and consists of 13 contractile chambers.
- **Respiratory system** consists of network of tracheae that opens through **10 pairs of spiracles** present on lateral side of body guarded by bristles or hair to keep out dirt.
- **Nervous system** comprises of central, peripheral and sympathetic nervous system.
- **Brain** is represented by bilobed supra-oesophageal ganglion which supplies nerves to antennae and compound eyes.
- **Compound eyes**, located dorsally, consists of **2000 hexagonal ommatidia** which make up **mosaic vision** of cockroach.
- Excretion is performed by **Malpighian tubules** which are lined by glandular and ciliated cells. They absorb nitrogenous waste products and convert them into **uric acid** therefore insects are called **uricotelic**.
- **Fat body, nephrocytes** and **uricose glands** also help in excretion.
- Cockroaches are **dioecious** *i.e.*, sexes are separate.
- **Male :** It has a pair of testes in 4^{th}-6^{th} abdominal segments which is 3-lobed and consists of numerous whitish transparent follicles. **Vas deferens** arise from testes and opens into **ejaculatory duct** through **seminal vesicles**.
- Sperms are stored in seminal vesicles in the form of bundles called **spermatophores** which are discharged during copulation.
- An accessory **mushroom shaped gland** is located in 6^{th}-7^{th} abdominal segments. It provides nourishment to sperms.
- **External genitalia** are represented by male gonapophyses or phallomeres.
- **Female :** Ovaries are located in 2^{nd}–6^{th} abdominal segments and are formed of a group of ovarian tubules **(ovarioles)** which contain a chain of developing **ova**.
- **Oviducts** from each ovary unite into single median oviduct which opens into genital chamber. A pair of **spermatheca** present in 6^{th} segment also opens into genital chambers.
- Paired **colleterial glands** lie behind ovaries. Their secretion forms **egg-case** or **ootheca**.
- Sperms are transferred in form of spermatophores. Fertilised eggs are encased in **ootheca**, which are reddish brown capsules and are dropped or glued to a humid surface. On average, females produce 9-10 oothecae, each containing 14-16 eggs.
- The development is **paurometabolous** *i.e.*, gradual metamorphosis.
- As nymphal development proceeds, wing pads arise, body increases in size, colouration becomes darker and ultimately after about 6 - 7 successive moults **(ecdysis)**, adult takes its form with fully developed wings and genitalia.

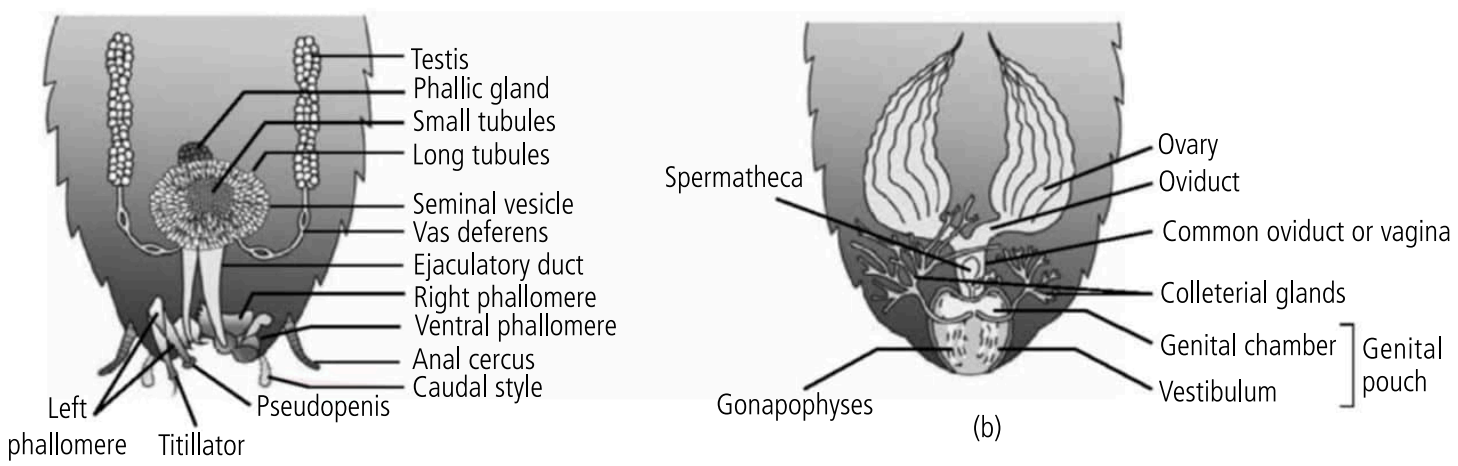


Fig.: Reproductive system of cockroach : (a) male (b) female

FROG

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

Morphology

- Body of a frog is pointed anteriorly and rounded posteriorly. Skin of frog is thin, moist, smooth, slimy and green coloured with black or brown spots dorsally and lighter pale yellow ventrally.

- Head is roughly triangular with a short **blunt** anterior **snout** terminating in a large transverse **mouth**. It bears external nares or nostrils, eyes, brow spot and ear drums on the upper side.
- Frogs have two large and protruding eyes, having an almost immovable upper eyelid and a thin semi-transparent and freely movable lower eyelid. From lower eyelid arises **nictitating membrane** that protects eyes during swimming.
- Trunk consists of **thorax, abdomen** and a paired **forelimbs** and **hindlimbs** are appended to it.
- Frog shows **sexual dimorphism** as male frog possesses developed **vocal sacs** and **nuptial pad** during breeding season and their body is somewhat slender and darker in colour than female frog.

Anatomy

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

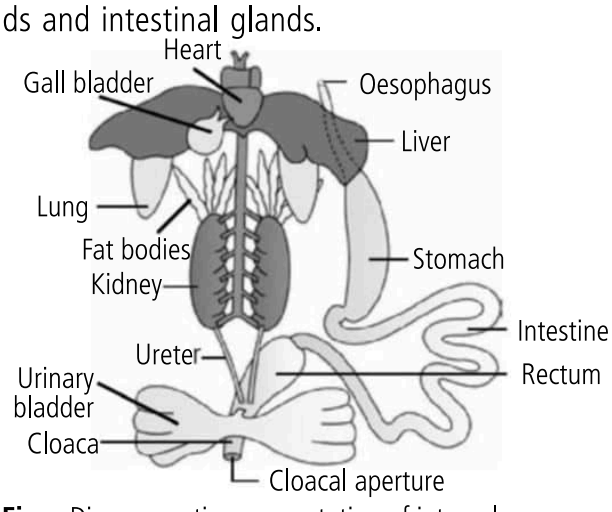


Fig. : Diagrammatic representation of internal organs of frog showing complete digestive system

- Circulatory system of frog is closed and includes **heart**, **arterial system**, **venous system**, **blood** and **lymphatic system**.
- Heart is **three chambered** made up of two anterior **atria** or **auricles** and a single posterior **ventricle**. Two additional chambers are **sinus venosus** and **truncus arteriosus**.

Respiratory system

- Adult frog respires by three different types of respiration:

(i) **Cutaneous respiration :** It occurs through the highly vascular skin of frog.

(ii) **Buccopharyngeal respiration :** It occurs on land or during partial immersion in water *via* mucous epithelial lining of buccopharyngeal cavity.

(iii) **Pulmonary respiration :** It is less frequent and takes place through lungs in adult frog when the frog is outside the water.

Nervous system

- Nervous system is highly developed and comprises of:

(i) **Central nervous system** (CNS) includes brain and spinal cord. **Brain** is covered by two meninges; **duramater** (outer) and **pia-arachnoid** (inner). Brain is divisible into three parts: Forebrain, midbrain and hindbrain. **Spinal cord** is located in the vertebral column and joins the medulla oblongata *via* **foramen magnum** of the cranium (brain case).

(ii) **Peripheral nervous system** (PNS) includes 10 pairs of **cranial nerves** and 9 pairs of **spinal nerves**. Rarely 10th (paired or unpaired) spinal nerve is found.

(iii) **Autonomic nervous system** (ANS) is made up of sympathetic and parasympathetic nerves which controls and coordinates the involuntary activities of the visceral organs.

Excretory system

- It comprises of kidneys, ureters (females), urinogenital ducts (males), cloaca and urinary bladder. Kidneys are the chief excretory organs which are made up of large number of **uriniferous tubules** or **nephrons**. From the kidneys, arise **ureter** in females and **urinogenital duct** in males.

Reproductive system

- In **males**, near each kidney there is a yellowish ovoid **testis** from which several thin **vasa efferentia**, connecting the testes to kidneys on each side. The vasa efferentia runs transversely through mesorchium and open into the **Bidder's canal** which in turn opens into the **ureter**.
- **Females** have two ovaries where ova are produced by ovarian follicles. On each side of an ovary is an oviduct which starts posteriorly and forms uterus, which opens into the cloaca. During breeding season ova are released into the coelom and then they reach the ovarian funnels from where they pass to the ovisacs, cloaca and then outside. Egg of frog is **telolecithal.**

INTEXT PRACTICE QUESTIONS

4. **How can you distinguish a female cockroach from a male cockroach?**
5. **Name the three regions of intestine in earthworm.**

☺☺

CBSE

Warm-up!

CLASS-XI

Chapterwise practice questions for CBSE Exams as per the latest pattern and syllabus by CBSE for the academic session 2024-25.

UNIT-II : STRUCTURAL ORGANISATION IN PLANTS AND ANIMALS

Series-3

- **Morphology of Flowering Plants**
- **Anatomy of Flowering Plants**
- **Structural Organisation in Animals**

General Instructions :

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

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

SECTION-A

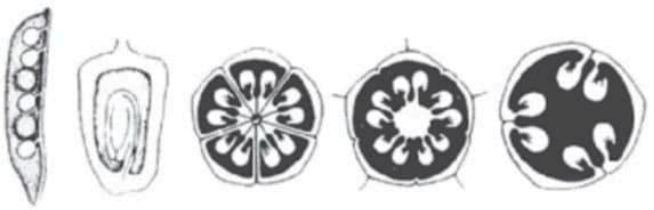
1. Select the characters which are not applicable to the Family Solanaceae?
(i) Epipetalous
(ii) Bicarpellary and syncarpous ovary
(iii) Obliquely placed carpels
(iv) Stamens six, arranged in two whorls
(v) Inferior ovary
(a) (ii) and (iii) only (b) (iv) and (v) only
(c) (ii), (iv) and (v) only (d) (i) and (iii) only

2. Ground tissue system includes
(a) all tissues except epidermis and vascular bundles
(b) epidermis and cortex
(c) all tissues internal to endodermis
(d) all tissues external to endodermis.

3. The number of pairs of cranial nerves arising from the brain of frog is
(a) 10 (b) 9
(c) 8 (d) 7.

4. Some vascular bundles are described as open because they
(a) possess conjunctive tissue between xylem and phloem
(b) are not surrounded by pericycle
(c) are surrounded by pericycle but not endodermis
(d) are capable of producing secondary xylem and phloem.

5. The given figure represent types of placentation. Identify A, B, C, D and E and select the correct option.



(A) (B) (C) (D) (E)

(a) A-Marginal placentation, B-Basal placentation, C-Free-central placentation, D-Axile placentation, E-Parietal placentation
(b) A-Marginal placentation, B-Basal placentation, C-Axile placentation, D-Free-central placentation, E-Parietal placentation
(c) A-Basal placentation, B-Axile placentation, C-Marginal placentation, D-Parietal placentation, E-Free-central placentation
(d) A-Parietal placentation, B-Free-central placentation, C-Marginal placentation, D-Axile placentation, E-Basal placentation

6. In frog, tympanum is a/an
   (a) small bone in middle ear
   (b) center of retina for bright vision
   (c) pair of membranous structure to receive sound signals
   (d) organ to regulate body temperature.

7. Select the correct statement.
   (a) The epiphyllous stamens are found in brinjal.
   (b) In pea, the stamens are polyadelphous.
   (c) The length of filament of stamens is different within a flower in *Salvia* and mustard.
   (d) The staminodes are bilobed fertile stamens.

8. Match the columns and find out the correct option.

	Column I		Column II
(P)	Casparian strips	(i)	Dicot leaf
(Q)	Starch sheath	(ii)	Dicot root
(R)	Spongy parenchyma	(iii)	Dicot stem
(S)	Bulliform cells	(iv)	Monocot leaf

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

9. Consider the following statements about frog.
   I. Skin acts as a respiratory organ only in water.
   II. Fertilisation is external.
   III. Bidder's canal is present in kidneys into which vasa efferentia open in male frog.
   IV. They possess well-developed renal portal system.
   Which of the given statements is/are incorrect?
   (a) Only I (b) Only I and II
   (c) I, II and III (d) Only II and IV

10. The vertical section of a dorsiventral leaf through the lamina shows three main parts namely, epidermis, __A__ and vascular system. The __B__ epidermis generally bears more stomata than the __C__ epidermis.
    Choose the correct combination of A, B and C.
    (a) A-mesophyll, B-adaxial, C-abaxial
    (b) A-endodermis, B-adaxial, C-abaxial
    (c) A-endodermis, B-abaxial, C-adaxial
    (d) A-mesophyll, B-abaxial, C-adaxial

11. The blood vascular system of the frog consists of
    (a) heart, blood vessels and blood without haemoglobin
    (d) blood vessels, capillaries and four chambered heart
    (c) haemolymph, blood vessels and heart
    (d) arteries, veins, capillaries, heart and blood containing RBCs and WBCs.

12. Which one of the following statements is correct?
    (a) Seeds of orchids have oil-rich endosperm.
    (b) Placentation in *Primrose* is basal.
    (c) A flower is a modified shoot.
    (d) Drupe fruit develops from monocarpellary inferior ovary.

Q. No. 13 to 16 consist of two statements – Assertion (A) and Reason (R). Answer these questions by selecting the appropriate option given below:

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

13. **Assertion (A) :** Bulliform cells are useful in the unrolling of leaf.
    Reason (R) : Bulliform cells store water.

14. **Assertion (A) :** Mustard is an example of asymmetric flower.
    Reason (R) : A flower is asymmetric (irregular) if it cannot be divided into two similar halves by any vertical plane passing through the centre.

15. **Assertion (A) :** Vascular system of frog is well developed and open type.
    Reason (R) : Frogs have lymphatic system also.

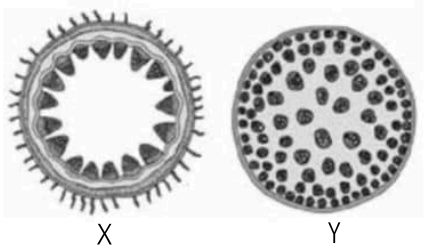
16. **Assertion (A) :** In cymose branching, growth of terminal bud stops after some time.
    Reason (R) : The growth of the main stem is definite.

SECTION-B

17. Write the functions of frog in brief in column B, appropriate to the structures given in column A.

Column A	Column B
(a) Nictitating membrane	_____
(b) Tympanum	_____
(c) Cloaca in males	_____

18. Refer to the given figures and answer the following questions.



X Y

   (a) Identify X and Y.
   (b) Write any two differences between X and Y.
   (c) Give two examples each of plant where X and Y are found.

19. Identify P, Q and R in the given table.

S.No.	Flower	Type of ovary	
A.	Hypogynous flower	P	Brinjal
B.	Perigynous flower	Half inferior	Q
C.	R	Inferior	Cucumber

20. **(a)** How will you differentiate between open and closed vascular bundles?

OR

(b) Study the difference between anatomy of dicot and monocot leaves and fill the given spaces A, B and C.

S.No.	Character	Dicot leaf	Monocot leaf
(i)	Type of leaf	A	Isobilateral
(ii)	Bulliform cells	Absent	B
(iii)	Mesophyll	C	Not differentiated

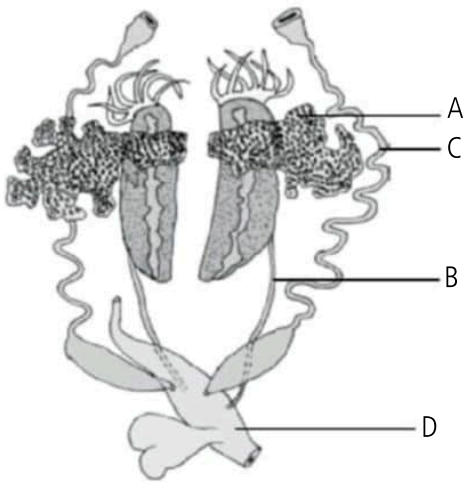
21. Mango and coconut are which type of fruits? What are their edible parts and what is the difference between their mesocarp?

SECTION-C

22. (a) What are medullary rays? What are their functions?

(b) What are the identifying features of dicot root?

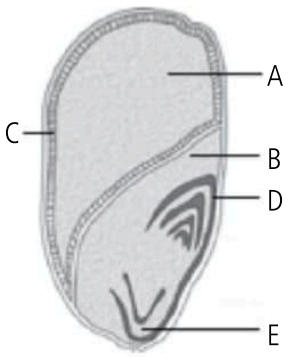
23. (a) The given figure shows female reproductive system of frog. Identify the parts labelled as A to D.



(b) Why are ureters in male frogs also known as urinogenital ducts?

24. Mention the functions of epidermal tissue system.

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



(i) Identify the given figure.
(ii) What do labellings A, B, C, D and E represent?
(iii) Discuss the functions of C, D and E.

26. Explain the excretory system of *Rana tigrina*.

27. (a) State any three vital functions performed by roots.

(b) What are the features that distinguish a stem from a root?

28. (a) (i) Which structure in male frogs joins the testes to the kidneys?

(ii) How can a male frog be distinguished from a female frog?

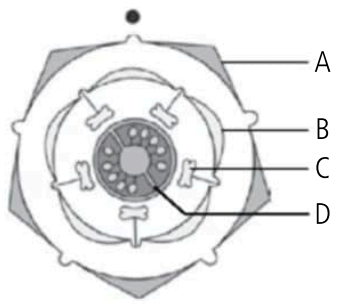
OR

(b) "Frog have a short alimentary canal". Justify this statement.

SECTION-D

Q. No. 29 and 30 are case based questions. Each question has 3 subparts with internal choice in one subpart.

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



(a) The given floral diagram belongs to which plant family? Identify symbols for labels A, B, C and D.

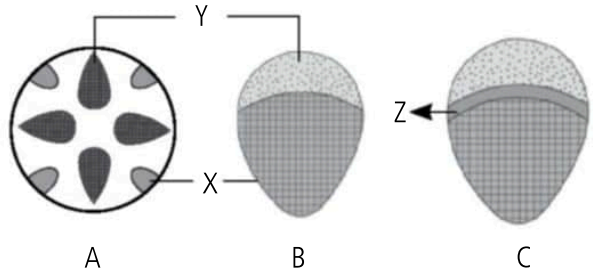
OR

(a) Write down the floral formula for the given floral diagram and give example of one plant species that shows similar kind of floral characters.

(b) Identify the aestivation as seen in B.

(c) Write some characters of D?

30. Read the given passage and answer the following questions.
In the classroom, teacher taught the vascular tissue system to students. After completing the topic, she drew the various types of vascular bundles on board as shown below.



(a) Identify X, Y and Z in figure A, B and C.

(b) What is the basic difference between B and C?

(c) Identify the type of vascular bundle shown in figure B and plant where it is found.

OR

(c) What does A represent?

MONTHLY TEST DRIVE CLASS XII ANSWER KEY

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

bears a sensory fleshy lobe, **prostomium** anteriorly. Peristomium encloses a crescent shaped mouth and anus is situated in the last or anal segment or pygidium.

- **Clitellum** (circular band of glandular tissue) is found from 14th to 16th segments. Due to its presence, body is differentiated into pre-clitellar, clitellar and post-clitellar regions.
- Except the first, last and clitellar segments, each segment bears a ring of tiny curved, chitinous structures called **setae** or **chaetae**.

Anatomy

- Body wall consists of cuticle, epidermis, muscular layer and parietal peritoneum.
- Coelom in earthworm is formed by splitting of embryonic mesoderm (schizocoelom). Coelomic fluid consists of phagocytes, circular cells, chloragogen cells (excretory) and mucocytes.
- Alimentary canal is complete and straight tube.
- **Mouth** leads to buccal cavity which extends from 1st to 3rd segment. **Oesophagus** extends from 5th to 7th segment and is dilated into gizzard in 8th-9th segment. **Stomach** extends from 9th to 14th segment.

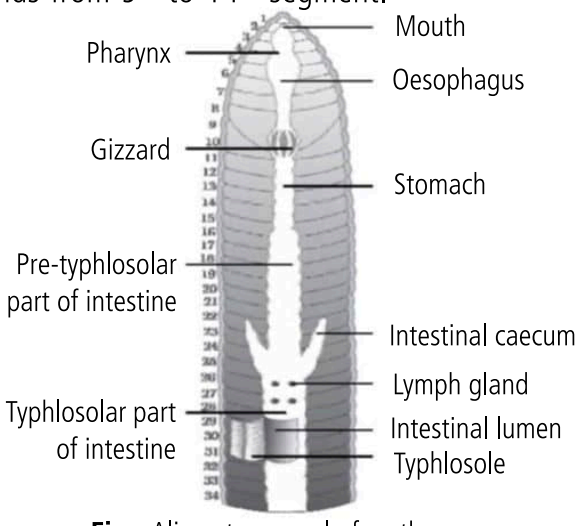
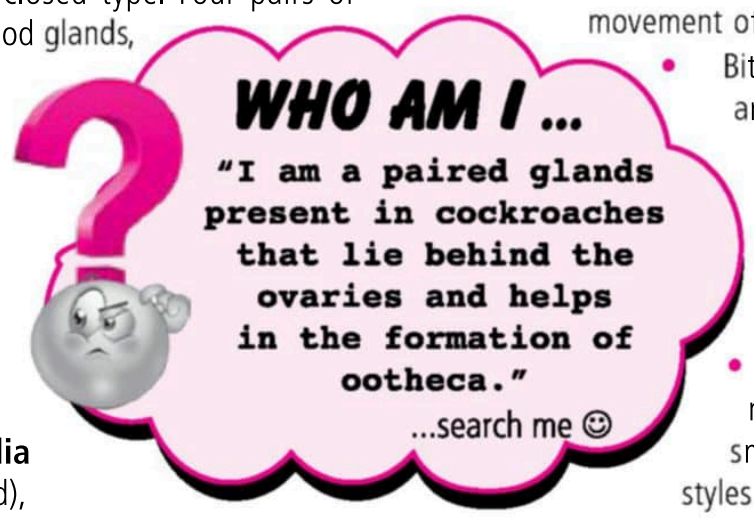


Fig.: Alimentary canal of earthworm

- **Intestine** is distinguished into pretyphlosolar region (15th-26th segment), typhlosolar region (from 27th segment upto 25th segments in front of anus) and post-typhlosolar region (in last 23rd to 25th segments).
- **Blood vascular system** is closed type. Four pairs of tubular hearts are present. Blood glands, present in segments 4th to 6th, produce blood corpuscles and haemoglobin.
- Earthworms are both **ammonotelic** and **ureotelic**.
- **Nephridia** perform the function of excretion and osmoregulation.
- According to their location nephridia are **septal nephridia** (occur in 15th segment onward), **pharyngeal nephridia** (occur in segments 4th, 5th and 6th) and **integumentary nephridia** (occur in all segments except first two).
- Nervous system is not very well developed. It is divided into central, peripheral and autonomic nervous system.
- Earthworms are **monoecious** but cannot fertilise their own eggs as they are **protandrous**.
- Male reproductive system includes testes, testes sacs, seminal vesicles, vasa deferentia, prostate glands and accessory glands.
- Two pairs of testes are present (one in 10th and other in 11th segment) that produce spermatozoa. They lie beneath the alimentary canal, on either side of nerve cord.
- Each testis sac of 10th and 11th segment encloses a testis and a spermiducal funnel.
- Female reproductive system consists of ovaries, oviducts and spermathecae.
- A pair of ovaries are attached to the posterior surface of septum present between 12th and 13th segments. They produce ova.
- Development is direct.



COCKROACH

- Cockroaches are brown or black bodied animals included in **Class Insecta** of **Phylum Arthropoda**. They are nocturnal omnivores, that live in damp places. They are the most common insects usually found in the houses. They are serious pests and vectors of diseases. The common species found in India is *Periplaneta americana*.

Morphology

- Adults are 34-53 mm long with their body segmented into three regions – **head**, **thorax** and **abdomen**.
- **Body** is elongated, bilaterally symmetrical and dorsoventrally flattened.
- Body is covered by chitinous brown coloured **exoskeleton** that provides support and rigidity. It has hardened plates called **sclerites** formed by cuticle (tergites dorsally and sternites ventrally). They are joined to each other by **articular (arthrodial) membrane** which allows movement of body and appendages.
- Biting and chewing type of mouth parts are present consisting of labrum, two mandibles, two maxillae, a labium and a hypopharynx.
- Thorax consists of three segments- **prothorax**, **mesothorax** and **metathorax**.
- Females can be distinguished from males externally due to presence of smaller wings and absence of anal styles.

Anatomy

- Alimentary canal is divided into 3 regions: foregut, midgut and hindgut.
- **Foregut** includes mouth that opens into pharynx and leads to narrow oesophagus which opens into **crop** (used for storing food). This is followed by **gizzard** that has 6 highly chitinous plates called teeth.
- **Midgut** is short and narrow. At the junction of foregut and midgut, 6-8 blind tubules called **hepatic caecae** are present which secrete digestive juice. At the junction of midgut and hindgut, thin filamentous 100-150 **Malpighian tubules** are present which remove excretory products from haemolymph.
- **Hindgut** is differentiated into ileum, colon and rectum. Rectum opens out through anus.
- Blood vascular system is of open type and vessels open into **haemocoel**.
- Visceral organs located in haemocoel are bathed in blood **(haemolymph)** which consists of colourless plasma and haemocytes.
- Heart of cockroach is **neurogenic** and consists of 13 contractile chambers.
- **Respiratory system** consists of network of tracheae that opens through **10 pairs of spiracles** present on lateral side of body guarded by bristles or hair to keep out dirt.
- **Nervous system** comprises of central, peripheral and sympathetic nervous system.
- **Brain** is represented by bilobed supra-oesophageal ganglion which supplies nerves to antennae and compound eyes.
- **Compound eyes**, located dorsally, consists of **2000 hexagonal ommatidia** which make up **mosaic vision** of cockroach.
- Excretion is performed by **Malpighian tubules** which are lined by glandular and ciliated cells. They absorb nitrogenous waste products and convert them into **uric acid** therefore insects are called **uricotelic**.
- **Fat body, nephrocytes** and **uricose glands** also help in excretion.
- Cockroaches are **dioecious** *i.e.*, sexes are separate.
- **Male :** It has a pair of testes in 4^{th}-6^{th} abdominal segments which is 3-lobed and consists of numerous whitish transparent follicles. **Vas deferens** arise from testes and opens into **ejaculatory duct** through **seminal vesicles**.
- Sperms are stored in seminal vesicles in the form of bundles called **spermatophores** which are discharged during copulation.
- An accessory **mushroom shaped gland** is located in 6^{th}-7^{th} abdominal segments. It provides nourishment to sperms.
- **External genitalia** are represented by male gonapophyses or phallomeres.
- **Female :** Ovaries are located in 2^{nd}–6^{th} abdominal segments and are formed of a group of ovarian tubules **(ovarioles)** which contain a chain of developing **ova**.
- **Oviducts** from each ovary unite into single median oviduct which opens into genital chamber. A pair of **spermatheca** present in 6^{th} segment also opens into genital chambers.
- Paired **colleterial glands** lie behind ovaries. Their secretion forms **egg-case** or **ootheca**.
- Sperms are transferred in form of spermatophores. Fertilised eggs are encased in **ootheca**, which are reddish brown capsules and are dropped or glued to a humid surface. On average, females produce 9-10 oothecae, each containing 14-16 eggs.
- The development is **paurometabolous** *i.e.*, gradual metamorphosis.
- As nymphal development proceeds, wing pads arise, body increases in size, colouration becomes darker and ultimately after about 6 - 7 successive moults **(ecdysis)**, adult takes its form with fully developed wings and genitalia.

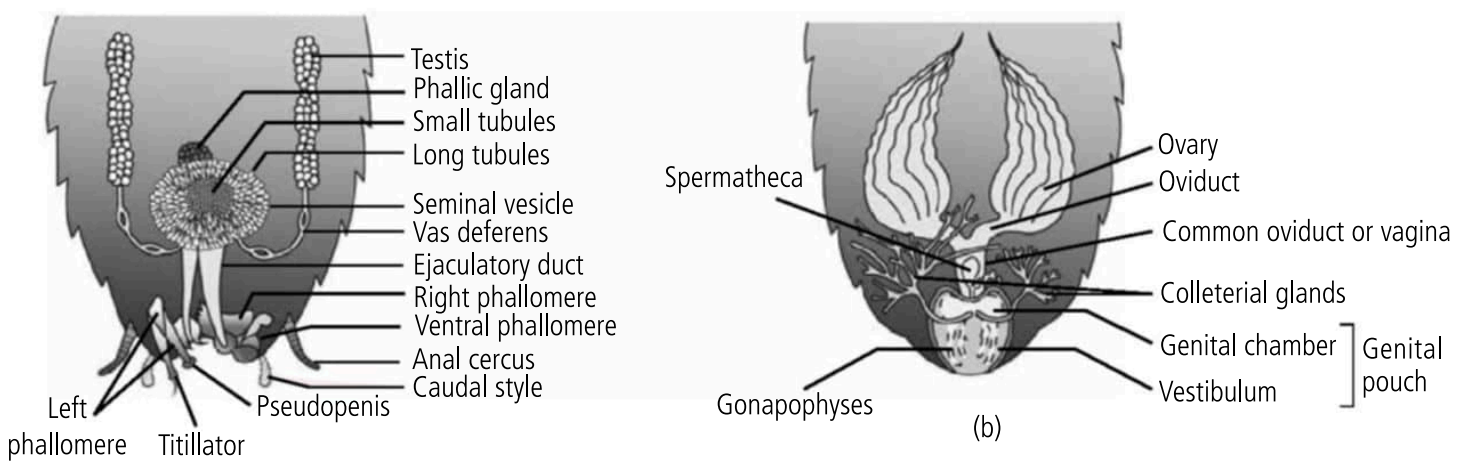


Fig.: Reproductive system of cockroach : (a) male (b) female

FROG

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

Morphology

- Body of a frog is pointed anteriorly and rounded posteriorly. Skin of frog is thin, moist, smooth, slimy and green coloured with black or brown spots dorsally and lighter pale yellow ventrally.

- Head is roughly triangular with a short **blunt** anterior **snout** terminating in a large transverse **mouth**. It bears external nares or nostrils, eyes, brow spot and ear drums on the upper side.
- Frogs have two large and protruding eyes, having an almost immovable upper eyelid and a thin semi-transparent and freely movable lower eyelid. From lower eyelid arises **nictitating membrane** that protects eyes during swimming.
- Trunk consists of **thorax, abdomen** and a paired **forelimbs** and **hindlimbs** are appended to it.
- Frog shows **sexual dimorphism** as male frog possesses developed **vocal sacs** and **nuptial pad** during breeding season and their body is somewhat slender and darker in colour than female frog.

Anatomy

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

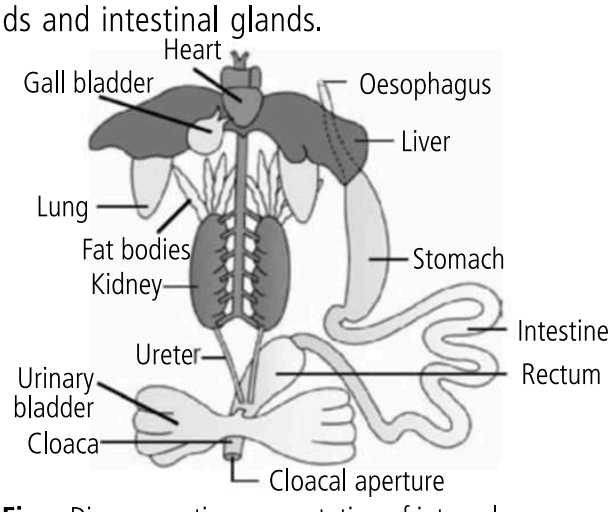


Fig. : Diagrammatic representation of internal organs of frog showing complete digestive system

- Circulatory system of frog is closed and includes **heart**, **arterial system**, **venous system**, **blood** and **lymphatic system**.
- Heart is **three chambered** made up of two anterior **atria** or **auricles** and a single posterior **ventricle**. Two additional chambers are **sinus venosus** and **truncus arteriosus**.

Respiratory system

- Adult frog respires by three different types of respiration:

(i) **Cutaneous respiration :** It occurs through the highly vascular skin of frog.

(ii) **Buccopharyngeal respiration :** It occurs on land or during partial immersion in water *via* mucous epithelial lining of buccopharyngeal cavity.

(iii) **Pulmonary respiration :** It is less frequent and takes place through lungs in adult frog when the frog is outside the water.

Nervous system

- Nervous system is highly developed and comprises of:

(i) **Central nervous system** (CNS) includes brain and spinal cord. **Brain** is covered by two meninges; **duramater** (outer) and **pia-arachnoid** (inner). Brain is divisible into three parts: Forebrain, midbrain and hindbrain. **Spinal cord** is located in the vertebral column and joins the medulla oblongata *via* **foramen magnum** of the cranium (brain case).

(ii) **Peripheral nervous system** (PNS) includes 10 pairs of **cranial nerves** and 9 pairs of **spinal nerves**. Rarely 10th (paired or unpaired) spinal nerve is found.

(iii) **Autonomic nervous system** (ANS) is made up of sympathetic and parasympathetic nerves which controls and coordinates the involuntary activities of the visceral organs.

Excretory system

- It comprises of kidneys, ureters (females), urinogenital ducts (males), cloaca and urinary bladder. Kidneys are the chief excretory organs which are made up of large number of **uriniferous tubules** or **nephrons**. From the kidneys, arise **ureter** in females and **urinogenital duct** in males.

Reproductive system

- In **males**, near each kidney there is a yellowish ovoid **testis** from which several thin **vasa efferentia**, connecting the testes to kidneys on each side. The vasa efferentia runs transversely through mesorchium and open into the **Bidder's canal** which in turn opens into the **ureter**.
- **Females** have two ovaries where ova are produced by ovarian follicles. On each side of an ovary is an oviduct which starts posteriorly and forms uterus, which opens into the cloaca. During breeding season ova are released into the coelom and then they reach the ovarian funnels from where they pass to the ovisacs, cloaca and then outside. Egg of frog is **telolecithal.**

INTEXT PRACTICE QUESTIONS

4. **How can you distinguish a female cockroach from a male cockroach?**
5. **Name the three regions of intestine in earthworm.**

☺☺

CBSE

Warm-up!

CLASS-XI

Chapterwise practice questions for CBSE Exams as per the latest pattern and syllabus by CBSE for the academic session 2024-25.

UNIT-II : STRUCTURAL ORGANISATION IN PLANTS AND ANIMALS

Series-3

- **Morphology of Flowering Plants**
- **Anatomy of Flowering Plants**
- **Structural Organisation in Animals**

General Instructions :

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

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

SECTION-A

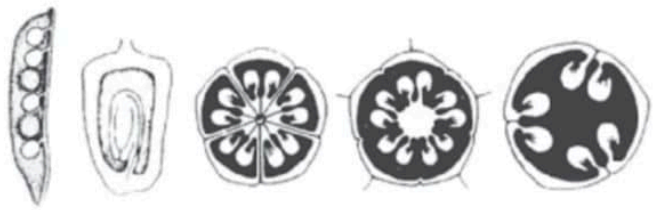
1. Select the characters which are not applicable to the Family Solanaceae?
(i) Epipetalous
(ii) Bicarpellary and syncarpous ovary
(iii) Obliquely placed carpels
(iv) Stamens six, arranged in two whorls
(v) Inferior ovary
(a) (ii) and (iii) only (b) (iv) and (v) only
(c) (ii), (iv) and (v) only (d) (i) and (iii) only

2. Ground tissue system includes
(a) all tissues except epidermis and vascular bundles
(b) epidermis and cortex
(c) all tissues internal to endodermis
(d) all tissues external to endodermis.

3. The number of pairs of cranial nerves arising from the brain of frog is
(a) 10 (b) 9
(c) 8 (d) 7.

4. Some vascular bundles are described as open because they
(a) possess conjunctive tissue between xylem and phloem
(b) are not surrounded by pericycle
(c) are surrounded by pericycle but not endodermis
(d) are capable of producing secondary xylem and phloem.

5. The given figure represent types of placentation. Identify A, B, C, D and E and select the correct option.



(A) (B) (C) (D) (E)

(a) A-Marginal placentation, B-Basal placentation, C-Free-central placentation, D-Axile placentation, E-Parietal placentation
(b) A-Marginal placentation, B-Basal placentation, C-Axile placentation, D-Free-central placentation, E-Parietal placentation
(c) A-Basal placentation, B-Axile placentation, C-Marginal placentation, D-Parietal placentation, E-Free-central placentation
(d) A-Parietal placentation, B-Free-central placentation, C-Marginal placentation, D-Axile placentation, E-Basal placentation

6. In frog, tympanum is a/an
   (a) small bone in middle ear
   (b) center of retina for bright vision
   (c) pair of membranous structure to receive sound signals
   (d) organ to regulate body temperature.

7. Select the correct statement.
   (a) The epiphyllous stamens are found in brinjal.
   (b) In pea, the stamens are polyadelphous.
   (c) The length of filament of stamens is different within a flower in *Salvia* and mustard.
   (d) The staminodes are bilobed fertile stamens.

8. Match the columns and find out the correct option.

	Column I		Column II
(P)	Casparian strips	(i)	Dicot leaf
(Q)	Starch sheath	(ii)	Dicot root
(R)	Spongy parenchyma	(iii)	Dicot stem
(S)	Bulliform cells	(iv)	Monocot leaf

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

9. Consider the following statements about frog.
   I. Skin acts as a respiratory organ only in water.
   II. Fertilisation is external.
   III. Bidder's canal is present in kidneys into which vasa efferentia open in male frog.
   IV. They possess well-developed renal portal system.
   Which of the given statements is/are incorrect?
   (a) Only I (b) Only I and II
   (c) I, II and III (d) Only II and IV

10. The vertical section of a dorsiventral leaf through the lamina shows three main parts namely, epidermis, __A__ and vascular system. The __B__ epidermis generally bears more stomata than the __C__ epidermis.
    Choose the correct combination of A, B and C.
    (a) A-mesophyll, B-adaxial, C-abaxial
    (b) A-endodermis, B-adaxial, C-abaxial
    (c) A-endodermis, B-abaxial, C-adaxial
    (d) A-mesophyll, B-abaxial, C-adaxial

11. The blood vascular system of the frog consists of
    (a) heart, blood vessels and blood without haemoglobin
    (d) blood vessels, capillaries and four chambered heart
    (c) haemolymph, blood vessels and heart
    (d) arteries, veins, capillaries, heart and blood containing RBCs and WBCs.

12. Which one of the following statements is correct?
    (a) Seeds of orchids have oil-rich endosperm.
    (b) Placentation in *Primrose* is basal.
    (c) A flower is a modified shoot.
    (d) Drupe fruit develops from monocarpellary inferior ovary.

Q. No. 13 to 16 consist of two statements – Assertion (A) and Reason (R). Answer these questions by selecting the appropriate option given below:

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

13. **Assertion (A) :** Bulliform cells are useful in the unrolling of leaf.
    Reason (R) : Bulliform cells store water.

14. **Assertion (A) :** Mustard is an example of asymmetric flower.
    Reason (R) : A flower is asymmetric (irregular) if it cannot be divided into two similar halves by any vertical plane passing through the centre.

15. **Assertion (A) :** Vascular system of frog is well developed and open type.
    Reason (R) : Frogs have lymphatic system also.

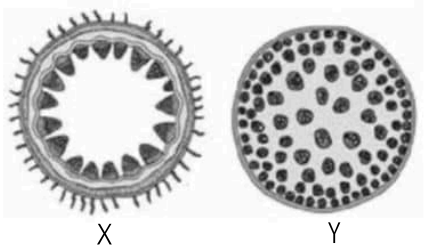
16. **Assertion (A) :** In cymose branching, growth of terminal bud stops after some time.
    Reason (R) : The growth of the main stem is definite.

SECTION-B

17. Write the functions of frog in brief in column B, appropriate to the structures given in column A.

Column A	Column B
(a) Nictitating membrane	_____
(b) Tympanum	_____
(c) Cloaca in males	_____

18. Refer to the given figures and answer the following questions.



X Y

   (a) Identify X and Y.
   (b) Write any two differences between X and Y.
   (c) Give two examples each of plant where X and Y are found.

19. Identify P, Q and R in the given table.

S.No.	Flower	Type of ovary	
A.	Hypogynous flower	P	Brinjal
B.	Perigynous flower	Half inferior	Q
C.	R	Inferior	Cucumber

20. **(a)** How will you differentiate between open and closed vascular bundles?

OR

(b) Study the difference between anatomy of dicot and monocot leaves and fill the given spaces A, B and C.

S.No.	Character	Dicot leaf	Monocot leaf
(i)	Type of leaf	A	Isobilateral
(ii)	Bulliform cells	Absent	B
(iii)	Mesophyll	C	Not differentiated

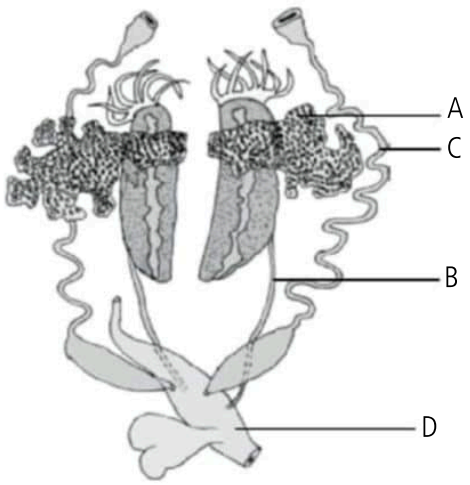
21. Mango and coconut are which type of fruits? What are their edible parts and what is the difference between their mesocarp?

SECTION-C

22. (a) What are medullary rays? What are their functions?

(b) What are the identifying features of dicot root?

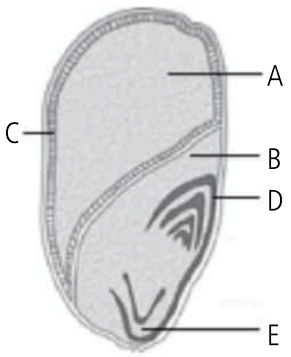
23. (a) The given figure shows female reproductive system of frog. Identify the parts labelled as A to D.



(b) Why are ureters in male frogs also known as urinogenital ducts?

24. Mention the functions of epidermal tissue system.

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



(i) Identify the given figure.
(ii) What do labellings A, B, C, D and E represent?
(iii) Discuss the functions of C, D and E.

26. Explain the excretory system of *Rana tigrina*.

27. (a) State any three vital functions performed by roots.

(b) What are the features that distinguish a stem from a root?

28. (a) (i) Which structure in male frogs joins the testes to the kidneys?

(ii) How can a male frog be distinguished from a female frog?

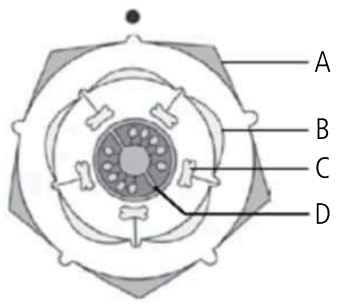
OR

(b) "Frog have a short alimentary canal". Justify this statement.

SECTION-D

Q. No. 29 and 30 are case based questions. Each question has 3 subparts with internal choice in one subpart.

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



(a) The given floral diagram belongs to which plant family? Identify symbols for labels A, B, C and D.

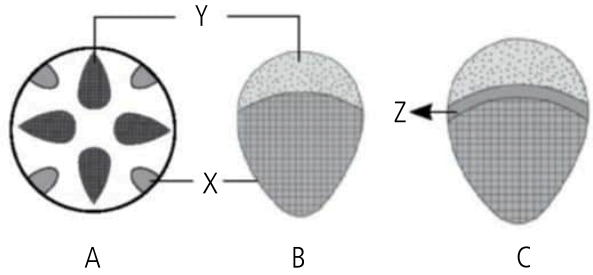
OR

(a) Write down the floral formula for the given floral diagram and give example of one plant species that shows similar kind of floral characters.

(b) Identify the aestivation as seen in B.

(c) Write some characters of D?

30. Read the given passage and answer the following questions.
In the classroom, teacher taught the vascular tissue system to students. After completing the topic, she drew the various types of vascular bundles on board as shown below.



(a) Identify X, Y and Z in figure A, B and C.

(b) What is the basic difference between B and C?

(c) Identify the type of vascular bundle shown in figure B and plant where it is found.

OR

(c) What does A represent?

MONTHLY TEST DRIVE CLASS XII ANSWER KEY

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

SECTION-E

31. (a) (i) Frog is a poikilotherm, exhibits camouflage and undergoes aestivation and hibernation, how are all these beneficial to it?

(ii) Briefly discuss three modes of respiration in frog.

OR

(b) (i) Describe about the eyes of frogs.

(ii) Explain the male reproductive system of frog with a well labelled diagram.

32. (a) (i) Differentiate between monocot seed and dicot seed.

(ii) Explain various zones in a typical root with the help of a labelled diagram.

OR

(b) (i) "Flower is a modified shoot." Justify the statement.

(ii) Define aestivation. Briefly describe its various types with the help of labelled diagrams.

33. (a) Write different structural and characteristic features of dicot stem.

OR

(b) Describe the internal structure of a dorsiventral leaf with the help of labelled diagram.

SOLUTIONS

1. (b) : The characters of Family Solanaceae are : androecium consists of five stamens, stamens are free, epipetalous, anthers bithecous, dehiscence longitudinal. Gynoecium consists of bicarpellary, syncarpous, superior ovary, carpels placed obliquely, generally bilocular, placentation axile, placenta swollen.

2. (a) : All tissues except epidermis and vascular bundles constitute the ground tissue or fundamental tissue. It consists of simple tissues such as parenchyma, collenchyma and sclerenchyma. Ground tissue includes cortex, pericycle, pith and medullary rays. In leaves, the ground tissue consists of mesophyll.

3. (a) : In frogs, there are ten pairs of cranial nerves arising from brain.

4. (d) : In open vascular bundle, cambium is present between xylem and phloem, *e.g.*, dicot stem and dicot root. Due to the presence of cambium, secondary growth occurs and secondary permanent tissues are formed.

5. (b)

6. (c) : On either side of eyes, a membranous tympanum is present that receives sound waves.

7. (c)

8. (c)

9. (a) : Frogs respire on land and in water differently. In water, skin acts as respiratory organ. On land, inspite of skin, the buccal cavity and lungs majorly act as respiratory organs. Pulmonary respiration occurs on land through lungs.

10. (d) **11. (d)**

12. (c) : Orchids are non-endospermic. In *Primrose*, placentation is free-central and drupe fruit develops from monocarpellary superior ovary.

13. (b) : In isobilateral leaves, the upper epidermis contains specialised cells, *i.e.* bulliform or motor cells. They are highly vacuolated and can store water, if available. However, in case of water deficiency, the bulliform cells lose water and become flaccid. As a result, the leaf gets rolled up to reduce the exposed surface. The bulliform cells are also useful in the unrolling of leaf during its development.

14. (d) : Mustard is not an example of asymmetric flower. It is an actinomorphic (radial symmetry) flower.

15. (d) : Vascular system of frog is well developed and close type.

16. (a) : In cymose branching, the growth of the main stem is definite, that is the terminal bud does not continue to grow, but lower down, the main stem produces one or more lateral branches which grow more vigorously than the terminal one. In some plants, the terminal bud gets modified into a flower, tendril, thorn, etc.

17. (a) Nictitating membrane - Protect the eyes while the frog is in water
(b) Tympanum - Receives sound signals
(c) Cloaca in males - It is used to pass faecal matter, urine and sperms to the exterior.

18. (a) X is T.S. of dicot stem and Y is T.S. of monocot stem.

(b) Differences between dicot stem (X) and monocot stem (Y) are as follows :

S.No.	Dicot stem	Monocot stem
(i)	Vascular bundles are arranged in ring around the pith.	Vascular bundles are scattered throughout the ground tissue.
(ii)	Endodermis is present.	Endodermis is absent.

(c) X is found in sunflower and *Cucurbita* whereas Y is found in maize and grass.

19. In the given table, P is superior ovary, Q could be plum, rose or peach and R is epigynous flower.

20. Differences between open and closed vascular bundles are as follows:

S. No.	Open vascular bundle	Closed vascular bundle
(i)	Vascular bundle contains a strip of cambium in between phloem and xylem (intrafascicular cambium).	Intrafascicular cambium is absent.

(ii)	Phloem and xylem do not lie in direct contact with each other.	Phloem and xylem occur in direct contact with each other.
(iii)	Open vascular bundles occur in dicot root, dicot stem gymnosperm stems.	Closed vascular bundles are found in leaves, monocot stem and monocot root.

OR

(b) In the given table,
A - Dorsiventral (dicotyledonous) leaves.
B - Bulliform cells are present in monocot leaves.
C - Mesophyll is differentiated into palisade and spongy parenchyma.

21. Mango and coconut are drupe type of fruits. Mesocarp is edible part in mango whereas, endosperm is edible part in coconut. In mango, mesocarp is middle layer which is fleshy and edible whereas in coconut, mesocarp is fibrous.

22. (a) Medullary rays are the radially arranged living cells present in between the xylem and phloem. They are usually one to few layers in thickness and one to several layers in height. They form the radial system which is responsible for the radial conduction of solutes. They also maintain connection between pith and cortex.

(b) Dicotyledonous root can be easily identified on account of the following features :
(i) Presence of root hairs
(ii) Endodermis is less thickened and Casparian strips are more prominent.
(iii) Pith is small or inconspicuous.
(iv) Number of xylem and phloem bundles varies from 2-5.
(v) Presence of exarch xylem

23. (a) In the given figure of female reproductive system of frog, the labelled parts are as follows :
A - Ovary
B - Ureter
C - Oviduct
D - Cloaca

(b) Ureter in male frog is a common pathway for the release of urine and spermatozoa. Hence, it is called urinogenital duct.

24. The functions of epidermal tissue system are as follows:
(i) The epidermal tissue system forms a covering of all the plant parts and therefore, provides protection to the underlying tissues.
(ii) It helps in the reduction of surface evaporation of water due to presence of cuticle.
(iii) It forms water and mineral absorptive system of the root.
(iv) Presence of epidermal hair form an insulating layer over the surface.
(v) Stomata take part in exchange of gases and transpiration.
(vi) Trichomes help in preventing water loss due to transpiration.

25. (i) The given figure represents the structure of a monocotyledonous seed *i.e.*, maize.

(ii) A - Endosperm B - Scutellum
C - Aleurone layer D - Coleoptile
E - Coleorhiza

(iii) C represents aleurone layer which is 1 – 3 celled thick. The cells have dense cytoplasm filled with aleurone (protein grains) and produce enzyme during the process of grain germination. D represents coleoptile in which the plumule is enclosed and E represents coleorhiza which encloses radicle.

26. *Rana tigrina* (frog) has well developed excretory system to eliminate nitrogenous wastes from body. The excretory system consists of a pair of kidneys, ureters, cloaca and urinary bladder. Kidneys are compact, dark red and bean like structures situated a little posteriorly in the body cavity on both sides of vertebral column. Each kidney is composed of several structural and functional units called uriniferous tubules or nephrons. Two ureters emerge from the kidneys in the male frogs. The ureters act as urinogenital duct which opens into the cloaca. In females the ureters and oviduct open separately in the cloaca. The thin-walled urinary bladder is present ventral to the rectum which also opens in the cloaca. The frog excretes urea and thus is a ureotelic animal. Excretory wastes are carried by blood into the kidneys where it is separated and excreted.

27. (a) Roots perform the following vital functions:
(i) They absorb water and nutrients from the soil which are necessary for growth of plants.
(ii) Roots take part in fixation of plant in soil and support the shoot system.
(iii) Roots hold the soil particles firmly to prevent soil erosion.

(b) Features that distinguish a stem from a root are as follows:
(i) The ascending portion of the axis of the plant, bears leaves, branches and flowers.
(ii) When young, it is normally green in colour.
(iii) The stem often bears multicellular hairs of different kinds.
(iv) Presence of nodes and internodes.
(v) Leaves and branches normally develop from the nodes.
(vi) Presence of buds.

28. (a) (i) Mesorchium is thin peritoneum fold by which each testis remains attached with the dorsal wall of kidney and abdomen.

(ii) The male frogs may be distinguished by presence of sound producing vocal sacs. They also have a copulatory pad on the first digit of the forelimbs. Vocal sacs and copulatory pads are absent in female frogs.

OR

(b) The digestive system of frog consists of alimentary canal and digestive gland. The alimentary canal is short because frogs are carnivores. This means that their diet consists of food which is purely of animal origin. Carnivores have shorter digestive tracts as meat is easier to digest than plant material.

29. **(a)** The given floral diagram belongs to Family Solanaceae.

A is calyx - Symbol K

B is corolla - Symbol C

C is androecium - Symbol A

D is gynoecium - Symbol G

OR

(a) The floral formula for Family Solanaceae is

$\oplus ⚥ K_{(5)} \overparen{C_{(5)} A_5} \underline{G}_{(2)}$.

Solanum nigrum belonging to Family Solanaceae has similar kind of characters as shown in floral diagram.

(b) According to the figure, B is corolla (petals) and has valvate aestivation. In valvate aestivation, the margins of adjacent sepals/petals are close to each other without overlapping.

(c) D represents gynoecium and the given figure clearly shows syncarpous, bilocular, superior ovary with many ovules having axile placentation.

30. **(a)** In the given figure A, B and C; X is Xylem, Y is Phloem and Z is Cambium.

(b) The basic difference between B and C is that in B cambium is absent whereas in C cambium is present.

(c) The given figure is of conjoint closed vascular bundle found in monocot stem, *e.g.*, wheat, rice, etc.

OR

(c) A represents the radial vascular bundle.

31. **(a)** **(i)** Frog is a poikilotherm (cold blooded), *i.e.*, it cannot maintain constant body temperature and it varies with change in environmental temperature. Being cold blooded, frog cannot withstand very cold weather and extreme high temperature and thus, burries itself deep in mud during winters and summers, known as hibernation (winter-sleep) and aestivation (summer sleep) respectively. These periods are of little activities and energy required is obtained from fat bodies, or stored glycogen in liver, which have been stored earlier. Camouflage is the ability to change body colour with change in its surroundings and climatic conditions. It helps the animal to escape from predators or to attack its prey.

(ii) Adult frog respires by three different modes of respiration:

Cutaneous respiration : It occurs through the highly vascularised skin of frog in water or land.

Buccopharyngeal respiration : It occurs on land or during partial immersion in water *via* mucous epithelial lining of buccopharyngeal cavity.

Pulmonary respiration : It is less frequent and takes place through lungs in adult frog when the frog is outside the water.

OR

(b) **(i)** Eyes of frogs are well organised structure. They are bulged, paired spherical structures situated in the orbit in skull and covered by a nictitating membrane that protects them while in water.

(ii) Male reproductive organs consist of a pair of yellowish ovoid testes which are found adhered to the upper part of kidneys by a double fold of peritoneum called mesorchium. Vasa efferentia are 10-12 in number that arise from testes. They enter the kidneys on their side and open into Bidder's canal. Finally, it communicates with the urinogenital duct that comes out of the kidneys and opens into the cloaca. The cloaca is a small, median chamber that is used to pass faecal matter, urine and sperms to the exterior.

TRIO

The same THREE LETTERS will complete these four words.

Can you find the three-letter sequence?

_ _ _ O P H Y T E S

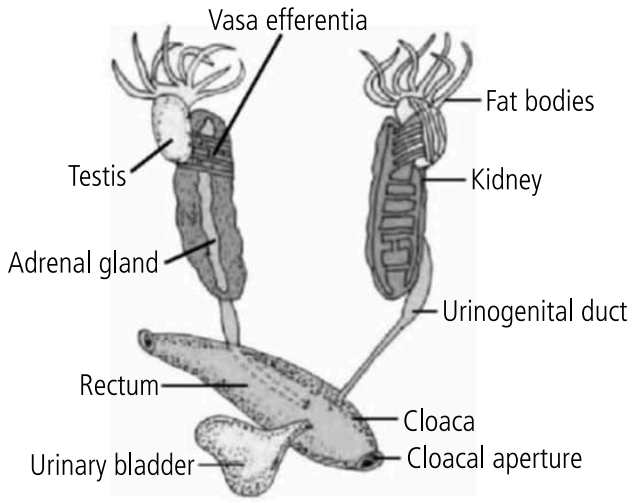
F A _ _ _ C L E

A B _ _ _ S S I O N

P R O B O _ _ _ S

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

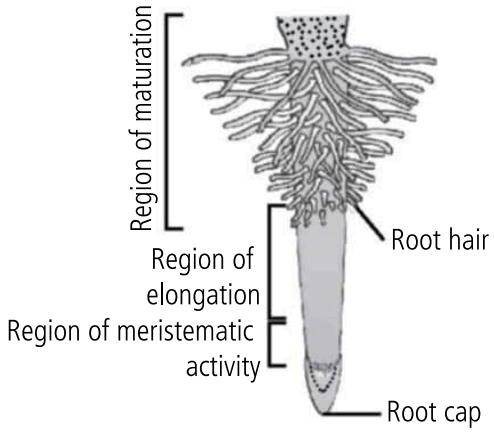
The well labelled diagram of male reproductive system of frog is as follows:



32. (a) (i) Differences between monocot seed and dicot seed are as follows:

S.No.	Monocot seed	Dicot seed
(i)	The seed contains a single cotyledon.	The seed possesses two cotyledons.
(ii)	The food is commonly stored inside endosperm (exception-orchids).	The food may be stored inside endosperm or cotyledons.
(iii)	An aleurone layer of special protein-rich cells is found on the outside of endosperm.	Aleurone layer is absent.
(iv)	Plumule lies at one end near the cotyledon.	Plumule lies in between the two cotyledons.
(v)	Embryo occupies one side of the seed.	Embryo occupies the whole interior or only the central part of the seed.

(ii) The various zones of a typical root are as follows:



(I) Region of root cap : It is a thimble-shaped or cap-like parenchymatous multicellular structure which covers the root meristem. The cells of the root cap secrete mucilage which lubricates the passage of root through the soil. It also protect the root meristem from friction of the soil particles.

(II) Region or zone of growing point of meristematic activity : The growing point of the root is subterminal and lies protected below the root cap. It is made up of compactly or closely arranged small thin walled isodiametric and meristematic cells which have dense protoplasm. They undergo repeated divisions and produce new cells for the root cap and the basal region of the root.

(III) Region or zone of elongation: It lies behind the growing point. The cells of this region are newly formed cells which lose the power of division. They elongate rapidly. This increases length of the root.

(IV) Region or zone of mature cells : It forms the bulk of the root. The cells of this region do not undergo any further change. The outermost layer of this region has thick walled or impermeable cells. So, this region cannot help the root in water absorption. Its only function is to anchor the plant firmly in the soil. Lateral roots also arise from the interior of this region. From this region some of the epidermal cells form very fine and delicate, thread-like structures called root hairs. These root hairs absorb water and minerals from the soil.

OR

(b) (i) Flower is a modified shoot consisting of a highly reduced stem branch to form thalamus in which the nodes are borne only towards the tip. The floral parts, that is, sepals, petals, stamens and carpels are arranged in their respective whorls and arise from nodes. The growing point of floral bud is used up in the production of floral organs.

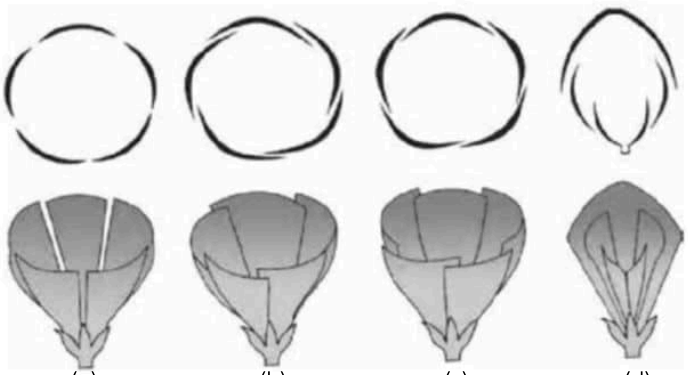
(ii) The mode of arrangement of sepals or petals in floral bud with respect to the other members of the same whorl is known as aestivation. The main types of aestivation are valvate, twisted, imbricate and vexillary.

Valvate aestivation : It is a type of aestivation when sepals or petals in a whorl just touch one another at the margin, without overlapping, as in *Calotropis*.

Twisted aestivation : If one margin of the appendage overlaps that of the next one and so on, as in china rose, lady's finger and cotton.

Imbricate aestivation : In this type of aestivation, the margins of sepals or petals overlap one another but not in any particular direction as in *Cassia* and gulmohur.

Vexillary aestivation : In this type of aestivation, there are five petals, the largest (standard) overlaps the two lateral petals (wings) which in turn overlap the two smallest anterior petals (keel) ,as in pea and bean flowers. It is also known as papilionaceous aestivation.



(a) Valvate aestivation | (b) Twisted aestivation | (c) Imbricate aestivation | (d) Vexillary aestivation

33. (a) The T.S. of dicot stem shows following structures:

(I) Epidermis : It is single outermost layer of stem and is composed of brick-shaped cells with their outer walls cutinised. It generally bears trichomes and a few stomata.

(II) Cortex : Depending on the species, it may be entirely parenchymatous or the outer few layers may be collenchymatous forming the hypodermis, followed by the parenchymatous cortex. The young stem contains chlorenchyma. In ribbed stems, the ridges are collenchymatous and the furrows contain only parenchyma. The innermost layer of the cortex is called endodermis. It is the starch sheath composed of barrel-shaped cells with abundant starch grains.

(III) Pericycle : It is in the form of semi-lunar patches of sclerenchyma.

(IV) Medullary rays : In between the vascular bundles there are few layers of parenchymatous cells which constitute medullary rays. These are slightly larger in size as compared to the other cortical cells.

(V) Vascular bundles : In all dicotyledonous stems, the vascular bundles are conjoint and open. The xylem is characteristically endarch. Phloem is composed of sieve tubes, companion cells and phloem parenchyma. The fascicular cambium is present between the primary xylem and primary phloem.

(VI) Pith : This is the central portion of the stem consisting of rounded, parenchymatous cells with plenty of intercellular spaces.

OR

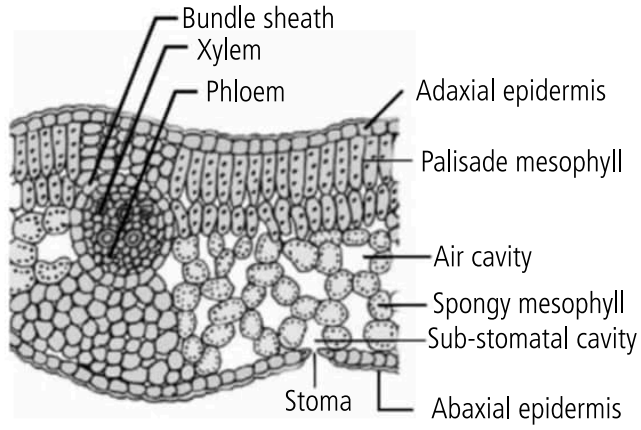
(b) Dorsiventral leaves are found in dicots. The important anatomical features of dorsiventral leaves are discussed below:

(I) Epidermis : It is the outermost layer of cells present on the upper (adaxial) and lower (abaxial) sides of the leaf. The cells appear rectangular in a transverse section of the leaf and have a wavy out line in surface view. They are without intercellular spaces and chloroplasts. The continuity of the epidermis is interrupted by the presence of minute pores or openings called stomata. The epidermis is covered by a cuticle. It is a waxy substance and being impermeable to water, checks excessive water loss from leaves. It is thin in plants receiving adequate water supply and usually thick in plants growings in dry situations. The cuticle is thicker on the upper epidermis than on the lower epidermis.

(II) Mesophyll : It is the ground tissue of leaves differentiated into palisade and spongy parenchyma. The palisade cells occur towards the adaxial side. They are columnar cells with very few intercellular spaces and remain arranged more or less at right angles to the upper epidermis. Chloroplasts are abundant and occur particularly along the radial walls of the cells. The spongy parenchyma occurs towards the lower epidermis. The cells are loosely arranged with conspicuous intercellular spaces so that a large part of their surface is exposed to the gases in the intercellular spaces. The chloroplasts are fewer here .

(III) Vascular system : Since the venation is reticulate, large and small veins run through the mesophyll. The bundles of ribs are thicker than those of lateral veins. Each bundle is conjoint and closed. Each vascular bundle is surrounded by bundle sheath of parenchyma.

The T.S. of a dorsiventral leaf is as follows :



☺☺

Class XI

Monthly test drive

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

Series V ▸ Cell : The Unit of Life ▸ Cell Cycle and Cell Division

Total Marks : 160 **Time :** 40 Min.

1. Match the following columns and select the correct option.

	Column-I (Scientists)		Column-II (Discoveries/Proposed theories)
A.	Leeuwenhoek	1.	First saw and described a living cell
B.	Robert Brown	2.	Presence of cell wall is unique to plant cells
C.	Schleiden	3.	Discovered the nucleus
D.	Schwann	4.	All plants are composed of different kind of cells

	A	B	C	D
(a)	1	3	4	2
(b)	3	1	4	2
(c)	1	3	2	4
(d)	1	4	2	3

2. Choose the correct sequence of two main events in mitosis.
(a) Karyokinesis followed by cytokinesis.
(b) Cytokinesis followed by karyokinesis.
(c) Karyokinesis followed by S phase.
(d) Karyokinesis followed by G_1 phase.

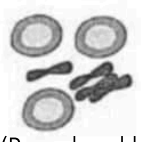
3. Which of the following statements is not true about nucleus?
(a) It was discovered by Robert Brown.
(b) Chromatin found in nucleus is stained by acidic dyes.
(c) Its envelope consists of two membranes with perinuclear space between them.
(d) Its outer membrane usually remains continuous with endoplasmic reticulum.

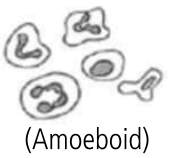
4. Which statement best explains the evolutionary advantage of meiosis?
(a) Meiosis decreases genetic variability.
(b) Genetic recombinations are possible from generation to generation.
(c) Meiosis alternates with mitosis from generation to generation.
(d) Restoration of nucleo-cytoplasmic ratio.

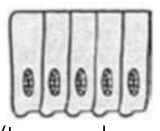
5. G_0-phase is
(a) phase after G_2-phase
(b) phase after M-phase, in which daughter cell enters new cell cycle
(c) state of arrest of cell cycle on the onset of division
(d) all of these.

6. Which of the following represents the incorrect pair?

(a)  – Mesophyll cells
(Round and oval)

(b)  – Red blood cells
(Round and biconcave)

(c)  – Platelets
(Amoeboid)

(d)  – Columnar epithelial cells
(Long and narrow)

7. Study the following table and select the correct match from the given options.

	Column-A		Column-B
A.	Synthesis of protein	1.	Zygotene
B.	Action of recombinase	2.	G_2-phase

C.	Movement of daughter chromosomes towards opposite pole	3.	Pachytene
D.	Formation of bivalent occurs	4.	Anaphase-I
		5.	Anaphase-II

	A	B	C	D
(a)	2	3	5	1
(b)	3	2	1	5
(c)	2	3	4	5
(d)	2	5	4	3

8. Schleiden and Schwann are associated with
(a) protoplasm as the physical basis of life
(b) cell theory
(c) theory of cell lineage
(d) discovery of nucleus as control centre of cell.

9. Endomembrane system is formed by
(a) ER + Golgi body + Lysosome + Vacuole
(b) ER + Ribosome + Lysosome + Vacuole
(c) ER + Ribosome + Mitochondria + Plastid
(d) ER + Golgi body + Ribosome + Lysosome.

10. If the cell has 14 chromosomes at interphase, then how many chromosomes will the cell have at G_1-phase of cell cycle?
(a) 28 (b) 14 (c) 7 (d) 21

11. In a eukaryotic cell, vacuoles
(a) contain water, sap and excretory product
(b) are bound by a single membrane called tonoplast
(c) occupy upto 90% of the volume of the cell.
(d) all of these.

12. What does (i) and (ii) represent in the given flowchart?

Parent cell (2n) $\xrightarrow{\text{M-I}}$ 2 Daughter cells (i) $\xrightarrow{\text{M-II}}$ 4 Daughter cells (ii)

(a) (i) = 2n, (ii) = n (b) (i) = n, (ii) = n
(c) (i) = n, (ii) = 2n (d) (i) = 2n, (ii) = 2n

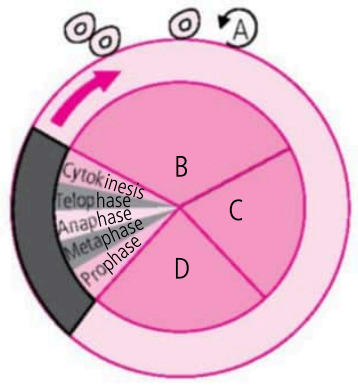
13. In the following table, the prokaryotic cell structure and related functions are given. Select the correct match.

	Structural	Function
A.	Mesosome	Cell wall formation and DNA replication
B.	Lysosome	Help in the formation of glycoproteins
C.	Stroma	Contains enzymes for carbo-hydrates and proteins synthesis
D.	Mitochondria	Site of aerobic respiration

(a) A, B and C are correct.
(b) Only B and C are correct.
(c) A, C and D are correct.
(d) A, B and D are correct.

14. Read the given statements and select the correct option.
Statement I : Ribosomes are membraneless organelles present in both prokaryotic and eukaryotic cells.
Statement II : In plants, ribosomes are also present in chloroplast and mitochondria.
(a) Both statement I and statement II are correct.
(b) Both statement I and statement II are incorrect.
(c) Statement I is correct but statement II is incorrect.
(d) Statement I is incorrect but statement II is correct.

15. Identify A, B, C and D in the given diagram depicting cell cycle and select the correct option.



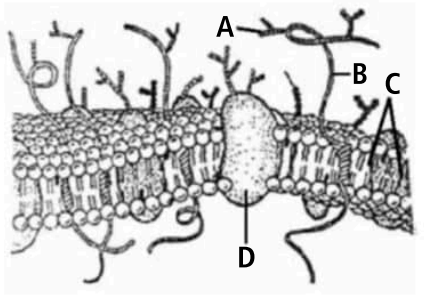
	A	B	C	D
(a)	G_0	G_1	S	G_2
(b)	G_1	S	G_2	G_0
(c)	G_1	G_0	S	G_2
(d)	S	G_0	G_1	G_2

16. 'X' is a phase of mitosis, in which the chromatin condenses into compact chromosomes. At the end of 'X' phase, cells do not show nuclear envelope, Golgi complexes, endoplasmic reticulum and nucleolus. Identify 'X'.
(a) Interphase (b) Anaphase
(c) Telophase (d) Prophase

17. Movement of water by diffusion is called
(a) passive transport (b) active transport
(c) osmosis (d) facilitated diffusion.

18. Which of the following represents DNA content and chromosome number respectively after S-phase in a diploid cell if initial amount of DNA is 2C?
(a) 4C, n (b) 4C, 2n (c) 2C, 2n (d) 4C, 4n

19. Identify the components labelled A to D in the given diagram of cell membrane from the list 1 to 7 mentioned along with it.



Components
1. Sugar
2. Peripheral protein
3. Phospholipid bilayer
4. Cell wall
5. Cytoplasm
6. Integral protein

The correct components are
(a) A-1, B-2, C-3, D-6
(b) A-2, B-1, C-3, D-4
(c) A-1, B-5, C-3, D-6
(d) A-1, B-2, C-3, D-5.

20. The prophase I of first meiotic division is quite longer and divided into five subsequent stages. Which among the following gives a correct sequence of various stages of prophase I?
(a) Diakinesis, Diplotene, Pachytene, Zygotene, Leptotene
(b) Leptotene, Diakinesis, Pachytene, Diplotene, Zygotene
(c) Leptotene, Pachytene, Zygotene, Diplotene, Diakinesis
(d) Leptotene, Zygotene, Pachytene, Diplotene, Diakinesis

21. Following are some statements about lysosomes. Select the incorrect statement.
(a) Lysosomes are formed by packaging in Golgi apparatus.
(b) Lysosomes contains all types of hydrolytic enzymes.
(c) The enzymes of lysosomes are active at acidic pH.
(d) Formation of lysosome occurs due to budding off vesicles from RER.

22. Select the incorrect statement about meiosis.
(a) Pairing of homologous chromosomes
(b) Four haploid cells are formed
(c) At the end of meiosis, number of chromosomes are reduced to half
(d) Two cycles of DNA replication occur.

23. In plant cell, the cytokinesis begins with
(a) wall formation in the centre, grows towards periphery
(b) wall formation at periphery, grows towards centre
(c) furrow formation in the plasma membrane
(d) deposition of material by ER to form cell plate that extends towards centre.

24. Read the given statements and fill the blanks by selecting an appropriate option.
A. The compaction of chromosomes begins during (i) .
B. Crossing over is an enzyme-mediated process, it involves enzyme (ii) .
C. Meiosis I is (iii) division.
D. X-shaped structure called chiasmata are seen during (iv) stage of prophase I.

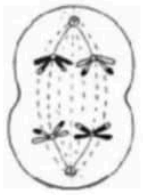
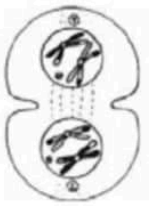
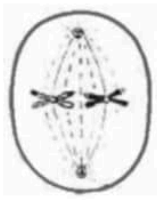
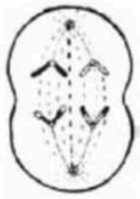
	(i)	(ii)	(iii)	(iv)
(a)	pachytene	recombinase	equational	diplotene
(b)	leptotene	helicase	equational	diakinesis
(c)	leptotene	recombinase	reductional	diplotene
(d)	zygotene	helicase	reductional	diakinesis

25. Match the following columns and select the correct option.

	Column-I (Cell organelles)		Column-II (Functions)
A.	Golgi apparatus	1.	Synthesis of protein
B.	Lysosomes	2.	Trap waste and excretory products
C.	Vacuoles	3.	Formation of glycoproteins and glycolipids
D.	Ribosomes	4.	Digestion of biomolecules

	A	B	C	D
(a)	3	4	2	1
(b)	4	3	1	2
(c)	3	2	4	1
(d)	1	2	4	3

26. Which of the following correctly shows anaphase-I stage of meiosis?

(a) 
(b) 
(c) 
(d) 

27. What is not true about mitochondria?
(a) Matrix has single circular DNA
(b) Have few RNA molecules
(c) Have 70S and 80S ribosomes
(d) Division occurs by fission

28. Which of the following statements are incorrect?
(i) Centriole is present in plant cells.
(ii) Centriole helps in cell division.
(iii) Centriole has single membrane.
(iv) Centriole is present in animal cell.
Choose the correct answer from the given options.
(a) (ii) and (iv) only
(b) (ii) and (iii) only
(c) (i) and (iv) only
(d) (i) and (iii) only

29. In animal cell, cytokinesis involves
(a) separation of sister chromatids
(b) formation of a furrow in the plasma membrane
(c) growth of furrow to outside from centre of animal cell
(d) formation of cell-plate in the centre of cell.

30. Read the given statements and select the correct option.
Statement I : Golgi apparatus remains in close association with the endoplasmic reticulum.
Statement II : Proteins are modified in the cisternae of Golgi apparatus.
(a) Both statement I and statement II are correct.
(b) Both statement I and statement II are incorrect.
(c) Statement I is correct but statement II is incorrect.
(d) Statement I is incorrect but statement II is correct.

31. At the end of meiosis II, we get
(a) two cells, each with 2n number of chromosomes
(b) four cells, each with n number of chromosomes
(c) two cells, each with n number of chromosomes
(d) four cells, each with 2n number of chromosomes.

32. In the following options, find the incorrect match for the type of leucoplast and stored material.

	Leucoplast	**Storage**
(a)	Aleuroplast	Proteins
(b)	Elaioplast	Oils and fats
(c)	Aleuroplast	Fats
(d)	Amyloplast	Starch

33. Select the correct statement from the following regarding cell membrane.

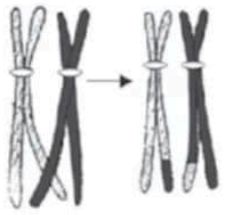
(a) Na^+ and K^+ ions move across cell membrane by passive transport.

(b) Proteins make up 40% of the erythrocyte cell membrane.

(c) Lipids are arranged in a bilayer with polar heads towards the inner part.

(d) Fluid mosaic model of cell membrane was proposed by Singer and Nicolson.

34. The given figure is the representation of a certain event at a particular stage of a type of cell division. Which is this stage?



(a) Prophase I during meiosis

(b) Prophase II during meiosis

(c) Prophase of mitosis

(d) Both prophase and metaphase of mitosis

35. Consider the following statements.

(A) Plant cells have centrioles which are absent in almost all animal cells.

(B) Ribosomes are the site of protein synthesis.

(C) The middle lamella is a layer mainly of calcium carbonate which holds the different neighbouring cells together.

(D) In animal cell, steroidal hormones are synthesised by smooth endoplasmic reticulum.

Of the above statements,

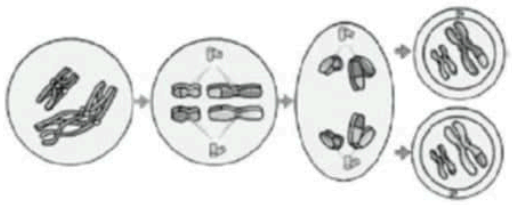
(a) only (A) and (B) are correct

(b) only (C) and (D) only are correct

(c) only (B) and (D) only are correct

(d) only (A) and (D) only are correct.

36. Refer to the given stages A, B, C and D of meiosis I and select the incorrect statement regarding them.



A B C D

(a) The last stage of A is diakinesis which is marked by terminalisation of chiasmata.

(b) In stage B, microtubules from the opposite poles of the spindle attach to the pair of homologous chromosomes.

(c) In stage C, homologous chromosomes separate, while sister chromatids remain associated at their centromeres.

(d) In stage D, separation of chromosomes takes place, cytokinesis follows this stage and this is called as dyad of cells.

37. How many peripheral doublets are present in cilia?

(a) 2 (b) 0

(c) 9 (d) 7

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

Statement I : In mitosis, each replication cycle of DNA is followed by one cell division.

Statement II : In meiosis, one replication cycle of DNA is followed by two divisions.

(a) Both statements I and II are true.

(b) Statement I is true but statement II is false.

(c) Statement I is false but statement II is true.

(d) Both statements I and II are false.

39. Which of the following statements are correct?

(i) Prokaryotic cells are represented by PPLO.

(ii) Blue green algae lack membrane bound organelles.

(iii) Prokaryotic cell multiply more rapidly than eukaryotic cell.

(iv) Vibrio is spherical shaped bacteria.

(a) (i), (ii) and (iii)

(b) (i), (iii) and (iv)

(c) (ii), (iii) and (iv)

(d) (ii) and (iii)

40. Select the correct option with respect to mitosis.

(a) Chromatids separate but remain in the centre of the cell in anaphase.

(b) Chromatids start moving towards opposite poles in telophase.

(c) Golgi complex and endoplasmic reticulum are still visible at the end of prophase.

(d) Chromosomes move to the spindle equator and get aligned along equatorial plate in metaphase.

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SELF CHECK

No. of questions attempted .....

No. of questions correct .....

Marks scored in percentage .....

Check your score! If your score is

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

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CLASS XI

SYLLABUS*

Following the protocol of NEP (2020), NCF (2023), NCERT and CBSE guidelines, National and various State Boards for the convenience of schools and students, any change/reduction in the syllabi will be reflected in actual question papers.

Section – 1 : *Physics* : Units and Measurements, Mechanics, Properties of Matter, Heat and Thermodynamics, Oscillations, Waves. *Chemistry* : Some Basic Concepts of Chemistry, Structure of Atom, Classification of Elements and Periodicity in Properties, Chemical Bonding and Molecular Structure, Thermodynamics, Equilibrium, Redox Reactions, Organic Chemistry - Some Basic Principles and Techniques, Hydrocarbons.

Total Questions : 50 Time : 1 hr.

PATTERN & MARKING SCHEME			
Section	**(1) Physics & Chemistry**	**(2) Achievers Section**	**(3) Mathematics or Biology**
No. of Questions	**25**	**5**	**20**
Marks per Ques.	**1**	**3**	**1**

Section – 2 : Higher Order Thinking Questions - Syllabus as per Section – 1.

Section – 3 : Sets, Relations and Functions, Logarithms, Complex Numbers & Quadratic Equations, Linear Inequalities, Sequences and Series, Trigonometry, Straight Lines, Conic Sections, Permutations and Combinations, Binomial Theorem, Statistics, Limits and Derivatives, Probability, Introduction to 3-D Geometry.

OR

Section – 3 : Diversity in the Living World, Structural Organisation in Plants and Animals, Cell : Structure and Functions, Plant Physiology, Human Physiology.

Practice Questions

1. Select the correct combination of the statements (i-iv) regarding the characteristics of certain organisms.

(i) Methanogens are archaebacteria which produce methane in marshy areas.

(ii) *Nostoc* is a filamentous blue-green alga which fixes atmospheric nitrogen.

(iii) Chemosynthetic autotrophic bacteria synthesise cellulose from glucose.

(iv) Mycoplasma lack a cell wall and can survive without oxygen.

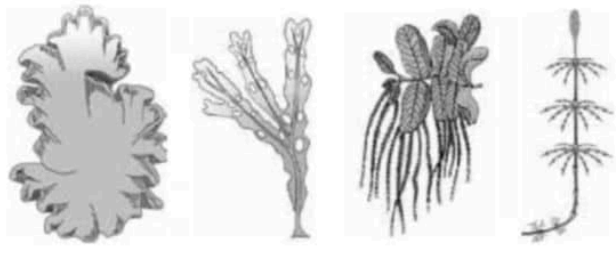
A. (ii) and (iii)
B. (i),(ii) and (iii)
C. (ii), (iii) and (iv)
D. (i), (ii) and (iv)

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

Class (Enzymes)	Type of reaction catalysed
P	Transfer of electrons
Transferases	**Q**
R	Break large molecule into smaller ones with the help of water molecule
Isomerases	**S**

	P	Q	R	S
A.	Ligases	Transfer of hydride ion	Oxido-reductases	Transfer of H atom
B.	Hydrolases	Hydrolysis reaction	Lyases	Transfer of ion
C.	Oxido-reductases	Group transfer reactions	Hydrolases	Intramole-cular rearr-angement
D.	Lyases	Transfer of H atom	Ligases	Transfer of electron

3. Study the following diagrams carefully and identify them.



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

	(i)	(ii)	(iii)	(iv)
A.	*Polysiphonia*	*Fucus*	*Selaginella*	*Equisetum*
B.	*Porphyra*	*Fucus*	*Salvinia*	*Equisetum*
C.	*Porphyra*	*Laminaria*	*Salvinia*	*Equisetum*
D.	*Polysiphonia*	*Laminaria*	*Selaginella*	*Funaria*

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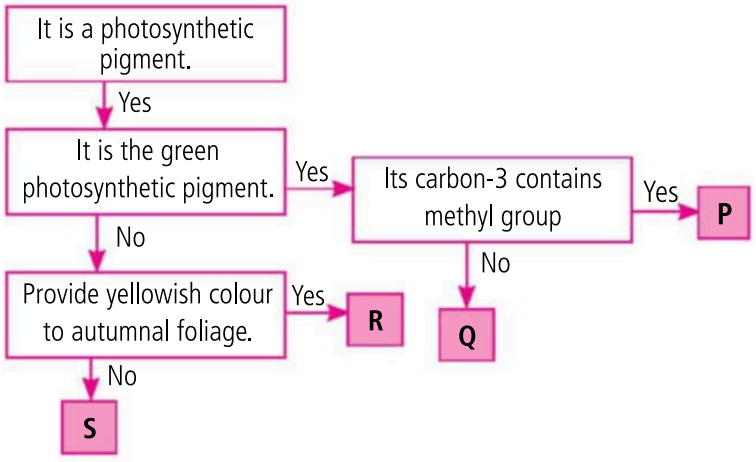
4. Which of the following shows correct sequence of various taxons in a taxonomic hierarchy of housefly?

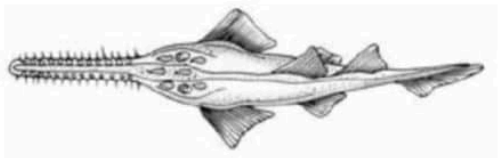
	Genus	Family	Order	Class	Phylum	Kingdom
A.	*Musca*	Muscidae	Diptera	Insecta	Arthropoda	Animalia
B.	*Musca*	Diptera	Muscidae	Insecta	Arthropoda	Animalia
C.	*Musca*	Muscidae	Primata	Diptera	Arthropoda	Animalia
D.	*Musca*	Diptera	Arthro-poda	Primata	Muscidae	Animalia

5. Study the given flow chart and identify P, Q, R and S.



	P	Q	R	S
A.	Chl. *a*	Chl. *b*	Carotene	Xanthophyll
B.	Chl. *b*	Chl. *a*	Carotene	Xanthophyll
C.	Chl. *a*	Chl. *b*	Xanthophyll	Carotene
D.	Chl. *b*	Chl. *a*	Xanthophyll	Carotene

6. Identify animal which is given in the diagram and choose correct statement for it.



A. This animal belongs to Class Chondrichthyes and these do not have to swim constantly to avoid sinking.
B. This animal belongs to Class Osteichthyes and these animals have cycloid/ctenoid scales.
C. This animal belongs to Class Chondrichthyes and these animals have cartilaginous endoskeleton and notochord is persistent throughout life.
D. This animal belongs to Class Cyclostomata and in these animals vertebral column is absent but notochord persists throughout life.

7. Select the incorrect statement.
A. Ammonia is generally excreted by diffusion across the body surfaces.
B. Little amount of urea is retained in the kidney matrix of some ureotelic animals to maintain osmolarity.
C. Many reptiles, aquatic amphibians and aquatic insects are ureotelic.
D. Both A and C

8. Read the given statements and select the correct option.
Statement 1 : In epigynous flowers, the ovary is said to be inferior.
Statement 2 : In epigynous flowers, the margin of thalamus grows upward enclosing the ovary completely and getting fused with it, the other parts of flower arise above the ovary.
A. Both statements 1 and 2 are correct and statement 2 is the correct explanation of statement 1.
B. Both statements 1 and 2 are correct but statement 2 is not the correct explanation of statement 1.
C. Statement 1 is correct but statement 2 is incorrect.
D. Both statements 1 and 2 are incorrect.

9. Which of the following is correct sequence regarding the digestive system of frog?
A. Prey → Mouth → Oesophagus → Stomach → Small intestine → Cloaca
B. Prey → Mastication by teeth → Stomach → Small intestine → Cloaca → Rectum
C. Tongue → Prey → Teeth → Large intestine → Cloaca
D. Prey → Mouth → Teeth → Pharynx → Stomach → Cloaca → Small intestine → Rectum

10. Match the column I with column II and choose the correct combination from the given options.

Column I (Organelle)		Column II (Site for)	
M.	Rough ER	(i)	Synthesis of glycoproteins
N.	Smooth ER	(ii)	Aerobic respiration
O.	Mitochondria	(iii)	Synthesis of lipid
P.	Golgi apparatus	(iv)	Protein synthesis

A. M-(i), N-(ii), O-(iii), P-(iv)
B. M-(ii), N-(iii), O-(iv), P-(i)
C. M-(iii),N-(iv), O-(ii), P-(i)
D. M-(iv),N-(iii), O-(ii), P-(i)

11. Which of the following characters are not applicable to the anatomy of dicot stem?
(i) Collenchymatous hypodermis
(ii) Exarch xylem
(iii) Pith is absent
(iv) Open vascular bundle
(v) Presence of medullary rays
A. (i), (iv) and (v) only B. (ii) and (iii) only
C. (ii) and (v) only D. (i), (ii) and (iii) only

12. Consider the following statements and select the option that correctly identifies the true (T) and false (F) ones.
(i) Each rib is a thin bone connected ventrally to the vertebral column and dorsally to the sternum.
(ii) Thoracic vertebrae, ribs and sternum together form the rib cage.

(iii) Pectoral and pelvic girdle bones help in the articulation of the lower and upper limbs respectively.

(iv) Scapula is a large triangular bone situated in the ventral part of the thorax.

	(i)	(ii)	(iii)	(iv)
A.	T	T	F	F
B.	T	F	F	T
C.	F	T	F	F
D.	F	F	F	T

13. Read the given statements.

(i) Partial pressure of oxygen in inspired air is 40 mmHg.

(ii) CO_2 is more soluble in arterial blood than in venous blood.

(iii) Formation of oxyhaemoglobin occurs on the alveolar surface.

(iv) Oxygen haemoglobin dissociation curve shift to right at the low temperature and high pH.

Of the above statements

A. (i), (ii) and (iii) are correct

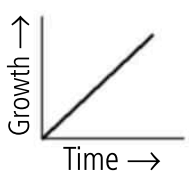
B. (iii) and (iv) are incorrect

C. (i), (ii) and (iv) are incorrect

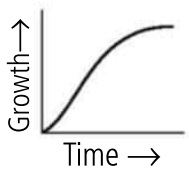
D. only (i) is correct.

14. What is the equation and corresponding graph of arithematic growth?

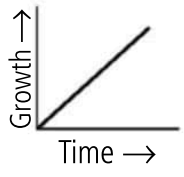
A. $L_t = L_o + rt$



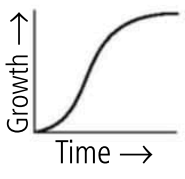
B. $\frac{dN}{dt} = rN\left(\frac{K-N}{K}\right)$



C. $W_1 = W_o e^{rt}$



D. $L_t = L_o + rt$



15. Read the statements given below carefully and find the correct statements about endocrine activity of hypothalamus.

(i) Somatostatin hormone promotes the secretion of growth hormones from anterior pituitary.

(ii) Releasing hormones from hypothalamus are transported through portal system to pituitary.

(iii) Some of the neurohormones from hypothalamus are stored in posterior pituitary.

(iv) Gonadotropins from anterior pituitary are not under regulation of hypothalamic releasing factors.

A. (i), (iii) and (iv) are correct.

B. (ii), (iii) and (iv) are correct.

C. Only (ii) and (iii) are correct.

D. Only (i) and (iv) are correct.

16. First husband of Asha had ABO blood type A and their child had type O. She remarried and her second husband had ABO blood type B and their child had type AB. What is the ABO genotype of Asha and also name her blood type?

A. *ii*; Blood type O

B. $I^B i$; Blood type B

C. $I^A I^B$; Blood type AB

D. $I^A i$; Blood type A

17. Consider the following statements each with one or two blanks.

(i) The first step in urine formation is __(1)__ and is carried out by __(2)__.

(ii) On an average __(3)__ mL of blood is filtered by the kidneys per __(4)__.

(iii) JGA is a special sensitive region formed by cellular modifications in __(5)__ and __(6)__.

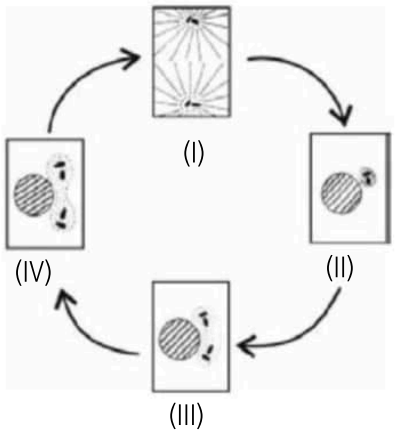
A. (1) - filtration of blood; (3) - 1200-1400, (5) - PCT

B. (2) - glomerulus; (4) - minute, (6) - afferent arteriole

C. (4) - second; (6) - efferent arteriole

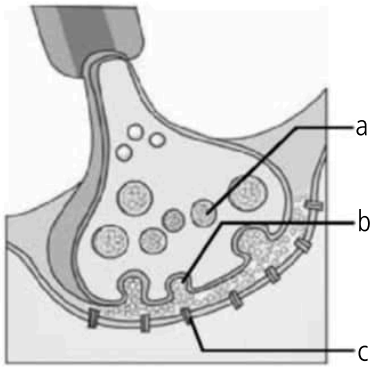
D. (3) - 1100-1200; (4) - minute; (6) - efferent arteriole

18. Refer to the given figure of centrosome cycle during cell division. Identify the stages of cell cycle to which these corresponds.



	I	II	III	IV
A.	M	G_1	G_2	S
B.	M	S	G_2	G_1
C.	S	G_1	M	G_2
D.	M	G_1	S	G_2

19. The given diagram shows axon terminal. Select the option that correctly matches the steps in transmission of impulses list (i–vii) with the labellings (a – c) in diagram.



(i) Chemicals called neurotransmitters are released in the synaptic cleft through ion channels.

(ii) When an impulse arrives at the axon terminal, it stimulates the movement of synaptic vesicles.

(iii) Neurotransmitters are endocytosed into the neurons.

(iv) The ion channels close with the binding of neurotransmitters to their specific receptors vesicles.

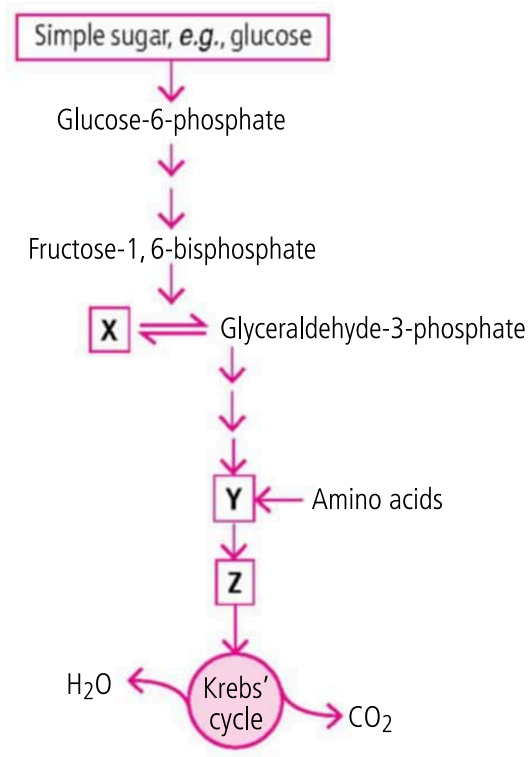
(v) Synaptic vesicles move towards the membrane where they fuse with the plasma membrane.

(vi) Neurotransmitters are released in the synaptic cleft.

(vii) The released transmitters bind to their specific receptors on post-synaptic membrane.

	(a)	(b)	(c)
A.	(ii)	(iii)	(i)
B.	(v)	(vi)	(iv)
C.	(ii)	(vi)	(vii)
D.	(v)	(iii)	(iv)

20. Metabolism of common substrates are interlinked as given in diagram. X, Y and Z are intermediates in the metabolism. Which of the intermediates are of 3 carbon?



A. X only B. Y only
C. X and Z only D. X and Y only

Darken your choice with HB Pencil

1.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	5.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	9.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	13.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	17.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
2.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	6.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	10.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	14.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	18.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
3.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	7.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	11.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	15.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	19.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
4.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	8.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	12.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	16.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	20.	Ⓐ	Ⓑ	Ⓒ	Ⓓ

ANSWER KEYS

1.	(D)	2.	(C)	3.	(B)	4.	(A)	5.	(C)	6.	(C)	7.	(C)	8.	(A)	9.	(A)	10.	(D)
11.	(B)	12.	(C)	13.	(C)	14.	(A)	15.	(C)	16.	(D)	17.	(B)	18.	(D)	19.	(C)	20.	(D)

For other sections/subjects please refer to Physics For You and Chemistry Today

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CLASS XII

SYLLABUS*

Following the protocol of NEP (2020), NCF (2023), NCERT and CBSE guidelines, National and various State Boards for the convenience of schools and students, any change/reduction in the syllabi will be reflected in actual question papers.

Section – 1 : *Physics* : Electricity and Magnetism, Electromagnetic Induction, Alternating current, Electromagnetic waves, Optics, Modern Physics, Semiconductor Electronics.

Chemistry : Solutions, Electrochemistry, Chemical Kinetics, The *d*- and *f*-Block Elements, Coordination Compounds, Haloalkanes and Haloarenes, Alcohols, Phenols and Ethers, Aldehydes, Ketones and Carboxylic Acids, Amines, Biomolecules.

Total Questions : 50 Time : 1 hr.

PATTERN & MARKING SCHEME			
Section	**(1) Physics & Chemistry**	**(2) Achievers Section**	**(3) Mathematics or Biology**
No. of Questions	**25**	**5**	**20**
Marks per Ques.	**1**	**3**	**1**

Section – 2 : Higher Order Thinking Questions - Syllabus as per Section-1.

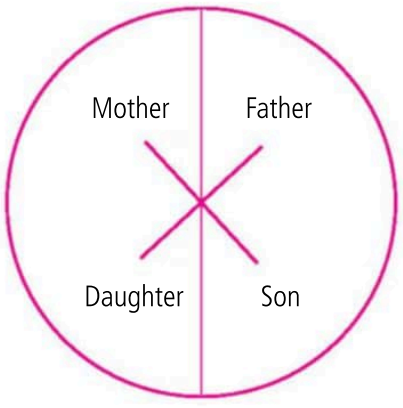
Section – 3 : Relations and Functions, Inverse Trigonometric Functions, Matrices and Determinants, Continuity and Differentiability, Application of Derivatives, Integrals, Application of Integrals, Differential Equations, Vector Algebra, Three Dimensional Geometry, Probability, Linear Programming.

OR

Section – 3 : Reproduction, Genetics and Evolution, Biology in Human Welfare, Biotechnology, Ecology.

Practice Questions

1. Represented below is the inheritance pattern of a certain type of trait in humans. Which one of the following conditions could be an example of this pattern?



A. Phenylketonuria B. Sickle cell anaemia
C. Haemophilia D. Thalassemia

2. Fill the blank spaces in the table given below by selecting the correct option.

Type of microbes	Scientific name	Products formed
Fungus	**P**	Penicillin
Bacterium	**Q**	Lactic acid
Fungus	*Trichoderma polysporum*	**R**
S	*Monascus purpureus*	Statins

A. P-*Aspergillus niger*, Q-*Streptococcus*, R-Citric acid, S-Fungus
B. P-*Claviceps purpurea*, Q-*Clostridium butyricum*, R-Acetic acid, S-Bacterium
C. P-*Penicillium notatum*, Q-*Lactobacillus* sp. R-Cyclosporin-A, S-Yeast
D. P-*Penicillium notatum*, Q-*Acetobacter aceti*, R-Ergot alkaloids, S-Yeast

3. Consider the following statements with respect to flowering plants.
(i) The pollen grains represent the male gametes.
(ii) The functional megaspore which develops into the embryo sac represent the female gamete.
(iii) Transfer of pollen grains from anther to the stigma of different plant is known as xenogamy.
(iv) Transfer of pollen grains from anther to the stigma of another flower of the same plant is known as geitonogamy.

Of the above statements.
A. Only (i) and (ii) are correct.
B. Only (i) and (iii) are correct.
C. Only (i) and (iv) are correct.
D. Only (iii) and (iv) are correct.

*For latest updates visit www.sofworld.org

4. Match the given fertilisation methods (a-h) to their respective characteristic (I-VI).

I. Collected gametes are made to form the zygote in the laboratory.
II. Zygote or early embryo with upto 8 blastomeres is transferred into the oviduct.
III. Embryo with more than 8 blastomeres, is transferred into the uterus.
IV. Fusion of the gametes in the female reproductive tract.
V. Transfer of the ovum from a donor to the oviduct of the recipient.
VI. Sperm is injected directly into the ovum, *in vitro*.

(a) GIFT (b) ZIFT
(c) AIT (d) ICSI
(e) IUT (f) IVF
(g) IUI (h) *In vivo* fertilisation

A. I-(f), II-(b), III-(e), IV-(h), V-(a), VI-(d)
B. I-(g), II-(b), III-(f), IV-(h), V-(a), VI-(d)
C. I-(g), II-(b), III-(f), IV-(h), V-(c), VI-(a)
D. I-(f), II-(b), III-(a), IV-(h), V-(d), VI-(g)

5. Consider the following differences and select the correct option.

	***In situ* conservation**	***Ex situ* conservation**
(i)	It is conservation of endangered species in their natural habitats.	It is conservation of endangered species outside their natural habitats.
(ii)	Endangered species are kept under human supervision.	The depleting resources are augmented.
(iii)	Offspring produced in captive breeding are released in natural habitat for acclimatisation.	The population recovers in natural environment.

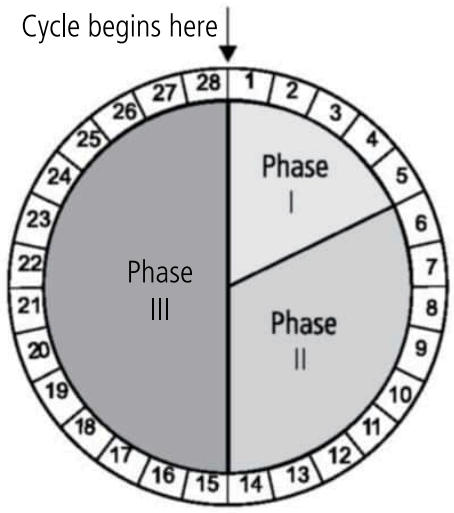
A. (i) and (iii) are incorrect.
B. (i) and (ii) are incorrect.
C. Only (iii) is incorrect.
D. (ii) and (iii) are incorrect.

6. Which of the following statements about transgenic animals is/are false?

(i) Transgenic animals are designed to study how genes are regulated.
(ii) They are specially made to serve as models for human diseases.
(iii) Transgenic cow Rosie was created to produce the human protein α-1-antitrypsin.
(iv) Transgenic mice are used to test the safety of vaccines.

A. (iii) only
B. (i) and (iii) only
C. (ii) only
D. (ii) and (iii) only

7. Refer to the given schematic representation of menstrual cycle showing three phases I, II and III. Select the option that correctly matches these phases with the following events.



(i) FSH secreted by the anterior pituitary stimulates the ovarian follicle to secrete oestrogen which stimulates the proliferation of the endometrium.
(ii) LH secreted by the anterior pituitary stimulates the development of corpus luteum which secretes progesterone.
(iii) Progesterone production is reduced thereby endometrium lining disintegrates.

	Phase I	**Phase II**	**Phase III**
A.	(i)	(ii)	(iii)
B.	(iii)	(i)	(ii)
C.	(ii)	(iii)	(i)
D.	(iii)	(ii)	(i)

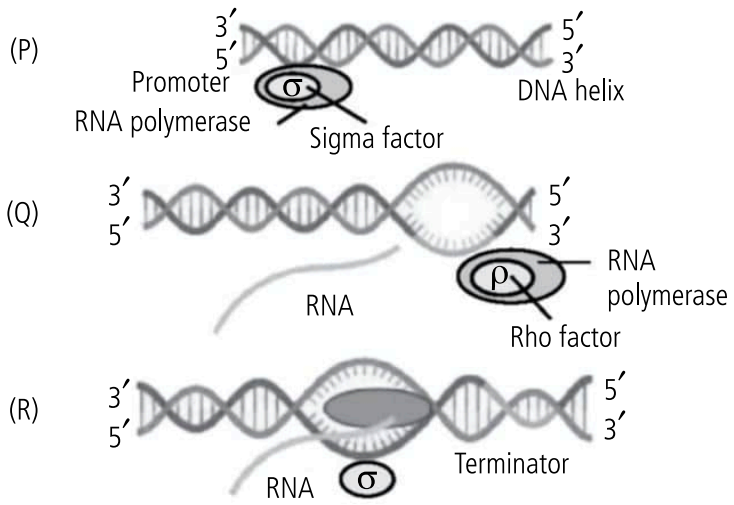
ANSWERS AUGUST 2024

Across
1. *Gonyaulax*
3. Albuminous
5. Glycolipid
7. Aneuploidy

Down
2. Vasectomy
4. Thalloid
6. Smack
8. Unipolar

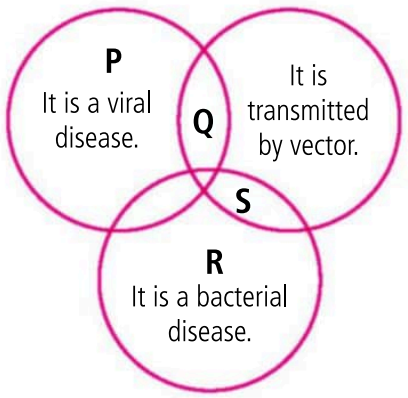
Winner : *Pawan Gupta (Bihar)*

8. Identify (P), (Q) and (R).



A. (P) Elongation, (Q) Termination, (R) Initiation
B. (P) Initiation, (Q) Termination, (R) Elongation
C. (P) Initiation, (Q) Elongation, (R) Termination
D. (P) Termination, (Q) Elongation, (R) Initiation

9. Refer to the given Venn diagram.



Identify P, Q, R and S and select the correct option.

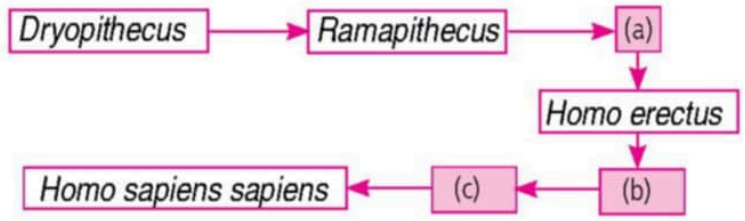
	P	Q	R	S
A.	Dengue	Poliomyelitis	Typhoid	Cholera
B.	Rabies	Hepatitis	Leprosy	Pertussis
C.	Rhinitis	AIDS	Tetanus	Cholera
D.	Mumps	Chikungunya	Diphtheria	Bubonic plague

10. Arrange the following steps involved in the process of recombinant biotechnology in correct order.

I. Extraction of the desired gene product
II. Amplification of the gene of interest
III. Isolation of a desired DNA fragment
IV. Ligation of the DNA fragment into a vector
V. Insertion of recombinant DNA into the host

A. I, II, III, IV and V
B. III, II, IV, V and I
C. III, II, V, IV and I
D. I, IV, V, III and II.

11. Given flow chart shows the chronological order of evolution of human from early to recent. Identify the missing links (a), (b) and (c) from options given below.



A. (a) – *Homo habilis*, (b) – *Australopithecus*, (c) – Cro-magnon man
B. (a) – *Australopithecus*, (b) – Neanderthal man, (c) – *Homo habilis*
C. (a) – *Homo habilis*, (b) – Cro-magnon man, (c) – *Homo sapiens fossilis*
D. (a) – *Australopithecus*, (b) – Neanderthal man, (c) – Cro-magnon man

12. Select the correct statement.

A. In a population, number of births is different from birth rate
B. A sigmoid growth curve is depiction of exponential growth
C. In a logistic growth curve the asymptote is beyond the carrying capacity
D. '*r*' is equal to the summation of number of births and number of deaths in a population.

13. Select the correct option regarding the ploidy level of different structures of an angiospermic ovule.

	Synergid	Nucellus	Antipodal	Egg
A.	n	n	2n	2n
B.	n	2n	n	n
C.	n	2n	n	2n
D.	n	n	n	2n

14. The result of which of the following experiments carried out by Avery *et. al.*, on *Streptococcus pneumoniae* has proved conclusively that DNA is the genetic material?

A. Live 'R' strain + DNA from 'S' strain + RNase
B. Live 'R' strain + DNA from 'S' strain + DNase
C. Live 'R' strain + Denatured DNA of 'S' strain + Protease
D. Heat killed 'R' strain + DNA from 'S' strain + DNase

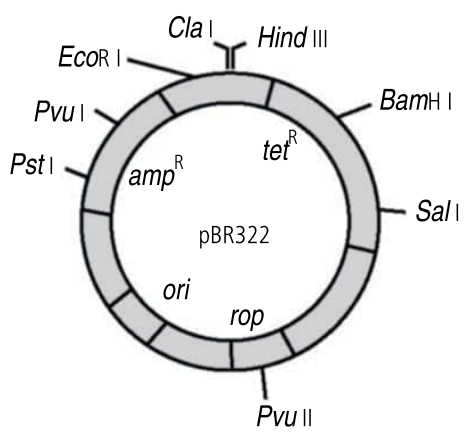
15. The given table shows some information about the trophic levels of a food chain.

Trophic level	Energy in the trophic level	Number of organisms
P	10,000 kJ	1000
Q	200 kJ	10
R	100,000 kJ	1
S	2000 kJ	500

Select the option with correct order of trophic levels in a food chain.

A. Q → S → P → R B. S → Q → R → P
C. P → R → Q → S D. R → P → S → Q

16. 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)?



A. *ori*-original restriction enzyme
B. *rop*-reduced osmotic pressure
C. *Hin*dIII, *Eco*RI - selectable markers
D. amp^R, tet^R–antibiotic resistance genes

17. Select the correct statement from the following.

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 sediments in settlement tanks of sewage treatment plant is a rich source of aerobic bacteria.

18. In an organism, tall phenotype is dominant over recessive dwarf phenotype, and the alleles are designated as T and t, respectively. Upon crossing two different individuals, total 250 offsprings were obtained, out of which 124 displayed tall phenotype and rest were dwarf. Thus, the genotype of the parents were

A. TT × TT B. TT × tt
C. Tt × Tt D. Tt × tt.

19. Which of the following statements is not true?

A. The biodiversity decreases with increasing latitude.
B. The biodiversity decreases with increasing altitude.
C. The fishes show greatest biodiversity among vertebrates.
D. The biodiversity of bryophytes is greater than that of angiosperms.

20. A person suffering from a disease caused by *Plasmodium* experiences recurring chill and fever at the time when

A. the sporozoites released from RBCs are being rapidly killed and broken down inside spleen
B. the trophozoites reach maximum growth and give out certain toxins
C. the parasite after its rapid multiplication inside RBCs ruptures them, releasing the stage to enter fresh RBCs
D. the microgametocytes and megagametocytes are being destroyed by the WBCs.

Darken your choice with HB Pencil

1.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	5.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	9.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	13.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	17.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
2.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	6.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	10.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	14.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	18.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
3.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	7.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	11.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	15.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	19.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
4.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	8.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	12.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	16.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	20.	Ⓐ	Ⓑ	Ⓒ	Ⓓ

ANSWER KEYS

1.	(C)	2.	(C)	3.	(D)	4.	(A)	5.	(D)	6.	(A)	7.	(B)	8.	(B)	9.	(D)	10.	(B)
11.	(D)	12.	(A)	13.	(B)	14.	(B)	15.	(D)	16.	(D)	17.	(D)	18.	(D)	19.	(D)	20.	(C)

For other sections/subjects please refer to Physics For You and Chemistry Today

☺☺

Quiz CLUB

Unlock Your Knowledge!

1. Which of the following is known as smallest angiospermic parasite?
(a) *Thalassia* (b) *Wolffia*
(c) *Arceuthobium* (d) *Santalum*

2. On which date World Contraception Day is observed every year?
(a) 4th September (b) 26th September
(c) 26th October (d) 30th September

3. Identify a rare protozoan disease caused by tick bites.
(a) Typhus (b) Scarlet fever
(c) Babesiosis (d) Botulism

4. Who among the following is regarded as 'Father of biochemical genetics'?
(a) Sir Archibald E.Garrod (b) Francis Galton
(c) Andrew Wang (d) Severo Ochoa

5. What is the term used to describe abnormal enlargement of pupil?
(a) Agraphia (b) Ataxia
(c) Alexia (d) Mydriasis

6. What did Marcello Malpighi discovered?
(a) Lymphocytes (b) Capillaries
(c) Arteries (d) Spermatogonia

7. Which of the following is the most radiosensitive tissues in the body?
(a) Skeletal tissue (b) Nervous tissue
(c) Adipose tissue (d) Bone marrow

8. What is the study of sponges called?
(a) Kinesiology (b) Parazoology
(c) Exobiology (d) Entomology

9. What is the collapse of the air sacs of the lung called?
(a) Cyanosis (b) Turbinals
(c) Orthopnea (d) Atelectasis

10. Identify the smallest bone in the skull of frog.
(a) Septomaxillary (b) Astragalus
(c) Calcaneum (d) Antebrachium

11. Which type of cell division helps in regeneration of cells?
(a) Amitosis (b) Mitosis
(c) Meiosis (d) Karyokinesis

12. What is the medical term for red colourblindness?
(a) Deuteranopia (b) Tritanopia
(c) Protanopia (d) Deuteranomaly

13. Which rule states that the birds of colder areas have narrow and acuminate wings while those of warmer areas have broader wings?
(a) Jordon's rule
(b) Rensch's rule
(c) Bergaman's rule
(d) Allen's rule

14. Which of the following causes the mammary glands to enlarge at puberty?
(a) Testosterone (b) Progesterone
(c) Estrogen (d) Oxytocin

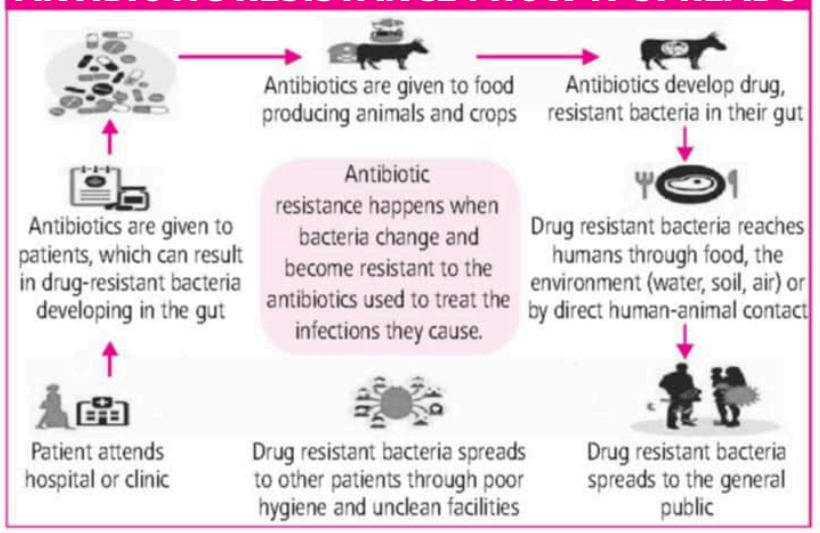
15. What is the family of *Theobroma cacao*?
(a) Rubiaceae (b) Asteraceae
(c) Solanaceae (d) Malvaceae

Answer Key

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

☺☺

ANTIBIOTIC RESISTANCE : HOW IT SPREADS



GK CORNER

Enhance Your General Knowledge with Current Updates!

WORLD OF MICROBIOLOGY

- **ISAPP's board of directors announced Dr. Rounak Chourasia Ph.D, a research associate at the National Agri-food Biotechnology Institute, Mohali, Punjab (India) as the 2024 winner of the Gregor Reid Award for an outstanding scholar in developing nations.** Dr. Chourasia's work focuses on discovering microorganisms with specific properties that contribute to the enhanced health benefits of a traditional cheese called chhurpi from Sikkim Himalaya (a state in Northeast India). He has developed a process for the production of milk cheese using selected strains of lactic acid bacteria, resulting in the release of novel bioactive peptides with potential nutraceutical applications.
- A recent study by researchers at the Central University of Punjab found abnormal platelet activity in Parkinson's disease (PD). **Using the neurotoxin, a rotenone to simulate PD conditions, researchers shed light on why PD patients have a lower risk of ischaemic strokes and heart attacks, by focusing on the role of platelets in thrombosis.** PD is a progressive neurodegenerative disorder that affects dopaminergic neurons, responsible for dopamine synthesis in the brain. Dopamine, often referred to as the "feel-good hormone," or 'happy hormone" plays a crucial role in regulating the Autonomic Nervous System (ANS), which controls involuntary bodily functions such as heart rate, blood pressure, and respiration. The depletion of dopamine in PD can significantly impact these functions. Researchers said that certain changes in platelets might protect PD patients from experiencing ischemic brain strokes and heart attacks, given the crucial role of platelets in clot formation. They evaluated four major functional parameters of platelets: adhesion, activation, degranulation, and aggregation'.
- **Research from the Stowers Institute for Medical Research has revealed that dengue virus genome, along with hundreds of viruses, uses less efficient codons to make its own proteins using the host's machinery to replicate, and spread.** This finding, published in the journal *Molecular Systems Biology* on July 22, 2024, suggests that dengue virus and other similar viruses may exploit these suboptimal codons to evade the host's antiviral response and enhance their replication. The study, led by Luciana Castellano and Ariel Bazzini, also identified that viruses like HIV and SARS-CoV-2 use less efficient codons in humans, indicating a potential universal strategy among viruses to manipulate host cell machinery, this new understanding of viral "vocabulary" could aid in developing novel antiviral treatments and vaccines.
- **A recent small clinical trial has shown that fecal microbiota transplants (FMTs) can boost the effectiveness of immunotherapy in a range of gastrointestinal cancers.** Published on July 25 in the journal *Cell Host & Microbe*, the study involved 13 patients with cancers such as gastric, oesophageal and hepatocellular carcinoma who were resistant to immune checkpoint inhibitors. Of these, 6 patients benefited from FMTs from donors who had previously responded to similar treatments. The research highlighted the role of gut microbiota in modulating immune response and revealed specific bacterial strains linked to better or worse responses to FMTs and immune checkpoint therapies. This study, which extends the application of FMT beyond melanoma, demonstrates the potential of this approach to overcome resistance to immune inhibitors in other cancers.
- Researchers at George Mason University's Center for Infectious Disease Research (CIDR) and Tulane National Primate Research Center conducted a breakthrough proof of concept study in Nature's Gene Therapy that found an HIV-like virus particle that could cease the need for lifelong medications. Scientists have made great strides in the treatment of HIV (human immunodeficiency virus) over the past few decades, yet those with the virus must still take antiretroviral therapy (ART) for life as the disease is difficult to eradicate. Professor Yuntao Wu, have developed a new HIV treatment approach using HIV Rev-dependent lentiviral vector. This technology selectively targets and activates therapeutic genes in HIV-infected cells by leveraging the HIV Rev protein. The approach termed "rehab and redeem", aims to reduce viral reservoirs and stimulate

antiviral immune responses by turning infected cells into defective virus producers that can act as vaccine.

- A team of researchers from Penn State College of Medicine found a new target for treating diseases associated with human T-cell leukemia virus type 1 (HTLV-1). **They determined that blocking a class of enzymes called kinases, which regulates cellular functions,** leads to cell death caused by the degradation of Tax, **a protein essential for viral gene expression, viral transmission and survival of cells infected by HTLV-1.** The team published the findings in *Nature Communications*. The research team set out to identify kinases that HTLV-1-infected cells need to survive. Using human cells transformed by the virus, the researchers performed a short hairpin RNA screen - a molecular analysis that allowed the team to inhibit the expression of over 600 genes that encode kinases. The results showed that only KDR, a tyrosine kinase also known as VEGFR2, was essential for the viability of the cells.
- Scientists of University of Southern California have discovered a way to turn the body's B cells into tiny surveillance machines and antibody factories that can pump out specially designed antibodies to destroy cancer cells or HIV, two of medicine's most formidable foes. The research, published on July 22nd 2024 in **Nature Biomedical Engineering**, **describes a technique for editing the genes of immune cells called B cells, turbocharging them to fight even the sneakiest invaders.** B cells behave differently, making them more suitable for fighting chronic conditions. They function as both a security system and antibody factory, residing long-term in the bone marrow, lymph nodes and spleen — and firing up when needed. To make these tiny fighters, they used CRISPR gene editing methods to place the instructions for custom antibodies at the exact site in the B cell's DNA where antibodies are naturally made. This trick means that B cells can be reprogrammed as biofactories making the custom antibodies.

Test Yourself!

1. Which award was received by Dr.Rounak Chourasia (Indian microbiology researcher) for an outstanding scholar in developing nations?
(a) Vigyan Ratan award
(b) Gregor Reid award
(c) FEMS-Lwoff award
(d) Selman A.Walksman award

2. For which disease researcher of Central University of Punjab used the neurotoxin rotenone?
(a) Alzhiemer's disease (b) Rubella
(c) Parkinson's disease (d) Alopecia areata

3. Which class of enzymes need to be blocked to treat the disease associated with human T-cell leukemia virus type 1 (HTLV-1)?
(a) Kinases (b) Transferases
(c) Isomerases (d) Lyases

4. Professor _____ has developed a new HIV treatment approach using HIV Rev-dependent lentiviral vector at George Mason University's Center for Infectious Disease Research (CIDR).
(a) Ariel Bazzini (b) Yuntao Wu
(c) Luciana Castellano (d) Samir Kumar Beura

5. Identify the hormone which is also known as 'feel good hormone'?
(a) Adrenaline (b) Cortisol
(c) Melatonin (d) Dopamine

6. What is the full form of FMT?
(a) Forensic medicine and toxicology
(b) Fecal microbiota transplants
(c) Forensic medicine transportation
(d) Functional medicine transfer

7. Which journal revealed that the dengue virus genome uses less efficient codons, to make its own proteins using the host's machinery to replicate, and spread?
(a) *Nature Biomedical Engineering*
(b) *Nature's Gene Therapy*
(c) *Cell Host & Microbe*
(d) *Molecular Systems Biology*

8. Dr. Chourasia used which traditional cheese from India to discover microorganisms with specific properties that contributed to enhance their health benefits?
(a) Kalari from Jammu and Kashmir
(b) Bandel from West Bengal
(c) Chhurpi from Sikkim.
(d) Kalimpong Cheese from Kalimpong, West Bengal

9. In clinical trial, fecal matter transplant helped patients suffering from which cancer?
(a) Gastrointestinal cancers
(b) Bone tumor
(c) Bladder cancer
(d) Pancreatic cancer

10. On which date, scientists of University of Southern California published their work regarding a technique for editing the genes of immune cells called B cells, turbocharging them to fight even the sneakiest invaders?
(a) 26th July 2024 (b) 22nd July 2024
(c) 25th July 2024 (d) 30th July 2024

☺☺

Answer Key

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

WORD GRID

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

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

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

Clues

1. Finger-like projections that help in collection of the ovum after ovulation.
2. A type of aestivation, where the largest petal, *i.e.*, standard overlaps two wings which in turn overlap the two smallest keel.
3. A segment of DNA coding for a polypeptide.
4. It is a hollow foliar structure that encloses few leaf primordia in monocotyledons.
5. A condition that is characterised by the presence of glucose in urine.
6. A fish-like reptile evolved from land reptiles that went back into water around 200 mya.
7. Another name for forewings of cockroaches that are opaque dark and leathery and cover the hind wings when at rest.
8. Term used for vertical distribution of different species occupying different levels.
9. A thick waxy layer present outside the epidermis that prevent the loss of water.
10. An active chemical produced by plant *Rauwolfia vomitoria* showing differences in the potency and concentration due to genetic diversity.
11. It is the first heart sound in humans that is associated with the closure of the tricuspid and bicuspid valves.
12. The term used for the use of bio-resources by multinational companies and other organisations without proper authorisation from the countries.
13. It is a free-living bacteria in the soil, that fixes atmospheric nitrogen, thus enriching the nitrogen content of the soil.
14. A member of Kingdom Protista, that multiply rapidly and make the sea appear red.
15. The third germinal layer present in the developing embryo of animals belonging to the Phylum Platyhelminthes.
16. A very thin middle layer present inside the skull of human brain.
17. A type of nuclease enzyme which remove nucleotides from the ends of DNA.
18. A group of algae with major pigments as chlorophyll *a*, *c* and fucoxanthin.
19. A secondary lymphoid organ having a large reservoir of erythrocytes.
20. A hallucinogenic alkaloid also known as crack having a stimulating action on central nervous system.

Note : Please send entries of solutions, both with words and a scanned copy of the grid, by the 10th of every month.

Class XI

ZOOM in BIO

The syllabus of biology for boards and competitive exams is very vast which impedes students from acquiring indepth knowledge and covering the entire syllabus at the same time. An important topic for biology is therefore presented here in elaborate form to enable students grasp the topic.

Human Endocrine System

Cell functions are broadly controlled by nervous and endocrine system. Endocrine system achieves coordination and integration by the release of physiologically active substances called **hormones** directly into the blood stream. It has slower action (*i.e.*, much longer latent period) and affects number of cells over a longer period.

In vertebrate body, glands are classified into exocrine and endocrine glands on the basis of presence or absence of ducts.

Types of Glands

Exocrine glands

- Glands with ducts
- Secretions of these glands are carried by ducts to a particular organ.
- *E.g.*, salivary glands, liver, etc.

Endocrine glands

- Ductless glands or glands of internal secretion.
- Their secretion get absorbed into immediate surrounding blood circulation to reach specific organs to initiate particular metabolic change.
- Chemicals secreted are called hormones.
- *E.g.*, pituitary gland, hypothalamus, etc.

Holocrine glands

Endocrine glands which secrete only hormones. *E.g.*, thyroid, parathyroid, adrenal, pituitary gland

Heterocrine glands

Glands which have dual functions (secretion of hormones and some other functions). *E.g.*, pancreas, testes, ovaries, etc.

Properties of Hormones

(i) They have low molecular weight.
(ii) They are soluble in water and blood.
(iii) They have no cumulative effect.
(iv) They can act in very low concentration.
(v) They are non-antigenic.
(vi) They may act slowly or quickly.
(vii) Hormone controlled reactions are not reversible.
(viii) Their excess or deficiency leads to disorders.
(ix) They do not provide energy or building materials.
(x) Many hormones are produced in inactive form called prohormones, *e.g.*, insulin is secreted as proinsulin.

CLASSIFICATION OF HORMONES

Amino Acid Derivative Hormones

- Epinephrine, nor-epinephrine,
- T_3, melatonin, serotonin

Protein Hormones

- Hormones generally water soluble and circulate unbound in plasma.
- Hormones are synthesised on ribosomes, attached to ER.
- *E.g.*, anterior pituitary hormones, parathormone, insulin, glucagon, etc.

Steroid Hormones

- Hydrophobic, lipid soluble substances synthesised from cholesterol.
- *E.g.*, aldosterone, cortisol, androgens, etc.

Peptide Hormones

- Hormones of posterior lobe of pituitary gland.
- *E.g.*,oxytocin and vasopressin

Hypothalamus secrete neurohormones that act on the cells of the pituitary gland.
Releasing hormones: GHRH, ARH, TRH, GnRH, PRH
Inhibitory hormones: GHIH, PIH, MSHIH

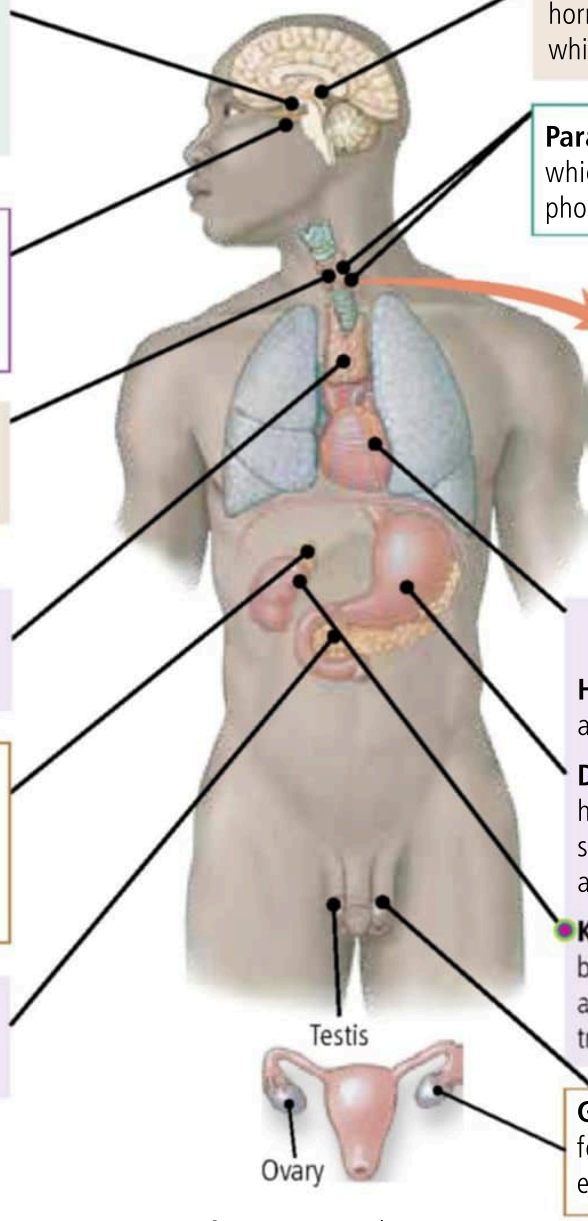
Pituitary gland secretes multiple hormones that regulate the endocrine activities of the adrenal cortex, thyroid gland and reproductive organs, *e.g.*, ACTH, TSH, FSH, LH, etc.

Thyroid gland secretes hormones that affect metabolic rate and calcium levels in body fluids, *e.g.*, **thyroxine, calcitonin, tri-iodothyronine.**

Thymus gland secrete **thymosin** involved in the stimulation and coordination of the immune response.

Adrenal gland secretes hormones involved with mineral balance, metabolic control and resistance to stress; the adrenal medulla release **epinephrine** and **nor-epinephrine** and adrenal cortex secretes **cortisol, aldosterone,** etc.

Pancreas secretes hormones that regulate the rate of glucose uptake and utilisation by body tissues, *e.g.*, **insulin, glucagon**.



Pineal gland secretes **melatonin**, a sleep hormone. Pineal gland acts as biological clock which helps to establish circadian rhythms.

Parathyroid glands secrete **parathormone** which maintains proper levels of calcium and phosphorus by regulating renal action.

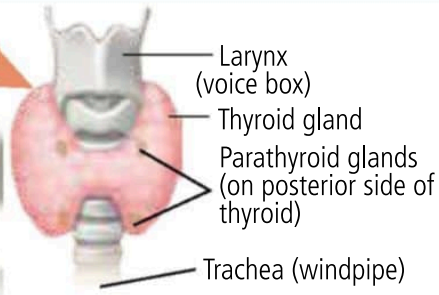


Fig.: Enlarged view of thyroid gland

Organs with secondary endocrine functions

Heart: Secretes hormone **ANF** from cells of atria, called **cardiocytes.**

Digestive Tract: Secretes numerous hormones involved in the coordination of system functions, glucose metabolism and appetite, *e.g.*, gastrin, secretin, etc.

Kidneys: Secrete hormones that regulate red blood cell production and the rate of calcium and phosphate absorption by the intestinal tract, *e.g.*, renin, erythropoietin, calcitriol.

Gonads: Secrete hormones affecting gamete formation and sexual characteristics, *e.g.*, estrogen, testosterone, etc.

Fig.: Human Endocrine System

HUMAN ENDOCRINE GLANDS

Hypothalamus (Supreme Commander)

It is a neuroendocrine organ that produces several neurohormones and its target organ is pituitary. Hypothalamus is the basal part of diencephalon (a part of forebrain) and it regulates a wide spectrum of body functions.

The hormones produced by hypothalamus are of two types, the **releasing hormones** (which stimulate secretions of pituitary hormones) and the **inhibiting hormones** (which inhibit secretions of pituitary hormones).

Table : Hormones of hypothalamus

S.No.	Hormones	Functions
(i)	Adrenocorticotropic releasing hormone (ARH) or corticotropin releasing hormone	Stimulates the anterior lobe of the pituitary gland to secrete its adrenocorticotropic hormone (ACTH).
(ii)	Thyrotropin releasing hormone (TRH)	Stimulates the anterior lobe of the pituitary gland to secrete its thyroid stimulating hormone (TSH) or thyrotropin.
(iii)	Growth hormone-releasing hormone (GHRH)	Stimulates the anterior lobe of the pituitary gland to release its growth hormone (GH) or somatotropin.
(iv)	Growth hormone-inhibitory hormone (GHIH) or Somatostatin	Inhibits the secretion of growth hormone from the anterior lobe of the pituitary gland.
(v)	Gonadotropin releasing hormone (GnRH)	Stimulates the anterior lobe of the pituitary gland to secrete two gonadotropic hormones follicle stimulating hormone (FSH) and luteinising hormone (LH).
(vi)	Prolactin releasing hormone (PRH)	Stimulates the anterior lobe of the pituitary gland to secrete its prolactin.
(vii)	Prolactin inhibitory hormone (PIH)	Inhibits the secretion of prolactin from the anterior lobe of pituitary gland.
(viii)	MSH releasing hormone (MSHRH)	Stimulates the intermediate lobe of the pituitary gland to secrete its melanocyte stimulating hormone (MSH).
(ix)	MSH inhibitory hormone (MSHIH)	Inhibits the secretion of melanocyte stimulating hormone from the intermediate lobe of the pituitary gland.

Pituitary Gland (Master Endocrine Gland)

It is **smallest endocrine gland** present in a depression called sella turcica of sphenoid bone in skull. It is attached to the brain by a stalk called **infundibulum** which is continuous with the hypothalamus.

Morphologically there are two main lobes – **anterior lobe** or adenohypophysis or pars distalis and **posterior lobe** or neurohypophysis or pars nervosa. A third lobe called intermediate lobe or pars intermedia is a part of adenohypophysis.

Table : Hormones of pituitary gland

S.No.	Hormones	Functions
	Hormones of anterior lobe	
(i)	Growth hormone (GH) or Somatotropin hormone (STH)	Stimulates growth, promotes protein anabolism, etc.
(ii)	Thyroid stimulating hormone (TSH) or thyrotropin	Controls growth and activity of thyroid gland and influences iodine uptake.

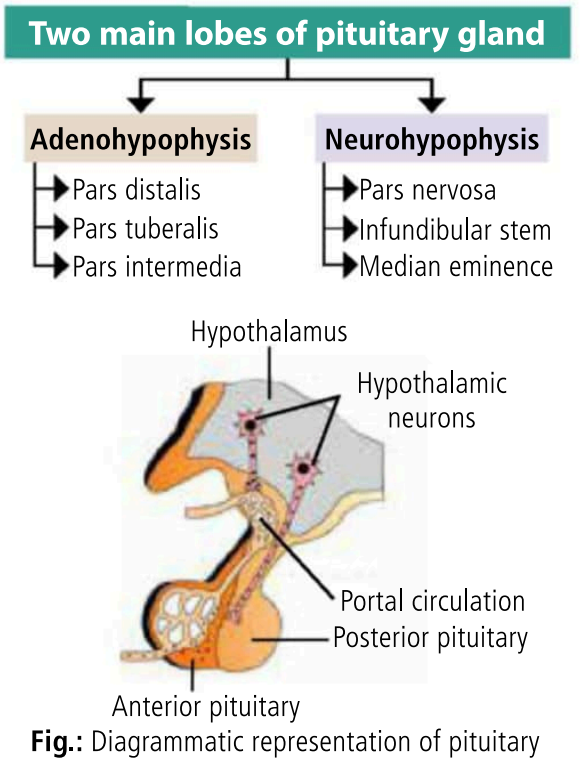


Fig.: Diagrammatic representation of pituitary and its relation with hypothalamus

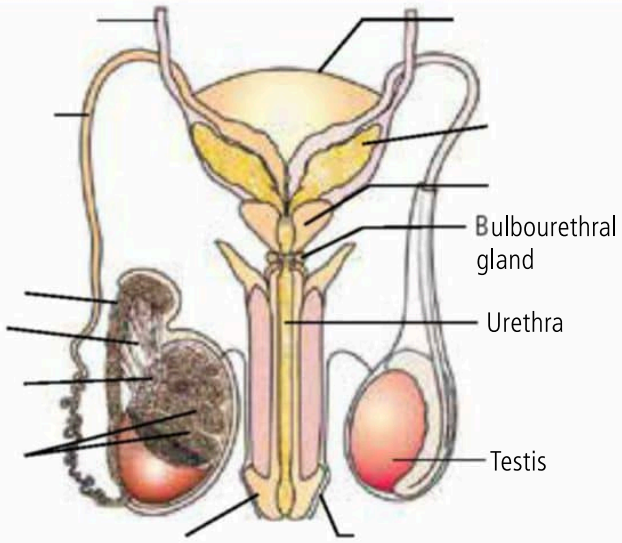
CONCEPT MAP

Human Reproduction

Humans are sexually reproducing and viviparous organisms. Reproductive events c differences between the reproductive events in the male and female. Reproductive s which can be distinguished into primary organs which produce gametes and sex neither produce gametes nor secrete sex hormones but perform important functio

Male Reproductive System

- Consists of paired structure testes lying in scrotum. It helps in spermatogenesis or sperm formation.
- Accessory glands include paired seminal vesicles, a prostate and paired bulbourethral glands.



Female Reproductive System

- Consists of a pair of ovaries along with a pair of oviducts (fallopian tubes), uterus, cervix,vagina and external genitalia.
- Oogenesis or ova formation occurs in ovaries.

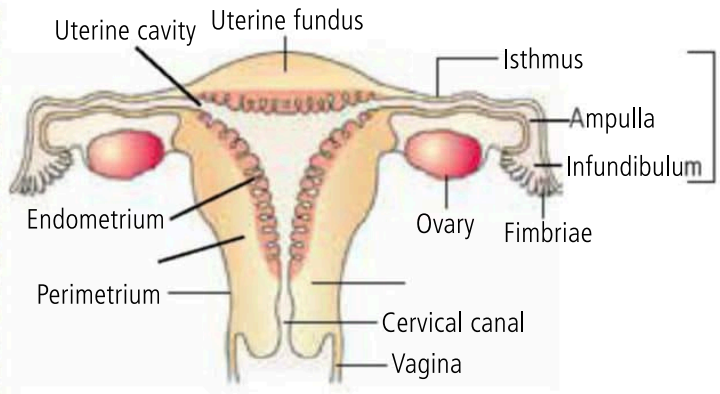
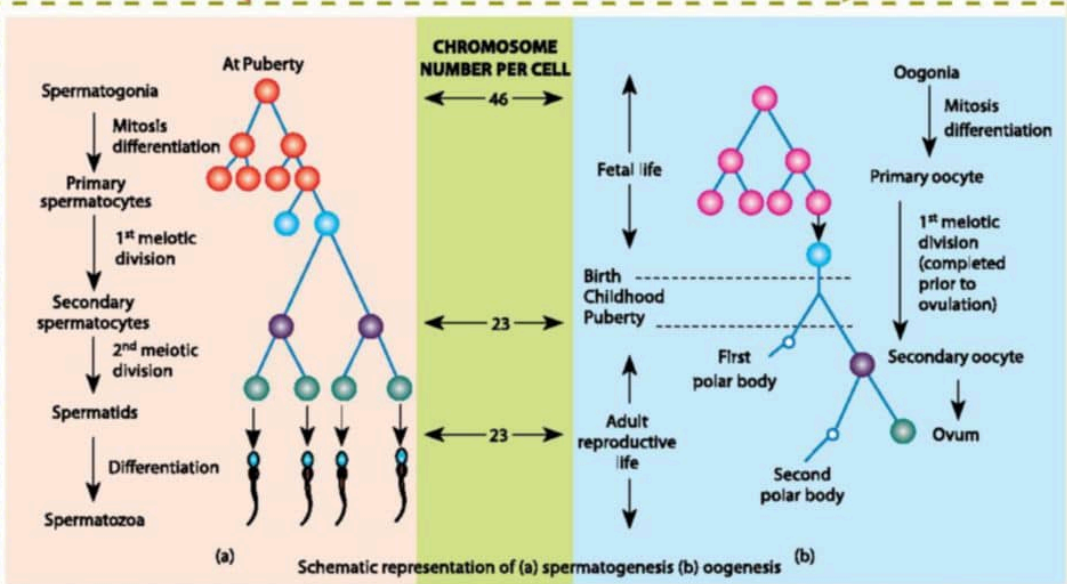


Fig.: Diagrammatic sectional view of the female reproductive system



Schematic representation of (a) spermatogenesis (b) oogenesis

Gametogenesis

- It is the process by which male and female sex cells or gametes, *i.e.*, sperms and ova are formed in the testes and ovaries, respectively.
- **Spermatogenesis** is the process of formation of haploid spermatozoa (sperms) from diploid spermatogonia inside the testes of male.
- **Spermatogenesis** occurs in the seminiferous tubules of the testes, which are lined by germinal epithelium and mainly consists of four phases : multiplication phase, growth phase,maturation phase and spermiogenesis.
- **Oogenesis** is the process of formation of functional haploid ova from the diploid germinal cells in the ovary.
- Oogenesis consists of three phases : multiplication, growth and maturation.

occur after puberty. There are remarkable system of both the sexes consist of organs hormones and secondary organs which ns in conduction of gametes (sex organs).

Menstrual Cycle

- The series of cyclic changes that occur throughout the reproductive phase in female primates (humans, monkeys and apes) in a definite period to prepare them for fertilisation and pregnancy is called menstrual cycle.
- There are four phases of menstrual cycle : menstrual phase, follicular phase, ovulatory phase and luteal phase.

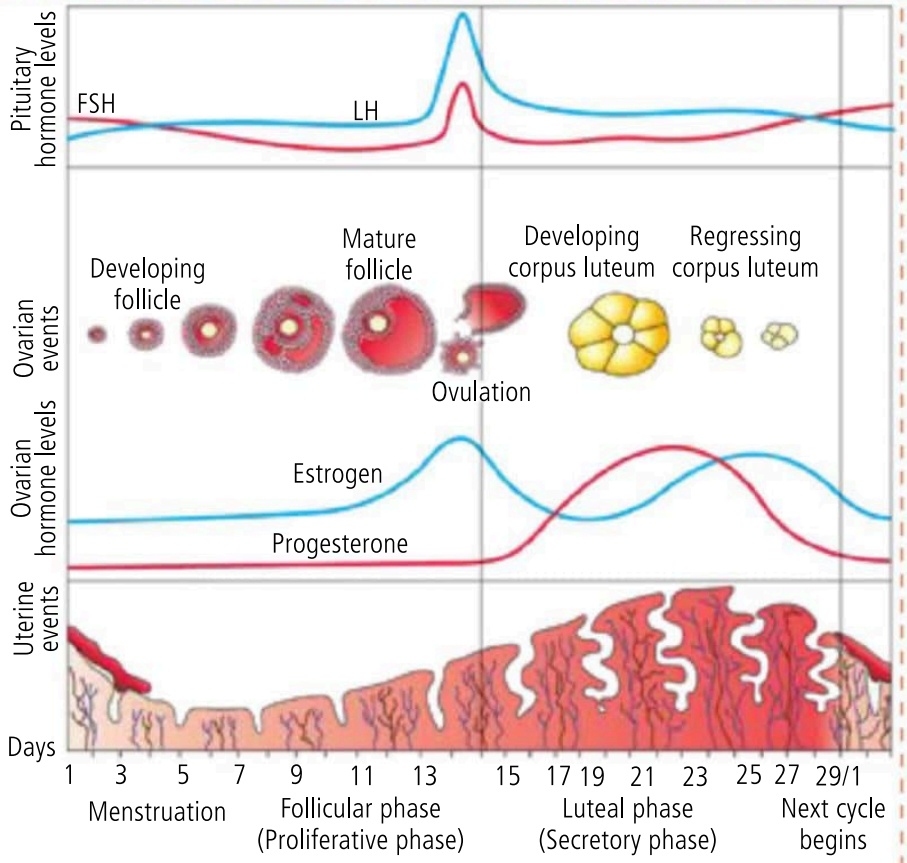


Fig.: Diagrammatic representation of various events during a menstrual cycle

Fertilisation

- It is the process of fusion of sperm and egg (ova) to produce zygote.
- Mixing up of the chromosomes of a sperm and an ovum is called amphimixis; this completes the act of fertilisation.
- The presence of X or Y chromosomes in the sperm determines the sex of the embryo.
- Significances of fertilisation : Restores diploid number of chromosomes; introduces variations, etc.

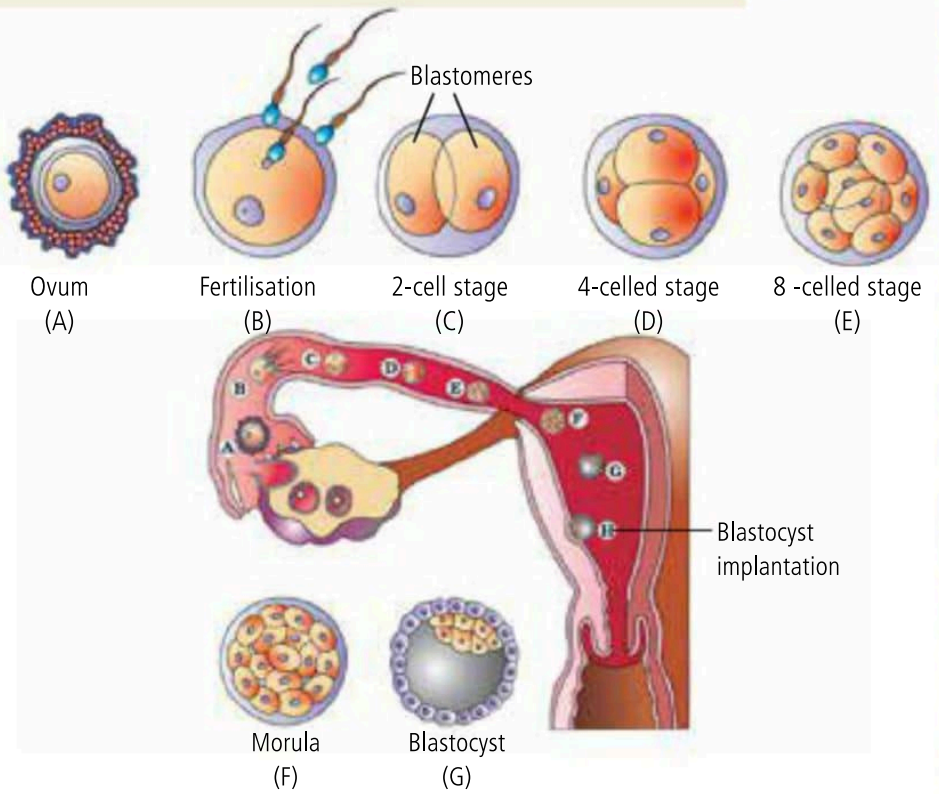


Fig.: Transport of ovum, fertilisation and passage of growing embryo through fallopian tube

Pregnancy

- Zygote undergoes repeated mitotic division to form a blastocyst, which is implanted in the uterus resulting in pregnancy.

Embryonic Development

- The embryo after implantation differentiates into an outer layer called ectoderm, an inner layer called endoderm and mesoderm in between the two.
- These three layers, also called as germ layers give rise to specific tissues, organs and organ systems.
- By the end of 9 months, the fetus is fully developed and is ready for delivery.

Parturition and Lactation

- Parturition is the process of child-birth.
- It is induced by a complex neuro-endocrine mechanism involving cortisol, estrogen and oxytocin.
- Mammary glands differentiates during pregnancy and secrete milk towards the end of pregnancy (lactation).
- The new-born baby is fed milk by the mother during the initial few months of growth.
- Milk produced during initial few days of lactation is called colostrum, which is rich in antibodies.

(iii)	Adrenocorticotropic hormone (ACTH)	Stimulates adrenal cortex to produce its hormones.
(iv)	Gonadotropinc hormones (a) Follicle stimulating hormone (FSH)	Stimulates gamete production, secretion of sex hormones, development of follicles.
	(b) Interstitial cell-stimulating hormone (ICSH) in males or Luteinising hormone (LH) in females	Stimulates the Leydig's cells of testis and induces secretion of testosterone hormones in males and development of corpus luteum and ovulation in females.
(v)	Luteotropic hormone (LTH) or Prolactin	Stimulates the growth of mammary glands during pregnancy and secretion of milk after child birth.
	Hormone of intermediate lobe	
(vi)	Melanocyte stimulating hormone (MSH)	Growth and development of melanocytes which gives colour to skin.
	Hormones of posterior lobe	
(vii)	Oxytocin	Stimulates ejection of milk from mammary glands; and contraction of uterus during parturition.
(viii)	Antidiuretic hormone (ADH) or Vasopressin	Regulates water balance and stimulates contraction of smooth muscles, blood vessels and results in rise in blood pressure.

Disorders of Pituitary Gland

Simmonds' Disease

Degeneration of anterior lobe of pituitary, resulting in dry and wrinkled skin of face and premature ageing.

Gigantism

Excessive secretion of growth hormone from early age.

Dwarfism

Deficiency of GH from childhood.

Acromegaly

Hypersecretion of growth hormone after adult size is reached. It results in disproportionate increase in size of bones of face, hands and feet.

Diabetes insipidus

Deficiency of ADH, resulting in excessive dilute urine.

Hyperpigmentation

Hypersecretion of MSH.

Pineal Gland

It develops from the ectoderm of the embryo. Pineal gland secretes a hormone called **melatonin** which plays a very important role in the regulation of 24 hours **(diurnal)** rhythm of our body. For example, it helps in maintaining the normal rhythms of sleep-wake cycle and in mammals it act as inhibitory factor for sexual maturation and also help to lightens skin colour. Serotonin is a neurotransmitter found in pineal gland.

Thyroid Gland

It is the **largest endocrine gland** and it develops from the endoderm of the embryo. It is present between the trachea and larynx.

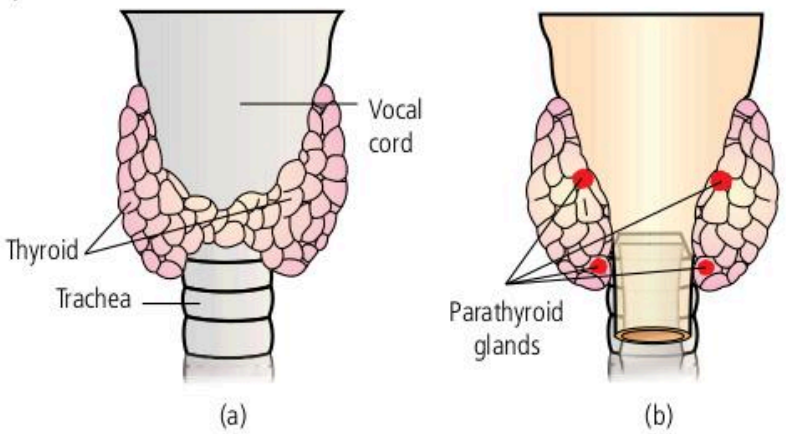


Fig. : Diagrammatic view of the position of thyroid and parathyroid glands (a) ventral side (b) dorsal side

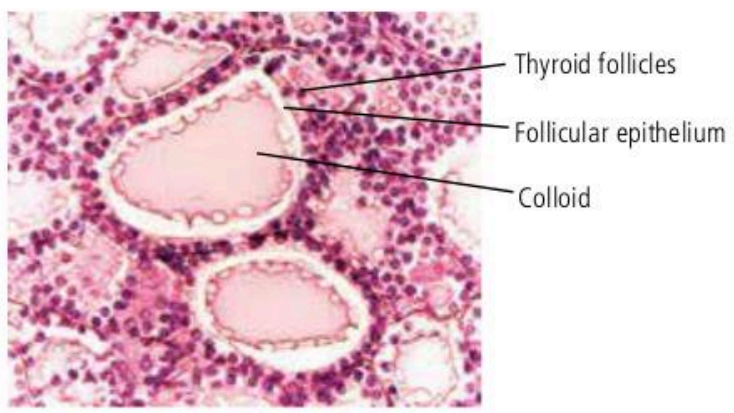


Fig.: T.S. of thyroid gland

It is a bilobed organ and two lobes are connected with isthmus. The microscopic structure of the thyroid gland shows **thyroid follicles** composed of cubical epithelium and filled with a homogenous material called **colloid.** Small amount of loose connective tissue forms **stroma** of the gland. Besides containing blood capillaries, the stroma contains small clusters of specialised parafollicular cells or **'C' cells.**

Thyroid gland secretes three hormones: Thyroxine, tri-iodothyronine and calcitonin. Thyroxine (T_4) and tri-iodothyronine (T_3) are secreted by thyroid follicular cells. Both are iodinated forms of an amino acid tyrosine. T_3 is more active and potent than T_3. T_4 gets converted into T_3 by removal of one iodine atom.

Functions of Thyroid Hormones

- Regulate the **metabolic rate** of the body and maintain **BMR** (basal metabolic rate)
- Regulate **growth** of body tissues and development of **mental faculties**
- Stimulate **tissue differentiation** (*e.g.*, promote metamorphosis of tadpoles into adult frogs)
- Regulate carbohydrate and fat metabolism

Calcitonin (Calcium lowering hormone) is secreted by C-cells of the thyroid gland. Calcitonin is secreted in response to high blood calcium level. Calcitonin suppress release of calcium ions from the bones and lowers the calcium level.

Disorders of thyroid gland

(i) **Hyperthyroidism -** Excessive secretion of thyroid hormones results in **Grave's disease** or **exophthalmic goitre** characterised by bulging eyes due to fluid accummulation, loss of weight, nervousness and rapid heart beat.

(ii) **Hypothyroidism -** Deficiency of thyroid hormones causes **cretinism** in infants. Symptoms are retarded growth, undeveloped sex organ, mental retardation. **Myxoedema** or **gull's disease** is caused by deficiency of thyroxine in adults. It is characterised by puffy appearance due to fat accumulation in subcutaneous tissue, lack of alertness, slow heart beat, etc.

Parathyroid Gland

The parathyroid glands develop from the endoderm of the embryo. The parathyroid glands consist of four separate glands located on the posterior surface of the lobes of the thyroid gland. They consist of two types of cells : **chief cells** (small) and **oxyphil cells** (large). The chief cells secrete **parathormone** or **Collip's hormone**. Parathyroid glands are under the feedback control of blood calcium level.

Parathyroid hormone (PTH) increases the Ca^{2+} level in the blood by withdrawing calcium from the bones into the plasma. PTH also stimulates resorption of Ca^{2+} by the renal tubules and increases Ca^{2+} absorption from the digested food. It is, thus, clear that PTH is a hypercalcemic hormone. A fall in blood calcium stimulates release of parathormone and rise in blood calcium inhibits secretion of parathormone. Parathormone is antagonistic to calcitonin.

Disorders of parathyroid gland

(i) **Hyposecretion -** Deficiency of PTH causes fall in Ca^{2+} level of blood. It causes convolusions and cramps, this is called **parathyroid tetany** or **hypocalcemic tetany**.

(ii) **Hypersecretion -** Excess of PTH draws more calcium from bones, causing their demineralisation leading to **osteoporosis**.

Snap Shots

Hassall's corpuscles are spherical or oval bodies present in the thymus. They are **phagocytic** in function.

Thymus Gland

This gland is derived form the endoderm of the embryo. It is located in the mediastinum between the sternum and aorta. It is a soft, pinkish, bilobed mass of lymphoid tissue. It is a prominent gland at the time of birth but it gradually atrophies with age.

Thymus secretes a hormone named **thymosin** which stimulates the development and differentiation of immunologically competent T-cells, increasing resistance to infections.

Adrenal Gland (Suprarenal Gland)

Adrenal glands are paired structures (conical, yellowish bodies) located on the top of kidneys. These are also called as **glands of emergency**.

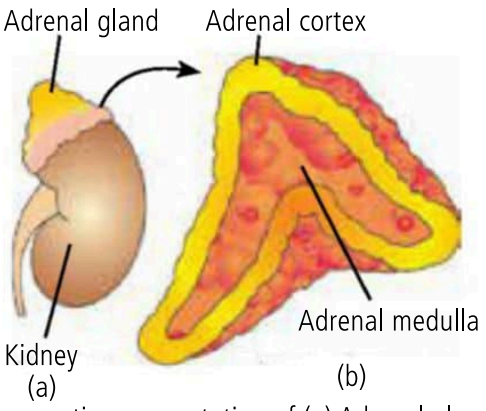


Fig.: Diagrammatic representation of (a) Adrenal gland above kidney (b) Section showing two parts of adrenal gland

Adrenal gland has two parts

Adrenal Cortex

- It is derived from the mesoderm of the embryo.
- It is divided into three layers:
  - **(i) Zona glomerulosa** is the **outer zone** that lies just below the capsule. It secrete hormones called **mineralocorticoids,** that affect mineral homeostasis.
  - **(ii) Zona fasciculata** is the **middle** and **widest zone** and consists of cells arranged in long, straight columns which secrete **glucocorticoids** because they regulate glucose homeostasis.
  - **(iii) Zona reticularis** is the **inner zone** and consists of cells arranged in branching cords which secrete **gonadocorticoids** or **sex corticoids**.

Adrenal Medulla

- It develops from the neuroectoderm of the embryo.
- The adrenal medulla secretes two hormones: **nor-epinephrine (nor-adrenaline)** and **epinephrine (adrenaline)** which are commonly called **catecholamines**. Nor-epinephrine and epinephrine are derived from the amino acid tyrosine.
- Adrenal medulla consists of chromaffin cells. These cells are modified postganglionic cells of sympathetic nervous system and are connected with preganglionic motor fibres of sympathetic nervous system.
- Sympathetic nervous system and adrenal medulla funciton as an integrated system and is called sympathetico-adrenal system.

Corticoids

(i) **Mineralocorticoids**: They maintain water and electrolyte balance and blood volume in the body by regulating mineral metabolism. The major mineralocorticoid is **aldosterone**, commonly called **salt-retaining hormone**. Low sodium level in body stimulates release of aldosterone. It causes retention of sodium from the kidney and increased urinary excretion of potassium.

(ii) **Glucocorticoids :** They affect carbohydrate metabolism however, they also affect metabolism of proteins and fats. Glucocortioids stimulate gluconeogenesis, lipolysis and proteolysis and inhibit cellular uptake and utilisation of amino acids. In our body, cortisol is the main glucocorticoid. Cortisol produces anti-inflammatory reactions and suppresses the immune response. Cortisol also increases the level of amino acids in the blood, stimulates the breakdown of fats in adipose tissue and release of fatty acids into the blood.

(iii) **Sexcorticoids:** Sexcorticoids include both male and female sex hormones. **Androgens** are important for development of male fetus and stimulate the development of **male secondary sexual characters. Estrogen** controls the development of **female secondary sexual characters.**

Catecholamines

(i) **Nor-epinephrine -** It regulates the blood pressure under normal condition. It causes constriction of essentially all the blood vessels of the body. It causes increased activity of the heart, inhibition of gastrointestinal tract, dilation of the pupils of the eyes and so forth.

(ii) **Epinephrine -** It is secreted at the time of emergency. Epinephrine has a greater effect on cardiac activity than nor-epinephrine. It causes only weak constriction of the blood vessels of the muscles in comparison with a much stronger constriction that results from nor-epinephrine.

Disorders of adrenal gland

Addison's Disease	Adrenal Virilism	Cushing's Syndrome	Gynaecomastia
Due to deficiency of mineralocorticoids and glucocorticoids. Its symptoms include low blood sugar, low plasma Na^+, high K^+ plasma, increased urinary Na^+, nausea, vomiting, diarrhoea.	Appearance of male characters in female is called virilism. Excessive production of male sexcorticoids (androgens) produces male secondary sexual characters like beard, moustache, hoarse voice in woman.	Caused by excess of cortisol. It is characterised by high blood sugar, appearance of sugar in the urine, rise in plasma Na^+, fall in plasma K^+, rise in blood volume, high blood pressure, etc.	Development of enlarged mammary glands (breasts) in the males, due to excessive secretion of estrogens in males. Decreased testosterone may also lead to gynaecomastia.

Pancreas

It is derived from the endoderm of the embryo. Pancreas is a composite gland which acts as both exocrine and endocrine gland. The endocrine pancreas consists of groups of cells called **'islets of Langerhans'**.

Table: Hormones of pancreas

S.No.	Hormones	Cells of Islets	Function
(i)	Insulin	β-cells	Stimulates glycogenesis, promotes synthesis of proteins and fats. Acts on cells of liver muscle and adipose tissue.
(ii)	Glucagon	α-cells	Stimulates glycogenolysis in the liver and muscles; increases the amount of sugar in blood.
(iii)	Somatostatin (SS)	δ-cells	Suppresses the release of hormones from the pancreas and digestive tract.
(iv)	Pancreatic polypeptide (PP)	Pancreatic polypeptide cells	Inhibits the release of digestive secretion of the pancreas.

Disorders of Pancreas

Hyperglycemia (Diabetes mellitus)

It is due to insulin deficiency, resulting in elevation in blood sugar level hence, glucose appears in urine. There is high blood cholesterol and ketone body formation. Symptoms are excessive urine production, thirst and eating.

Hypoglycemia

It is due to excess of insulin or deficiency of glucagon and blood glucose level falls below normal. Symptoms include weakness, profuse sweating, convulsions and requires urgent intake of sugar.

Gonads

They develop from the mesoderm of the embryo. The gonads are sex glands. Both testis and ovary serve dual function, as they act as primary sex organs (produce gametes) as well as endocrine glands (secrete hormones).

Testis : It is composed of **seminiferous tubules** and **stromal** or **interstitial tissue.** The **Leydig's cells** or **interstitial cells**, secrete hormones called **androgens,** mainly **testosterone.**

Testosterone stimulates growth and development of **male sex organs** and **secondary sexual characters** like beard, moustache and low pitch voice, stimulates **spermatogenesis** and promotes growth of **bones** and **muscles.**

Male hypogonadism: It is due to deficiency of androgens (hypofunction of Leydig's cells), deficiency of sperm formation (hypofunction of sertoli cells) and masculature and male secondary sex organs do not develop.

Ovary : It is composed of ovarian follicles and stromal tissues. Hormones secreted by ovaries are: **estrogen** secreted by the **growing ovarian follicles**, **progesterone**, **relaxin** and **inhibin** secreted by corpus luteum.

Estradiol is the principal estrogen. It stimulates the development of female secondary sex characters and maturation of ova, development of uterine epithelium.

Progesterone stimulates further development of uterine lining and mammary gland, required for formation of placenta and maintenance of pregnancy.

Relaxin is secreted only during later stages of pregnancy and inhibin inhibits production of FSH and GnRH.

Female hypogonadism: Due to deficiency of estrogens (female sex hormones) pituitary gonadotropins (LH, FSH or both) or can represent primary ovary failure. It results in the lack of development of female secondary sexual characters.

HORMONES OF HEART, KIDNEY AND GASTROINTESTINAL TRACT

Heart

The atrial wall of our heart secretes a very important peptide hormone called atrial natriuretic factor (ANF), which decreases blood pressure. When blood pressure is increased, ANF is secreted which causes dilation of the blood vessels. This reduces the blood pressure.

Gastrointestinal Tract

Endocrine cells present in different parts of the gastro-intestinal tract secrete four major peptide hormones, namely gastrin, secretin, cholecystokinin (CCK) and gastric inhibitory peptide (GIP).

Gastrin acts on the gastric glands and stimulates the secretion of hydrochloric acid and pepsinogen. Secretin acts on the exocrine part of pancreas and stimulates secretion of water and bicarbonate ions.

CCK acts on both pancreas and gall bladder and stimulates the secretion of pancreatic enzymes and bile juice, respectively. GIP inhibits gastric secretion and motility. Several other non-endocrine tissues secrete hormones called growth factors which are essential for the normal growth of tissues and their regeneration.

Kidneys

They develop from the **mesoderm** of the embryo.

Hormones of Kidneys

Renin

Renin acts upon a plasma-protein, **angiotensinogen,** separating a compound, called angiotensin–II from it. **Angiotensin–II** accelerates heart beat and constricts arterioles, thereby increasing blood pressure.

It also stimulates secretion of aldosterone and enhances water and sodium reabsorption from nephrons.

Erythropoietin

The oxygen shortage stimulates the kidney cells to secrete a hormone named erythropoietin. It stimulates the bone marrow to increase the production of RBCs.

Calcitriol

Calcitriol is the active form of vitamin **cholecalciferol** (vitamin D). It promotes absorption of Ca^{2+} and phosphorus in the small intestine and accelerates bone formation.

Mechanism of Hormone Action

Amino acid derivative hormones

Epinephrine, nor-epinephrine, (derived from tyrosine).

Water soluble hormone.

Protein hormones

Hormones are generally water soluble and circulate unbound in plasma.

Hormones are synthesised on ribosomes, attached to ER.

E.g., anterior pituitary hormones, parathormone, insulin, glucagon, etc.

Classification of hormones based on their chemical nature

Steroid hormones

Hydrophobic, lipid soluble substances synthesised from cholesterol.

E.g., aldosterone, cortisol, androgens, etc.

Peptide hormones

Hormones of posterior lobe of pituitary gland.

Water soluble hormone.

E.g.,oxytocin and vasopressin.

Iodothyronines

Iodothyronines is a group of iodinated amino acids with a diphenyl ether ring system in the side chain, *e.g.*, Thyroid hormone. They are lipid soluble.

Two mechanisms of hormone action

cAMP mediated hormone activity

Most proteins and polypeptide hormones, many amino acid derivatives, specially catecholamines and some of prostaglandins (because of their large size, cannot enter the cells) binds to membrane-bound receptors. They acts as the **first messenger** and exert their effect by combining with specific fixed receptor site over the outer surface of the cell membrane, thereby activating the enzyme **adenylyl cyclase** on the inner surface of the membrane. This increases formation of intracellular cAMP from ATP. cAMP, the **second messenger**, is a basic regulator of cell metabolism, it acts by conversion of inactive protein kinases to their active form.

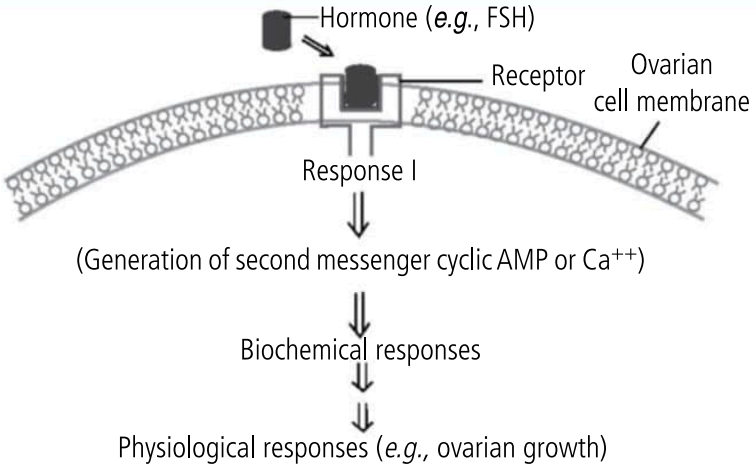


Fig.: Diagrammatic representation of the mechanism of protein hormone action

Transcription and translation effect

Steroid hormones being lipid soluble can easily enter into the target cells and exert their effect by combining to a specific cytoplasmic receptor protein in a target cell *i.e.*, cell that responds to the hormone. Each receptor molecule binds to hormone, forming a complex that enters the nucleus and becomes attached to the chromatin, the genetic material. The complex activates DNA, stimulates the transcription (*i.e.*, formation of *m*RNA) of a particular gene and specific messenger RNA (*m*RNA) synthesis increases.

The specific *m*RNA enters the cytoplasm, where it directs the ribosomes to synthesise specific proteins (translation). These proteins may be enzymes, structural proteins, receptor proteins or secretory proteins.

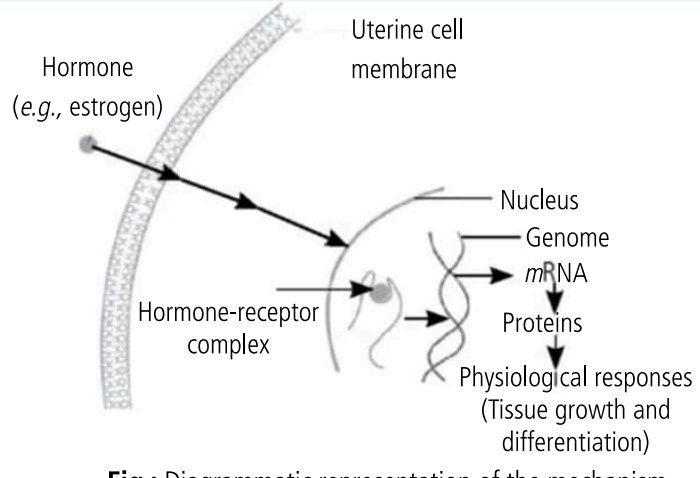


Fig.: Diagrammatic representation of the mechanism of steroid hormone action

Class XII

BIO

Digest

This article covers high yield facts of the given topic.

Evolution

- **Evolution** is the orderly heritable changes in populations over successive generations.
- **Evolutionary biology** is the study of history of life forms on earth.
- Universe or cosmos is the whole existing space and matter that is differentiated into several galaxies with each galaxy having several stars and clouds of gas and dust. The study of universe is known as **cosmology**.
- Most accepted theory to explain the origin of universe is the **Big-Bang Theory**, proposed by **Abbe Lemaitre** (1931) which states that the universe had an explosive beginning. Universe originated about 20 billion years ago by a thermonuclear explosion or big bang.
- In the solar system of the our galaxy-milky way galaxy, earth was supposed to have been formed about 4.5 billion years back.

ORIGIN OF LIFE

- Life is an inherent capacity possessed by an organism to maintain and reproduce itself. The origin of life is considered as an unique event in the history of universe.
- Life appeared 500 million years after the formation of earth.
- To explain the origin of life, many theories were put forward.
- According to the theory of special creation the earth is about 4000 years old, all living organisms (species or types) that we see today were created as such and diversity was always the same since creation and will be the same in future also.
- **Theory of spontaneous generation** or **autogenesis** or **abiogenesis** believe that under certain conditions non-living substances gave rise to living beings spontaneously. This concept was supported by **Thales, Anaximander, Aristotle, Plato**, etc.
- **Theory of Panspermia** was proposed by **Richter** in 1865, according to which life came from outside in the form of spores.
- **Louis Pasteur** by careful experimentation demonstrated that **life comes only from pre-existing life**. He showed that in pre-sterilised flasks, life did not come from killed yeast while in another flask open to air, new living organisms arose from 'killed yeast'.
- **Oparin-Haldane theory of origin of life** was put forward by **A.I. Oparin**, a Russian biochemist and **J.B.S. Haldane**, an English biologist. According to this theory, life originated on earth from non-living matter as a result of physio-chemical processes. First inorganic compounds and then organic compounds were formed in accordance with ever changing environmental conditions.
- Oparin-Haldane theory is also called **chemical theory** or **naturalistic theory**.
- Haldane gave the term **hot dilute soup** or **prebiotic**

soup for broth of chemicals formed in oceans of the early earth from which living cells are believed to have appeared.

- In 1953, **S.L. Miller**, an American scientist and student of **Harold C. Urey,** created primitive earth-like conditions in a laboratory. He passed electric discharge in a closed flask containing CH_4, H_2, NH_3 and water vapour at 800°C. He observed formation of amino acids.

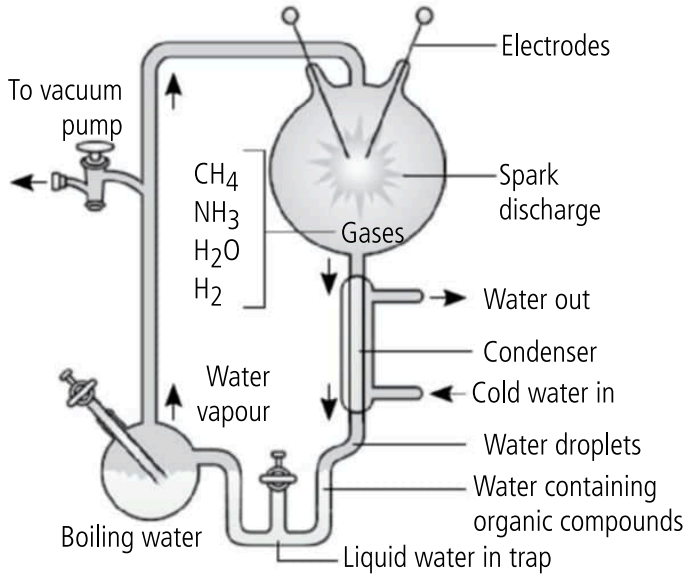


Fig.: Diagrammatic representation of Miller's experiment

- In similar experiments, formation of sugars, nitrogen bases, pigments and fats was observed. The synthesis of carbohydrates, fats and amino acids and other complex organic substances probably occurred in sea, which had been described by Haldane as '**The hot dilute soup'**. The formation of protein molecule is considered a land mark in the origin of life.
- The formation of complex organic molecules such as of carbohydrates, fats, amino acids and other organic molecules from simple organic molecules probably occurred in sea in primeval atmosphere. Electric discharge, ATP, solar energy, lightning might have provided the energy for polymerisation reactions.
- **Biological evolution** is defined as the process through which the characteristics of organisms change over successive generation by means of genetic variation and natural selection.
- Oparin gave the term **coacervates** for non-living structures, from which first living cells were formed. Coacervates consisted of a collection of organic molecules surrounded by a thin film of water. They lack a definite membrane but were able to grow in size in a favourable environment.

- Proteinoids are protein like structures formed by dehydration synthesis of amino acid. **Sydney Fox** demonstrated that **microspheres** could be formed from proteinoids placed in boiling water.
- The first living organisms which originated from organic molecules in oxygen free atmosphere (reducing atmosphere) were **anaerobes**. They were capable of anaerobic respiration and lived in the absence of oxygen. They depended on the existing organic molecules for their nutrition and thus they were **heterotrophs**.

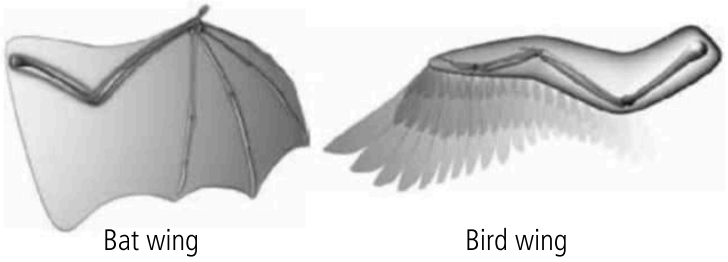
EVIDENCES OF EVOLUTION

- Evidence that evolution of life forms has indeed taken place on earth has come from many quarters. Some of these are described as follows:
- **Homologous organs** have the same fundamental structures but are different in functions. Thus, homology between organs of different animals is based on **common ancestry** or **common embryonic origin** and built on the same fundamental pattern but in adult conditions, they get modified to perform different functions. *E.g.*, the forelimbs of a man, cheetah, whale and bat perform different functions but exhibit same structural plan of bones.

Fig.: Examples of homologous organs in animals

- In plants also, the thorn and tendrils of *Bougainvillea* and *Cucurbita* represent homology.
- The homologous structures are a result of **divergent evolution**. Homology indicates common ancestry.
  - Development of different functional structures from common ancestral form is called **adaptive radiation**. It can also be defined as, the process of evolution of different species in a given geographical area starting from a point and radiating to other areas of geography.
- **Analogous organs** have similar functions but are different in their structural details and origin. *E.g.*, wings of a butterfly, bird and

bat serve the same function but their basic structures are totally different.



Bat wing Bird wing

Fig.: Wings of bat are analogous to wings of birds

- In plants, sweet potato (root modification) and potato (stem modification) is another example for analogy.
- The analogous structures are a result of **convergent evolution**.
- Different aspects of biochemical affinity like, metabolic processes, enzymes, hormones, blood, lymph and blood proteins are the most convincing evidences of common ancestry.
- **Recapitulation theory** or **Biogenetic Law** was proposed by Ernst Haeckel. It is based on this evolutionary relationship which states that "**Ontogeny repeats phylogeny**". This means an organism repeats its ancestral history during its development. *E.g.*, in development of frog a fish-like tailed larva (tadpole) is formed, which swims and respires by gills. It indicates that the frog has evolved from a fish-like ancestor. This theory was disapproved on careful study performed by Karl Ernst von Baer. He noted that embryos never pass through the adult stages of other animals.
- **Vestigial organs** are organs present in reduced form and are non-functional. *E.g.*, nictitating membrane, vermiform appendix, hair on body, etc.
- Some organisms possess characters of two different groups of organisms, hence are called **connecting links**. Some examples of connecting links are as follows:

Connecting links	Group of organisms
Euglena	Between plants and animals
Peripatus	Between Annelida and Arthropoda
Balanoglossus	Between Non-chordates and Chordates
Chimaera	Between cartilaginous fishes and bony fishes

- **Atavism**, the reappearance of certain ancestral characters which either disappeared or reduced, is another important evidence of evolution. *E.g.*, short tail in some human babies, winged petiole in *Citrus*, etc.
- Direct evidence of organic evolution comes from the fossil study. **Fossils** are the petrified remains or impressions of organisms that lived in past and got preserved in the sedimentary rocks.
- The study of past life forms based on fossil records is known as **palaeontology**.
- The age of fossils is determined by **radioactive dating technique**. Fossil record can be arranged in chronological sequence once their age is determined.
- **Geological time scale** is prepared in chronological order based on fossil studies to illustrate the history of evolution.
- Fossil evidences which show combined features of two groups are called **missing links**. *E.g., Archaeopteryx* displays the characters of both reptiles and birds.

THEORIES OF EVOLUTION

- Various theories have been put forward to understand and explain the process of evolution.
- The first theory of evolution was proposed by **Jean Baptiste de Lamarck** in 1809 and was published in '*Philosophie Zoologique*'. It is popularly known as **Lamarckism**.
- According to Lamarckism:
  - **Doctrine of desire -** Changing environment gives rise to new needs in an individual.
  - **Use and disuse of organs -** Continuous use of an organ leads to its development and disuse results in degeneration.
  - **Inheritance of acquired characters** means structural and functional changes acquired during the lifetime of an individual are inherited by its offspring and by accumulation of acquired characters new species originates. *E.g.*, disappearance of limbs in snakes, evolution of flightless birds from their flying ancestors, etc.
- **Theory of continuity of germplasm-** Experiments conducted by **A. Weismann** discarded the law of inheritance of acquired characters. It proved that only those characters affecting germ cells are inherited. It proved the continuity of germplasm and not the somatoplasm to the next generation.
- According to **Neo-Lamarckism**, a modified form of Lamarckism, the acquired characters which become incorporated in the germplasm are heritable and accumulation through generation after generation results in the origin of new species.
- The '**Theory of Natural Selection**' was put forward by **Charles Darwin** in 1858.
- The main features of the theory of natural selection are:

Over production : All organisms possess enormous fertility and multiply in geometric ratio.

Limited food and space : Food and space remain almost constant, so, they affect the survival of an individual.

Struggle for existence : Limited supply of food and space causes struggle for existence either between individuals of same species or different species.

Appearance of variations : Continuous struggle for existence compels organisms to change according to

conditions in order to survive successfully. This produces variations among individuals.

– **Natural selection :** Organisms with favourable variations survive and are better adjusted to the changing environment. Originally, it was an idea of **Herbert Spencer** who termed it as "**Survival of the Fittest**". **Darwin** named it as "Natural Selection". Organisms capable of adapting to the changing environmental conditions have better rate of survival.

– **Inheritance of useful variations :** Only useful variations acquired by organism are transmitted to next generation, while non-useful variations get eliminated.

– **Formation of new species :** Useful variations keep on accumulating and are transmitted to generation after generation and new species is formed.

- **Mutation Theory** was proposed by **Hugo de Vries** in 1901. According to this theory new species originates due to discontinuous variations or mutations which appear suddenly. Mutations are subjected to natural selection where mutants found unsuitable are destroyed.
- Evolution for Darwin was gradual while Hugo de Vries, believed mutation caused speciation and hence called it **Saltation** (single step large mutation).

INTEXT PRACTICE QUESTIONS

1. **What is recapitulation theory?**
2. **What do you mean by 'doctrine of desire'?**

Synthetic Theory of Evolution

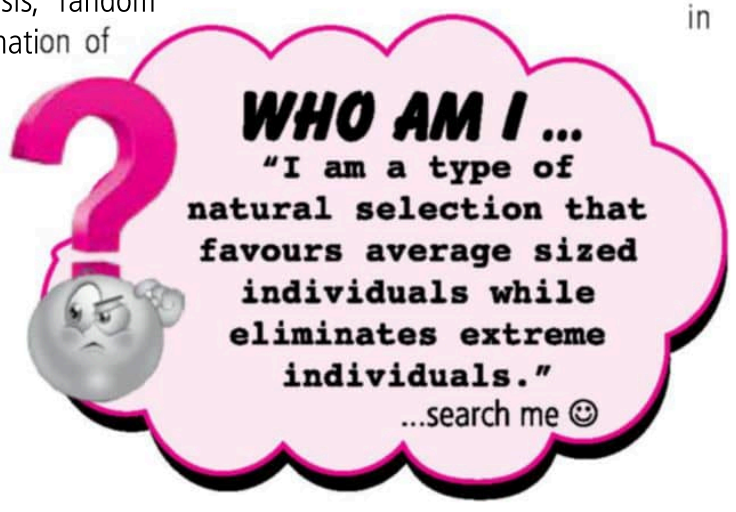
- Modern concept of evolution is the synthesis of Darwin's and Hugo de Vries theories. It is the result of the work of a number of scientists namely **T. Dobzhansky, R.A. Fisher, J.B.S. Haldane, Sewall Wright, Ernst Mayr** and **G.L. Stebbins**.
- According to **synthetic theory** there are five basic factors involved in the process of organic evolution.

I. **Genetic variations :** Evolution of species occurs through the accumulation of genetic variations in the gene pool of population over long period of time. Variations occur in many ways –

(i) **Mutations :** Gene mutation is the permanent random alteration of the nucleotide sequence of a gene. **Gene pool** is the sum total of all the different genes and their alleles present in a population. Variations occur in gene pool due to the change of gene frequency by mutation.

(ii) **Gene recombination :** It occurs due to the dual parentage, independent assortment of chromosomes, crossing over during meiosis, random fusion of gametes and formation of new alleles.

(iii) **Gene migration (Gene flow) :** It is the movement of alleles among populations by the migration of breeding individuals. A constant gene flow can occur between adjacent animal populations due to the migration of organisms.



(iv) **Genetic drift :** It is the drastic change in allele frequency when the population size becomes very small. It was proposed by **Sewall Wright** in 1930 and hence, also called **Sewall Wright Effect**. It occurs when a section of population migrates or dies of natural calamity and thus the gene frequency of the remaining population gets altered. Two important examples of genetic drift are founder effect and bottleneck effect.

– **Founder effect :** When a few individuals or a small group of individuals called **founders** move from some large population and invade a new geographical region, the population in new settlement may have different genotype frequency than that of parent population. The descendants of the founder isolate in new area and tend to have allele ratio similar to the founders rather than to the source population.

– **Bottleneck effect :** The yearly or seasonal cycle phenomenon of decrease or increase in size of a population causing periodic squeezing of some of the genes in gene pool is called bottleneck phenomenon.

(v) **Hybridisation :** It is the crossing of organisms which are genetically different in one or more characters. It helps in intermingling of genes of different groups of the same variety, species and sometimes of different species.

II. **Inheritance of Variations :** Transmission of variations or characteristics from parent to offspring is an important mechanism in evolution and is called **heredity**.

- Organisms possessing hereditary characters that are helpful in the changing environment, are favoured in the struggle for existence.

III. **Natural Selection :** It results from differential reproduction which means some members of population have traits that enable them to grow up and reproduce at a higher rate and leave more surviving offspring in the next generation than others. They are selected by nature.

- The different types of natural selections based upon different organism-environment relationship are discussed as follows:

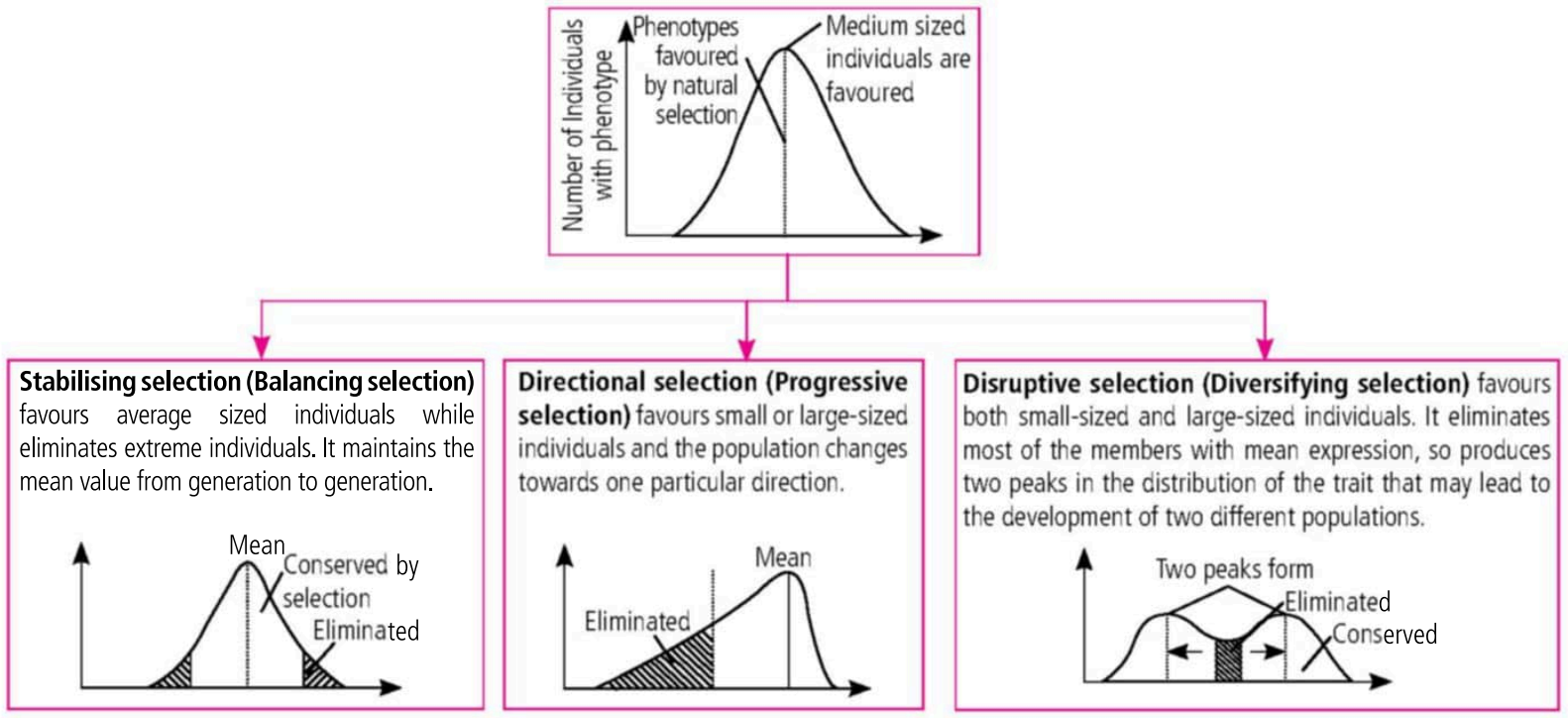


Fig.: Diagrammatic representation of different types of natural selection

- If disruptive selection results in formation of many new species then, it is termed as **adaptive radiation**.
- **Industrial melanism** is an example of natural selection in which the moths living in an industrial area adapted and developed melanin pigments to match their body to the tree trunks. It can be explained briefly as follows:

Before industrialisation After industrialisation

  - Before industrialisation, the peppered moth (*Biston betularia*) existed in two forms - light colour (white winged) and melanised (dark winged).
  - Bark of the trees in the past, were covered by whitish lichens, so, white moths were unnoticed due to camoflauge by predator birds and dark coloured moths were eaten.
  - After industrialisation, tree trunks became dark due to industrial smoke and soot, so the white moths were selectively picked up by birds and black moths remained unnoticed. This resulted in increase in population of black moths and decrease in population of white moths.
  - Thus, industrial melanism supports evolution by natural selection.

IV. **Isolation :** it is the prevention of mating amongst interbreeding groups due to **physical**, (*i.e.*, geographical, ecological) and **biotic**, (*i.e.*, physiological, behavioural, genetic, mechanical) barriers.

  - **Reproductive isolation** is the prevention of interbreeding between the two populations of two different species. Thus, it preserves the integrity of a species by checking hybridisation although it may lead to the origin of a new species by accumulating variations in a population.

V. **Speciation :** The populations of species separated by geographical and physiological barriers, accumulate different genetic differences (variations) due to mutations, recombination, hybridisation, genetic drift and natural selection. These populations undergo morphological and genetic differentiation, become reproductively isolated and form new species.

- Speciation is of following types:
  - **Allopatric speciation :** A part of the population becomes geographically separated from the main population and gradually forms a new species. *E.g.*, Darwin's finches in Galapagos Islands.
  - **Sympatric speciation :** It occurs without geographical isolation. A small segment of the original population becomes isolated reproductively, a new subspecies emerges and gradually a new species is formed.
  - **Parapatric speciation :** It occurs when a population of a species enters a new niche or habitat. It results in barrier for gene flow between the populations of new niche and two species are formed due to reproductive isolation.
  - **Quantum speciation :** The budding off of a new and very different daughter species from a semi-isolated peripheral population of the ancestral species.

HARDY-WEINBERG PRINCIPLE

- It was proposed by **G.H.Hardy** and **W.Weinberg** in 1908. It describes a theoretical situation in which a population is undergoing no evolutionary change.
- The Hardy - Weinberg Principle states that "the relative frequencies of various kinds of genes and their alleles in a large and randomly mating sexual panmictic population tend to remain constant from generation to generation in the absence of mutation, selection and gene flow." This is called **genetic equilibrium**.
- In a population at equilibrium, for a locus with two alleles D and d, having frequencies of p and q respectively, the genotype frequencies are : DD = p^2, Dd = 2pq and dd = q^2.
- The allelic frequency is p + q = 1 and genotype frequency is $p^2 + 2pq + q^2 = 1$, where,

  p = Frequency of the dominant allele in the population.

  q = Frequency of the recessive allele in the population.

  p^2 = Percentage of homozygous dominant individual.

  q^2 = Percentage of homozygous recessive individual.

  2pq = Percentage of heterozygous individuals.

  1 = Sum total of all allelic frequencies.
- The gene frequency will remain static only in the absence of evolutionary forces like – mutation, gene flow, selection pressure, genetic drift, recombination and migration.

A BRIEF ACCOUNT OF EVOLUTION

- About **2000 million years ago** (mya) the **first cellular forms of life** appeared on earth. Slowly-single celled organisms became multicellular life forms. By the time of **500 mya, invertebrates** were **formed** and active. **Jawless** fish probably evolved around **350 mya**. **Sea weeds** and few plants existed probably around **320 mya**. The first organisms that invaded land were **plants**. They were widespread on land when animals invaded land.

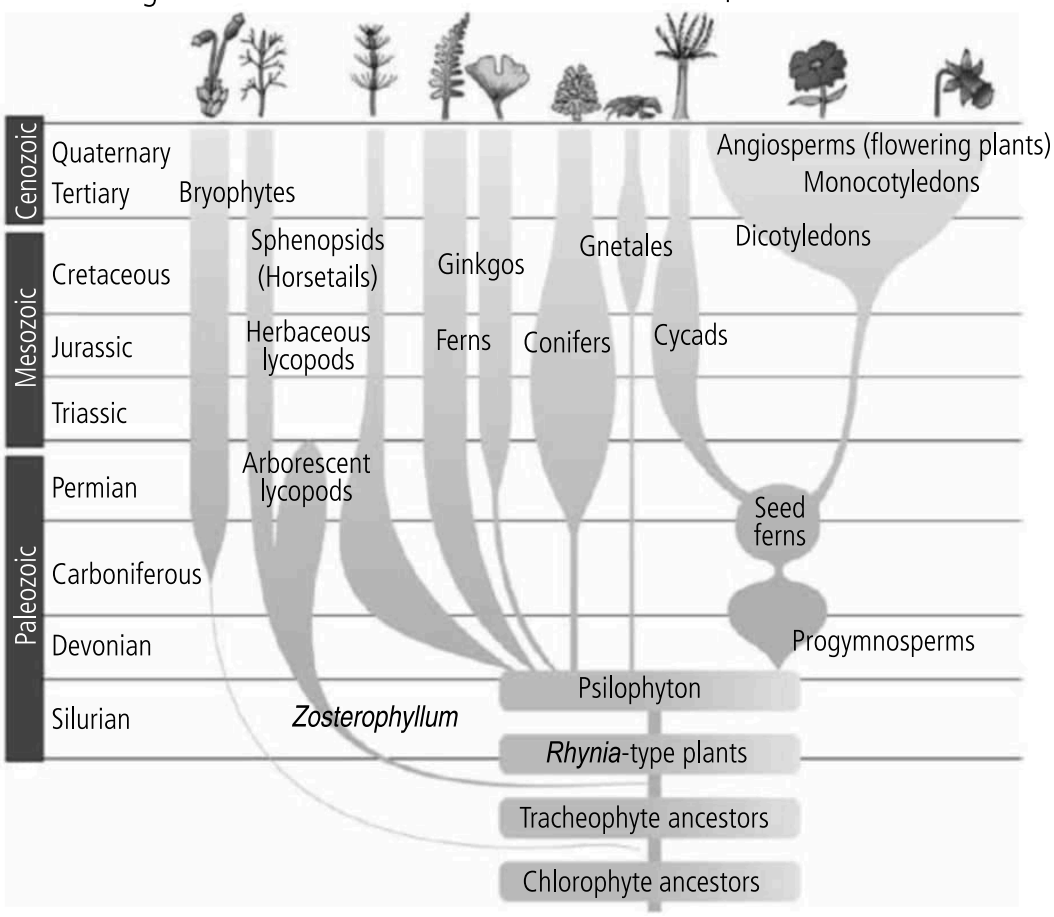


Fig.: A sketch of the evolution of plant forms through geological periods

- Fish with stout and strong fins could move on land and go back to water. This was about 350 mya. In 1938, a fish caught in South Africa happened to be a **Coelacanth** which was thought to be extinct. These animals called **lobefins** evolved into the **first amphibians** that lived on both land and water. There are no specimens of these left with us. However, these were ancestors of modern day frogs and salamanders. The amphibians evolved into reptiles. They lay thick shelled eggs which do not dry up in sun unlike those of amphibians.
- In the next **200 millions** years or so, **reptiles** of different shapes and sizes dominated on earth. **Giant ferns** (**pteridophytes**) were present but they all fell to form **coal deposits** slowly. Some of these land reptiles went back into water to evolve into fish like reptiles probably 200 mya (*e.g.*, *Ichthyosaurs*).
- The land reptiles were, of course, the dinosaurs. The biggest of them, *i.e.*, *Tyrannosaurus rex* was about 20 feet in height and had huge fearsome dagger like teeth. About **65 mya, the dinosaurs suddenly disappeared** from the earth. True reason is not known. This may have happened **due to climatic changes** or because most of them evolved into birds. The truth may live in between, small sized reptiles of that era still exist today.
- The first mammals were like **shrews**. Their fossils are small sized. Mammals were **viviparous** and protected their unborn young inside the mother's body. Mammals were more intelligent in sensing and avoiding danger.
- When reptiles came down mammals took over this earth. There were in South America mammals resembling horse, hippopotamus, bear, rabbit, etc. Due to continental drift, when South America joined North America, these animals were overridden by North American fauna. Due to the same continental drift pouched mammals of Australia survived because of lack of competition from any other mammal. Some mammals live wholly in water. Whales, dolphins, seals and sea cows are some examples.

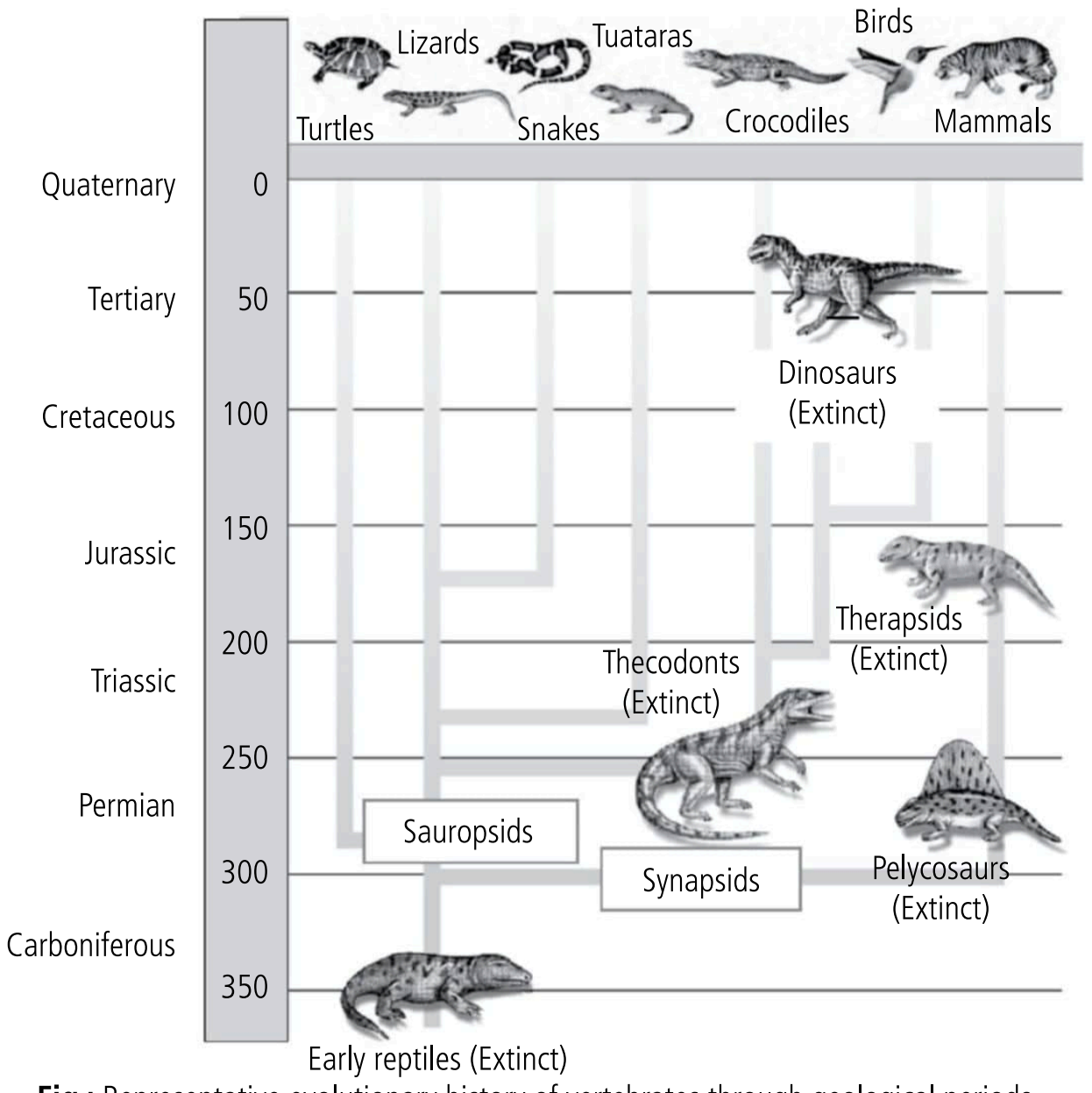


Fig.: Representative evolutionary history of vertebrates through geological periods

HUMAN EVOLUTION

- Human evolution, or anthropogenesis, is the part of biological evolution concerning the emergence of *Homo sapiens sapiens* as a distinct species from other hominids, great apes and placental mammals.

1 *Dryopithecus and Ramapithecus*

About 15 mya, primates called *Dryopithecus* and *Ramapithecus* were existing.
They were hairy and walked like gorillas and chimpanzees.
Ramapithecus was more man-like while *Dryopithecus* was more ape-like.

2 *Australopithecus*

Two mya, *Australopithecines* probably lived in East African grasslands.
They hunted with stone weapons but essentially ate fruit.

3 *Homo habilis*

First human-like, having hominid features.
The brain capacities were between 650-800cc.
They probably did not eat meat.

4 *Homo erectus*

(Erect man)

Homo erectus, the next stage was revealed by fossils discovered in Java in 1891, about 1.5 mya.
They had a large brain around 900cc.
They probably ate meat.

5 *Homo sapiens neanderthalensis*
(Neanderthal man)

The Neanderthal man with a brain size of 1400cc lived in near east and central Asia between 1,00,000-40,000 years back.
They used hides to protect their body.
They buried their dead.

6 *Homo sapiens*

Homo sapiens arose in Africa and moved across continents and developed into distinct races.
During ice age between 75,000-10,000 years ago modern *Homo sapiens* arose.
Pre-historic cave art developed about 18,000 years ago. One such cave paintings by Pre-historic humans can be seen at Bhimbetka rock shelter in Raisen district of Madhya Pradesh.
Agriculture came around 10,000 years back and human settlements started.

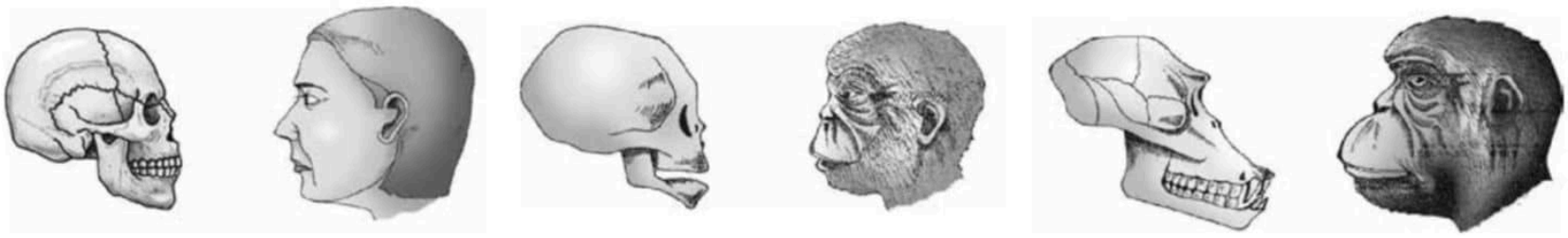


Fig.: A comparison of the skulls of adult modern human being, baby chimpanzee and adult chimpanzee. The skull of baby chimpanzee is more like adult human skull than adult chimpanzee skull.

INTEXT PRACTICE QUESTIONS

3. **What is Sewall Wright Effect?**
4. **In which type of the selection, the population changes towards one particular direction?**

☺☺

Check Your Vitals for NEET

CLASS XII

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

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

UNIT-VIII : BIOLOGY IN HUMAN WELFARE

CHAPTER 7 : HUMAN HEALTH AND DISEASE

Multiple Choice Questions

1. Which of the following statements is correct?
(a) Health does not merely mean the absence of disease.
(b) Health reflects metabolic and functional efficiency of living organisms.
(c) Health is adversely affected by diseases.
(d) All of these

2. Most fatal malaria is caused by _____ and is called _____.
(a) *Plasmodium vivax*, vivax malaria
(b) *Plasmodium malariae*, tertian malaria
(c) *Plasmodium falciparum*, malignant malaria
(d) *Plasmodium ovale*, mild tertian malaria

3. In the following table, drugs, their source and related effects are given. Find the correct match.

	Drug	Source	Effect
A.	Cocaine	*Papaver*	Stimulate CNS
B.	Crack	*Erythroxylum*	Excessive dosage causes hallucination
C.	Morphine	*Papaver*	Sedative and painkiller
D.	Marijuana	*Claviceps*	Effect on CNS

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

4. Where will you look for the sporozoites of the malarial parasite?
(a) Saliva of infected female *Anopheles* mosquito
(b) Red blood corpuscles of human suffering from malaria
(c) Spleen of infected humans
(d) Salivary glands of freshly moulted female *Anopheles* mosquito

5. X is a disease which cause symptoms like internal bleeding, muscular pain, fever, anemia and blockage of the intestinal passage. Identify X.
(a) Ascariasis (b) Filariasis
(c) Amoebiasis (d) Trypanosomiasis

6. Which one of the following statements is correct ?
(a) Benign tumors show the property of metastasis.
(b) Heroin accelerates body functions.
(c) Malignant tumors may exhibit metastasis.
(d) Patients who have undergone surgery are given cannabinoids to relieve pain.

7. How many of the following pathogens are related with skin infection accompanied by intense itching?
Wuchereria, *Microsporum*, *Entamoeba*, *Taenia*, *Trichophyton*, *Trypanosoma*, *Epidermophyton*
(a) Two (b) Three
(c) Four (d) One

8. Which of the following cells cause humoral immunity?
(a) B-lymphocytes (b) T-lymphocytes
(c) Mast cells (d) Both (a) and (b)

9. Following are the differences between innate immunity and acquired immunity.

	Innate immunity	Acquired immunity
(i)	It is present in an organism from birth.	It is acquired by an organism after birth during lifetime.
(ii)	It is also called as specific immunity.	It is also called as non-specific immunity.
(iii)	It consists of different types of barriers that prevent the entry of foreign agents.	It consists of specialised cells (T-cells and B-cells) and antibodies that circulate in the body fluid.

Select the option with correct pair of differences.

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

10. Consider the following four statements (A-D) regarding kidney transplant and select the two correct ones out of these.

(A) Even if a kidney transplant is proper, then also the recipient may need to take immunosuppressants all his/her life.
(B) The cell-mediated immune response is responsible for the graft rejection.
(C) The B-lymphocytes are responsible for rejection of the graft.
(D) The acceptance or rejection of a kidney transplant depends on specific interferons.

The two correct statements are

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

11. Select the correct statement about effect of alcohol and drug abuse.

(a) Excessive doses of drug may cause liver damage and death.
(b) Chronic use of alcohol and drug together damages nervous system.
(c) Alcohol and drug abuse cause depression, fatigue and loss of interest in work, etc.
(d) All of these

12. Which one of the following immune system components does not correctly match with its respective role?

(a) Interferons - Secreted by virus-infected cells and protect non-infected cells from further viral infection.
(b) T-lymphocytes - Produce antibodies in response to pathogens into blood to fight with them.
(c) Macrophages - Phagocytose the microbes entering in the body.
(d) IgA - Present in colostrum and provide passive immunity to infant.

13. Patients with HIV are susceptible to a variety of infections because

(a) the virus produces cell surface receptors that bind to pathogens, making it easier for those pathogens to be infective
(b) synthesising a DNA copy of the viral genome makes a person fell sick
(c) HIV attacks and destroys the helper T-cells, which are central to mounting an effective immune response, making those individuals more susceptible to other infections
(d) HIV destroys B cells so that antibodies cannot be made in response to invading pathogens.

14. A child was infected by measles and get cured in about one week. The child never suffered from measles again throughout his life. The most probable reason is

(a) innate immunity developed in child
(b) infection of measles virus developed acquired immunity
(c) measles virus produced antibodies in child for whole life
(d) passive immunity developed due to viral infection.

15. Which of the following group of drugs is obtained from same plant?

(a) Smack, morphine and LSD
(b) Barbiturate, cocaine and morphine
(c) Marijuana, hashish, *charas* and *ganja*
(d) Hashish, amphetamine and cocaine

Match The Columns

16. Match column I with column II.

Column I	Column II
A. Chemical carcinogen	(i) UV rays
B. Ionising radiation	(ii) Cigarette smoke
C. Biological carcinogen	(iii) X-rays
D. Non-ionising radiation	(iv) Oncogenic viruses

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

Column I	Column II
A. Ringworm	(i) *W. malayi*
B. Pneumonia	(ii) *Trichophyton*
C. Elephentiasis	(iii) *P. falciparum*
D. Malaria	(iv) *Microsporum*
	(v) *Haemophilus influenzae*
	(vi) *W. bancrofti*
	(vii) *Streptococcus pneumoniae*
	(viii) *P. vivax*

Passage Based Questions

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

Cancer is defined as (i) proliferation of cells without differentiation. Normal cells show a property called (ii) by virtue of which contact with other cells inhibits their (i) growth. Cancer cells appears to have lost this property,they (iii) cell death which promotes tumor development. Tumors are of two types: (iv) and (v). (iv) tumors normally remain confined to their (vi) location and do not spread to other parts of the body and cause little damage. The (v) tumors, on the other hand are a mass of proliferating cells called (vii) or tumor cells. These cells grow very (viii), invading and damaging the surrounding normal tissues.

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

Lymphoid organs are organs where origin, maturation and proliferation of lymphocytes occur. The primary lymphoid organs are spleen and thymus where mature lymphocytes differentiate into antigen-sensitive lymphocytes. After maturation the lymphocytes migrate to secondary lymphoid organ like bone marrow, lymph nodes, tonsils, Peyer's patches of large intestine and appendix. The secondary lymphoid organs provide the sites for interaction of lymphocytes with the antigen, which then proliferate to become affector cells.The primary lymphoid organ thymus is a lobed organ located near the lungs and beneath the breastbone. The thymus is quite small at the time of birth but keeps increasing in size with age.

Assertion & Reason

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

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

19. **Assertion :** Opioids are drugs derived from *Papaver somniferum*.
Reason : Opioids slow down metabolism and causes hallucinations.

UNSCRAMBLE ME

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

Column I	Column II
1. IOASBHPL	(a) A type of a body cavity in which the mesoderm is present as scattered pouches in between ectoderm and endoderm.
2. GGALONCU	(b) A process by which non-coding sequences are removed to produce functional RNA.
3. RELAIPTA	(c) The condition that causes rapid spasms in muscles due to low calcium in body fluids.
4. EMOODLOPEUSC	(d) Cells present at the chalazal end of mature embryo sac.
5. ISOATMCABL	(e) A type of granulocyte involved in inflammatory reactions and secretes serotonin.
6. GCRCONNIESA	(f) A step of decomposition by which bacterial and fungal enzymes degrade detritus into simpler inorganic substances.
7. EIRMOMYUTM	(g) A type of placentation where ovary becomes two-chambered due to formation of false septum.
8. ILCNPSIG	(h) The middle thick layer of smooth muscle present in the wall of uterus.
9. ODNAPITLA	(i) Hormone secreted by α-cells of Islets of Langerhans.
10.YATENT	(j) Biological, physical and chemical agents that induces the transformation of normal cells into cancerous neoplastic cells.

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

20. **Assertion :** *Streptococcus pneumoniae* and *Haemophilus influenzae* are responsible for causing infectious disease in human beings.
Reason : A healthy person can acquire the infection by inhaling the droplets released by an infected person.

21. **Assertion :** Interferons are a type of antibodies produced by body cells infected by bacteria.
Reason : Interferons are cytokine barriers.

22. **Assertion :** *Streptococcus pneumoniae* infects the alveoli of the lungs.
Reason : *Streptococcus pneumoniae* is a bacteria.

23. **Assertion :** Cancerous cells spread to distant site by a process called metastasis.
Reason : Cancerous cells lack contact inhibition.

24. **Assertion :** In malaria, a person experiences chills and high fever recurring every three to four days.
Reason : Chills and high fever occur due to the release of haemozoin with rupture of liver cells.

25. **Assertion :** Mucosa-associated lymphoid tissues (MALT) are specialised immune barrier located on skin.
Reason : MALT constitutes about 50 percent of the lymphoid tissue in human body.

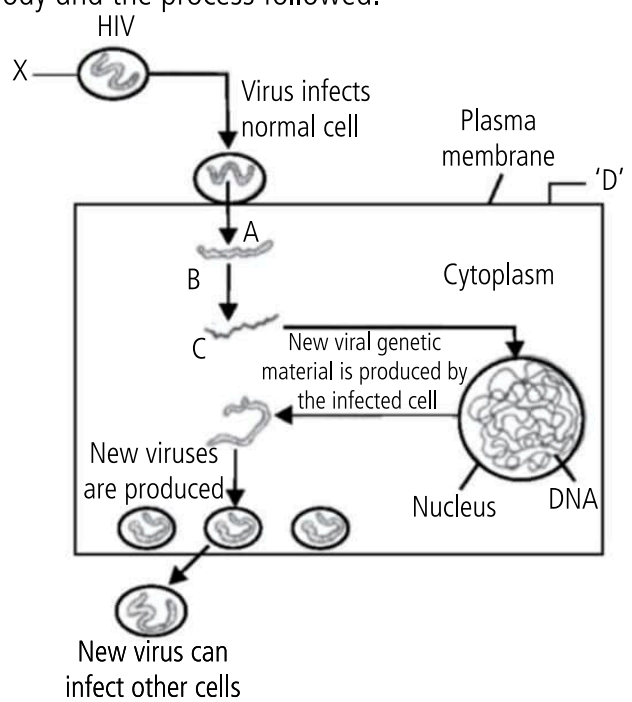
26. **Assertion :** Benign tumors are a mass of proliferating cells.
Reason : Malignant tumor spreads to other organs of the body.

27. **Assertion :** Inspite of exposure to large number of infectious agents, only a few result in disease.
Reason : Humans are able to defend against most of the foreign agents due to the ability to fight disease-causing organisms.

28. **Assertion :** Filariasis is caused by worms.
Reason : *Wuchereria bancrofti* is responsible for elephantiasis.

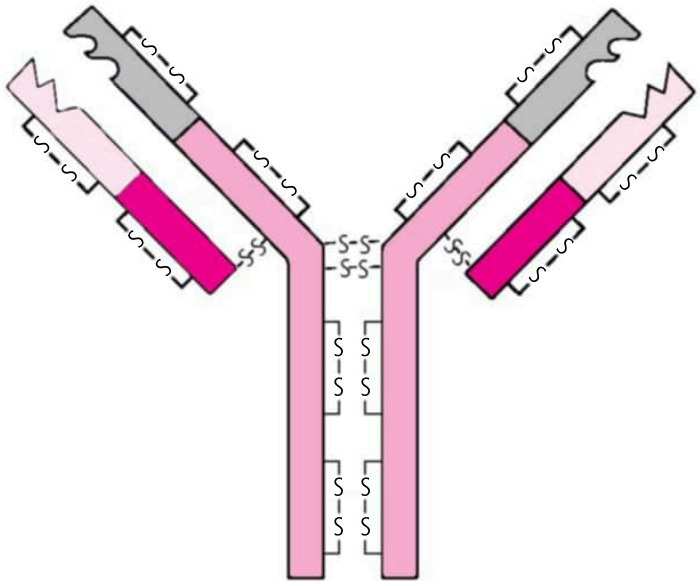
Figure Based Questions

29. Study the diagram showing the entry of HIV into the human body and the process followed.



(a) Mention the name of the host cell 'D' the HIV attack first when it enters into the human body.
(b) Write the chemical nature of the coat 'X'.
(c) Name enzyme 'B' that acts on 'A' to produce molecule 'C'.

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



Molecule X

(a) Identify molecule 'X'.
(b) Which cell produces 'X' ?
(c) What type of immune response is produced by molecule X?

CHAPTER 8 : MICROBES IN HUMAN WELFARE

Multiple Choice Questions

1. Which of the following is not the benefit of LAB?
(a) Increase vitamin B_{12} amount, thus increasing nutrient quality of curd.
(b) Checks disease causing microbes in stomach.
(c) It helps in removing clots from the blood vessels.
(d) It converts milk to curd at suitable temperature.

2. Consider the following statements,
I. Biochemical oxygen demand (BOD) represents the amount of dissolved oxygen that would be consumed if all the organic matter in 1 L of water were oxidised by microorganism.
II. Low value of BOD means the water is less polluted by organic matter.
III. Treatment of wastewater is done by the heterotrophic microbes naturally present in the sewage.
Which of the following statements given above are correct?
(a) I and II only (b) I and III only
(c) II and III only (d) I, II and III

3. Which of the following statements regarding baculoviruses as biocontrol agents are correct?
I. Baculoviruses are pathogens that attack insects and other arthropods.

II. Most of these biocontrol agents belong to the Genus *Nucleopolyhedrovirus*.
III. They do not harm plants, mammals, birds, fish and other non-target insects.
IV. Baculoviruses are helpful in Integrated Pest Management (IPM) programme, in which beneficial insects are conserved.

Choose the correct option.
(a) I, II and III only (b) II and IV only
(c) III and IV only (d) All of these

4. Which of the following is distilled alcoholic beverage?
(a) Whisky (b) Wine
(c) Beer (d) Both (a) and (b)

5. Read the following statements and select the pair of incorrect ones.
(i) Activated sludge formation does not require aeration.
(ii) Flocs are masses of bacteria held together by slime and fungal filaments.
(iii) Activated sludge is formed during secondary sewage treatment.
(iv) A lot of decomposition occurs during formation of primary sludge.
(a) (i) and (iii) (b) (ii) and (iv)
(c) (i) and (iv) (d) (iii) and (iv)

6. Statins, a blood-cholesterol lowering agent, is commercially obtained from
(a) *Trichoderma polysporum*
(b) *Acetobacter aceti*
(c) *Clostridium butylicum*
(d) *Monascus purpureus.*

7. Select the incorrect statement from the following.
(a) *Dosa* and *idli* are prepared by fermenting paste of rice and black gram by some bacterial species.
(b) *Saccharomyces cerevisiae* is used for fermenting malted cereals and fruit juices to produce alcohol.
(c) Wine, beer and whiskey are produced without distillation whereas brandy and rum are produced by distillation of fermented broth.
(d) Yeasts are used commercially for production of various alcoholic beverages.

8. Consider the following statements.
I. Yeast used in making bread and beverages is a prokaryotic fungus.
II. Streptokinase is produced by *Streptococcus* and modified by genetic engineering is used as a clot buster.
III. Lipases are added in detergent for removing oily stains from laundry.
IV. Pectinases are used in clearing fruit juices.

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

9. After sewage treatment, the water samples A, B and C are tested for BOD value and recorded value of BOD was 6 mg/L, 400 mg/L and 20 mg/L respectively. What is correct about these samples?
(a) Sample A could have been taken from untreated sewage water.
(b) Sample B could have been taken from secondary effluent of sewage water treatment.
(c) Sample C could have been taken from river water.
(d) Sample A could have been taken from river water.

10. Consider the following statements.
I. Antibiotics are chemical substances produced by some microorganisms which can kill or retard the growth of other disease-causing microorganisms.
II. Penicillin is the first antibiotic discovered by Alexander Fleming (1928), while working on bacterium *Staphylococcus.*
III. The function of penicillin as an antibiotic was established by Ernest Chain and Howard Florey.

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

11. What would happen if oxygen availability to activated sludge flocs is reduced?
(a) It will increase the rate of degradation of organic matter.
(b) The centre of flocs will become anoxic, which would cause death of bacteria and eventually breakage of flocs.
(c) Flocs would increase in size as anaerobic bacteria would grow around flocs.
(d) Protozoa would grow in large numbers.

12. Read the following statements and select the incorrect option.
(i) Cyanobacteria is used as a biofertiliser in rice fields.
(ii) *Azotobacter* is a symbiotic nitrogen fixing anaerobic bacteria.

MONTHLY TEST DRIVE CLASS XI ANSWER KEY

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

(iii) More the amount of nitrogen, more the productivity of the soil resulting in high yield.
(iv) *Nostoc* and *Oscillatoria* are chemical fertilisers which increases soil fertility.
(a) (ii) and (iv) only
(b) (i) and (iv) only
(c) (iii) only
(d) (i), (ii) and (iii) only

13. Ganga Action Plan and Yamuna Action Plan have been initiated by
(a) Indian Agricultural Research Institute (IARI)
(b) Khadi and Village Industries Commission (KVIC)
(c) Ministry of Environment and Forests (MOEF)
(d) both (a) and (b).

14. A fungal microbes *Aspergillus niger* is used extensively for commercial and industrial production of
(a) acetic acid (b) butyric acid
(c) citric acid (d) lactic acid.

15. Consider the following statements about secondary sewage treatment.
I. In secondary treatment useful aerobic microbes grow rapidly and form flocs. Flocs are masses of bacteria associated with fungal filaments to form mesh-like structures.
II. The growing microbes consume organic matter and thus reduce the biochemical oxygen demand.
III. When BOD of sewage has reduced, the effluent is passed into settling tank. In settling tank, the bacterial flocs settle and the sediment is called activated sludge.
IV. A small part of the sludge is used as an inoculum in the aeration tank and the remaining part is passed into large tanks called anaerobic sludge digesters.
Which of the statements given above are correct?
(a) I and II only (b) III and IV only
(c) II and III only (d) I, II, III and IV

Match The Columns

16. Match column I with column II.

	Column I		Column II
A.	Citric acid	(i)	*Acetobacter*
B.	Acetic acid	(ii)	*Clostridium*
C.	Mycorrhiza	(iii)	*Aspergillus*
D.	Butyric acid	(iv)	*Glomus*

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

	Column I		Column II
A.	*Streptococcus*	(i)	Cyclosporin A
B.	*Monascus purpureus*	(ii)	Blood cholesterol lowering agent
C.	*Trichoderma polysporum*	(iii)	Remove clots from blood vessels
D.	*Saccharomyces cerevisiae*	(iv)	Ethanol
		(v)	Immunosuppressive agent
		(vi)	Statins
		(vii)	Yeast
		(viii)	Streptokinase

Passage Based Questions

18.(A) Complete the given passage with appropriate words or phrases.
Microbial biocontrol agents that can be introduced in order to control butterfly caterpillars is the bacteria (i) . A biological control being developed for use in the treatment of plant disease is the (ii) *Trichoderma*. *Trichoderma* are (iii) species that are very common in the (iv) ecosystems. They are effective biocontrol agents of several plant pathogens. (v) are pathogens that attack insect and other arthropods. The majority of (v) used as biological control agents are in the genus (vi) .These viruses are excellent candidates for species-specific, (vii) spectrum insecticidal applications. They have no (viii) impacts on plants, mammals, birds, fish or even on non-target insects.

(B) Read the given passage and correct the errors, wherever present.
In sewage treatment plants, autotrophic microbes are naturally present in sewage and carry out the process of fermentation. The primary stage of treatment is biological, second stage is chemical and third stage is physical. In case of primary treatment, the sediment is called primary effluent while the supernatant is called sludge. In secondary treatment, the BOD of the waste matter is reduced and is passed into aeration tank. The lesser the BOD of wastewater, more is its polluting potential. In settling tank, the bacterial flocs are allowed to undergo decomposition.

Assertion & Reason

In each of the following questions, a statement of Assertion (A) is given and a corresponding statement of Reason (R) is given just below it. Of the statements, mark the correct answer as :
(a) If both A and R are true and R is the correct explanation of A.
(b) If both A and R are true but R is not the correct explanation of A.
(c) If A is true but R is false.
(d) If A is false but R is true.

19. **Assertion :** Bottled fruit juices are clearer as compared to those made at home.
Reason : Bottled juices are clarified by the use of lipases and pectinases.

20. **Assertion :** Biogas is a methane rich fuel gas.
Reason : Biogas is formed by the action of methanogenic bacteria on organic wastes.

21. **Assertion :** *Lactobacillus* is used for curd making.
Reason : LAB play very beneficial role in checking disease causing microbes.

22. **Assertion :** Secondary treatment of sewage is also called biological treatment while primary treatment is called physical treatment.
Reason : Primary sewage treatment depends only upon filtration and sedimentation properties of materials present in sewage.

23. **Assertion :** Integrated pest management (IPM) programme at the same time deals with conservation of insects and destruction of insects.
Reason : IPM programmes are specially used in dealing with ecologically sensitive areas.

24. **Assertion :** *Azotobacter* is symbiotically associated with the root nodules of legumes.
Reason : *Azotobacter* is a free living in soil, enriching the nutrient content of the soil.

25. **Assertion :** Penicillium was the first discovered antibiotic.
Reason : Antibiotics are certain chemicals that are produced by some microbes to kill or retard the growth of harmful microbes.

26. **Assertion :** Sewage should not be directly left into rivers, streams and other water bodies.
Reason : Sewage contains human excreta and other organic wastes.

27. **Assertion :** Biogas is used as fuel for cooking and lighting.
Reason : Biogas is considered as eco-friendly and pollution free source of energy.

28. **Assertion :** Biofertilisers are preferred over chemical fertilisers.
Reason : Chemical fertilisers are generally more expensive and hazardous to environment.

Figure Based Questions

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

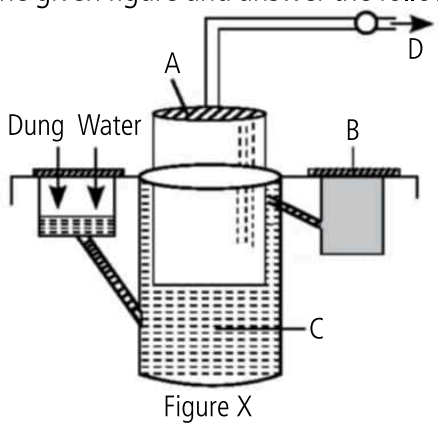
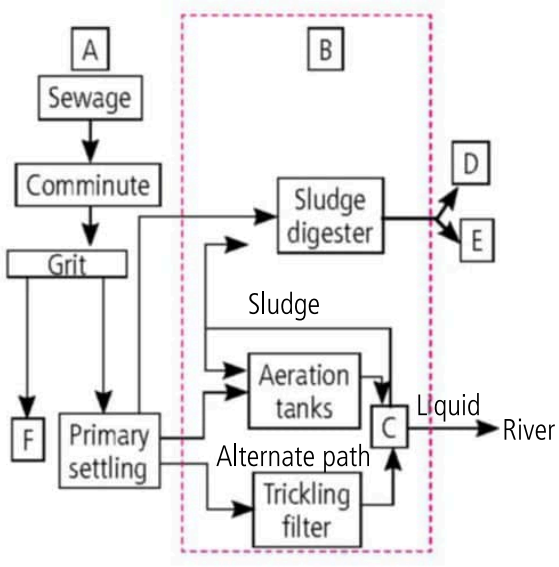


Figure X

(a) Identify the figure X.
(b) Identify the labelled parts A, B, C and D.
(c) Name the components that get collected in 'A'.

30. Study the given flow chart of sewage treatment and answer the following questions.



(a) What do A and B represent?
(b) What do aeration tank and trickling filter form, *i.e.*, C and also identify D, E and F.
(c) Explain the labelled part A.

SOLUTIONS

CHAPTER 7 : HUMAN HEALTH AND DISEASES

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

16. A-(ii), B-(iii), C-(iv), D-(i)

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

18. **(A)** (i) uncontrolled (ii) contact inhibition
(iii) resist (iv) benign
(v) malignant (vi) original
(vii) neoplastic (viii) rapidly

(B) Lymphoid organs are organs where maturation and proliferation of lymphocytes occur. The primary lymphoid organs are ~~spleen~~ bone marrow and thymus where ~~mature~~ immature lymphocytes differentiate into antigen-sensitive lymphocytes. After maturation the lymphocytes migrate to secondary lymphoid organs like ~~bone marrow~~ spleen, lymph nodes, tonsils, Peyer's patches of ~~large~~ small intestine and appendix. The secondary lymphoid organs provide the sites for interaction of lymphocytes with the antigen, which then proliferate to become ~~affector~~ effector cells.The primary lymphoid organs thymus is a lobed organ located near the ~~lungs~~ heart and beneath the breastbone. The thymus is quite ~~small~~ large at the time of birth but keeps ~~increasing~~ reducing in size with age.

19.	(c)	20.	(b)	21.	(d)	22.	(b)	23.	(b)
24.	(c)	25.	(d)	26.	(d)	27.	(a)	28.	(b)

29. **(a)** HIV first attack macrophages (D) when it enters into the human body.
(b) The chemical nature of the coat 'X' is protein.
(c) Enzyme reverse transcriptase (B) acts on viral RNA (A) to produce viral DNA (C).

30. **(a)** X is the structure of an antibody molecule.
(b) B cells or B-lymphocytes produce an army of proteins called antibodies (X) in response to pathogens into our blood to fight against them.

(c) The immune response generated specifically by B-lymphocytes is called humoral immune response. B-cells produce antibodies to fight against foreign bodies or antigens like bacteria, viruses, pollen, dust, mites, etc.

CHAPTER 8 : MICROBES IN HUMAN WELFARE

1. (c) **2.** (d) **3.** (d) **4.** (a) **5.** (c)
6. (d) **7.** (c) **8.** (c) **9.** (d) **10.** (d)
11. (b) **12.** (a) **13.** (c) **14.** (c) **15.** (d)
16. A-(iii), B-(i), C-(iv), D-(ii)
17. A-(iii,viii); B-(ii,vi); C-(i,v); D-(iv, vii)
18. **(A)** (i) *Bacillus thuringiensis* (ii) fungus
(iii) free-living (iv) root
(v) Baculoviruses (vi) *Nucleopolyhedrovirus*
(vii) narrow (viii) negative

(B) In sewage treatment plants, ~~autotrophic~~ heterotrophic microbes are naturally present in sewage and carry out the process of ~~fermentation~~ decomposition. The primary stage of treatment is ~~biological~~ physical, second stage is ~~chemical~~ biological and third stage is ~~physical~~ chemical. In case of primary treatment, the sediment is called primary ~~effluent~~ sludge while the supernatant is called ~~sludge~~ effluent. In secondary treatment, the BOD of the waste matter is reduced and is passed into ~~aeration~~ settling tank. The ~~lesser~~ greater the BOD of wastewater, more is its polluting potential. In settling tank, the bacterial flocs are allowed to undergo ~~decomposition~~ sedimentation.

19. (c) **20.** (b) **21.** (b) **22.** (b) **23.** (b)
24. (d) **25.** (d) **26.** (a) **27.** (a) **28.** (a)

29. **(a)** The given figure X is of biogas plant.
(b) A-Gas holder, B-Sludge, C-Digester, D-Gas
(c) Methane, carbon dioxide with traces of nitrogen, hydrogen sulphide and hydrogen get collected in gas holder (A).

30. **(a)** A-Primary (physical) process
B-Secondary (biological) process
(b) C-Secondary settling, D-Biogas, E-Manure, F-Compost landfilling
(c) A is primary or physical treatment of sewage. It is the process of removal of small and large, floating and suspended solids from sewage through two processes of filtration and sedimentation. First floating and suspended matter is removed through sequential filtration with progressively smaller pore filters. The filtrate is then kept in large open settling tanks where grit (sand, silt, small pebbles) settles down. Aluminium or iron sulphate is added in certain places for flocculation and settling down of solids. The sediment is called primary sludge while the supernatant is called effluent. The primary sludge traps a lot of microbes and debris. It is subjected to composting, land fill or anaerobic digestion to produce biogas and manure. ☺☺

NCERT XTRACT

This Section Covers Questions Based on Latest **NCERT Textbook** of Class XII

Unit-VI : Reproduction

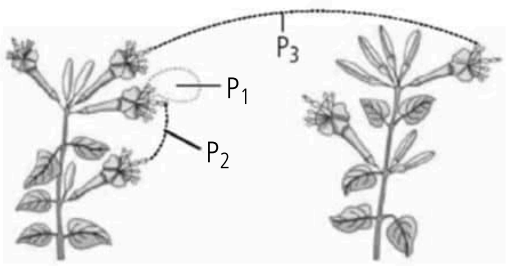
- Sexual Reproduction in Flowering Plants
- Human Reproduction
- Reproductive Health

1. Which of the following processes are necessary for the complete development of male gametophyte from pollen mother cell?
(a) One meiotic cell division and two mitotic cell divisions
(b) One meiotic cell division and one mitotic cell division
(c) Two meiotic cell divisions and one mitotic cell division
(d) Two mitotic cell divisions

2. The testes in humans are situated outside the abdominal cavity inside a pouch called scrotum. The purpose served is for
(a) maintaining the scrotal temperature lower than the internal body temperature
(b) escaping any possible compression by the visceral organs
(c) providing more space for the growth of epididymis
(d) providing a secondary sexual feature for exhibiting the male sex.

3. Which of the following is true about '*Saheli*'?
(i) Developed at CDRI, Lucknow
(ii) Contains a steroidal preparation
(iii) 'Once-a-week' pill
(iv) Many side effects
(v) High contraceptive value
(vi) Very few side effects
(vii) Low contraceptive value
(a) (i), (ii), (iii), (v) and (vi) (b) (i), (iii), (v) and (vi)
(c) (i), (ii), (iii), (iv) and (v) (d) (i), (iii), (iv) and (vii)

4. The given diagram shows two plants of the same species. Identify the types of pollination indicated as P_1, P_2 and P_3 respectively.



(a) Allogamy, Chasmogamy, Cleistogamy
(b) Autogamy, Xenogamy, Geitonogamy
(c) Autogamy, Geitonogamy, Xenogamy
(d) Geitonogamy, Allogamy, Autogamy

5. Which of the following diseases is completely curable if detected early and treated properly?
(a) Syphilis (b) Hepatitis-B
(c) Genital herpes (d) HIV infection

6. The main function of the fimbriae of the fallopian tube in females is to
(a) release ovum from the Graafian follicle
(b) make necessary changes in the endometrium for implantation
(c) help in the development of corpus luteum
(d) help in the collection of the ovum after ovulation.

7. Double fertilisation involves
(a) fertilisation of the egg by two male gametes
(b) fertilisation of two eggs in the same embryo sac by two male gametes brought by one pollen tube
(c) fertilisation of the egg and the central cell by two male gametes brought by different pollen tubes
(d) fertilisation of the egg and the central cell by two male gametes brought by the same pollen tube.

8. Which of the following statements is incorrect?
(a) Sertoli cells provide nutrition to the developing male germ cells.
(b) Leydig cells synthesise and secrete androgens.
(c) Secretions of the acrosome help in fertilisation of the ovum.
(d) Secondary spermatocytes are diploid.

9. Read the following statements and select the correct option.
I. There are many side effects of tubectomy and vasectomy.
II. Purpose of tubectomy is to prevent egg formation.
III. The most important component of the oral contraceptive pills is progesterone.
IV. Contraceptive oral pills help in birth control by preventing ovulation.
V. In India, there is rapid decline in infant mortality rate and maternal mortality rate.
(a) I, II and III only (b) I, II and V only
(c) III, IV and V only (d) II and V only

10. Which one of the following statements with regard to embryonic development in humans is correct?
(a) Cleavage divisions bring about considerable increase in the mass of protoplasm.
(b) In the second cleavage division, smaller blastomere usually divides a little sooner than the larger blastomere.
(c) With more cleavage divisions, the resultant blastomeres become larger and larger.
(d) Cleavage division results in a solid ball of cells called morula.

11. Periodic abstinence is a method in which
(a) barrier is created
(b) contraceptives are taken orally
(c) coitus is avoided for a particular duration
(d) ovulation is inhibited.

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

	Column I		**Column II**
A.	Parthenocarpy	(i)	Seed formation without fertilisation
B.	Polyembryony	(ii)	More than one embryo in same seed
C.	Apomixis	(iii)	Seedless fruits without fertilsation
		(iv)	Embryo develops from a somatic cell

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

13. Consider the given statements and identify the option which is correct regarding umbilical cord.
(i) It carries oxygen and nutrients to embryo.
(ii) It joins placenta and the embryo.
(iii) It carries wastes and nutrients from embryo.
(iv) It produces steroidal pregnancy hormones.
(a) (i), (ii), (iii) and (iv) (b) (i), (ii) and (iii) only
(c) (iv) only (d) (i) only

14. Which one of the following statements is correct?
(a) Pollen grains represent the female gametophytes.
(b) Endothecium produces microspores.
(c) Tapetum nourishes the developing pollen.
(d) Thin inner layer of pollen is called exine.

15. Read the given statements and select the correct option.
Statement I : MTP is considered relatively safe during the first trimester of pregnancy.
Statement II : In India Government legalised MTP in 1971 with some restrictions.
(a) Both Statement I and Statement II are correct.
(b) Both Statement I and statement II are incorrect.
(c) Statement I is correct but statement II is incorrect.
(d) Statement I is incorrect but statement II is correct.

16. Perisperm differs from endosperm in
(a) being a diploid tissue
(b) its formation by fusion of secondary nucleus with several sperms
(c) being a haploid tissue
(d) having no reserve food.

17. What is the function of copper-T?
(a) Stops cleavage
(b) Inhibit fertilisation
(c) Checks mutation
(d) Stops gastrulation

18. Study the statement given below and answer the question.
"Vigorous contraction of the 'X' at the end of the 'Y' causes expulsion of the fetus." Identify X and Y.
(a) X – Vagina; Y – Fertilisation
(b) X – Uterus; Y – Pregnancy
(c) X – Placenta; Y – Implantation
(d) X – Embryo; Y – Ovulation

19. The mature typical embryo sac of angiosperms contains
(a) 3 celled egg apparatus, 3 antipodal cells and 2 polar nuclei
(b) 2 celled egg apparatus, 3 antipodal cells and 2 polar nuclei
(c) 3 celled egg apparatus, 2 antipodal cells and 1 polar nuclei
(d) 3 celled egg apparatus, 1 antipodal cell and 2 polar nuclei.

20. First polar body is formed during the formation of _____ and completion of _____ meiotic division.
(a) primary oocytes, II
(b) secondary oocytes, I
(c) secondary spermatocytes, II
(d) primary spermatocytes, I

21. A childless couple can be assisted to have a child through a technique called GIFT. The full form of this technique is
(a) Gamete intra fallopian transfer
(b) Gamete internal fertilisation and transfer
(c) Germ cell internal fallopian transfer
(d) Gamete inseminated fallopian transfer.

22. Read the given statements regarding structure of mega-sporangium and select the correct option.
I. Ovule is attached to the placenta by funicle.
II. Hilum represents the junction between integument and funicle.
III. Micropyle represents the basal part of the ovule.
IV. Nucellus have abundant reserve food material.
V. An ovule generally has a single embryo sac formed from four megaspore.
Choose the correct option for the given statements.
(a) I, II and III are true and IV and V are false.
(b) II, III and V are true and I and IV are false.
(c) III, IV and V are true and I and II are false.
(d) I and IV are true and II, III and V are false.

23. Match the items given in column I with those in column II and select the correct option given below.

	Column I		**Column II**
A.	Proliferative phase	(i)	Breakdown of endometrial lining
B.	Secretory phase	(ii)	Follicular phase
C.	Menstruation	(iii)	Luteal phase

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

24. Inspite of all corrective measures, a couple is unable to produce child. Some other techniques used to produce child are together called
(a) RCH (b) MTP (c) ART (d) IUD.

25. The correct sequence of male reproductive structures of mammals through which sperms pass out is

I.	Rete testes	II.	Epididymis
III.	Vasa efferentia	IV.	Vasa deferentia

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

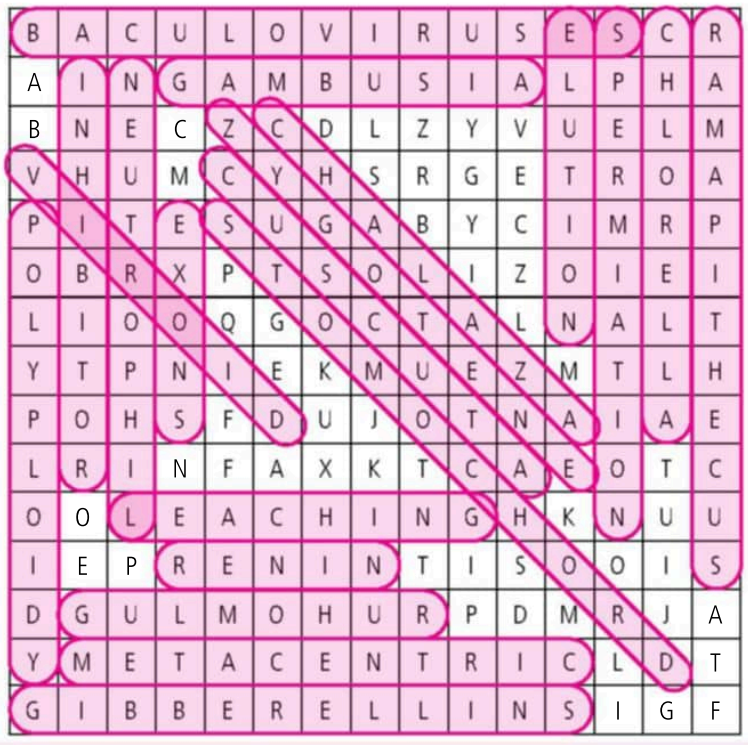
26. Fill up the blanks in the following paragraph by selecting the correct option.
A. (i) methods work on the principle of avoiding chances of ovum and sperms meeting.
B. (ii) is one such method in which the couples avoid coitus from day 10 to 17 of the menstrual cycle.
C. (iii) is another method in which the male partner withdraws his penis from the vagina just before ejaculation so as to avoid insemination.
D. (iv) method is based on the fact that ovulation and therefore the cycle do not occur during the period of intense lactation following parturition.

	(i)	**(ii)**	**(iii)**	**(iv)**
(a)	Barrier	Coitus interruptus	Periodic abstinence	Lactational amenorrhea
(b)	IUDs	Lactational amenorrhea	Coitus interruptus	Periodic abstinence
(c)	Natural	Periodic abstinence	Coitus interruptus	Lactational amenorrhea
(d)	Surgical	Periodic abstinence	Coitus interruptus	Lactational amenorrhea

27. What is the correct sequence of the formation of female gametophyte in angiosperms?
(a) Nucellus, megaspore tetrad, megaspore mother cell, megaspore, female gametophyte
(b) Megaspore tetrad, nucellus, megaspore mother cell, megaspore, female gametophyte
(c) Nucellus, megaspore mother cell, megaspore tetrad, megaspore, female gametophyte

Contributed by : Anitha MC, (Karnataka)

SOLUTIONS TO AUGUST 2024 WORD GRID



1. Viroid
2. Chalaza
3. *Chlorella*
4. Exons
5. Stomochord
6. *Ramapithecus*
7. Gulmohur
8. *Gambusia*
9. Metacentric
10. Baculoviruses
11. Inhibitor
12. Elution
13. Zygotene
14. Spermiation
15. Gibberellins
16. *Cuscuta*
17. Renin
18. Leaching
19. Neutrophil
20. Polyploidy

(d) Megaspore mother cell, megaspore tetrad, megaspore, nucellus, female gametophyte

28. In which of the following ART, embryo is formed *in vitro* and sperm is directly injected into the ovum?
(a) Intra cytoplasmic sperm injection
(b) Inter cytoplasmic sperm insemination
(c) Intra cellular sperm injection
(d) Inter cellular sperm insertion.

29. From the statements given below choose the option that are true for a typical female gametophyte of a flowering plant.
(i) It is 8-nucleate and 7-celled at maturity.
(ii) It is free-nuclear during the development.
(iii) It is situated inside the integument but outside the nucellus.
(iv) It has an egg apparatus situated at the chalazal end.
(a) (i) and (iv) (b) (ii) and (iii)
(c) (i) and (ii) (d) (ii) and (iv)

30. During spermatogenesis, how many spermatozoa are formed from a single primary spermatocyte?
(a) 1 (b) 2 (c) 4 (d) 8

31. If the cells of the nucellus in the angiosperm ovule contain 24 chromosomes, what will be the number of chromosomes in the endosperm of a self-pollinated flower?
(a) 12 (b) 24 (c) 36 (d) 48

32. Fluid filled cavity, antrum is present in
(a) primary follicle (b) secondary follicle
(c) tertiary follicle (d) none of these.

33. Hormone releasing IUD is
(a) copper-T (b) progestasert
(c) multiload 375 (d) lippes loop.

34. Read the given statements and select the correct option.
Statement I : Geitonogamy is genetically similar to autogamy.
Statement II : In geitonogamy, pollen grains come from the same plant.
(a) Both statement I and statement II are correct.
(b) Both statement I and statement II are incorrect.
(c) Statement I is correct but statement II is incorrect.
(d) Statement I is incorrect but statement II is correct.

35. The secretory phase in the human menstrual cycle is also called
(a) luteal phase and lasts for about 6 days
(b) follicular phase and lasts for about 6 days
(c) luteal phase and lasts for about 13 days
(d) follicular phase and lasts for about 13 days.

36. Select the option which correctly matches the type of IUD with its related example.

	IUD		Example
(a)	Non medicated IUD	–	Multiload 375
(b)	Hormone releasing IUD	–	Lippes loop
(c)	Copper releasing IUD	–	Multiload 375
(d)	Non medicated IUD	–	LNG- 20

37. The germ pores in the pollen grain are the regions
(a) which are made up of lignin and suberin
(b) that can withstand high temperature and strong acids and alkalies
(c) which lack sporopollenin
(d) through which sperms are released into the female gametophyte.

38. Read the given statements and select the correct option.
Statement I : Uterus opens into cervix through vagina.
Statement II : The cavity of cervix along with vagina forms birth canal.
(a) Both Statement I and Statement II are correct.
(b) Both Statement I and Statement II are incorrect.
(c) Statement I is correct but Statement II is incorrect.
(d) Statement I is incorrect but Statement II is correct.

39. During the pollen-pistil interaction,
(a) pollen recognition is followed by promotion of post pollination events
(b) pollen recognition is followed by inhibition of post pollination events
(c) post pollination events are followed by pollen recognition
(d) both (a) and (b)

40. Implantation in human female occurs in stage of
(a) morula, 8-16 celled stage
(b) blastocyst
(c) 16 celled embryo
(d) blastocyst without trophoblast.

41. ICSI is
(a) embryo implantation after *in vivo* fertilisation
(b) sperm injection for *in vivo* fertilisation
(c) embryo implantation after *in vitro* fertilisation
(d) egg implantation for *in vitro* fertilisation.

42. Secretion from which gland helps in lubrication of penis?
(a) Bartholin's gland (b) Bulbourethral gland
(c) Clitoris (d) Seminal vesicle

43. Primary endosperm nucleus (PEN) is formed by the fusion of
(a) 2 polar nuclei + 1 synergid cell nucleus
(b) 1 polar nucleus + 1 antipodal cell nucleus + 1 synergid cell nucleus
(c) 2 polar nuclei + 1 male gamete nucleus
(d) 2 antipodal cell nuclei + 1 male gamete nucleus.

44. Which of the following is not a task under Reproductive and Child Health Care (RCH) programme?
(a) Providing facilities to build up a reproductively health society.
(b) Creating awareness regarding reproduction related aspects.
(c) Awareness regarding water borne disease.
(d) Awareness regarding contraceptive measures.

45. Apomictic embryos in *Citrus* arise from
(a) synergids (b) nucellus
(c) antipodal cells (d) diploid egg.

46. Select the correct option describing gonadotropin activity in a normal pregnant female.
(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 estrogen and progesterone.
(d) High level of hCG stimulates the thickening of myometrium.

47. What measures should be taken to avoid the transmission of STD?
I. Avoid sex with unknown partner
II. Avoid sex with multiple partners
III. Do protected sex
IV. Avoid sharing needles
(a) I, II and IV only (b) I, II and III only
(c) I, III and IV only (d) All of these

48. Which of the given statements are true?
(i) During the development of a dicot embryo, heart-shaped stage of embryo is followed by globular stage of embryo.
(ii) The part of embryonal axis above the level of cotyledons is epicotyl, while the part below the level of cotyledons is hypocotyl.
(iii) Monocot seeds possess a single cotyledon represented by scutellum.
(a) (i) and (ii) (b) (ii) and (iii)
(c) (i) and (iii) (d) (i), (ii) and (iii)

49. In adult human females, oxytocin
(a) stimulates pituitary to secrete vasopressin
(b) causes strong uterine contractions during parturition
(c) is secreted by anterior pituitary
(d) stimulates growth of mammary glands.

50. Diaphragms are contraceptive devices used by the females. Choose the correct option from the statements given below:
(i) They are introduced into the uterus.
(ii) They are placed to cover the cervical region.
(iii) They act as physical barriers for sperm entry.
(iv) They act as spermicidal agents.
(a) (i) and (ii) (b) (i) and (iii)
(c) (ii) and (iii) (d) (iii) and (iv)

SOLUTIONS

1. (a)

2. (a) : In mammals like humans, testes are formed in abdominal cavity but descend two months prior to birth and present in pouch called, scrotum, to keep temperature about 2°C lower than internal body temperature to facilitate spermatogenesis.

3. (b)

4. (c)

5. (a) : Syphilis is a chronic bacterial disease that is contracted chiefly by infection during sexual intercourse, but also congenitally by infection of a developing fetus. Syphilis is completely curable if detected early and treated properly.

6. (d) : Fallopian tube (oviduct, uterine tube) is either of a pair of tubes that conduct ova (egg cells) from the ovary to the uterus. The ovarian end opens into the abdominal cavity *via* a funnel-shaped structure with finger like projection (fimbriae) surrounding the opening. Movements of the fimbriae at ovulation assist in directing the ovum to the fallopian tube.

7. (d) : Double fertilisation is the fusion of two male gametes brought by a pollen tube to two different cells of the same female gametophyte in order to produce two different structures. It is found only in angiosperms where it was first discovered by Nawaschin in 1898 in *Fritillaria* and *Lilium*. Out of the two male gametes one fuses with egg or oosphere to perform generative fertilisation (syngamy or true fertilisation). It gives rise to a diploid zygote or oospore. The second male gamete fuses with the two haploid polar nuclei or diploid secondary nucleus of the central cell to form a triploid primary endosperm nucleus (PEN). This is called as vegetative fertilisation (or triple fusion).

8. (d) : Secondary spermatocytes are haploid.

9. (c)

10. (d) : In humans, due to cleavage, a solid ball of cells is formed called morula which further changes to blastocyst.

11. (c) : Periodic abstinence is a method in which the couples avoid or abstain from coitus from day 10 to 17 of the menstrual cycle when ovulation could be expected.

12. (b) **13. (b)** **14. (c)**

15. (a) : MTP is the termination of pregnancy before the fetus becomes viable. It is done to get rid of unwanted pregnancies and is comparatively safe upto first trimester (12 weeks) of pregnancy. After the first trimester, MTP becomes more risky as the fetus becomes intimately associated with the maternal tissues. Government of India legalised MTP in 1971.

16. (a) : Both perisperm and endosperm are nutritive layers. Perisperm is residual persistent nucellus of seed, formed prior to fertilisation while endosperm develops when one

UNSCRAMBLED WORDS

AUGUST 2024

1-h-CLITORIS
2-g-MULTIPOLAR
3-d- HAEMOPHILIA
4-c-OOGAMOUS
5-j- COMMENSALISM
6-i-MYOFIBRILS
7-f-PROMOTER
8-e-NOTOCHORD
9-b-INTEGUMENTS
10-a-VALVATE

Winner : *Ekus Arora (New Delhi)*

of the sperm cells fuses with two haploid polar nuclei. Thus, perisperm is diploid while endosperm is a triploid tissue.

17. (b) : Copper ions released from Cu-T, an IUD suppress sperm motility and the fertilisation capacity of sperms.

18. (b) : Vigorous contraction of the uterus at the end of the pregnancy causes expulsion of the fetus.

19. (a) : Fully developed embryo sac of angiosperm is 8 nucleated and 7 celled structure *i.e.*, egg apparatus at micropylar end is having 3 cells (2 synergids + 1 egg cell), 3 antipodal cells at chalazal end and a central cell having two polar nuclei at centre.

20. (b) **21. (a)**

22. (d) : Hilum represents the junction between ovule and funicle. Chalaza represents the basal part of the ovule. An ovule generally has a single embryo sac formed from a megaspore.

23. (c)

24. (c) : ART stands for Assisted Reproductive Technology where various techniques are used to help the sterile couple to produce child.

25. (d) : In mammals, sperms are produced in seminiferous tubules, which open into a network called rete testes. It opens by several fine ductless glands called vasa efferentia, into epididymis. The basal end of each epididymis leads into a muscular tube called vas deferens.

26. (c)

27. (c) : In angiosperms, the body of the ovule consists of a mass of parenchymatous cells called nucellus. In the hypodermal region of nucellus towards the micropylar end develops a primary archesporial cell, which by further divisions forms a diploid megaspore mother cell. The latter undergoes meiosis to form megaspore tetrad. Usually the chalazal megaspore remains functional while the other three degenerate. The functional megaspore is the first cell of female gametophyte (embryo sac).

28. (a) : Intra cytoplasmic sperm injection (ICSI) is a specialised procedure to form an embryo in the laboratory in which sperm is injected into the ovum.

29. (c)

30. (c) : A primary spermatocyte completes first meiotic division leading to formation of two haploid secondary spermatocytes. Secondary spermatocytes undergo second meiotic division to produce four haploid spermatids which on differentiation will produce four spermatozoa.

31. (c) : Nucellus consists of diploid cells *i.e.*, 2n and endosperm is a triploid structure *i.e.*, 3n. If, 2n = 24, then 3n = 36.

32. (c)

33. (b) : Hormone releasing IUDs makes the uterus unsuitable for implantation and the cervix hostile to the sperms, *e.g*, progestasert, LNG-20.

34. (a) : Geitonogamy is genetically similar to autogamy since the pollen grains come from the same plant.

35. (c) **36. (c)**

37. (c) : The outer layer of a mature pollen grain is called exine (which is made up of sporopollenin) and inner layer is intine (made up of pecto-cellulose). At certain places, exine remains thin and lacks sporopollenin. These areas are called germ pores. During pollen germination, pollen tube comes out through these pores.

38. (d) **39. (a)**

40. (b) : Implantation occurs in blastocyst stage usually on 7th day after fertilisation.

41. (b) **42. (b)**

43. (c) : During the event of double fertilisation in angiosperms, the second male gamete fuses with the two haploid polar nuclei or diploid secondary nucleus of the central cell to form a triploid primary endosperm nucleus (PEN). This second fertilisation is called vegetative fertilisation.

44. (c) : Creating awareness among people about various reproduction related aspects and providing facilities and support for building up a reproductively healthy society are the major tasks under 'Reproductive and Child health care (RCH) programmes'.

45. (b)

46. (c) : The trophoblastic cells secrete human chorionic gonadotropin hormone which has properties similar to those of luteinising hormone (LH) of the pituitary gland. It takes over the job of pituitary LH during pregnancy. The hCG maintains the corpus luteum and stimulates it to secrete progesterone.

47. (d) : Simple precautions that can prevent STD are:
(i) avoid sex with unknown multiple partners.
(ii) always use condoms during coitus.
(iii) in case of doubt go to the qualified doctors.

48. (b) : During the development of dicot embryo, initially the dicot embryo is globular and undifferentiated. This early embryo with radial symmetry is called proembryo. It transforms into embryo with the development of radicle, plumule and cotyledons. Two cotyledons differentiate from the sides with a faint plumule in the centre. At this time the embryo becomes heart-shaped.

49. (b) : In adult human females, oxytocin is a hormone released by the pituitary gland (neurohypophysis) that causes contraction of the uterus during labour and stimulates milk flow from the breasts by causing contraction of muscle fibres in the milk ducts.

50. (c) ☺☺

Class XII

Monthly test drive

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

Series V

Biotechnology Principles and Processes
Biotechnology and its Applications

Total Marks : 160 **Time :** 40 Min.

1. Match the following columns and select the correct option.

	Column-I		Column-II
(A)	Recombinant DNA	1.	Sea weeds
(B)	Gel electrophoresis	2.	DNA staining
(C)	Ethidium bromide	3.	Plasmid DNA that has incorporated human DNA
(D)	Agarose	4.	Process by which DNA fragments are separated based on their size

	A	B	C	D
(a)	3	4	2	1
(b)	3	2	1	4
(c)	2	1	4	3
(d)	3	4	1	2

2. A totipotent cell means
(a) an undifferentiated cell capable of developing into entire plant
(b) a differentiated cell capable of developing into an organ
(c) a differentiated cell capable of developing into complete organ system
(d) cell which lacks the capability to differentiate into an organ or system.

3. The colonies of recombinant bacteria appear white in contrast to blue colonies of non-recombinant bacteria because
(a) insertional inactivation of alpha-galactosidase in recombinant bacteria
(b) insertional inactivation of beta-glycosidase in non-recombinant bacteria
(c) insertional inactivation of beta-galactosidase in recombinant bacteria
(d) insertional inactivation of alpha-galactosidase in non-recombinant bacteria.

4. Pomato, a somatic hybrid formed by fusing
(a) germ cells of tomato and potato only
(b) nucleus of somatic cells of tomato and potato
(c) protoplast of tomato with that of potato
(d) none of these.

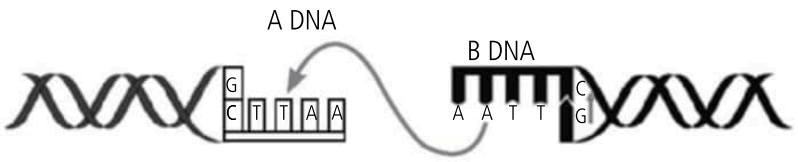
5. *Hin*dII cuts DNA molecule at a specific point by recognising a specific sequence of
(a) 2 base pairs (b) 3 base pairs
(c) 5 base pairs (d) 6 base pairs.

6. Genetic modification (GM) has been used
(a) in the form of fuels and pharmaceuticals
(b) to supply alternative resources to industries
(c) to enhanced nutritional value of food
(d) all of these.

7. Read the given statements and select the correct option.
Statement (A) : *E. coli* having pBR322 with DNA insert at *Bam*HI site cannot grow in medium containing tetracycline.
Statement (B) : Recognition site for *Bam* HI is present in tet^R region of pBR322.
(a) Statement (A) is correct but statement (B) is incorrect.
(b) Statement (B) is correct but statement (A) is incorrect.
(c) Both statements (A) and (B) are correct.
(d) Both statements (A) and (B) are incorrect.

8. Which one of the following statements is incorrect in relation to transgenic Bt cotton plant?
(a) Crop yield loss due to attack by *Bacillus thuringiensis* bacterium is reduced.
(b) Crop yield loss due to attack by lepidopteran insect pests is reduced.
(c) The use of chemical insecticides in the cotton field is minimised.
(d) Better quality cotton is produced.

9. Refer to the given figure where A and B are taken as vector/ plasmid DNA and foreign DNA respectively. Select the correct option regarding it.



	Restriction enzyme recognising palindrome	**Enzyme joining the sticky ends**
(a)	*Eco*RI	DNA ligase
(b)	DNA ligase	*Eco*RI
(c)	Exonuclease	DNA ligase
(d)	DNA ligase	Exonuclease

10. Which among the following genes control the cotton bollworms?
(a) *cry IAc* (b) *cry IIAb*
(c) *cry IAb* (d) Both (a) and (b)

11. Genetic engineering means
(a) experiment of tissue culture
(b) manipulation of chromosomes
(c) manipulation of genes
(d) producing completely new types of genes.

12. Which of the following are used in gel electrophoresis?
I. Ethidium bromide II. *Taq* polymerase
III. Agarose IV. UV radiation
Choose the correct option.
(a) I and II only (b) I and III only
(c) I, II and IV (d) I, III and IV

13. Read the given statements and select the correct option.
Statement I : Nematode-specific genes were introduced into the host plant using *Agrobacterium* vector.
Statement II : Host plant generated dsDNA triggers protection against nematode infestation.
(a) Both statements I and II are correct.
(b) Statement I is incorrect but statement II is correct.
(c) Statement I is correct but statement II is incorrect.
(d) Both statements I and II are incorrect.

14. Read the following statements about gene gun method.
I. This method is also known as biolistics technique.
II. In this method, cells are bombarded with high velocity micro-particles of gold or tungsten coated with DNA.
III. This method is suitable for plants.
Which of the statements given are correct?
(a) I and II only (b) I and III only
(c) II and III only (d) I, II and III only

15. C-peptide of human insulin is
(a) a part of mature insulin molecule
(b) responsible for formation of disulphide bridges
(c) removed during maturation into insulin
(d) responsible for its biological activity.

16. Select the option that correctly states the working action of restriction endonuclease *Eco*RI on DNA sequence.

(a) 5′ – GAATTC – 3′
3′ – CTTAAG – 5′

(b) 5′ – GAATTC – 3′
3′ – CTTAAG – 5′

(c) 5′ – GAATTC – 3′
3′ – CTTAAG – 5′

(d) 5′ – GAATTC – 3′
3′ – CTTAAG – 5′

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

	Column-I		**Column-II**
A.	Tobacco	I.	Vitamin-A
B.	Bt cotton	II.	High yield and pest resistant
C.	Golden rice	III.	*Meloidogyne incognita*

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

18. 'Rosie' cow known to produce a type of milk which has the following characteristics:
I. protein content of 2.4 g/L
II. human α-lactalbumin
III. more nutritionally balanced for human babies than natural cow milk.
Which of the given statements are correct?
(a) I and II only
(b) I and III only
(c) II and III only
(d) I, II and III

19. Which of the following statements is correct?
(a) The first restriction endonuclease was *Eco*RI.
(b) Plasmid pBR322 has two selectable markers *i.e.*, ampicillin resistance and tetracycline resistance.
(c) Electrophoresis is a technique of separation of DNA molecule on the basis of their density.
(d) Topoisomerases are called molecular scissors.

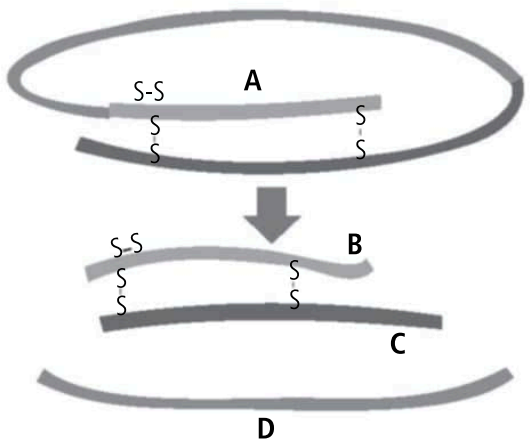
20. Match the column-I with column-II and select the correct option.

	Column-I		Column-II
A.	Gene modification	I.	Vitamin A enriched rice
B.	Gene therapy	II.	Chemical safety testing
C.	Transgenic animals	III.	ADA deficiency treatment
D.	Bt toxin	IV.	*cry* gene

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

21. Primers are
(a) chemically synthesised oligonucleotides that are complementary to the regions of DNA
(b) chemically synthesised oligonucleotides that are not complementary to the regions of DNA
(c) chemically synthesised, autonomously replicating circular DNA molecules
(d) specific sequences present on recombinant DNA.

22. Identify the correct labels for A, B, C and D marked in figure given below.



	A	B	C	D
(a)	Proinsulin	B-peptide	A-peptide	Insulin
(b)	Proinsulin	A-peptide	B-peptide	Free C-peptide
(c)	Proinsulin	A-peptide	B-peptide	Insulin
(d)	Proinsulin	B-peptide	A-peptide	Free C-peptide

23. Match column-I with column-II and select the correct answer from the given codes.

	Column-I		Column-II
A.	Recombinant DNA technology	(i)	Chilled ethanol
B.	Precipitation of DNA	(ii)	Genetic engineering
C.	*Thermus aquaticus*	(iii)	Thermostable DNA polymerase
D.	*Agrobacterium tumefaciens*	(iv)	Ti plasmid

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

24. *Bacillus thuringiensis* forms protein crystals which contain insecticidal protein. This protein
(a) binds with epithelial cells of midgut of the insect pest ultimately killing it
(b) is coded by several genes including the gene *cry*
(c) is activated by acidic pH of the foregut of the insect pest
(d) does not kill the carrier bacterium which is itself resistant to this toxin.

25. Match the items in column-I with their uses in column-II and choose the right option.

	Column-I		Column-II
A.	ELISA	(i)	Antigen-antibody interaction
B.	PCR	(ii)	Gene amplification
C.	Biolistics	(iii)	Direct introduction of recombinant DNA
D.	Micro-injection	(iv)	Gold coated DNA

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

26. A doctor while operating on an HIV (+)ve patient accidentally cuts himself with a scalpel. Suspecting himself to have contracted the virus which test will he take to confirm his suspicion?
(a) PCR (b) Routine urine examination
(c) TLC (d) Autopsy

27. The gene '*rop*' present in pBR322 cloning vector, codes for
(a) the proteins involved in the translation
(b) the proteins involved in the replication of the plasmid
(c) the proteins involved in the synthesis of ampicillin only
(d) the proteins involved in the synthesis of tetracycline only.

28. Read the statements and choose the correct option.
Statement-I : Transgenic mice are being developed for use in testing the safety of vaccines.
Statement-II : Transgenic animals carry genes which make them more sensitive to toxic substances than non-transgenic animals.
(a) Both statements I and II are correct.
(b) Statement I is correct but statement II is incorrect.
(c) Statement I is incorrect but statement II is correct.
(d) Both statements I and II are incorrect.

29. The function of a selectable marker is to
(a) eliminate the transformants and permit the growth of non-transformants
(b) identify *ori* site
(c) eliminate non-transformants and permit the growth of transformants
(d) destroy recognition sites.

30. The process of RNA interference has been used to make tobacco plant resistant to
(a) *Bacillus thuringiensis* (b) *Meloidogyne incognita*
(c) flies and mosquitoes (d) both (a) and (b).

31. Plasmids are extra-chromosomal circular DNA molecules
(a) which have their own origin of replication and can replicate independently
(b) which have their own origin of replication but cannot replicate independently
(c) which do not have their own origin of replication and cannot replicate independent of bacterial chromosomal DNA
(d) none of these.

32. Read the statements and choose the correct option.
Statement-I : Genetic modification of organisms can have unpredictable results when such organisms are introduced into ecosystem.
Statement-II : The Indian Government has set up organisations such as GEAC that will make decisions regarding the validity of GM research and the safety of introducing GM-organisms for public services.
(a) Both statements I and II are correct.
(b) Statement I is correct but statement II is incorrect.
(c) Statement I is incorrect but statement II is correct.
(d) Both statements I and II are incorrect.

33. Restriction enzyme *Eco*RI cuts the DNA between bases G and A only when the sequence in DNA is
(a) GATATC (b) GAATTC
(c) GATTCC (d) GAACTT.

34. RNA interference which is employed in making tobacco plant resistant to *Meloidogyne incognita* is essentially involved in
(a) preventing the process of replication of DNA
(b) preventing the process of translation of *m*RNA
(c) preventing the process of splicing of hnRNA
(d) preventing the process of transcription.

35. The technique of elution is
(a) cutting of DNA by restriction endonuclease
(b) separation of DNA fragments using agarose gel
(c) staining of DNA and exposure to UV light
(d) cutting of DNA fragments and extracting them from gel.

36. Why does patient requires periodic infusion of genetically engineered lymphocytes in case of ADA gene therapy?
(a) The lymphocytes are immortal cells.
(b) Lymphocytes are mortal cells.
(c) Our body may generate rejection reaction against genetically engineered lymphocyte.
(d) None of these

37. An enzyme catalysing the removal of nucleotides from the ends of DNA is
(a) *Eco*RI (b) *Hin*d II
(c) exonuclease (d) reverse transcriptase.

38. Which of the following is/are correct?
(i) Transgenic animal – Animal that have had their DNA manipulated to possess and express an extra gene.
(ii) GEAC – Gene Engineering approval Committee.
(iii) Biopiracy – Exploitation of bioresources of the nations without proper authorisation.
(a) Only (ii) (b) Only (i)
(c) (i) and (ii) (d) (i) and (iii)

39. In insertional inactivation method, selection of transformant and non-transformant using antibiotic is done by
(a) simultaneous plating on two plates with different antibiotics
(b) simultaneous plating on two plates with same antibiotics
(c) plating on one plate with one antibiotic followed by other plate with same antibiotic
(d) alternate plating on two plates with same antibiotic.

40. The illegal and unlawful development of biomaterials without payment to the inhabitants of their origin is called
(a) biopatent (b) biotechnology
(c) biowar (d) biopiracy. ☺☺

Key is published in this issue. Search now! ☺

SELF CHECK

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

Check your score! If your score is

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

CBSE Warm-up!

CLASS-XII

Chapterwise practice questions for CBSE Exams as per the latest pattern and syllabus by CBSE for the academic session 2024-25.

UNIT-VII : GENETICS AND EVOLUTION

Series-2 • Principles of Inheritance and Variation • Molecular basis of inheritance • Evolution

General Instructions :

(i) All questions are compulsory.

(ii) The question paper has five sections and 33 questions.

(iii) Section–A has 16 questions of 1 mark each; Section–B has 5 questions of 2 marks each; Section– C has 7 questions of 3 marks each; Section– D has 2 case-based questions of 4 marks each; and Section–E has 3 questions of 5 marks each.

(iv) There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.

(v) Wherever necessary, neat and properly labelled diagrams should be drawn.

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

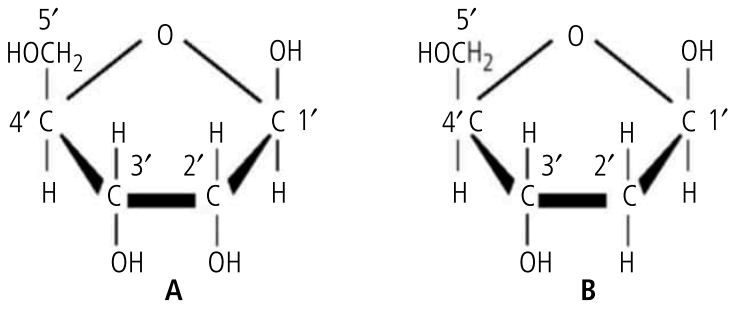
SECTION-A

1. 450 out of 1000 individuals in a population have a genotype of AA while 350 have Aa genotype. Frequency of allele A in this population is

(a) 0.5 (b) 0.45

(c) 0.77 (d) 0.67.

2. Observe structures A and B given below. Which of the following statements are correct?



(a) A have 2′-OH group which makes it less reactive and structurally stable whereas B have 2′-H group which makes it more reactive and unstable.

(b) A have 2′-OH group which makes it more reactive and structurally unstable whereas B have 2′-H group which makes it less reactive and structurally stable.

(c) A and B both have –OH groups which make them more reactive and structurally stable.

(d) A and B both are having –OH groups which make them less reactive and structurally stable.

3. In *Antirrhinum*, RR is phenotypically red flowers, rr is white and Rr is pink. Select the correct phenotypic ratio in F_1 generation when a cross is performed between RR × Rr.

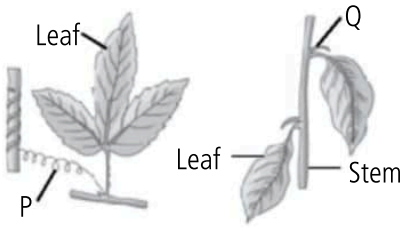
(a) 1 red : 2 pink : 1 white

(b) 3 pink : 1 white

(c) 1 red : 1 pink

(d) All pink

4. Refer to the given figures and select the correct option.



(a) Structures P and Q provide morphological and anatomical evidence to trace evolutionary relationships.

(b) P and Q are analogous organs as they have similar basic structural design and origin but perform different functions.

(c) Structures P and Q depict convergent evolution in plants.
(d) P and Q are homologous organs as they are quite different in fundamental structure and origin but perform similar function.

5. Sex determination in grasshoppers, humans and *Drosophila* is similar because
(a) females are hemizygous
(b) males have one X-chromosome and females have two X-chromosomes
(c) all males always have one Y-chromosome in all three species
(d) the ratio of autosomes to sex chromosomes is the same in all three organisms.

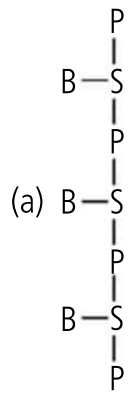
6. What would happen if in a gene encoding a polypeptide of 50 amino acids, 25th codon (UAU) is mutated to UAA?
(a) A polypeptide of 24 amino acids will be formed.
(b) Two polypeptides of 24 and 25 amino acids will be formed.
(c) A polypeptide of 49 amino acids will be formed.
(d) A polypeptide of 25 amino acids will be formed.

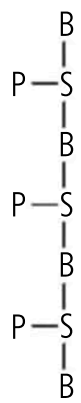
7. Which one is the incorrect match?
(a) – Consanguineous mating
(b) – Sex unspecified
(c) – Male
(d) – Mating

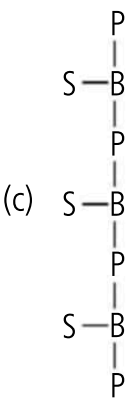
8. Which of the following statements is incorrect?
(a) Jawless fish probably evolved around 350 mya.
(b) Tyrannosaurus rex was the biggest dinosaur, about 20 feet in height and had huge fearsome dagger-like teeth.
(c) About 15 mya, primates called *Dryopithecus* and *Ramapithecus* existed.
(d) *Australopithecus* lived in East and Central Asia and probably ate meat.

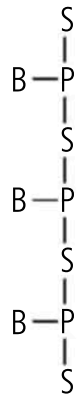
9. If the sequence of bases in DNA is 3′-GCTTAGGCAA-5′, then the sequence of bases in its transcript will be
(a) GCTTAGGCAA
(b) CGAATCCGTT
(c) CGAAUCCGUU
(d) AACGGAUUCG.

10. Which of the following shows the correct positions of the phosphate (P), sugar (S) and base (B) molecules in the given line diagrams representing the structure of DNA?

(a) 

(b) 

(c) 

(d) 

11. Which of the following is a correct match?
(a) Down's syndrome – 21st chromosome
(b) Turner's syndrome – XXY-chromosome
(c) Haemophilia – Y-chromosome
(d) Klinefelter's syndrome – XO females

12. Which of the following is correct order of the evolutionary history of man?
(a) *Australopithecus, Homo sapiens,* Neanderthal man, *Homo erectus*
(b) *Australopithecus, Homo habilis,* Neanderthal man, *Homo sapiens*
(c) *Ramapithecus,* Neanderthal man, *Homo sapiens, Australopithecus*
(d) *Homo sapiens,* Neanderthal man, *Homo erectus, Ramapithecus*

Q. No. 13 to 16 consist of two statements – Assertion (A) and Reason (R). Answer these questions by selecting the appropriate option given below:
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true and R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

13. **Assertion (A) :** ABO blood group system provides a good example of multiple alleles.
Reason (R) : In ABO blood grouping system, when I^A and I^B alleles are present together, they both express their own types.

14. **Assertion (A) :** Eukaryotic *m*RNA requires post-transcriptional processing for formation of functional *m*RNA.
Reason (R) : Eukaryotic transcripts possess extra non-functional segments called introns.

15. **Assertion (A) :** Hardy-Weinberg principle explains the variations occurring in population and species over a number of generations.
Reason (R) : Hardy-Weinberg principle is applicable in absence of genetic drift and gene flow.

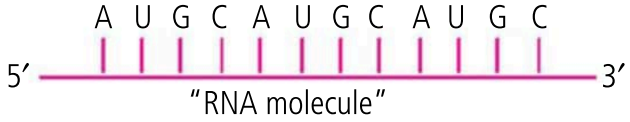
16. **Assertion (A) :** Human skin colour is controlled by 3 pairs of genes.
Reason (R) : Skin colour in humans show pleiotropic inheritance.

SECTION-B

17. Identify a, b and c in the given table.

S.No.	Pattern of inheritance	Monohybrid F_1 phenotypic expression
1.	Codominance	'a'
2.	Dominance	'b'
3.	Incomplete dominance	'c'

18. Construct and label a transcription unit from which the RNA segment given below has been transcribed. Write the complete name of the enzyme that transcribed this RNA.



19. Write about the ancestry and evolution of bat, horse and human on the basis of a comparative study of their forelimbs. What are these limbs categorised as?

20. **(a)** State the 'central dogma' as proposed by Francis Crick. Are there any exceptions to it? Support your answer with a reason and an example.

OR

(b) Monocistronic structural genes in eukaryotes have interrupted coding sequences. Explain. How are they different in prokaryotes?

21. A plant of *Antirrhinum majus* with red flowers was crossed with another plant of the same species with white flowers The plants of the F_1 generation bear pink flowers. Explain the pattern of inheritance with the help of a cross.

SECTION-C

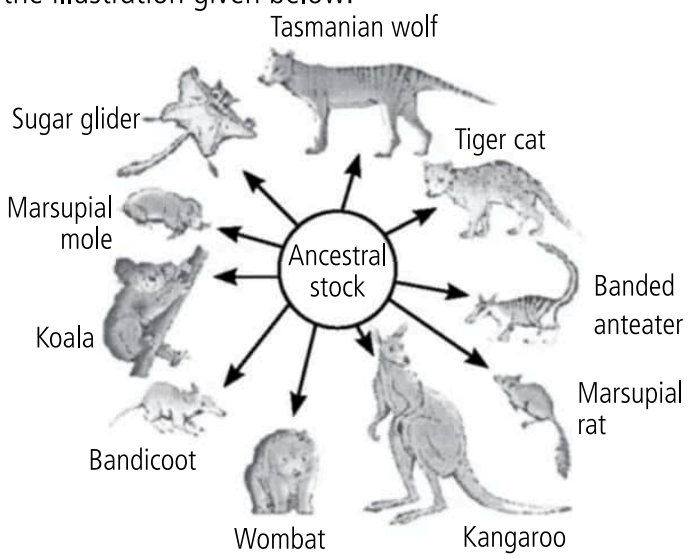
22. **(a)** Describe Hardy-Weinberg Principle.

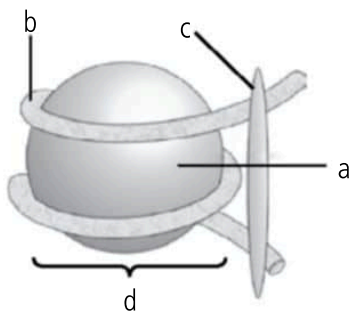
(b) List any four factors which affect genetic equilibrium.

23. **(a)** What is the significance of satellite DNA in DNA fingerprinting technique?

(b) Enlist some applications of DNA fingerprinting.

24. Name and explain the evolutionary concept represented in the illustration given below:



25. 

(a) What is this diagram representing?

(b) Name the parts a, b, c and d.

(c) In the eukaryotes, the DNA molecules are organised within the nucleus. How is the DNA molecule organised in a bacterial cell in absence of nucleus?

26. A dihybrid heterozygous round yellow seeded garden pea (*Pisum sativum*) offspring was crossed with a double recessive parent.

(a) What type of the cross is this ? What principle of Mendel is illustrated through the result of this cross?

(b) Work out the genotype and phenotype of the progeny.

27. "Appearance of melanised moths post-industrialisation in England is a classic example of evolution by natural selection." Explain.

TRIO ANSWERS AUGUST 2024

The three letter sequence is **A N T**.

P E R I **A N T** H

A N T I P O D A L

M **A N T** T L E

C O E L A C **A N T** H

Winner : *Soumili Mitra Roy (West Bengal)*

28. (a) (i) Why are grasshopper and *Drosophila* said to show male heterogamety? Explain.

(ii) Explain female heterogamety with the help of an example.

OR

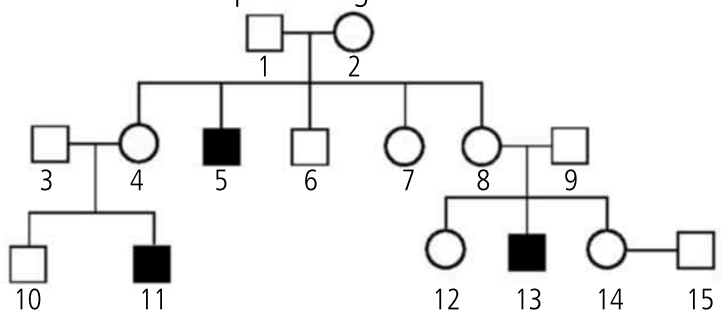
(b) (i) What are linked genes?

(ii) Differentiate between linkage and crossing over.

SECTION-D

Q. No. 29 and 30 are case based questions. Each question has 3 subparts with internal choice in one subpart.

29. The pedigree chart given below shows the inheritance of haemophilia in one family. Study the pattern of inheritance and answer the questions given:



(a) Is the trait recessive or dominant?

OR

(a) Is the trait sex-linked or autosomal?

(b) Give all the possible genotypes of the members 4, 5 and 6 in the pedigree chart.

(c) A blood test shows that the individual 14 is a carrier of haemophilia. The member numbered 15 has recently married the member numbered 14. What is the probability that their first child will be a haemophilic male?

30. Read the following passage and answer the questions.

An experiment 'X' provided evidence in support of 'Y'. In this experiment, four gases were circulated - 'A', 'B', 'C', and 'D' in an air tight apparatus and electrical discharge from electrodes was passed at 800°C. The mixture of gases was passed through a condenser. After a week, the chemical composition of the liquid inside the apparatus was analysed. The results provided evidence through which 'Y' was more or less accepted.

(a) Identify gases A, B, C and D.

(b) What was the ratio of gases in experiment 'X'?

(c) Which theory of origin of life is supported by the given experiment?

OR

(c) Draw a diagrammatic representation of experiment 'X'.

SECTION-E

31. (a) (i) Differentiate between 'unambiguous' and 'degenerate' codons.

(ii) Write two functions of the codon AUG.

(iii) Genetic code is specific and nearly universal. Justify.

OR

(b) (i) Draw a schematic representation of transcription unit showing the polarity of both the strands. Label the promoter gene and the template strand.

(ii) Mention the condition when template strand becomes coding strand.

(iii) Give the function of the promotor gene.

32. (a) A true breeding pea plant homozygous for axial violet flowers (AAVV) is crossed with another pea plant with terminal white flowers (aavv).

(i) What would be the phenotype and genotype of F_1 and F_2 generations?

(ii) Give the phenotypic ratio of F_2 generation.

(iii) List the Mendel's generalisations that can be derived from the above cross.

OR

(b) (i) Explain the phenomena of multiple allelism and co-dominance taking ABO blood group as an example.

(ii) What is the phenotype of the following: I^A *i* and *ii*.

(iii) A man with blood group A married a woman with blood group B. They have a son with AB blood group and a daughter with blood group O. Work out the cross to show the possibility of such inheritance.

33. (a) Give a note on the various types of natural selection.

OR

(b) Highlight the salient features of Hugo de Vries theory of mutation.

SOLUTIONS

1. (d) : Frequency of dominant individuals

$$= \frac{\text{Frequency of homozygous individuals}}{\text{Total population}}$$

$$= \frac{450}{1000} = 0.45$$

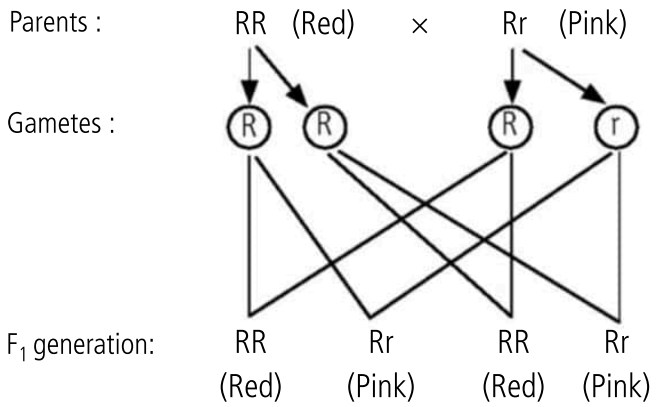
Frequency of allele $A = \sqrt{.45} = 0.67$

2. (b) : 'A' is a structure of ribose sugar and 'B' is a structure of deoxyribose sugar. Ribose sugar is present in RNA in which an additional OH group is present at 2′-carbon which makes it more reactive and structurally unstable, whereas deoxyribose sugar is present in DNA having 2′–H group which makes it less reactive and structurally more stable.

WHO AM I ...

1.	Areolar tissue	Pg. 16
2.	Colleterial glands	Pg. 18
3.	Gene flow	Pg. 58
4.	Stabilising selection	Pg. 60

3. **(c) :** The cross between RR and Rr:



Genotypic ratio = RR : Rr
1 : 1

Phenotypic ratio = Red : Pink
1 : 1

4. **(a)**

5. **(b) :** In these species, females have two X-chromosomes and males have one X-chromosome. In grasshoppers, males are heterogametic (XO), with half the male gametes carrying X-chromosome (A + X) while the other half being devoid of it (A + 0). In humans and *Drosophila*, females carry two X chromosomes and males have one X and one Y chromosome.

6. **(a) :** UAA is a stop codon. It signals for polypeptide chain termination. Hence, only 24 amino acids chain will be formed.

7. **(c)**

8. **(d) :** *Australopithecus* probably lived in East African grasslands with 500 c.c. of brain capacity and essentially ate fruits.

9. **(c) :** *m*RNA strand is complementary to one of the DNA strands *i.e.*, template strand. In RNA, uracil is present instead of thymine which is complementary to adenine. Cytosine and guanine are also complementary to each other. Hence, the sequence of bases in transcript would be CGAAUCCGUU.

10. **(a) :** DNA helix is made up of two polynucleotide chains, where the backbone is constituted by sugar-phosphate and the bases project inside.

11. **(a) :** Haemophilia is X-linked but not holandric/Y-linked. Klinefelter's synodrome is caused due to presence of additional copy of X chromosome resulting into a karyotype of 47, XXY and Turner's syndrome have only one X chromosome, *i.e.*, 45 with XO.

12. **(b) :** Sequence of human evolution :

Dryopithecus → *Australopithecus* → *Homo habilis* → *Homo erectus* → Neanderthal man → *Homo sapiens*.

13. **(b)**

14. **(a)**

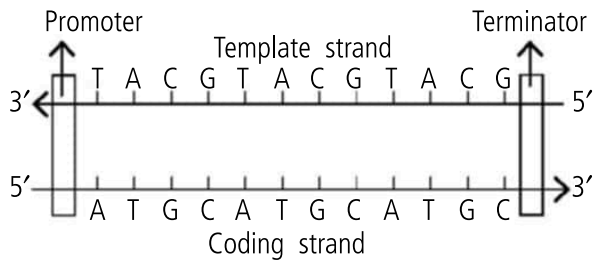
15 **(d) :** The relative frequencies of various kinds of genes in a large and randomly mating, sexual panmictic population tend to remain constant from generation to generation in the absence of mutation, selection and gene flow. This is called Hardy-Weinberg principle or Hardy-Weinberg equilibrium. Genetic drift can cause elimination of certain alleles or fixation of the other in the population leading to a change in the population of alleles in the gene pool. So, genetic drift must not occur to maintain the equilibrium.

16. **(c) :** Human skin colour is a polygenic trait.

17. a – Both the forms of a trait are equally expressed in F_1 generation.
b – The progeny resembled only one of the parents.
c – Phenotypic expression of F_1 generation is somewhat intermediate between the two parental forms of a trait.

18. Given RNA strand :

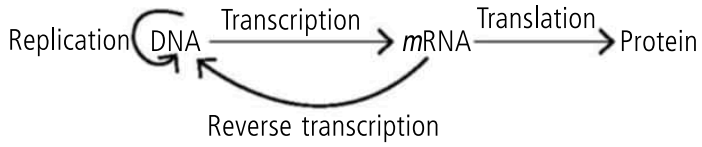
For the given RNA, the transcription unit is given as:



DNA dependent RNA polymerase is an enzyme that transcribed this RNA segment.

19. Comparative study of forelimbs of bat, horse and human shows common ancestry or common embryonic origin. Bat, horse and human share similarities in the pattern of bones of forelimbs, as they have similar anatomical structure – humerus, radius, ulna, carpals, metacarpals and phalanges, but perform different functions (in bat for flying, running in horse and walking in humans). These limbs are categorised as homologous organs as same structure developed along different directions due to adaptations to different needs.

20. **(a)** Francis Crick (1958) proposed 'central dogma' in molecular biology which states that the flow of information first occurs from DNA to *m*RNA by the process of transcription and then the information present in *m*RNA is decoded for the formation of polypeptide chain by the process of translation. The central dogma suggests that DNA contains the information needed to make all of our proteins and that RNA is a messenger that carries this information to ribosomes. The ribosomes serve as factories in the cell where the information is translated from a code into the functional product.



Yes, central dogma differs in retroviruses, *e.g.*, HIV, etc., where it is called reverse central dogma (inverse flow of information) *i.e.*, from RNA to DNA. RNA of these viruses first synthesises DNA through reverse transcription and DNA then transfers information to RNA which takes part in translation of coded information to form a polypeptide.

OR

(b) In eukaryotes, the monocistronic structural genes have interrupted coding sequences, *i.e.*, the genes in eukaryotes are split. The coding sequences or expressed sequences are defined as exons. They are said to be those sequence that appear in mature or processed RNA. The exons are interrupted by introns or intervening sequences which do not appear in mature or processed RNA. Thus, post-transcription processing, which involves splicing of introns and fusion of exons is required to form functional *m*RNA.
Differences between structural gene in prokaryotes and structural gene in eukaryotes are as follows :

S.No.	Structural gene in prokaryotes	Structural gene in eukaryotes
(i)	Consists of functional coding sequences.	Consists of both exons and introns.
(ii)	Information is continuous as only exons are present.	Information is split due to presence of introns in between exons.
(iii)	Splicing does not take place.	Splicing occur to make functional *m*RNA.

21. **Parents :** Red flowers × White flowers
Genotype of parents : RR × rr
Gametes : R, r
F_1 Generation : Rr, Pink flower
Selfing

F_2 Generation :

♀ \ ♂	R	r
R	RR Red flower	Rr Pink flower
r	Rr Pink flower	rr White flower

The pattern of inheritance is known as incomplete dominance. The F_2 phenotypic and genotypic ratio is same, *i.e.*, 1 : 2 : 1.

22. **(a)** Hardy-Weinberg equilibrium states that there is a balance in the frequency of alleles from generation to generation within a large population over a period of time assuming that : (i) mating is random; (ii) there is no natural selection; (iii) there is no migration; (iv) there is no mutation. He also stated that sum of all allelic frequency is 1. In such a stable population, for a gene with two alleles, A (dominant) and a (recessive), the frequency of both allele is denoted as p and q respectively. Then the frequencies of the three possible genotypes (AA, Aa, and aa) can be expressed by the equation : $p^2 + 2pq + q^2 = 1$, where p^2 = frequency of AA (homozygous dominant) individuals, $2pq$ = frequency of Aa (heterozygous) individuals, and q^2 = frequency of aa (homozygous recessive) individuals.

(b) The factors that affect genetic equilibrium are gene flow, mutation, natural selection and genetic recombination.

23. **(a)** Satellite DNA are very specific in each individual, vary in number from person to person and are inherited. These sequences show high degree of polymorphism. Each individual inherits the satellite DNA from his/her parents which are used as genetic markers in DNA fingerprinting.

(b) Applications of DNA fingerprinting are as follows:
(i) Paternity or maternity disputes can be solved by DNA fingerprinting as it can identify the real genetic mother, father and the offspring.
(ii) This technique is used to identify genes connected with hereditary diseases.
(iii) It is useful in detection of crime and legal pursuits.
(iv) It can identify racial groups, their origin, historical migrations and invasions.

24. Given illustration represents adaptive radiation of Australian marsupials within Australian island continent. A number of marsupials, each different from the other evolved from an ancestral stock, but all within Australian island continent. This pattern occurs when organisms coming from same stocks evolve different features and adapt to the different habitat. This is also referred to as divergent evolution.

25. **(a)** The diagram represents the structure of a nucleosome.

(b) a = Histone octamer, b = DNA molecule, c = Linker DNA, d = Core of histone molecule.

(c) In a bacterial cell, DNA lies in cytoplasm. It is supercoiled with the help of RNAs and non-histone basic proteins. The compacted mass of DNA is called as nucleoid.

26. **(a)** This is a test cross. Principle of independent assortment is illustrated through the result of this cross.

(b)

Parents genotype : RrYy (Round yellow) × rryy (Wrinkled green)
Gametes : RY, Ry, rY, ry × ry
F_1 generation

♀ \ ♂	RY	Ry	rY	ry
ry	RrYy Round yellow	Rryy Round green	rrYy Wrinkled yellow	rryy Wrinkled green

Genotypic ratio – 1 : 1 : 1 : 1
Phenotypic ratio – 1 : 1 : 1 : 1

27. Natural selection is the process by which those organisms that are best suited to their environment and are able to reproduce well in changed environmental conditions, survive. One of the most striking examples which demonstrates the action of natural selection in the wild is the case of peppered moth, *Biston betularia* that lives in all parts of England.

Due to industrial smoke and soot, the pale tree trunks became more and more blackened. As a result, the light moths stood out in contrast to its background, increasing the possibility of being easily detected and eaten by their predators, such as birds, in much greater number than the dark melanic variety. Decrease in the number of light winged moths and increase in the number of dark varieties was the ultimate result. Therefore, evolution favoured the dark winged melanic moths to reproduce more successfully for their adaptation in the polluted areas of England. Evolution of darker form in response to industrial pollution is known as industrial melanism.

28. (a) (i) In male heterogamety, males produce two different types of gametes. In *Drosophila*, the males have one X and one Y chromosome, whereas in grasshopper the male have only one X-chromosome (XO type). Thus, the males of these organisms show male heterogamety as they produce : (a) gametes either with or without X-chromosome or (b) some gametes with X-chromosome and some with Y-chromosome.

(ii) In some organisms, female produce two different types of gametes. This is termed as female heterogamety. In birds and some reptiles, female has two different sex chromosomes (one Z and one W chromosome) whereas male has a pair of same chromosome (a pair of Z-chromosomes).

OR

(b) (i) Linked genes are those genes that are physically close to one another on the same chromosome and are likely to be inherited together. They do not show independent assortment at the time of gamete formation.

(ii) Differences between linkage and crossing over are as follows:

S. No.	Linkage	Crossing over
(i)	It is tendency of genes in a chromosome to remain together and pass as such to the next generation.	It is exchange of genes/ chromosomal parts to break established linkages and formation of new linkages.
(ii)	It produces parental types.	It produces recombinations.
(iii)	Strength of linkage between two genes increases if they are closely placed in a chromosome.	Frequency of crossing over between two genes decreases if they are closely placed.
(iv)	It helps to maintain a newly improved variety.	It is the source of variations for producing new varieties.

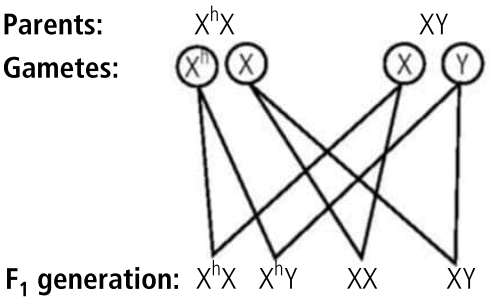
29. (a) It is a recessive trait.

OR

(a) It is a sex-linked trait.

(b) The possible genotypes of members 4, 5 and 6 are as follows: XX^h; X^hY and XY respectively.

(c) The probability of their first child being a haemophilic male is 25%.



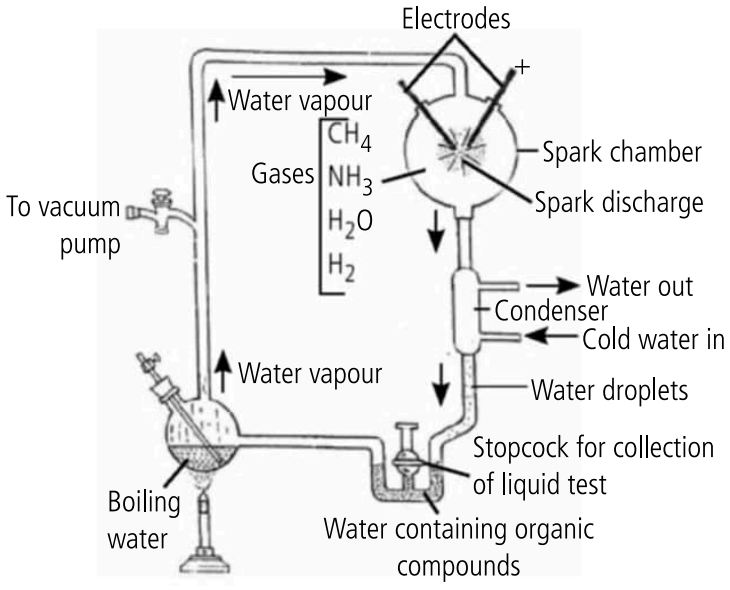
30. (a) Gases A, B, C and D respectively are CH_4, NH_3, H_2 and water vapour.

(b) Experiment 'X' is Miller's experiment. The ratio of methane, ammonia and hydrogen in Miller's experiment was 2 : 1 : 2.

(c) Miller's experiment (X) supported Oparin-Haldane theory (Y) which states the life originated on early earth through physico-chemical processes of atoms combining to form molecules, molecules in turn reacting to produce inorganic and organic compounds. Organic compounds interacting to produce all types of macromolecules which organised to form the first living system or cells.

OR

(c) The diagrammatic representation of Miller's experiment is as follows:



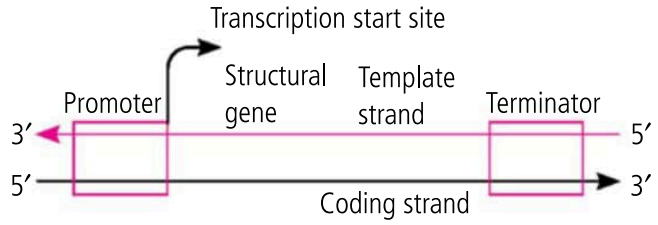
31. (a) (i) The difference between unambiguous and degenerate codons is as follows: Unambiguous codons : One codon codes for only one amino acid, hence, it is unambiguous and specific.
Degenerate codons : Some amino acids are coded by more than one codon, hence the code is degenerate.

(ii) AUG has dual functions. It codes for methionine (met). It also act as initiator codon.

(iii) Genetic code is specific as one codon codes for only one amino acid and it is nearly universal as the same codon would code for same amino acid from bacteria to human. Some exceptions to this rule have been found in mitochondrial codons and in some protozoans.

OR

(b) (i) A transcription unit in DNA is defined by these regions in DNA :



(ii) The promoter gene defines the template and coding strands. By switching its position with terminator the definition of coding and template strand can be reversed.

(iii) The promoter is located towards 5′-end of the coding strand. It is a DNA sequence that has RNA polymerase recognition site, it also provide binding site for RNA polymerase. Presence of a promoter in a transcription unit defines the template and coding strands.

32. (a) (i)

Genotype of parents : AAVV (Axial violet) × aavv (Terminal white)

Gametes: AV, av

F_1-generation : AaVv Axial violet

Selfing

♀ \ ♂	AV	Av	aV	av
AV	AAVV Axial violet	AAVv Axial violet	AaVV Axial violet	AaVv Axial violet
Av	AAVv Axial violet	AAvv Axial white	AaVv Axial violet	Aavv Axial white
aV	AaVV Axial violet	AaVv Axial violet	aaVV Terminal violet	aaVv Terminal violet
av	AaVv Axial violet	Aavv Axial white	aaVv Terminal violet	aavv Terminal white

F_2-generation

(ii) The phenotypic ratio of F_2 generation is –

Axial : violet flowers	Axial : white flowers	Terminal : violet flowers	Terminal : white flowers
9	3	3	1

(iii) The generalisation that can be derived from the above cross is Mendel's law of independent assortment. It states that in the inheritance of two pairs of contrastring characters, the factors of each pair of characters segregate independently of the factors of the other pair of characters.

OR

(b) (i) In the ABO system, there are four blood groups *i.e.*, A, B, AB and O. ABO blood groups are controlled by gene *I*. The gene *I* has three alleles I^A, I^B and *i*. This phenomenon is known as multiple allelism. I^A and I^B are completely dominant over *i*. When I^A and I^B are present together they both express themselves and produce blood group AB. This phenomenon is known as codominance.
Table showing the genetic basis of blood group in human population is as follows:

Allele from Parent 1	Allele from Parent 2	Genotype of offspring	Blood types of offspring
I^A	I^A	I^AI^A	A
I^A	I^B	I^AI^B	AB
I^A	*i*	I^Ai	A
I^B	I^B	I^BI^B	B
I^B	*i*	I^Bi	B
i	*i*	*ii*	O

(ii) Phenotype of I^Ai will be blood group A. Phenotype of *ii* will be blood group O.

(iii) **Parents** Man × Woman

Genotype : I^Ai × I^Bi

Gametes : I^A, *i* × I^B, *i*

Progeny : I^AI^B, I^Ai, I^Bi, *ii*

Blood group : AB, A, B, O

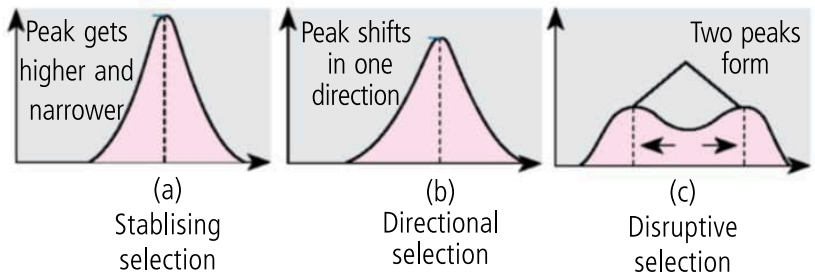
33. (a) Natural selection can produce three different types of results and hence is divided into following types :

(i) Stabilising selection : This type of selection favours average sized individuals while eliminates small sized individuals. It reduces variation and hence does not promote evolutionary change. However, it maintains the mean value from generation to generation. If we draw a graphical curve of population, it is bell-shaped. For example, there is an optimum wing length for a hawk of a particular size with a certain mode of life in a given

environment. Stabilising selection, operating through differences in breeding potential, will eliminate those hawks with wings spans larger and smaller than this optimum length.

(ii) Directional selection : In this selection, the population changes towards one particular direction. It is also known as progressive selection and is seen in response to directional changes in the environment for a long time.
Examples – evolution of DDT resistant mosquitoes, industrial melanism in peppered moth, etc.

(iii) Disruptive selection : This type of selection simultaneously favours individuals at both extremes of the distribution curve. As a result, two peaks in distribution of a trait are produced. It is rare in occurrence but important for evolutionary changes.
Given figures shows the diagrammatic representation of natural selection on different traits.



OR

(b) Hugo de Vries (1901), on the basis of his experiment on *O. lamarckiana* put forward mutation theory to explain the mechanism of evolution. According to him, mutation causes species formation (and hence called it saltation) and thus evolution. These mutations are random and directionless.
Salient features of the mutation theory are:

(i) Mutations are discontinuous variations and the raw material of evolution.
(ii) Mutations appear all of a sudden. They become operational immediately.
(iii) Unlike Darwin's continuous variations or fluctuations, mutations do not revolve around the mean or normal character of the species.
(iv) The same type of mutations can appear in a number of individuals of a species.
(v) All mutations are inheritable.
(vi) Mutations appear in all conceivable directions.
(vii) Useful mutations are selected by nature. Lethal mutations are eliminated. However, useless and less harmful ones can persist in the progeny.
(viii) Accumulation of variations produce new species. Sometimes a new species is produced from a single mutation.

☺☺

THINK BIO

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Fill the grid with terms related to given images.

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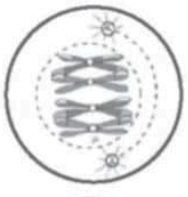
5. 
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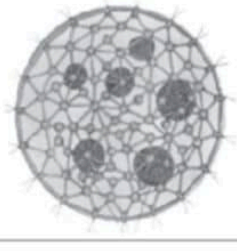
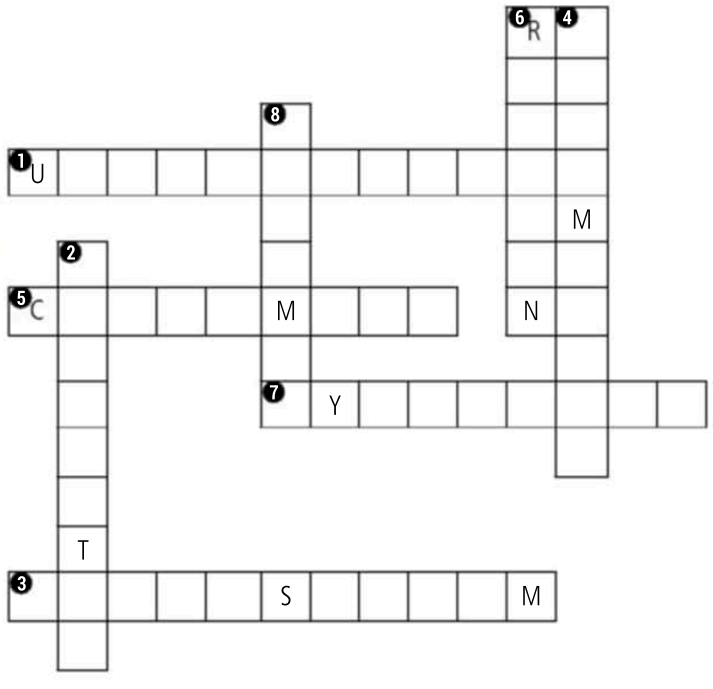
8. 



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