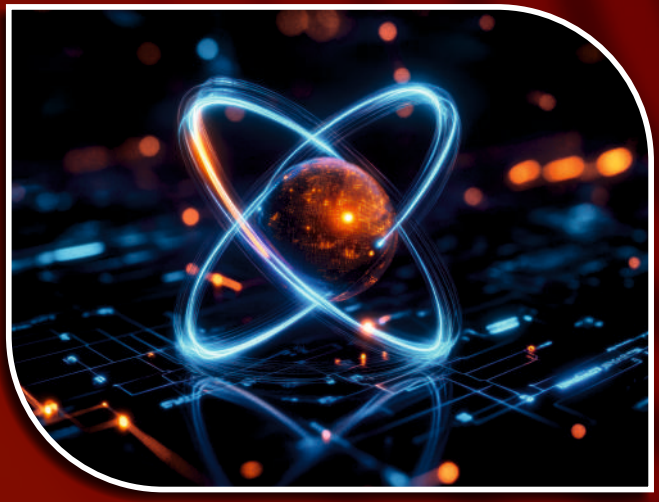
Class-11th

CBSE

FORMULA HANDBOOK

Chapterwise Key Formulas



Physics | Chemistry | Biology | Mathematics

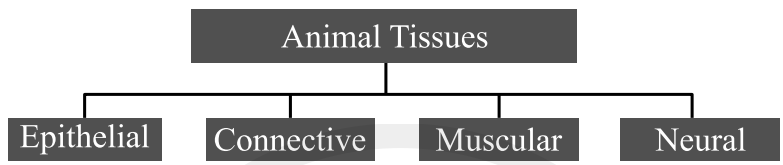
2026 EXAMINATION

CHAPTER

1

Structural Organization in Animals

In multicellular organism a group of similar cells along with intercellular substances perform a specific function. Such organization is called tissue.

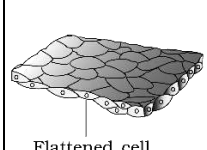
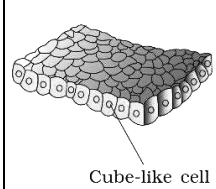
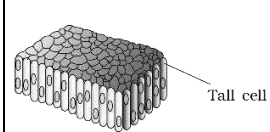
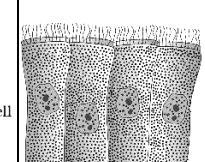
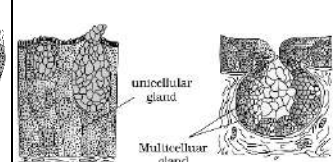


Epithelial Tissue:

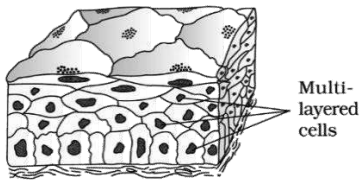
Has a free surface (faces either a body fluid or the outside environment). Compactly packed (with little intercellular matrix).

I. Simple Epithelium (Composed of a single layer of cells).

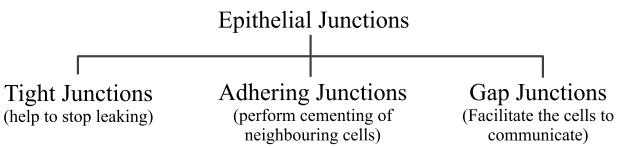
Function: Diffusion, secretion and absorption. Simple epithelium can be of following types on the basis of structural modifications of cells:

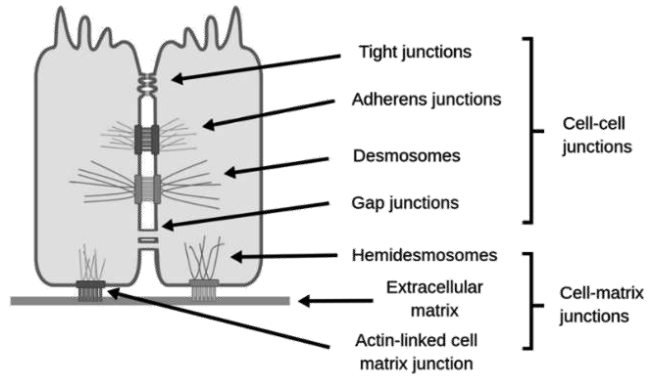
Features	Squamous	Cuboidal	Columnar	Ciliated	Glandular
Cells	Flattened cells	Cube-like cells	Tall and slender cells	Cells bear cilia	Cells get specialised for secretion
Position and shape of nucleus	Prominent and round	Central and round	Near to the base and oval		
Location	Walls of blood vessels and air sacs of lungs	In ducts of glands and tubular parts of nephrons in kidneys	In the lining of stomach and intestine	In the inner surface of hollow organs	Goblet cells of alimentary canal and salivary gland
Image					

II. Compound Epithelium (Composed of a multiple layer of cells)
Function: Provide protection.
Location: Dry surface of the skin, the moist surface of buccal cavity, pharynx, inner lining of ducts of salivary glands and of pancreatic ducts.



Compound Epithelium

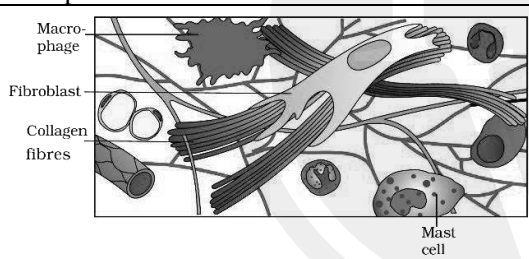
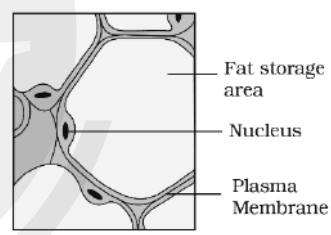




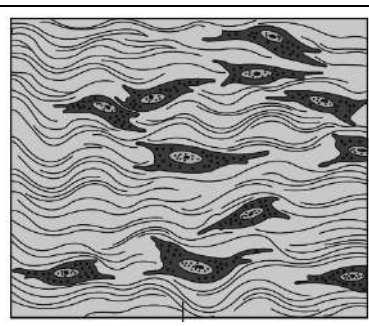
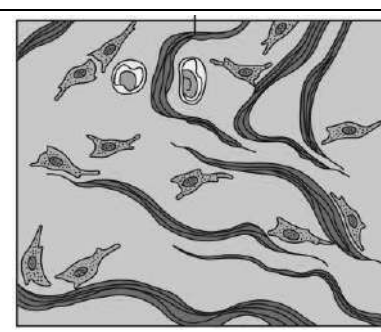
Epithelial Junctions

Connective Tissues:
The cells secrete fibres of structural proteins called collagen or elastin (except blood), also secrete modified polysaccharides (ground substance).

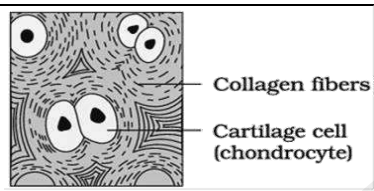
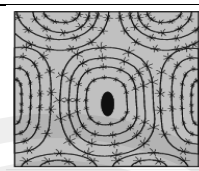
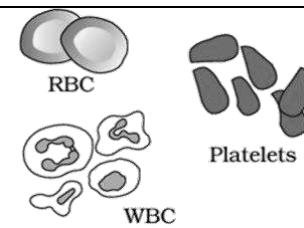
I. Loose connective tissue: Cells and fibres loosely arranged in a semi-fluid ground substance

Areolar Tissue	Adipose Tissue
• Present beneath the skin. • Contains fibroblasts (cells that produce and secrete fibres), macrophages and mast cells. • Often it serves as a support framework for epithelium.	• Located mainly beneath the skin. • Specialised to store fat.
 **Areolar tissue**	 **Adipose tissue**

II. Dense connective tissue: Fibres and fibroblasts are compactly packed

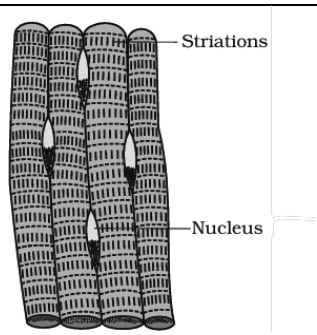
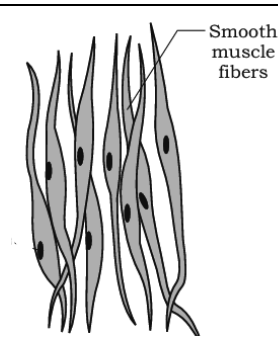
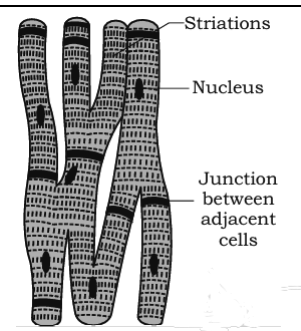
Dense Regular Tissues	Dense Irregular Tissues
• Regular pattern in orientation of fibres • Tendons, which attach skeletal muscles to bones and ligaments which attach one bone to another	• Irregular pattern in orientation of fibres • Present in the skin
 **Dense regular connective tissue**	 **Dense irregular connective tissue**

III. Specialised connective tissues

Cartilage	Bones	Blood
Solid and pliable intercellular material Cells: Chondrocytes enclosed in small cavities within the matrix called lacunae. Location: Cartilage is present in the tip of nose, outer ear joints, between adjacent bones of the vertebral column, limbs and hands in adults.	Hard and non-pliable intercellular material Cells: Osteocytes present in the spaces called lacunae. Functions: The long bones of the legs, serve weight-bearing functions. Provides structural framework to the body, etc.	Fluid connective tissue Cells: WBC, RBC and platelets Functions: Circulating fluid that help in transportation of substances
 **Cartilage**	 **Bone**	 **Blood**

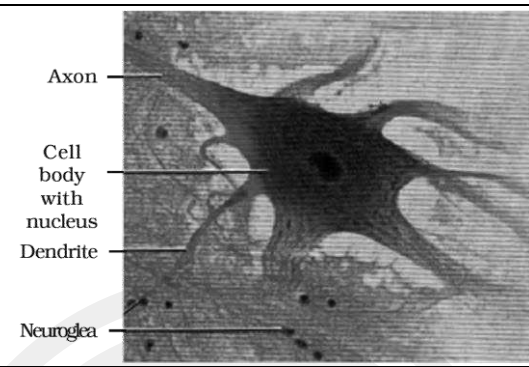
Muscle Tissue:

- Myofibrils (fine fibrils) → Fibres → Muscle.
- In general, muscles play an active role in all the movements of the body.
- Muscle fibres contract and relax (lengthen) in a coordinated fashion.
- Muscles are of three types: skeletal, smooth and cardiac.

Skeletal Muscle	Smooth Muscle	Cardiac Muscle
• Striated and voluntary. • Skeletal muscle fibres are bundled together in a parallel fashion. • Location: Closely attached to skeletal bones	• Fibres taper at both ends (fusiform). • Non-striated and involuntary. • Location: Wall of internal organs such as the blood vessels, stomach and intestine	• Contractile tissue • Striated and involuntary Intercalated discs present at some fusion points. • Location: Present only in the heart.
 **Skeletal (striated) muscle tissue**	 **Smooth muscle tissue**	 **Cardiac muscle tissue**

Neural Tissue

- Exerts the greatest control over the body's responsiveness to changing conditions.

	Neurons	Neuroglial Cells
Composition	Unit of neural system.	Make more than one-half the volume of neural tissue
Excitability	Yes	No
Function	Respond to various stimuli	Protect and support neurons
Image		

Organ and Organ System:

- The basic tissues organise to form organs which in turn associate to form organ systems in the multicellular organisms.
- Such an organisation is essential for more efficient and better coordinated activities of millions of cells constituting an organism.
- Each organ in our body is made of one or more type of tissues. For example, our heart consists of all the four types of tissues, i.e., epithelial, connective, muscular and neural.

Cockroach:

Habitat: They are nocturnal omnivores that live in damp places throughout the world.

Size - 1/4 inches to 3 inches (0.6-7.6 cm).

Colour: Cockroaches are brown or black bodied, Bright yellow, red and green coloured.

Classification Kingdom:

- **Animalia, Phylum-** Arthropoda, Class- Insecta, Genus- *Periplaneta*, Species- *americana*.

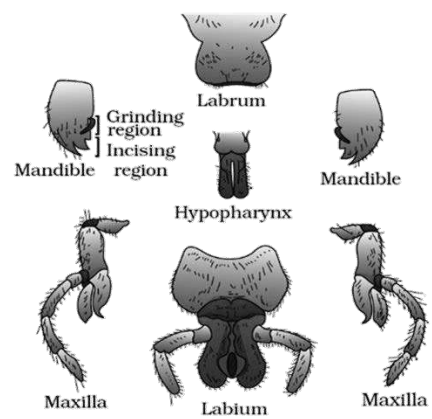
  Morphology- *Periplaneta americana* are about 34-53 mm long

Exoskeleton:

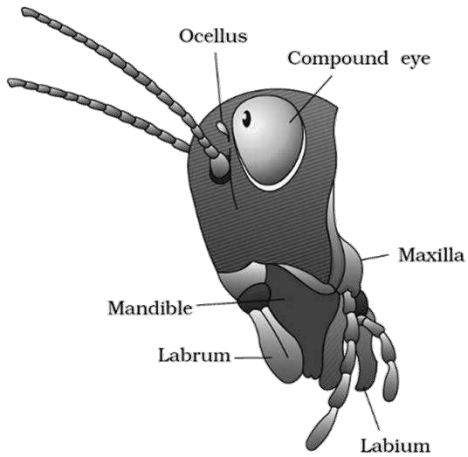
- Hardened plates called sclerites joined to each other by articular (arthrodial membrane).

1. Head:

- Triangular in shape.
- Anteriorly at right angles to the longitudinal body axis.
- Formed by the fusion of six segments.
- Bears a pair of compound eyes, a pair of antennae (monitor environment).
- Mouth parts (biting and chewing type) - labrum, a pair of mandibles, a pair of maxillae, a labium, hypopharynx.



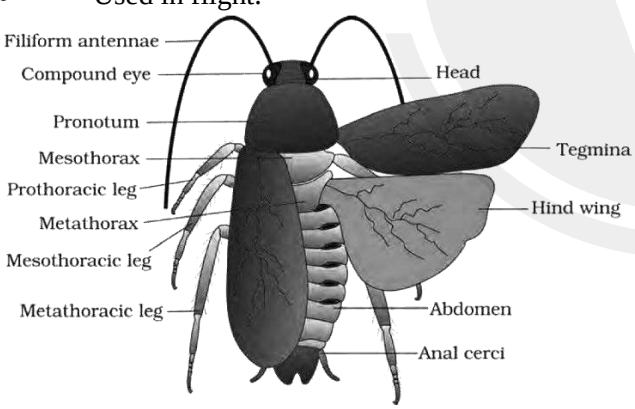
Head region of cockroach: mouth parts



Head region of cockroach: Parts of head region

2. Thorax

- Three parts-prothorax, mesothorax and metathorax Each thoracic segment bears a pair of walking legs.
- Two pairs of wings.
- Mesothoracic wings (Forewings/Tegmina)
- Opaque dark and leathery.
- Cover the hind wings when at rest.
- Metathoracic wings (Hindwings)
- Transparent and membranous.
- Used in flight.



External features of cockroach

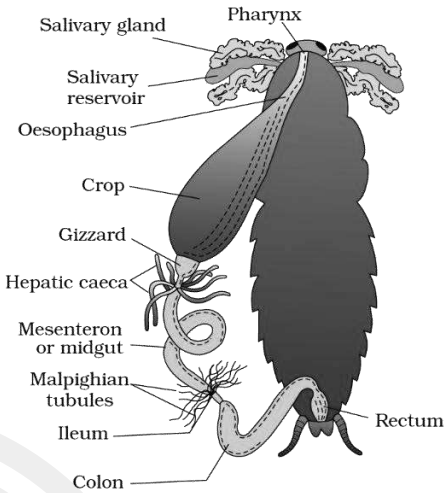
3. Abdomen:

- Consists of 10 segments.
- 7^{th} (boat shaped), 8^{th} and 9^{th} sterna forms a brood or genital pouch in females.
- 9^{th} and 10^{th} terga and 9^{th} sternum forms genital pouch in males.
- Anal styles present in males only & anal cerci (on 10^{th} segment) present in both sexes.

Anatomy

Digestive System

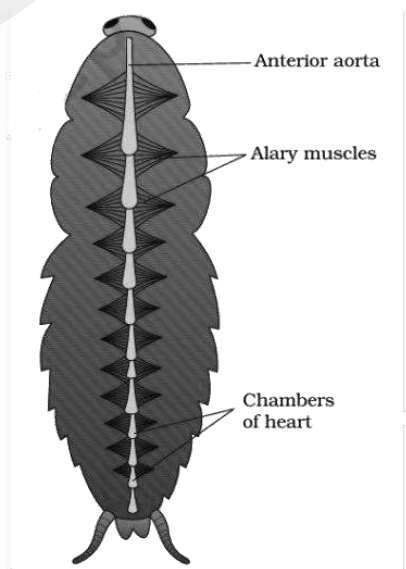
- Three regions: foregut, midgut and hindgut.
- Mouth → Pharynx → Oesophagus → Crop → Gizzard/ Proventriculus → Midgut → Ileum → Colon → Rectum



Alimentary canal of cockroach

Circulatory System

- Open type
- Haemolymph = Colourless plasma and haemocytes.
- Heart of cockroach = Elongated muscular tube (13 chambers).
- Blood from sinuses enter heart through ostia and is pumped anteriorly to sinuses again.



Open circulatory system of cockroach

Respiratory System

- Takes place by a network of trachea & 10 pairs of small holes called spiracles (regulated by the sphincters).
- Exchange of gases takes place at the tracheoles by diffusion.

Excretory System (Uricotelic)

- Performed by Malpighian tubules (100-150 in numbers) and present at the junction of midgut and hindgut.
- The fat body, nephrocytes and urecose glands also help in excretion of uric acid (uricotelic).

Nervous System

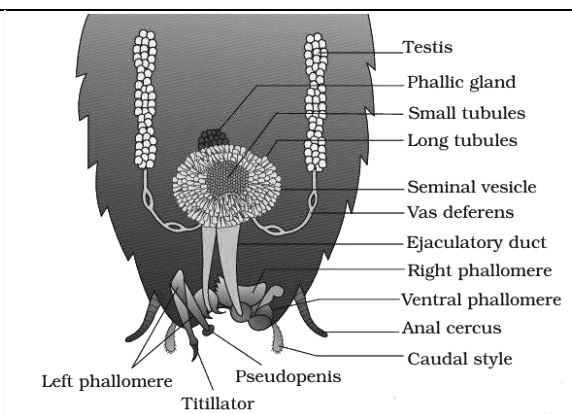
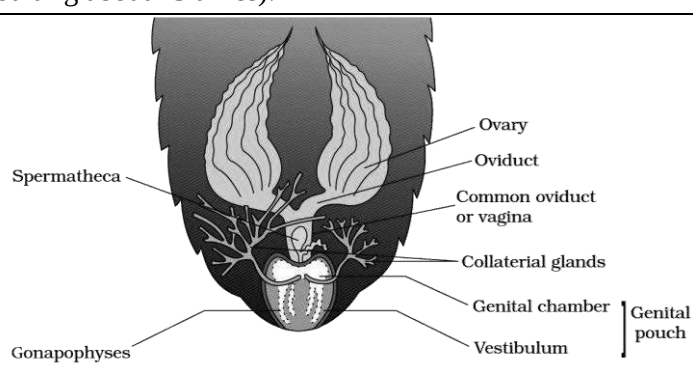
- Segmentally arranged ganglia and ventral nerve cord.
- Three ganglia lie in the thorax, and six in the abdomen.
- Brain - represented by supra-oesophageal ganglion.
- The head holds a bit of a nervous system and rest is situated along the ventral (belly-side) part of its body.

Sensory System

- Antennae, eyes, maxillary palps, labial palps, anal cerci, etc.
- Compound eyes (2000 hexagonal ommatidia) are situated at the dorsal surface of head.
- Mosaic vision with more sensitivity but less resolution, common during night.

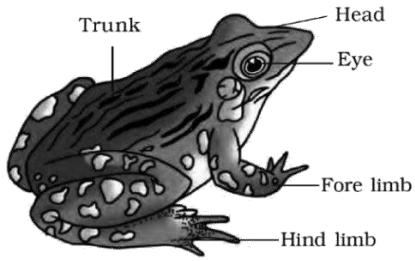
Reproductive system

Cockroaches are dioecious.

Male Reproductive System	Female Reproductive System
A pair of testes (4^{th} - 6^{th} abdominal segments) → vas deferens → seminal vesicle (stored and glued sperms) → ejaculatory duct → male gonopore. Mushroom shaped gland (6^{th} - 7^{th} segments) - An accessory reproductive gland. External genitalia - Represented by male gonapophysis or phallomere. Sperms are stored in seminal vesicles and glued to form bundles (spermatophores).	Two large ovaries (2^{nd} - 6^{th} abdominal segments) → oviducts → vagina → genital chamber. Each ovary is formed of a group of eight ovarian tubules or ovarioles. Oviducts of each ovary unite into a single median oviduct or vagina. Ootheca(fertilised eggs encased in capsules) is a dark reddish to blackish brown capsule, about 3/8" (8 mm) long. Produce 9-10 ootheca (containing 14-16 eggs each). Development - paurometabolous (through nymphal stage by moulting about 13 times).
 **Male reproductive system of cockroach**	 **Female reproductive system of cockroach**

Frogs:

- Class Amphibia of phylum Chordata.
- *Rana tigrina* - Indian bull frog.
- Camouflage (protective coloration is called mimicry).
- Live on land and in freshwater



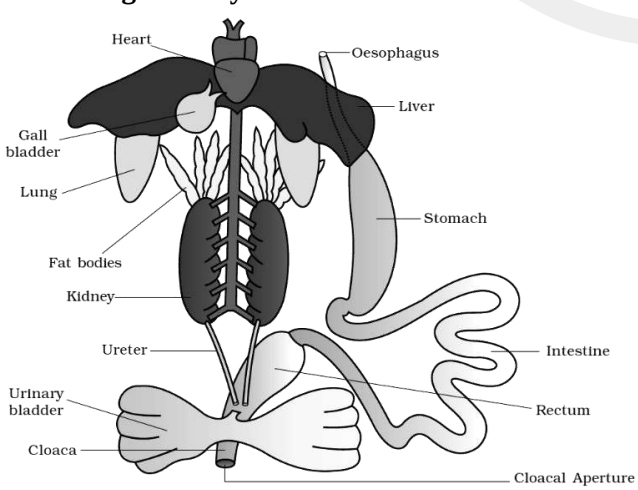
External features of frog

Morphology

- Skin is smooth and slippery due to mucus.
- Dorsal body is olive green and ventral side is pale yellow.
- Body is divisible in head and trunk.
- Nictitating membrane on eyes and tympanum represents ear (hearing & equilibrium).
- Hind limbs have five digits and fore limbs have four digits.
- Male frogs have sound producing vocal sacs and a copulatory pad on first digit of fore limbs which are absent in female frogs.

Anatomy

1. Digestive System



Diagrammatic representation of internal organs of frog showing complete digestive system

- Mouth → Buccal cavity → Pharynx → Oesophagus → Stomach → Intestine → Cloaca.
- Food is captured by the bilobed tongue.
- Secretion from liver and pancreas help in digestion.
- Bile emulsifies fat and pancreatic juices digest carbohydrates and proteins.
- Final digestion take place in the intestine (carnivores).

2. Respiratory System

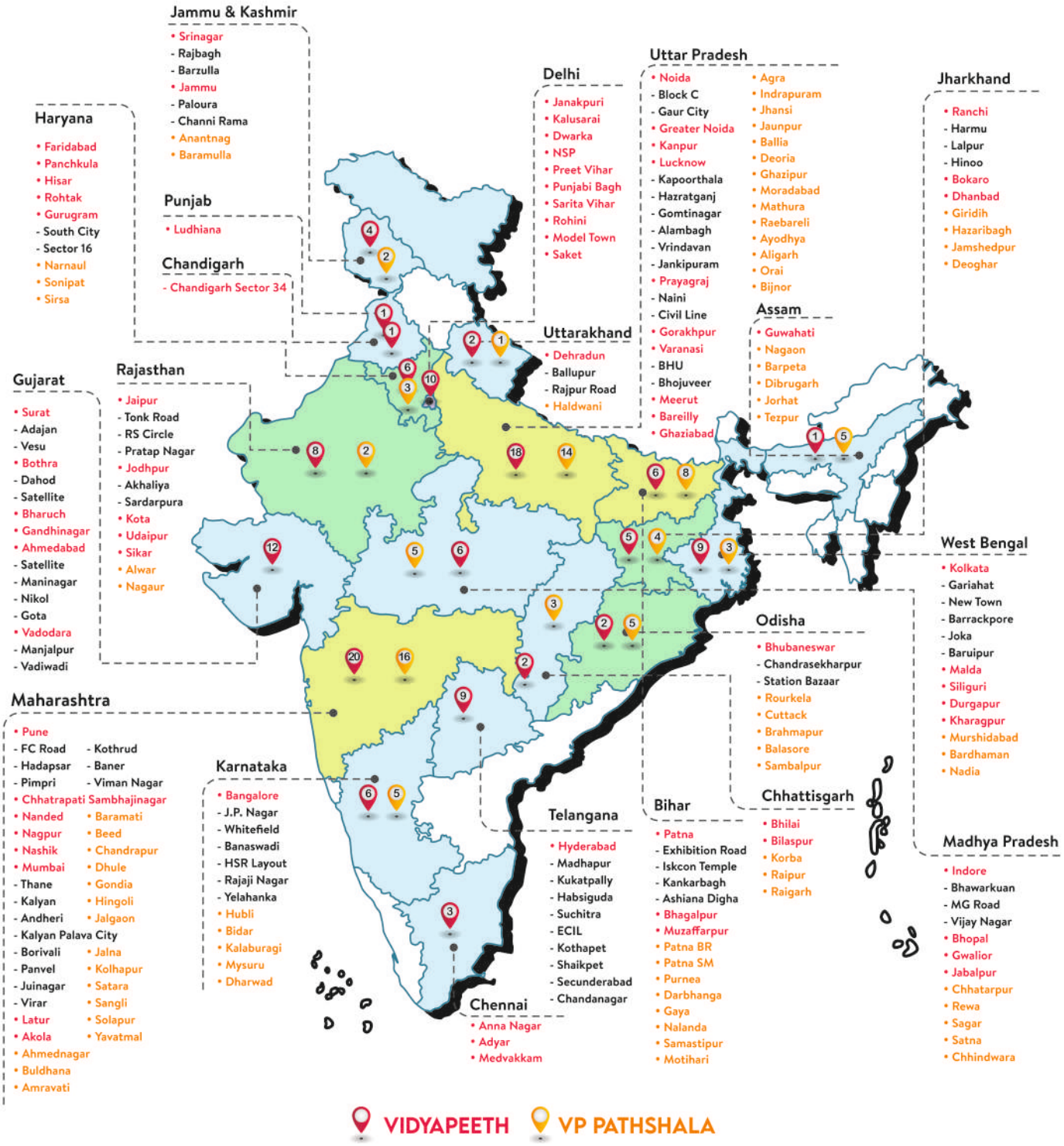
- On land it respires with the help of buccal cavity, skin and lungs (A pair of elongated, pink coloured sac-like).
- In water it respires through skin.
- Respiration by skin occurs during summer sleep (aestivation) and winter sleep (hibernation).

3. Circulatory System

- Well-developed closed type.
- It involves heart, blood vessels, blood and lymph.
- Heart consists of 3 chambers, two atria and one ventricle.
- A triangular structure called sinus venosus joins the right atrium.
- Ventricle opens into a sac like conus arteriosus on the ventral side of the heart.
- Venous connection between liver, intestine and kidney and lower body parts are present in frogs is called hepatic portal system or renal portal system.
- RBC's are nucleated and contain haemoglobin.

VIDYAPEETH
IIT-JEE | NEET | FOUNDATION

Is Now Present In 140+ Cities Across India



PHYSICS WALLAH PUBLICATION

Visit Your Vidyapeeth
SCAN ME!

To share Feedback
SCAN ME!

₹319/-

ISBN 978-93-6897-161-0

65a6904b-ec3d-44b2-bce3-854170689fda