Experiment # 1

Investigation of Adaptive Features of Hydrophytes, Halophytes, Mesophytes and Xerophytes From Fresh Material

Plants are classified into two groups:

- Hydrophytes
- Halophytes
- Xewphytes
- Mesophytes

Hydrophtes:-

Hydrophytes are the plants which grow in water reservoirs like ponds lakes streams or rivers.

Materials:-

Beaker, Microscope, Hand lens,

Forceps, prepared slides, Fresh plants or preserved plants.

Examples:

- Hydrilla, Vallisnrea
- Potamogeton
- Nymphaea lotus (water lily)

Habitat and Habit:-

Habitat grow inside water, moist and swampy banks photosynthetic green, weak stem plants.

Adaptations:-

➡ Bark cuticle or peridem is absent because plant parts are not exposed to high temperature or hard soil
➡ Stem modified into rhizome, stolen etc.
➡ Roots are absent or poorly developed.
➡ Mechanical tissues are absent.

Halophytes:-

Halophytes are plants which grow in localities with high concentration of salts like NaCl, $MgCl_2$, $MgSO_4$.

Materials:

Halophytes plants, seides, compound microscope, beakers, lens, dissecting box.

Example:

Phizophora, Suada fruticosa

Adaptations:

➡Root stem is extensive.
➡Stems are generally succulent due to water storage tissues.
➡Stomata generally present on lower surface only.
➡Solute potential is very low in cells and plants.

Material:

Microscope, slides of stem, root, leaves, plants, lens, dissecting box, beakers.

Example:

Many of our cultivated crops and ornamental plants.

Habitat of habit:

Mesophytes love to live in habitats which are between two extremes.

Adaptations:

➡ Mesophytes have well developed branched taproots in dicots.
➡ The stem is usually erect, solid and branched.
➡ The leaves are richly developed and are large with waxy coating.
➡ Mechanical tissues are well developed.
● Vascular bundles are well developed.

Xerophytes:

Xerophytes are plants living in xeric habitat."

Material:

Plants, microscope, prepared slides, lens, beakers, dissecting box.

Example:

Pinus, cactus, opuntia.

Habitat of habit:

Xeric habitat, physical,

dry habitat, intense heat, high wind velocity.

Adaptations:

➡ Plant body is small and herbaceous with small shoot system as plants.
➡ Root system is extensive with much lateral branching well developed.
➡ Root hairs and root caps.
➡ Solute potential of cells is quite low to keep water within the cells.
➡ Conducting tissue xylem is highly developed.
➡ Vegetative reproduction is quite common.
➡ Stems and leaves are covered with numerous hairs and waxy coating to protect underlying tissues.

Experiment #2

Study of Skeleton of Frog

Taxonomic Position:

- Phylum — Chordata
- Sub-phylum — Vertebrata
- Subclass — Lissamphibia
- Order — Anura
- Sub-order — Phanerogolossa
- Species — Rana Tigrina (Frog)

Materials:

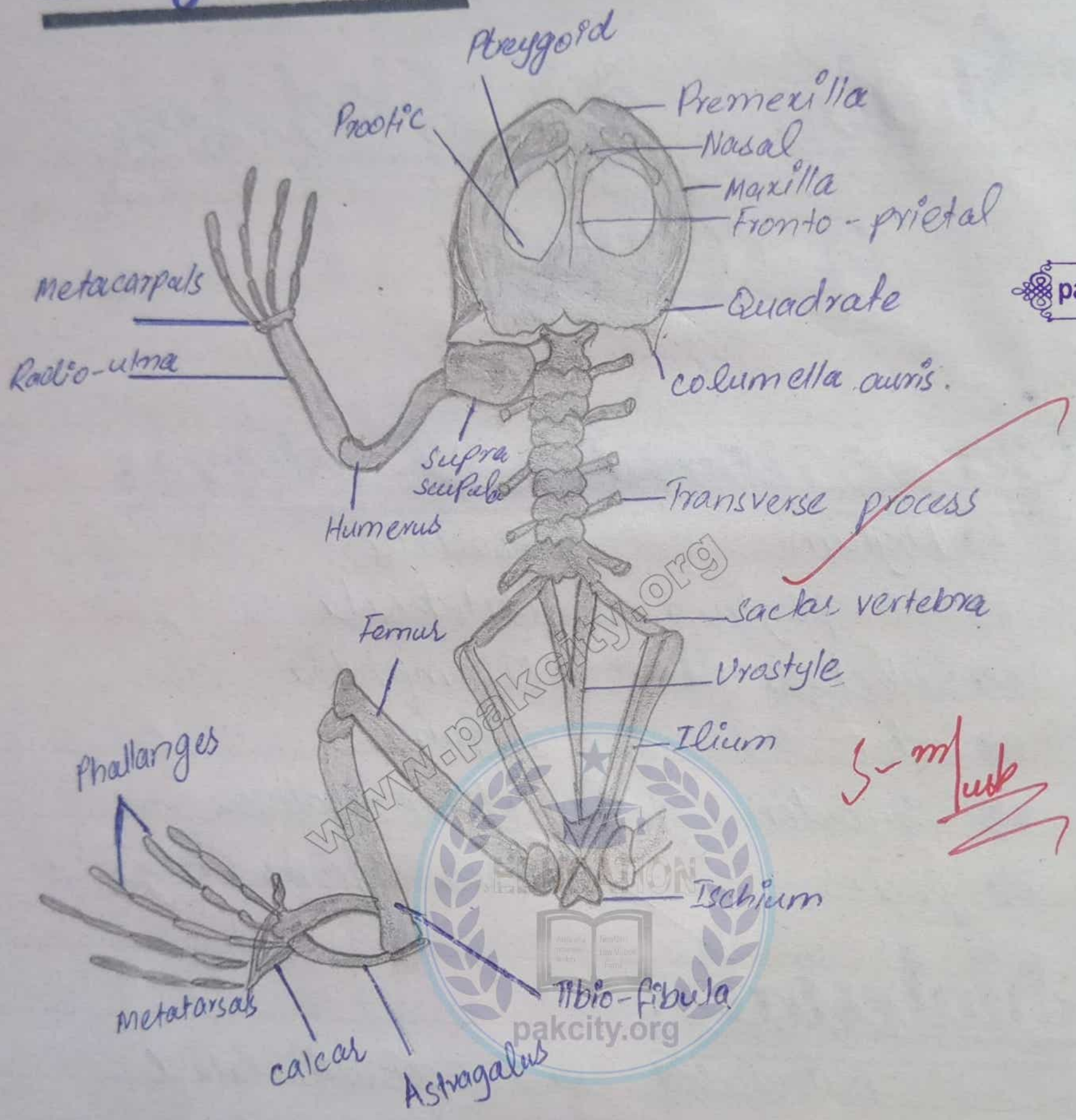
Articulated and disarticulated skeleton of frog.

Procedure:

Study articulated and disarticulated skeleton of frog. Draw and label different parts.

Skeleton:

Diagram:-



Skeleton of Frog:

The skeleton can be divided into two parts:

(i) An axial skeleton consisting of skull and vertebral column.

(ii) An appendicular skeleton consisting of limbs and girdles.

Skull:

The skull of frog consists of following parts:

(i) Cranium
(ii) Auditory capsules
(iii) Olfactory capsules
(iv) Upper and lower jaws
(v) Hypoid apparatus.

Cranium:-

The cranium (brain case) is an oblong middle portion of the skill and encloses the brain. It has an orbit on either side. The roof of the cranium is formed by two long glaff bones, the fronto-parietals which partially cover a tube like cartilage bone, Sphenethmoid. The sphenethmoid forms the the anterior part of the cranium, but a small diamond shaped area of this bone is visible.

Auditory Capsules:-

They enclose the auditory organs. They are cartilaginous and are fused with the sides of the posterior ends of the cranium. The anterior wall and surface of each capsule is formed of an irregular bond, the pro-otic.

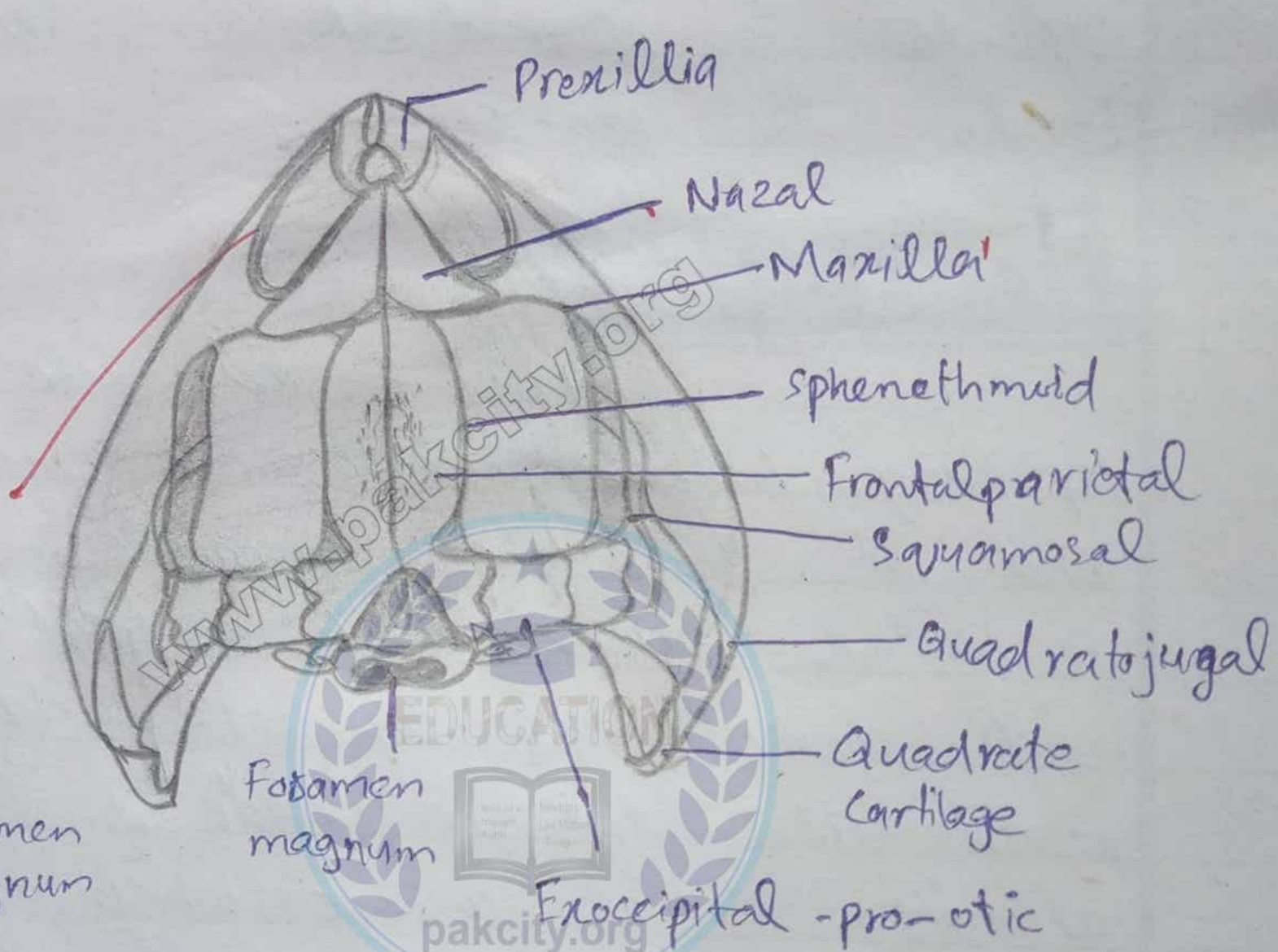
Urostyle:-

It is a rod-like bone tapering from anterior to posterior end. It has two concavities at its anterior end which articulate with convexities of the 9th vertebra. A prominent ridge or blade is present at its dorsal surface which gradually dimishes posteriorly. Neural canal is present at the anterior end.

Pectoral Gridle:-

The pectoral girdle looks like an inverted arch consisting of two similar halves of bones and cartilage and a central part called **sternum**.

Diagram:-



Scapular Region:-

The scapular region consists of the scapula below and supra-scapula above. The scappela is a flat long plate which is broader at both ends and gives rise to a prominent forword process called acromian process.

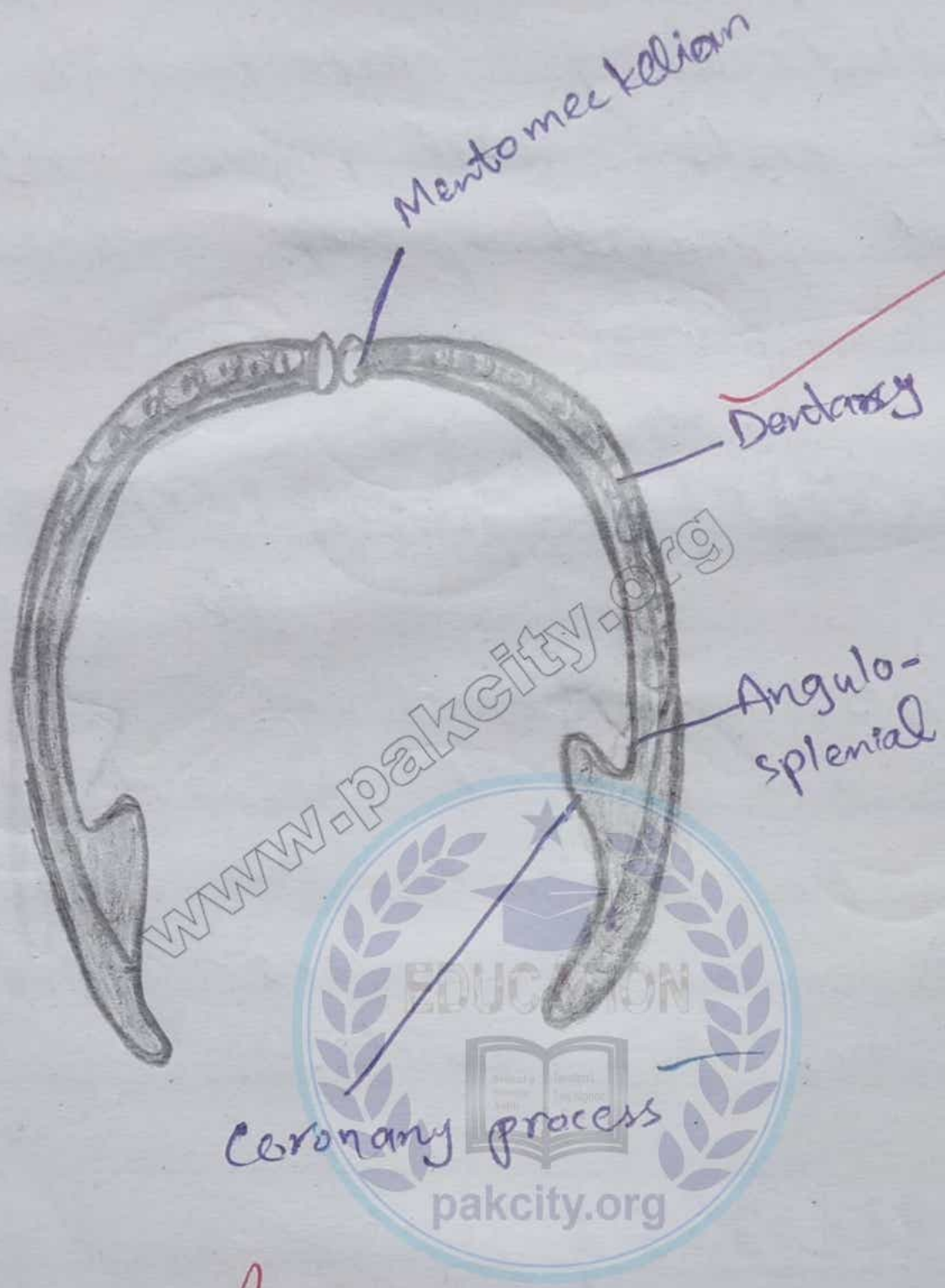
Coracoid Region:-

The coracoid region is composed of pre-coracoid in front and coracoid behind. The pre-coracoid is a slender bar of cartilage which is covered antero-dorsally by a thin bone, the clavicle.

Sternum:

It is attached to mid-ventral portion of the pectoral gridle. It is composed of two bony rods. The anterior rod consists of episternum and omosternum and runs forwards from clavicles. The episternum is round cartilage present at anterior while omosternum lies below it.

Diagram:-



Pelvic Gridle:-

The pelvic gridle consists of two curved halves which are attached posteriorly in the form of an irregular risk of bone and cartilage but free anteriorly. Pelvic gridle gives V-shaped appearance. The disc has a cavity on each side which is called acetabulum.

The disc is composed of three bones:

(i) ilium
(ii) Ischium
(iii) Pubis

Ilium:-

The ilium forms the anterior part of the disc and acetabulum and extends forwards as an elongated arm which has a prominent iliac crest on its dorsal side.

Ischium:-

The ischium is lying on the posterior part of disc and also forms posterior part of acetabulum. Illium and Ischium are bony parts.

Diagram:-

Pubis:-

It forms the ventral part of the disc and rest of acetabulum. It is cartilaginous.

Fore - limb:-

The fore limb divided into four parts:

- Upper arm
- Lower arm
- Wrist
- Hand

Upper arm:

The upper arm has a single bone called humerus which has a rounded upper end called head.

For- arm:

The for-arm also has a single bone called radio-ulna formed by the fusion of radius and ulna.

Wrist:-

The wrist or carpus is formed of six small irregular bones. the

Diagram:-

I to IX
vertebrae

5mm
Zoom

Vertebral column

the, Carpals, arranged in two rows; three in each. The carpals of proximal row are named awarding to their location.

Hand:-

The hand has two parts:

(i) Palm and metacarpus
(ii) Finger (digits) having phalanges.

Hind limb:

Hind limb can be divided into four parts.

- Thigh
- Shank
- Ankle
- Foot.

Thigh:

The thigh has long slightly curved bone, the femur, which bears a rounded head and its proximal end for articulation with acetabulum.

Shank:

The shank possesses a single bone, the tibio-fibula which is

formed by the union of tibia and fibula.

Ankle:

The ankle or tarsus is made up to two rows of bones called tarsals. There are two long tarsals in the proximal row which are called Astragulus and Calcaneum.

Foot:

The foot has two parts:

- Mid-foot (sole) or metatarsus
- Digits or toes.

Experiment - 7

(B)

Study of simple muscle twitch using Frog's muscle:-

Muscle Twitch:

The response of the muscle which respeel to stimulus is known as muscle twitch."

Procedure:

Muscle twitch can be studied by.

➡ (Applying electrical stimulation.)

Materials:

- Frog
- Chloroform
- Battery 6 volt
- Two pieces of insulated wires.
- Ringer's solution.
- Methylene blue.

- Dissecting box

Method :-

➡ Muscle Nerve Preparation / Preparation of Gastroenemius (calf) muscle of frog.

➡ Place freshly pitched or chloroformed frog on a dissecting box.

➡ Remove the skin from leg. This can be done easily if the skin is cut completely around the thigh of the frog leg. The entire skin of leg can then be pulled off in the same way that you would strip a glove from your hand.

➡ Place the frog dorsal side up on moist filter paper.

➡ keep the frog moist with physiological saline.

➡ Search the large calf muscle of lower leg.

➡ Run a blunt probe or the end of a forceps between gastrocenimus muscle and the long bone of leg.

➡ Noticed the well marked groove runing along the upper leg.

➡ Separate the muscle on either side of groove using a pair of forceps.

➡ Expose the faintly yellowish sciatic nerve and reddish blood vessels.
➡ Without touching or pulling the nerve, pull the muscle aside so that the nerve is exposed from a point near the knee up the hip.
➡ Using forceps, grasp the hip end of the nerve, and cutting across the nerve on the hip side of the forceps, gradually free the nerve down to a point near the knee joint.
➡ Lay the free nerve on top of lower leg.
➡ Separate the tendon at lower end of gastrocenemius muscle where it is attached to the foot.
➡ Cut the lower leg bone near the knee.

5th Feb
2

Experiment : 9

Study of ductless gland (Pancreas, thyroid) using microscopic Sections:-

Material:-

Compound microsope: Prepared and stained slides of the T.S. of pancreas and thyroid of an mammal

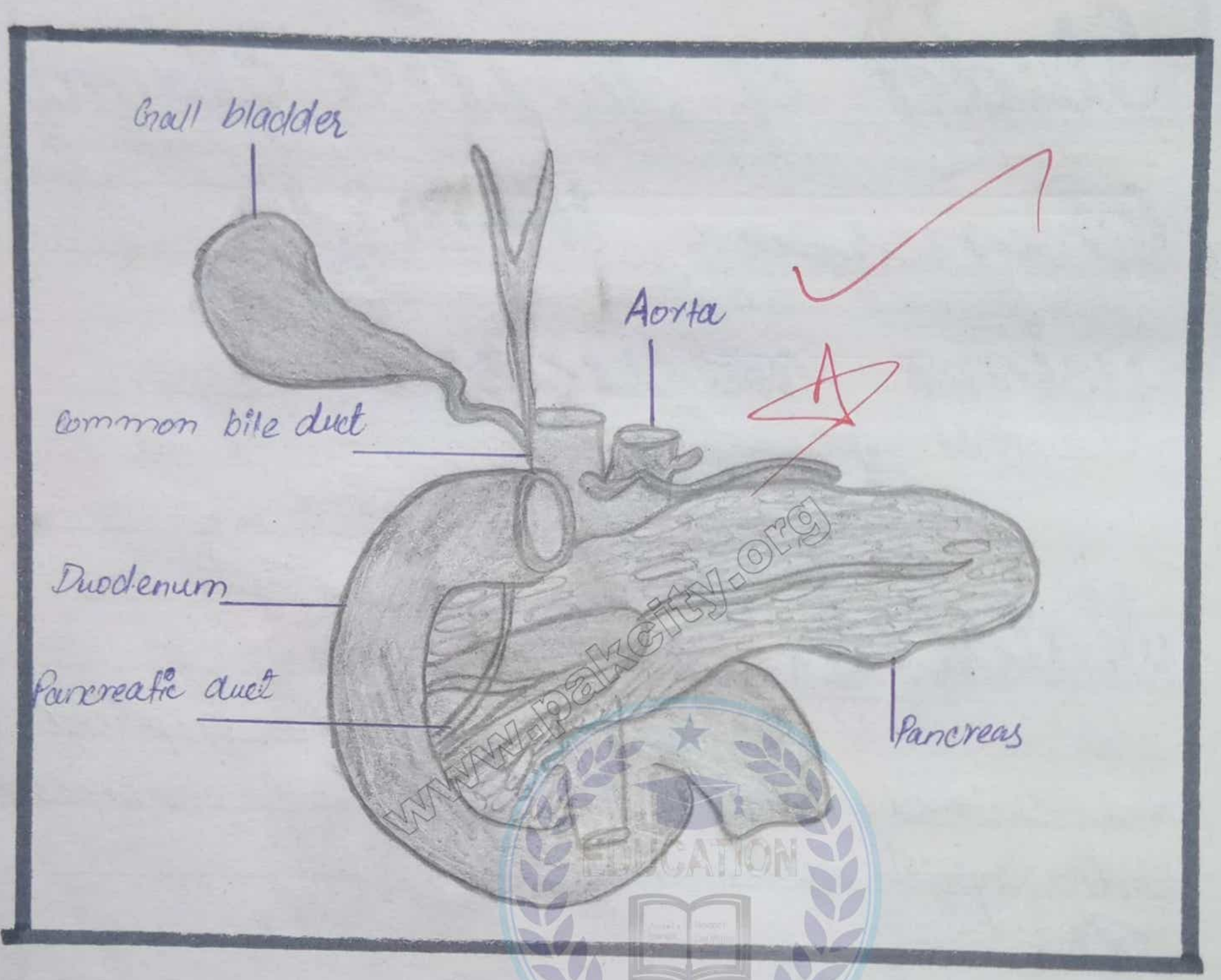
Procedure:

Examine the prepared and stained slides of the T.S. of pancreas under the low and high magnification of the microscope and note the following details.

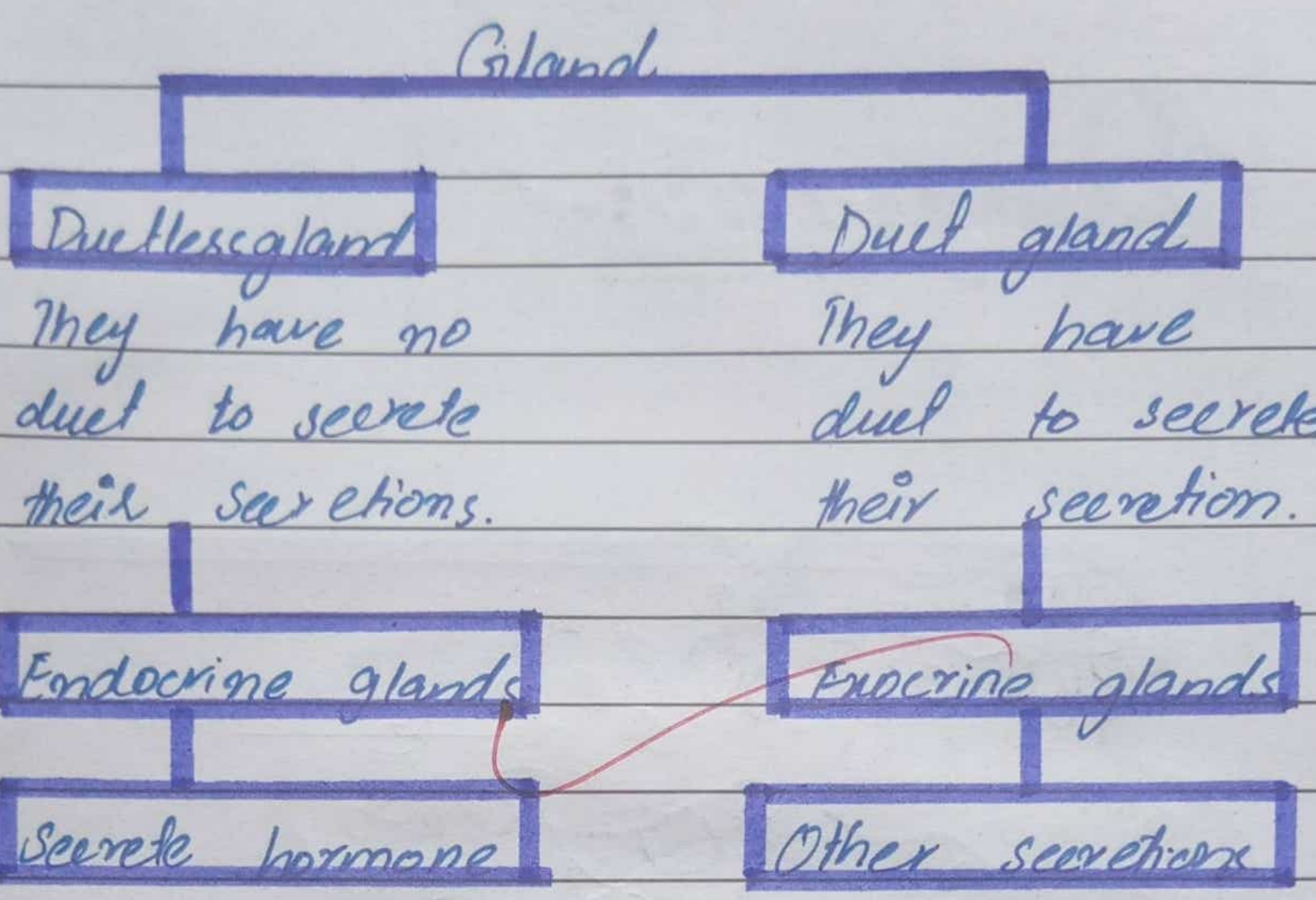
There are two types of glands in human body which are as follows:

- Ductless gland
- Duct gland

Diagram:



Anatomy of Pancreas:-



Part-1

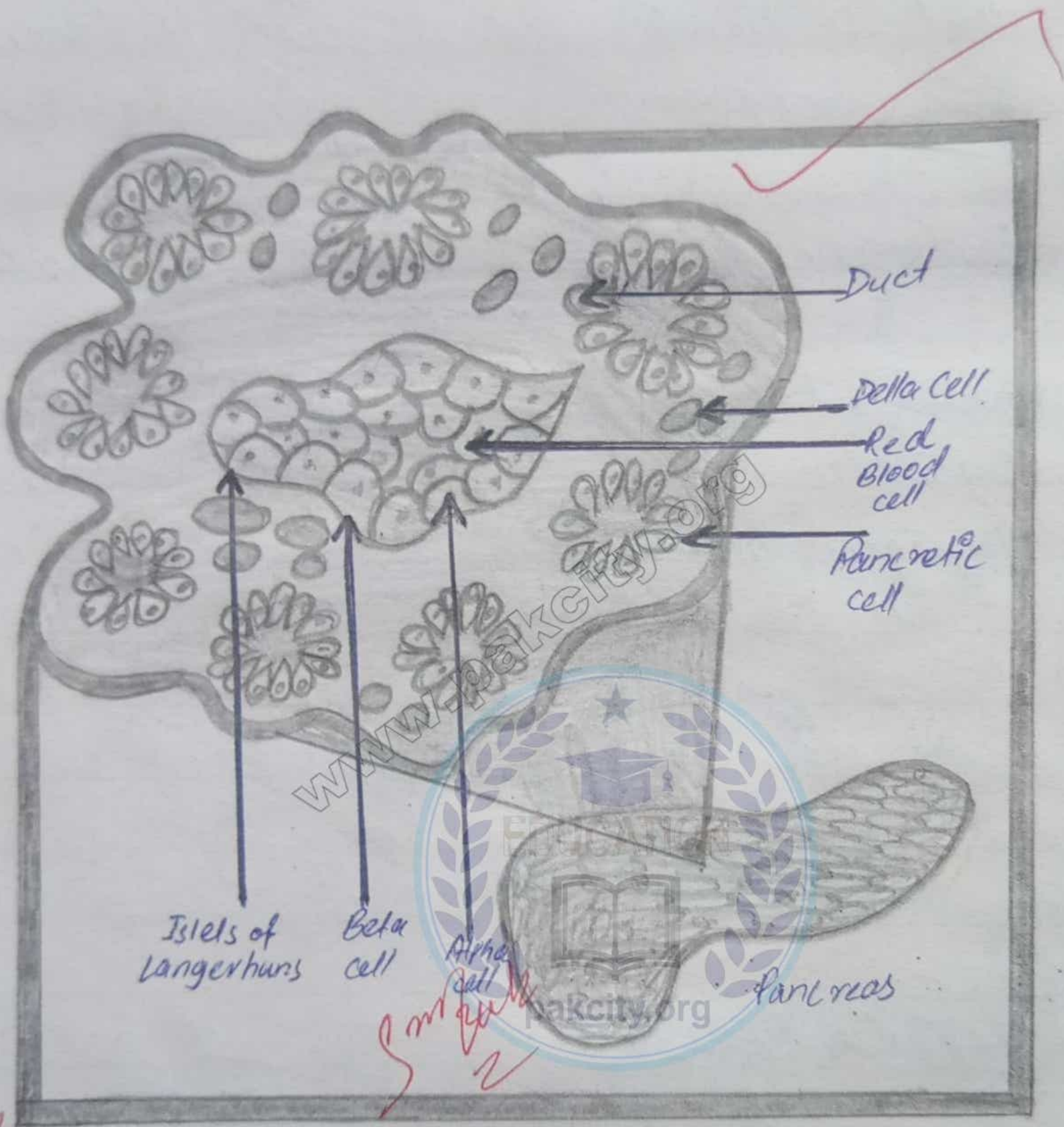
Pancreas:-

The pancreas is a diffuse gland consisting of both exocrine and endocrine gland.

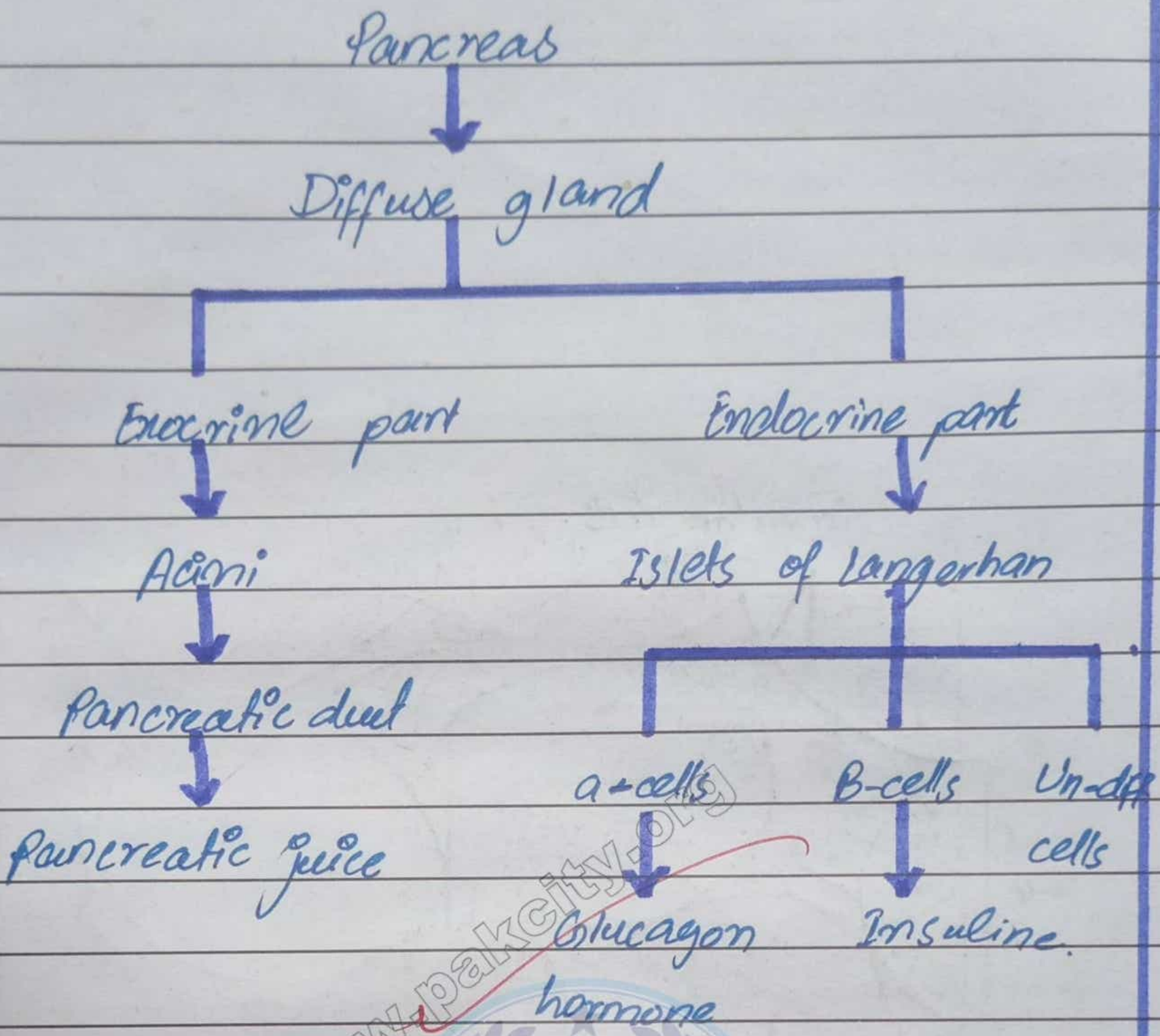
Nature:

- Pancreas
- Endocrine part
- Exocrine part

Diagram:-



Pancreas:-



Internal Structure:

The pancreas is covered with coelomic epithelium.

Acini:-

The bulk of gland is differentiated into distinct clusters of cells and rounded alveoli or acini. Each acinus has a wide lumen surrounded by the wall made up of columnar pyramidal cells. The cells of pancreatic acini secrete pancreatic juice containing several enzymes.

Islets of Langerhans:

In the connective tissue between acini are present clusters of cell arranged in elliptical areas. These clusters are known as the islets of Langerhans which secrete hormones. The region of islets reveals three kinds of cells:

- Alpha cells (α-cells) which secrete hormone
- Beta cells. (β-cells) which secrete the
- hormone, insulin.
- Undifferentiated cells.

Part - II

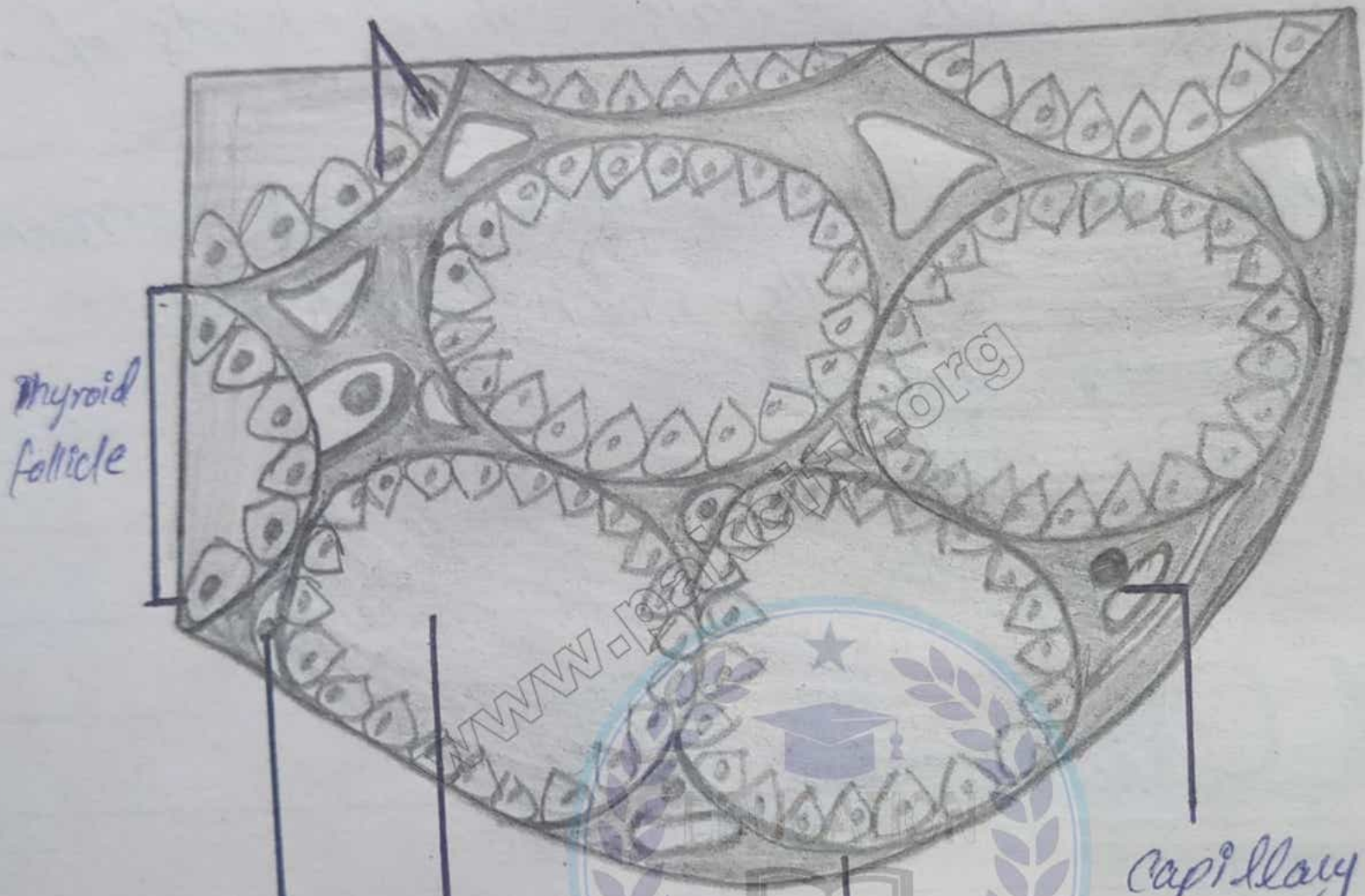
Thyroid

Procedure:-

Study the prepared and stained slide of the T.S. of thyroid under the low and high power of the microscope.

Diagram:-

Follicular cells.



Small fault 2

T.S. of Thyroid Gland:

Nature:

Thyroid gland is an endocrine gland found in almost all vetebrate animals and so called because it is located in front of and on each side of the thyroid cartilage of the laryonx.

External Structure:-

The thyroid gland in human beings is a brownish-red organ having two lobes connected by an isthmus, it normally weigs about 28g (about 1 oz) and consists of right and left lobes, joined by an "isthmus."

Experiment # 12

Study of Structure of Hen's Egg :-

The chick egg (called the yolk) is surrounded by various accessory coverings secreted by the female reproductive tract.

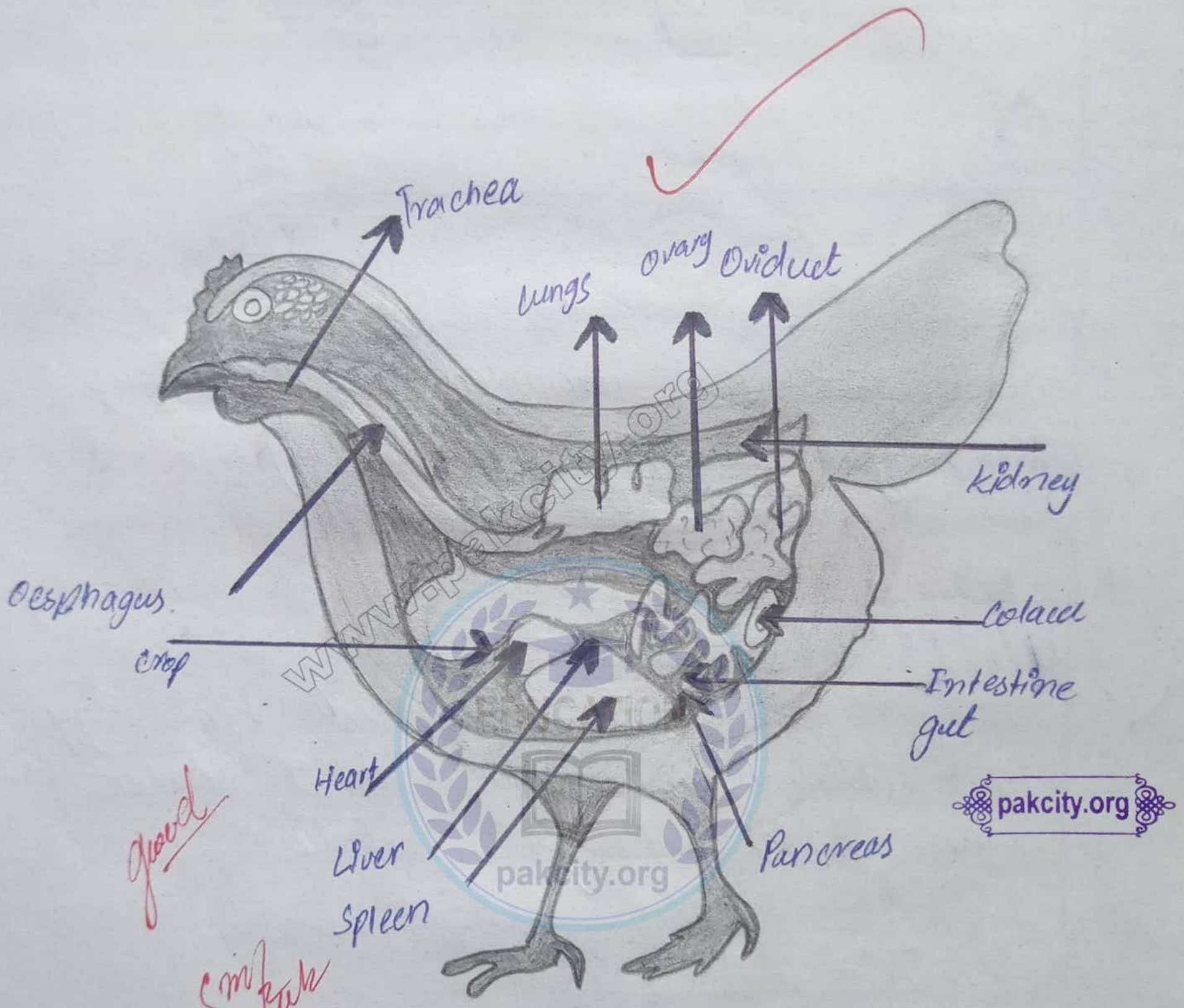
Material :-

Fresh fertilized hen's egg (unincubated), Shallow dish of water or warm chick Ringer's solution.

Procedure :

- Crack a fresh, fertilized hen's egg without breaking the yolk.
- Carefully put the contents in a dish or bowl containing water or warm chick Ringer's solution.
- The yolk with its developing embryo will float (If you find only a

Diagram:



Structure of Hen's Egg:-

white spot on the surface of the yalk, the egg has failed to develop so use anotha egg.).

➡ The embryo at this stage is very small, bit can be seen as a whitish spot, called the blastoderm (blastodisc) on the surface.

External Structure:-

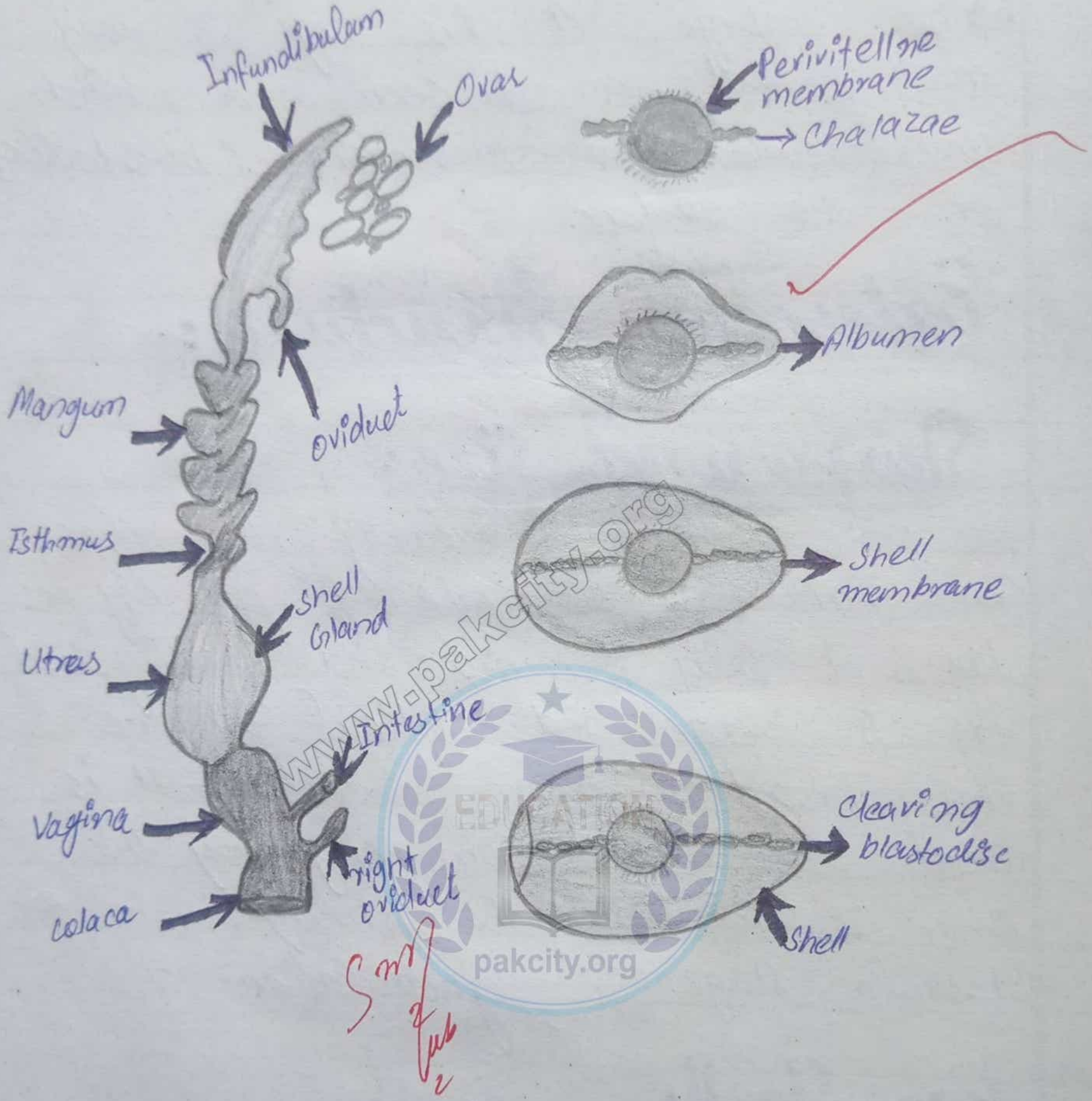
Shape and Size:-

Generally the eggs are laid at the rate of one egg per day. A fully formed and newly laid egg is large and elliptical with one end broader than the other. It is about 3cm broad 5cm long. By the time it is laid, the embryo is in the blastula stage or gastrulation.

Egg Shell:-

The egg is externally protected by a firm white or brown shell, at least 97 per cent, of which is calcium cantoonate. The shell is porous and allows diffusion of O_2 and CO_2 through it.

Diagram:-



Internal Structure:-

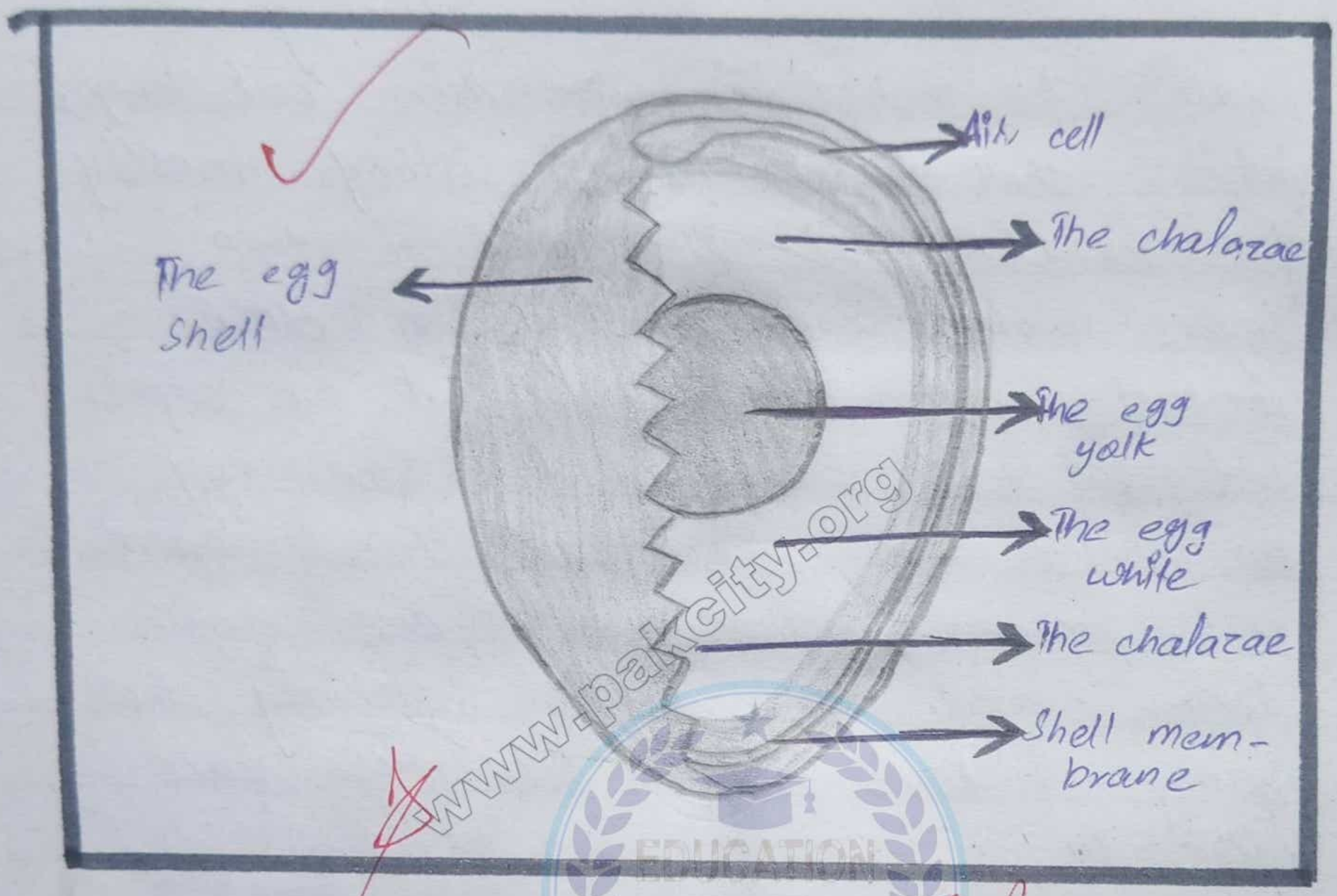
Shell membrane:-

Immediately underneath the shell is a thin but tough, white shell membrane consisting mostly of keratin. It is made of two layers which are mostly in close contact with each other but are separated at the broad end of the egg to enclose an air space. As development proceeds, the air space grows larger, and just before hatching the young chicken pierces the air space with its.

Albumen:-

Beneath the shell membrane lies the albumen or white of egg, surrounding a central mass of yolk. The albumen consists chiefly of water (85 percent) and protein. Other protein are also present. The albumen is deposited in several layers. The outermost albumen is more water. like and known as the

Diagram:-



Internal Structure of hen's egg:-

fluid, liquid, watery or thin albumen. The middle layer of albumen is thick and viscous.

Nucleus:

The ovum contains a nucleus surrounded by a negligible amount of yolk free cytoplasm forming the germinal disc or blastodisc.. It always floats on the upper surface of yolk and represents the animal pole of the ovum.

Experiment # 13

Study of development of chick embryo 48/72 Hours After Incubation

Part I study of 48 Hours Embryo
Part II study of 72 Hours Embryo

Material:-

Fertilized egg incubated for 48 hours; Fertilized egg incubated 72 hours; Fine, Sharp-pointed scissors; Filter paper; physiological saline solution, warmed to about 38°C, Petri dish; Fine, Sharp-pointed.

Procedure:

Opening the incubated egg:

- Insert point of scissors barely through shell and gently clip large openings.
- With the forceps carefully lift the loose piece of shell and discard

Diagram:

Method of opening egg:-

➡ Draw off albumen with medicine dropper until yolk surface is uncovered.

Removing the embryo by paper ring method :-

Use the paper ring method to remove the embryo from the yolk.

➡ Cut and place filter-paper ring of inside diameter barely smaller than the

➡ Grasp the edge of paper ring and adhering membrane with forceps, and clip the.

➡ Lift the filter-paper ring with adhering membranes and embryo.

➡ Physiological saline solution.

Observation :-

Place the petri dish with floating embryo on the stage a stereoscopic dissecting microscope and observe it under different powers. While you are observing the embryo, note carefully its stage of developement. You can see

Diagram:

Specimen Frog

the head and neck at this stage.

Part - I

The following structures are visible in 48 hours embryo:

- The head and neck are most prominent.
- The two bulges on each side of the front of the brain.
- Nineteen paired blocks, called somites, to the rear of the head will develop into the backbone.
- The brain and the nervous system develop from embryonic ectoderm.
- Heart is present on the right side.

Points of identifications:-

48 hr. Embryo

(i) Head and neck is prominent.
(ii) 19 pairs of somites are present.
(iii) Heart is present on the right side.

Part - II

The following structure are visible with

in 72 hours embryo:

- Three pairs of gill slits and the blood vessels (aortic arches).
- The neural tube has become a five-part brain anteriorly and spinal cord posteriorly.
- The optic vesicles have greatly enlarged.
- Dorsal to the gill slits on each side is an invaginated thickening of the ectoderm forming the auditory vesicle.
- The heart has become twisted and transformed into a two-chambered structure consisting of an auricle.

Point of identification:-

72 hr. Embryo

- Optic vesicles greatly enlarged.
- 36 pairs of somites are present.
- The heart becomes twisted.

5 mm
Tub
2

Experiment #18

Estimation of Syramids of numbers using Simple techniques:-

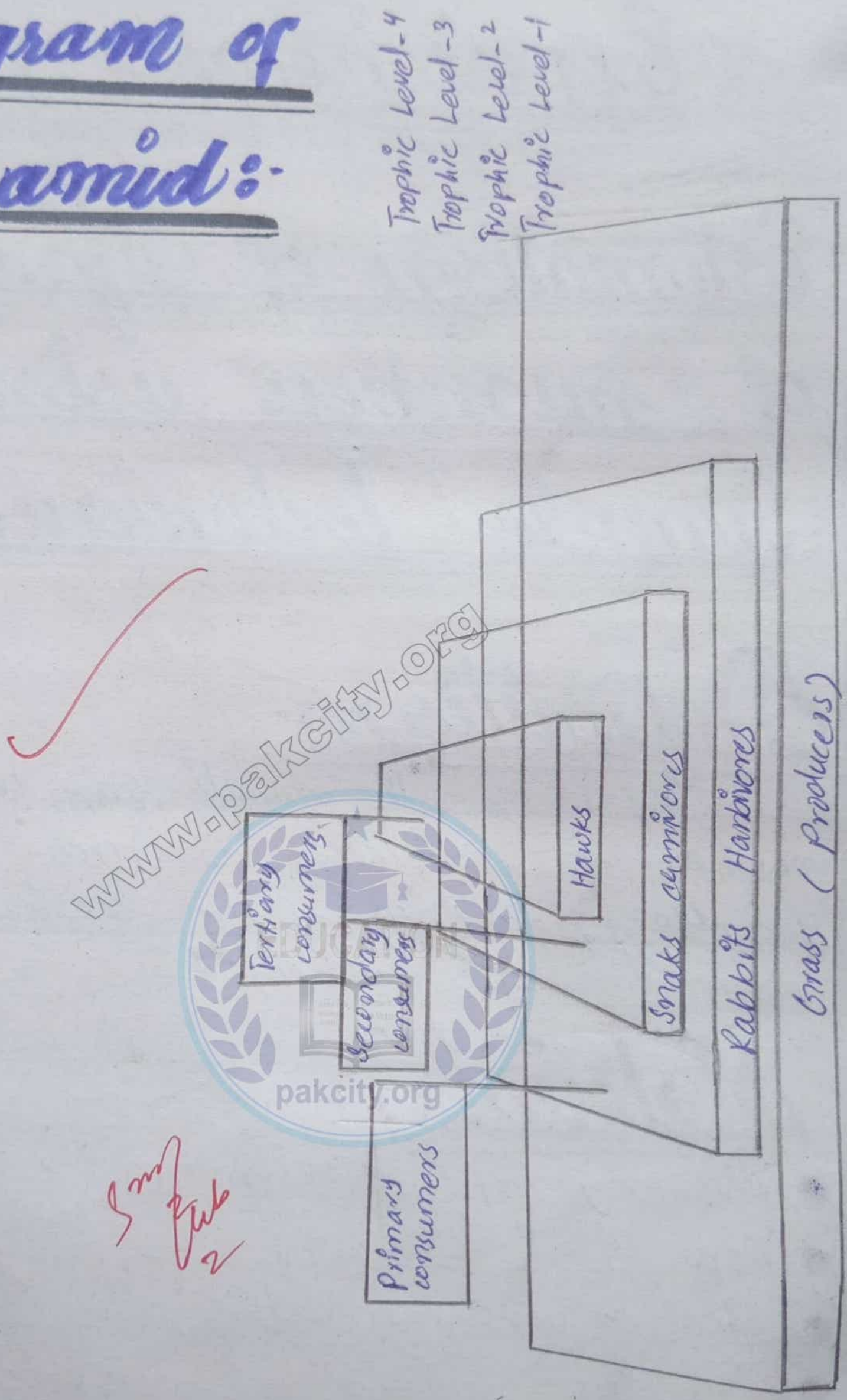
Definition:-

"The relationship between the number of producers, consumers of primary, secondary, tertiary levels constitutes the pyramid of numbers."

Materials:

- Measuring tape (100) metre.
- Rope
- Steel or wooden rods.
- Forceps
- Notebook
- Pencil
- Nets
- Plastic bags.

Diagram of Pyramid:-



Procedure:

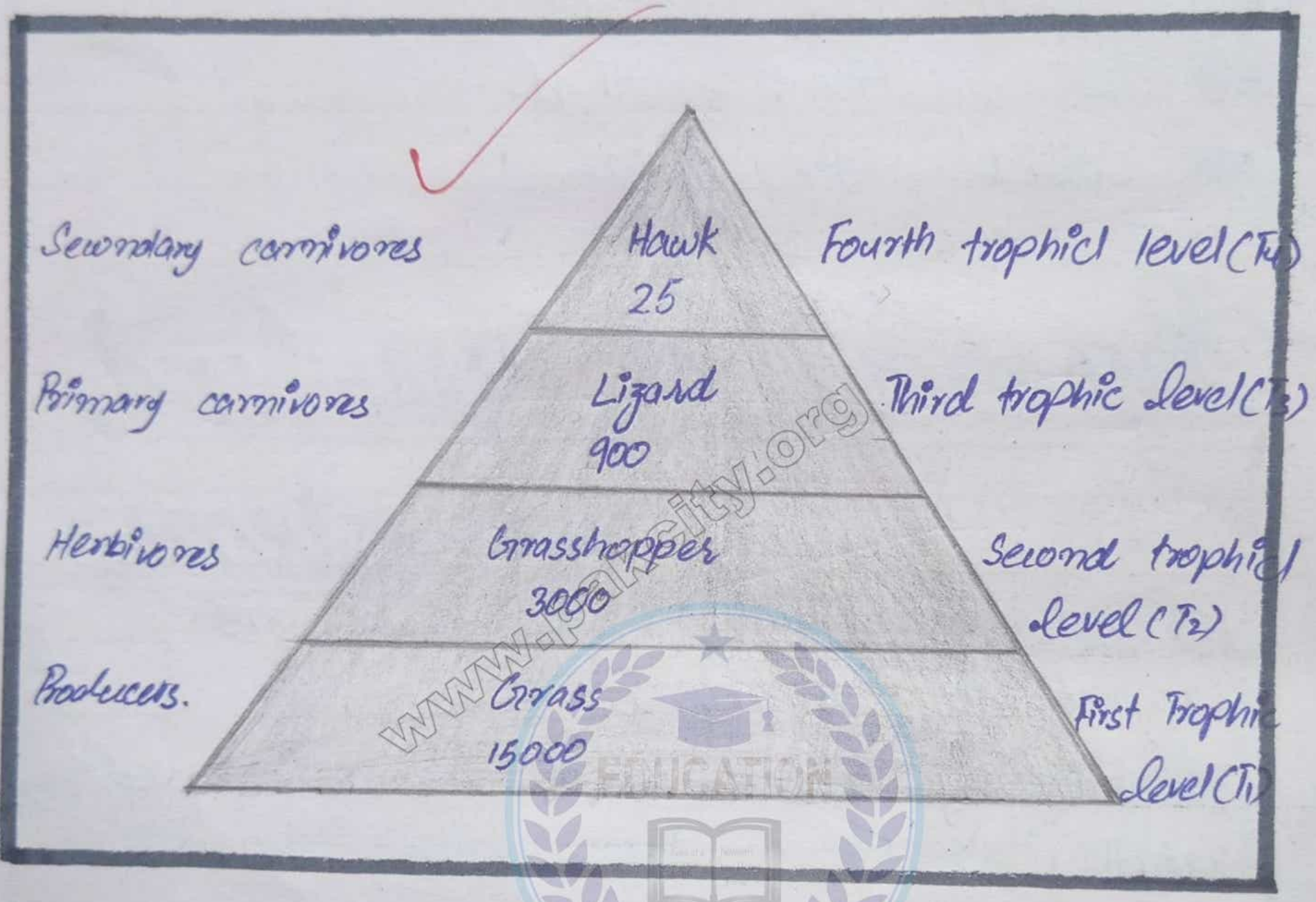
- Arrange a field trip to nearby terrestial or aquatic ecosystem.
- Select a plot for sampling in the undisturbed area of ecosystem.
- Use quadrant method.
- Collect the data.

Pyramid of grassland Ecosystem:

- Producers (grasses, herbs, forbs) are largest in number.
- Primary consumers or herbivores (grasshoper, rabbits) are less in number than producers.
- Secondary consumers or primary carnivores (snakes, lizards) are further less in number than primary consumers.
- Tertiary consumers or secondary carnivores (hawks) are smallest in number.
- The number of organisms decreases from base of pyramid to apex.

Observation:

Pyramids of numbers:



(Grassland ecosystem)

Construct a pyramid of numbers of forest organisms as shown in the figure below.

Pyramid of Sond:-

Producers (phytoplankton and other hydrophytes) are largest in number.

Herbivores (zooplankton, rotifers and small fish) are less in number than producers.

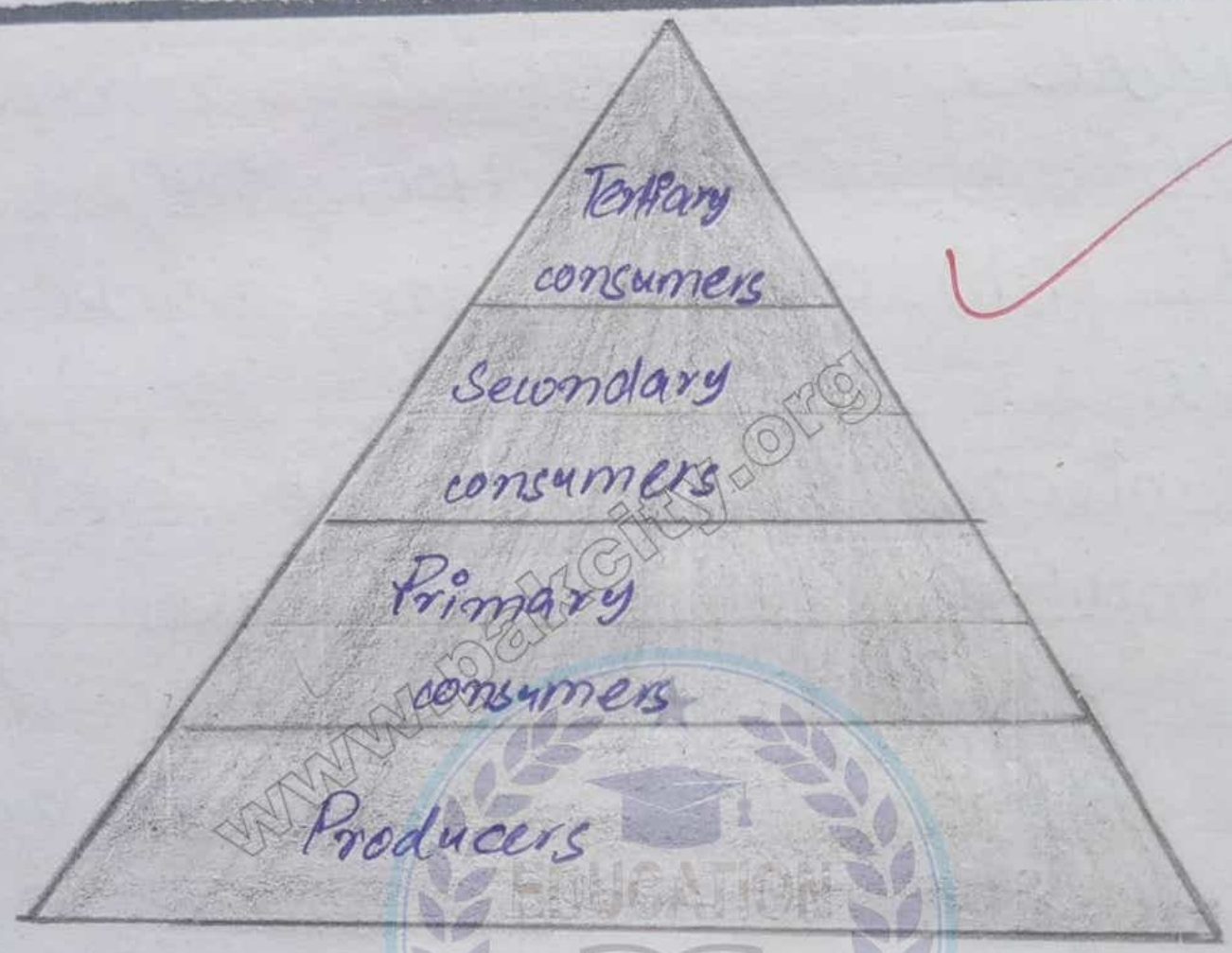
Carnivores (large fish) are even less in number than herbivores.

The number of organisms decreases from base of the pyramid to apex.

Observation:-

The tropic level goes on decreasing ($T_1 - T_4$) from producer to consumer.

Pyramids of numbers:-



Experiment # 19

Sampling of a grass-land Community by Quadrant method:-

Quadrat Sampling:-

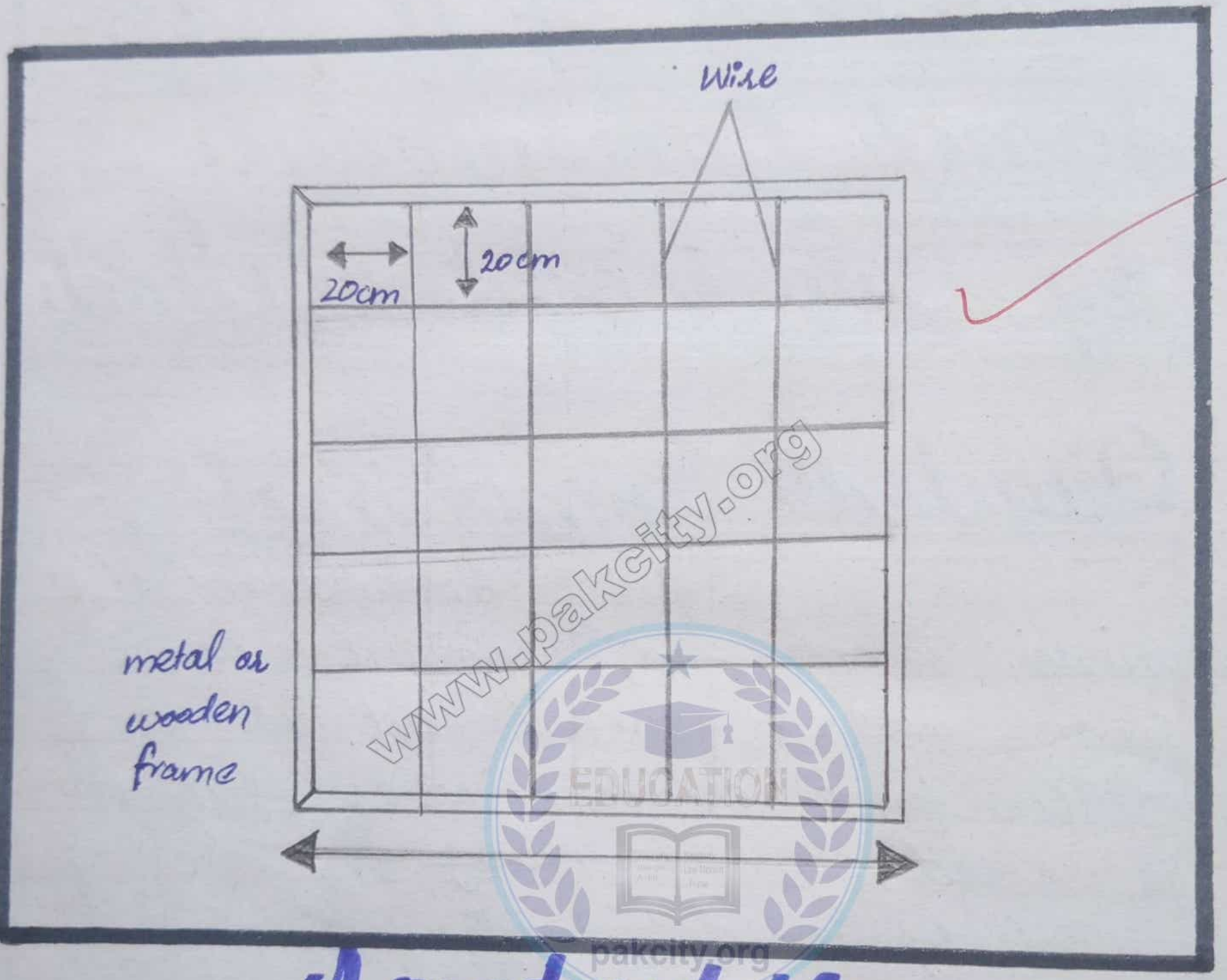
A quadrant is a square sample area, usually 0.5 or 1.0 square metre, marked out with a wooden frame or thick wire, that can be used in an ecological survey to study in detail the distribution anbudance of differente species i.e., random sampling with an area.

Grassland Ecosystem:-

Location:

Grassland ecosystem are found in Gilgit, Kashmir, Waziristan, lower Chitral and North kallat

Diagram:-



A quadrand 1 frame.

Prairies:-

Grassland present in temperate climate called prarries."

➡ The grassland do not have woody plants.

Example:

Pairies of North America.

Savana:

"The grassland in tropical climate called savand."

➡ They have woody trees.

Example:

Woody trees.

Rainfall:-

Annual rainfall is about 250 to 750 mm (10 30 inches) The grasslands usually face severe rains, which in tropical and subtropical grassland, reaches about 1500mm.

Producers:-

They mainly consists of grasses and small herbs.

Consumers:-

Herbivores:

Dominant species are herbivores; invetebrates including insect are very numerous, grasshoppers become so numerous that they can compete with other herbivores for plant fliage.

Predators:-

The predators are reptiles, amphibians, mammals such as lizards, toads, and turtles prey on insects. Foxes and wolves among mammals are very common.

Large Animals:-

Large animals like zebra, wild horses and bison are important.

Decomposers:-

They are microscopic organisms, responsible for attacking the dead and decaying remains of plants and animals. During this process,

Material:-

A quadrant frame; Microscope slides, Beakers, Petridishes, Insect net, Box for insects, Bottles 250ml, Formaline, Fungicide, Insecticide, Plastic bags, Rubber bands, Forceps.

Procedure:-

- Arrange a field trip to study grass land ecosystem.
- Select a plot in the undisturbed area of grassland.
- Throw a quadrant of one square metre at random in any part of the plot.
- Also collect the loose soil from small area in a plastic shopper.
- Repeat the throwing of quadrant and collection of specimens in the same way for at least three times.
- Now place a drop of water from the beaker on the slide.
- Examine under the low and high power of the microscope and count the number of bacteria and fungi.
- Record the data in the form of following table:

Calculations:-

(1) No. of plants (say grasses) of one species
(2) No. of plants (say grasses) of second species.

collect the animals of the area.
Different aspect of community eg. Density cover can be calculated. make the list of most dense areas and least dense area of plants.

Density = Total No. of division of speies in quad.. / No. of Quadrate Area.

Relative Density:

= Total No. of individuals of Species x 100 / Total No of Individual in a Quadrat

Relative Cover of One Speaie:

= Sum of cover of one species in Quadrate / Sum of cover of all speies in all Quadrate

Experiment # 20

Invisgation of Water Content of Soil Sample:

Following four kinds of unombined soil water contents:

- Gravitational water
- Callipary water
- Hygroscopic water
- Water vapours.

Gravitational Water:

"The extra amount of water displaces air from the pore space between soil particles and percolates downwardly under gravitational influences. This is called gravitational water."

Callipary Water:

"The water held by callipary forces in smaller soil channels when the gravitational and ground water are drained, called callpary water."

Hygroscopic Water:-

It is held very tightly by small soil particles, plants are unable to absorb it."

Water Vapours:

Some uncombined water occurs as moisture or water vapours in the soil atmosphere.

Field Capacity:

"The amount of water retained in soil by capillary attraction when it is free to percholate under the influence of gravity."

Material:-

Aluminum foil dish or evaporating basin basin (or crucible); Balance with weight box; Oven, Water bath; Beakers; Desiccator; Bunsen burner or spirit lamp; Tripod stand; wire gauze; Tongs.

Methods:-

- Take an avaporating dish or tray and weight it.

- Place the soil sample in the tray and re-weight it.
- Now place the tray containing wet soil sample in oven at 100c for about 24hrs.
- Remove the sample from the oven and cool in a desicator.
- Re weight the oven dried soil along with tray.
- The percentage of moisture or water in the soil sample is calculated.

Observation & Calculation:

Weight of tray = agm 10gm
Weight of tray + wet soil = bgm 50gm
Weight of tray + oven dried soil = cgm 46gm
Weigh of wet soil = ba = dgm 40gm
Weigh of dry soil = ca = egm 46-10 = 36gm
Amount of moisture = de = fgm 40-30 = 4gm

% age of moisture in the soil sample =

100 X 4/40 x 100