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1. (a) Determination of pH of Water :-

Aim: To detect the pH of the given sample solution through paper method.

Apparatus: pH paper, different solutions with different pH, a forceps.

Procedure: A piece of pH paper is held with forceps. It is dipped in the sample solution. colour is developed in a minute (or) two. This coloured paper is compared with the colour chart to find the pH of the given sample.

Precautions: The pH paper dipped should be touched with forceps but the forceps should not be dipped in sample solution.

Identification of pH using pH meter :-

pH of the sample solution, can also be found with the help of pH meter, Here the pH meter is taken & make it ready for experimentation as per the specifications given by the suppliers/ manufacturers.

Suitable buffer solutions are selected & used to dip the electrodes. The pH of the buffer should be nearer to the pH of the sample.

Teacher's Signature _____

Acid | Neutral | Alkaline

0 1 2 3 4 5 6 | 7 | 8 9 10 11 12 13 14

colour developed on pH paper	pH of given sample solution
1. Maroon	2 (acid)
2. Pale rose	4
3. Golden yellow	6
4. Greenish yellow	7 (Neutral)
5. Light Green	8
6. Grey	10
7. Blue	10.5 (Alkaline)

Details of pH of the above buffers at different temperature

Temperature (°C)	phthalate buffer	phosphate buffer	borax buffer
0	4.01	6.98	9.46
5	4.00	6.95	9.39
10	4.00	6.92	9.33
20	4.00	6.88	9.22
25	4.01	6.50	9.14

During experimentation the pH of the solution is identified & then compared with the above given buffer.

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Buffers commonly used:

1. Potassium hydrogen phthalate buffer prepared by dissolving 10.2 gm salt in 1000ml (water)

2. Phosphate buffer prepared by dissolving 3.4gm of potassium biphosphate (KH_2PO_4) & 4.5gm of sodium diphosphate ($Na_2HPO_4 \cdot 2H_2O$) in 100ml of the water.

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1. (b). Estimation of the pH of soil:-

pH is the measure of Hydrogen ion concentration of the given sample of either soil (or) water. It is expressed as the negative log of H^+ ion concentration of the sample. The range between 0 to <7 is acidic, while >7 is alkaline. When both H^+ & OH^- ions are equal, it becomes neutral.

i) Collect the 20gm of soil to be tested for pH into a 100ml beaker.

ii) Add 40ml of the distilled water.

iii) Add the sample well with a glass rod till it becomes homogenous.

iv) This is allowed to stand for half an hour with intermittent stirring

v) Take the supernant liquid of the soil into another beaker & the pH paper is dipped into it for few seconds. Observe the colour change. The resultant colour is compared with standard chart. The equivalent pH value marked on pH chart is noted.

vi) This value is directly proportional to the pH of the soil. However the above value is a rough estimate of pH. If exact value is to be evaluated, use the calibrated electronic pH device & follow the prescribed standard.

⇒ Thus the prepared soil water suspension the beaker is used to estimate the hydrogen ion concentration (or) pH. The electrode of the pH meter is immersed in the suspension.

Teacher's Signature

Sl. No	Sample water	Burette Reading: Initial	Burette Reading: final	$AgNO_3$ Rundown
01	100ml	0	20.5	20.5
02	100ml	0	20.5	20.5
03	100ml	0	20.5	20.5

$$= \frac{AgNO_3 \text{ Rundown} \times \text{Normality} \times 35.45}{100ml}$$

$$= \frac{20.5 \times 0.1 \text{HN} \times 35.45}{100}$$

$$= 10.24 \text{ppm}$$

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2. Estimation of the salinity of water:

Aim: To estimate the salinity of the given water in terms of chloride ions.

Apparatus: Burette, Burette stand, conical flask, pipette measuring jar, Sample water.

Reagent: Distilled water, 5% potassium chromate indicator silver nitrate solution (prepared by dissolving 2.395g of $AgNO_3$ in 100ml of distilled water) & then made upto 1000ml to get 0.1411N $AgNO_3$ solution.

Procedure: Take 100ml of the sample water into a conical flask. Add 2(or) 3 drops of potassium chromate indicator. Titrate the sample with silver nitrate solution taken into the burette.
End point is the formation of a red coloured ppt.
Record the final rundown reading of silver nitrate.
Repeat the experiment thrice (or) four times to get average values
Salinity of the solution is equal to the reading of the silver nitrate rundown. Hence the salinity of the Sample water in ppm =

Silver nitrate rundown x Normality x 35450 (constant)

Teacher's Signature _____

Bicarbonates:

Sl. No	Sample water	Burette reading		H_2SO_4 rundown	Burette reading		H_2SO_4 rundown
		initial	final		initial	final	
01	100ml	0	1.8	1.8	1.8	8.5	10.3
02	100ml	0	1.8	1.8	1.8	8.5	10.3
03	100ml	0	1.8	1.8	1.8	8.5	10.3

Formula :- $$\frac{H_2SO_4 \text{ rundown} \times \text{Normality} \times 1000}{100}$$

$$= \frac{10.3 \times 0.02 \times 1000}{100}$$

$$= 10.3 \times 0.02$$

$$= 2.06 ml$$

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3. Estimation of Total Hardness:

Aim: To estimate the total alkalinity of given sample

Apparatus: Burette, pipette, burette stand, conical flask, 100ml measuring jar.

Reagents: H_2SO_4 of 0.02N, phenopthlane indicator & methyl orange.

Procedure: 100ml of sample water is taken into a clean conical flask & 2 drops of phenapthalein indicator is added. phenaphthalein gives a light pink colour showing a pH of 8.2 & indicates the presence of OH^- (or) CO_3^- ions (or) both. Titrate the sample with 0.02 N H_2SO_4 taken into a clean burette. end point is the disappearance of the colour. Then note down the acid rundown as A. This reading is the phenaphthalein alkalinity.

Then add one (or) two drops of methyl orange indicator. The contents turn to light yellow indicating the presence of HCO_3 ions. Titrate the sample against the acid till the colour changes to light orange. The reading is noted as B. This colour indicator the conversion of HCO_3 ions to carbonic acid. The volume of the acid rundown is noted & total alkalinity of the sample is calculated.

Carbonates:

Sl. No	Sample water	Burette reading		H_2SO_4 rundown
		initial	final	
01	100ml	0	1.8	1.8
02	100ml	0	1.8	1.8
03	100ml	0	1.8	1.8

Formula:

$$= \frac{H_2SO_4 \text{ rundown} \times \text{Normality} \times 100}{100}$$

$$= \frac{1.8 \times 0.02 \times 1000}{100}$$

$$= 0.36 ml$$

Bicarbonates:

Sl. No	Sample water	Burette reading		H_2SO_4 rundown
		initial	final	
01	100ml	1.8	10.3	8.5
02	100ml	1.8	10.3	8.5
03	100ml	1.8	10.3	8.5

Expt. No.

Aim: To est

Apparatus:

Reagents:

Procedure:
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Aim: To e

Apparatus

Reagents:

Procedure:
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of HCO_3 ion
is noted a

Carbonates:

Aim: To estimate the alkalinity of the given sample.

Apparatus: Burette, pipette, Burette stand, conical flask, 100ml measuring jar.

Reagents: H_2SO_4 of 0.02N, phenapthlene indicator & Methyl orange.

Procedure: 100ml of sample water is taken into a clean conical flask & 2 drops of phenapthalein indicator is added, phenapthalein gives a light pink colour showing a pH of 8.2 & indicator the presence of OH^- (or) CO_3^{--} ions (or) both. Titrate the sample with 0.02 NH_2SO_4 taken into a clean burette. End point is disappearance of colour. Note down the acid (rundown as 'A'. This reading is phenapthalene alkanity.

Bicarbonates:

Aim: To estimate the alkalinity of the given sample.

Apparatus: Burette, pipette, Burette stand, conical flask, 100ml measuring jar.

Reagents: H_2SO_4 of 0.02N phenapthalene indicator & Methyl orange.

Procedure: To the acid rundown 'A', add 1 (or) 2 drops of Methyl orange indicator. The contents turn to light yellow indicating the presence of HCO_3 ions. Titrate the sample against the acid till colour changes to light orange. The reading is noted as B. The colour indicates the convertion of HCO_3 ions to carbonic acid. The volume of acid rundown is noted & total alkalinity calculated.

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11. Estimation of Dissolved Oxygen:-

Aim: To estimate the amount of dissolved oxygen in different water samples at different temperatures.

Apparatus: Burette, Burette stand, pipette, conical flask, Sample bottle, boat water bath.

Reagents: 0.025N Hypo (Sodium thiosulphate solution) starch & winkles ABC.

Procedure: collect large volume of water sample to natural from a river (or) reservior. Adjust the pH of water sample to natural using HCl (or) NaOH. Volume of the bottle may be determined either by weighing method (or) by measuring the sample. to the sample in the bottle 1ml of winkler A and 1ml of winkler B added slowly & gently after removing the stopper.

Replace the stopper & the mixture is vigorously shaked by tilling the bottle & holding the stopper right. The ppt formed is then allowed to settle for 20mins by keeping the bottle in a dark chamber to avoid photochemical reaction. Take out the bottle & add 2ml of winklers 'c' carefully by inserting the pipette just below the surface of the sample. Replace the stopper carefully thus avoiding the air bubbles Then shake the bottle until all the ppt. is dissolved.

Transfer 50ml of the above sample solution with the help of a volumetric flask into a conical flask.

Teacher's Signature

It is titrated immediately against a 0.025N hypo solution taken into the burette. Titrate until the solution turns to light yellow in colour. Then add 1ml of starch solution. The contents of flasks turns to blue colour continue the titrate with drop by drop from the burette till the blue colour disappears. Note down the volume of the hypo rundown. The amount of O_2 present in the sample is calculated by using the following formula.

$$O_2 (ml/l) = \frac{\text{Hypo reading} \times N \times 8 \times 1000}{\text{Sample counter (ml)}}$$

Estimate the dissolved oxygen in different samples of water in the same way explained above by collecting the samples from different areas like sewage, industrial affluent, slum area etc. Tabulate the values & see the difference in the quantity of the dissolved oxygen in different samples.

(a) volume of oxygen in flask A containing pure well water =

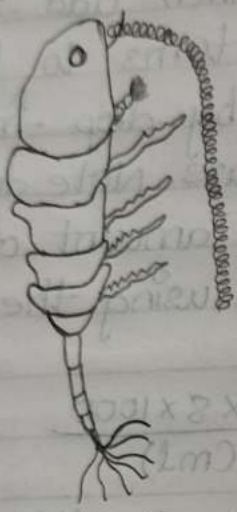
(b) volume of oxygen in flask B containing sewage water =

(c) volume of oxygen in flask C containing industrial affluent =

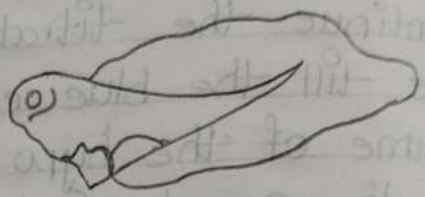
(d) volume of oxygen in flask D containing impure water from slum area =

Result: Quantity of dissolved oxygen gradually decreases in different samples.

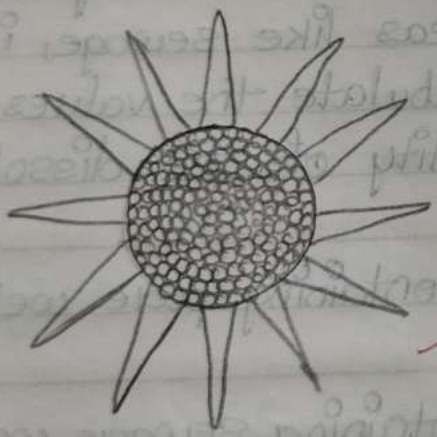
Teacher's Signature



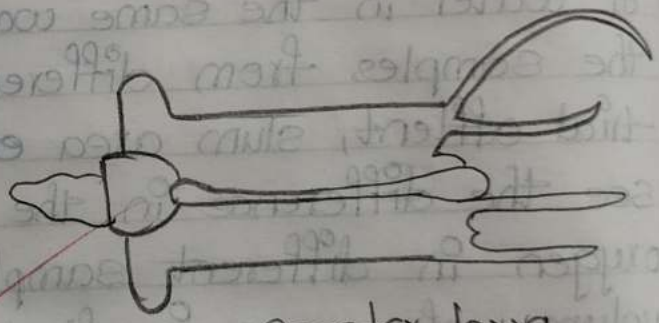
A copepod a tiny crustacean



Fish larva



A radiolarian



Seastar larva

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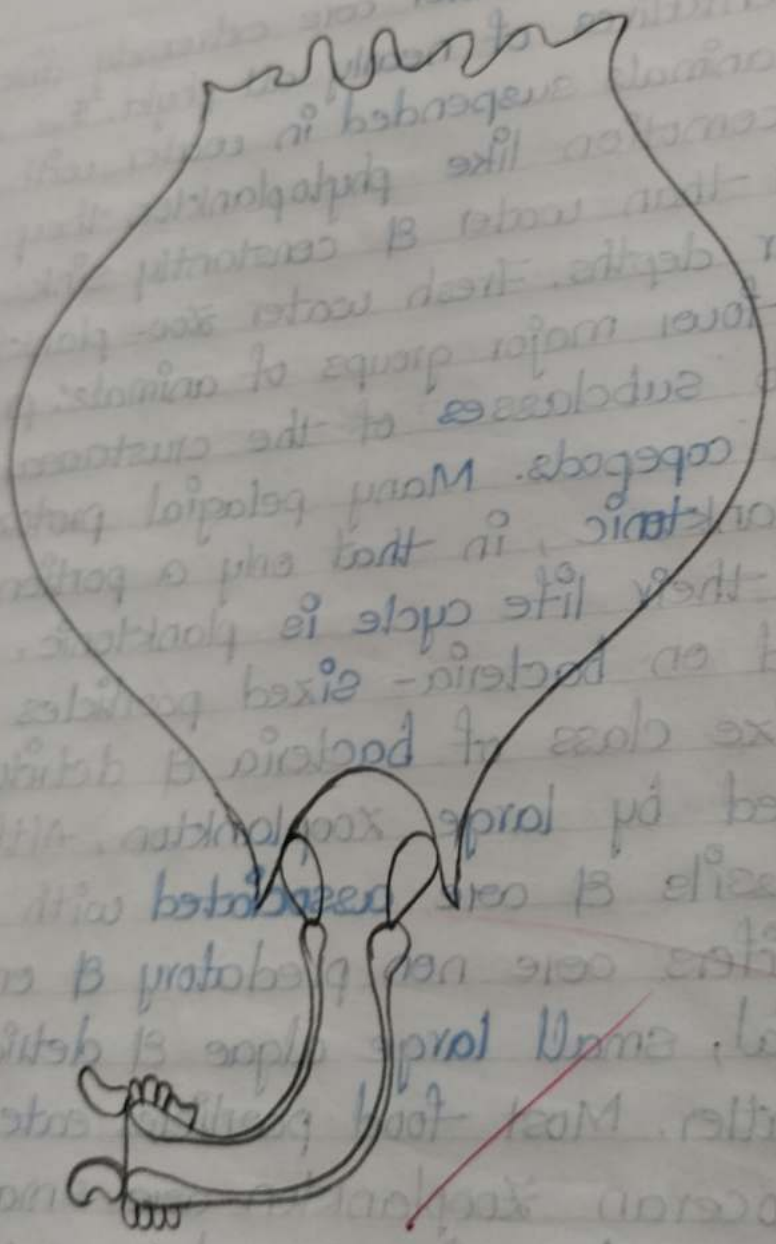
5. Zoo Plankton.

Animals of fresh water are extremely diverse & include representatives of nearly all phyla. The Zooplankton include animals suspended in water with limited powers of locomotion like phytoplankton they are usually denser than water & constantly sink by gravity to lower depths. Fresh water zoo-plankton are dominated by four major groups of animals: protozoa, rotifers & two subclasses of the crustacea, the cladocerans & copepods. Many pelagial protozoa (5-300 µm) are zooplanktonic, in that only a portion, usually in summer of their life cycle is planktonic. Many protozoans feed on bacteria-sized particles & there by utilize a size class of bacteria & detritus generally not utilizered by large zooplankton. Although most rotifers are sessils & are associated with littoral zone, Most rotifers are non predatory & omnivorously feed on bacterial, small large algae & detrial particulate organic matter. Most food particles eaten are small. Most cladoceran zooplankton are small & have a distinct head the body is covered by a bivalve carapace. Locomotion is accomplished mainly by means of large second antennae. planktonic cepepoas consist of two major groups, the calamoids & the cyclopoids these two groups are separated on the basis of body structure, length of antennae & legs.

Teacher's Signature _____



Branchionus

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(a). Branchianus plicatilis:

⇒ This is commonly called as a wheel animalcule leading a planktonic life in both sea & fresh water.

⇒ These rotifers have a transparent turtle like shell called a lorica & are found in variety of habits including moist soil.

⇒ This marine rotifer is an important live food, as it is first food which can be eaten by many marine fish & some crustaceans.

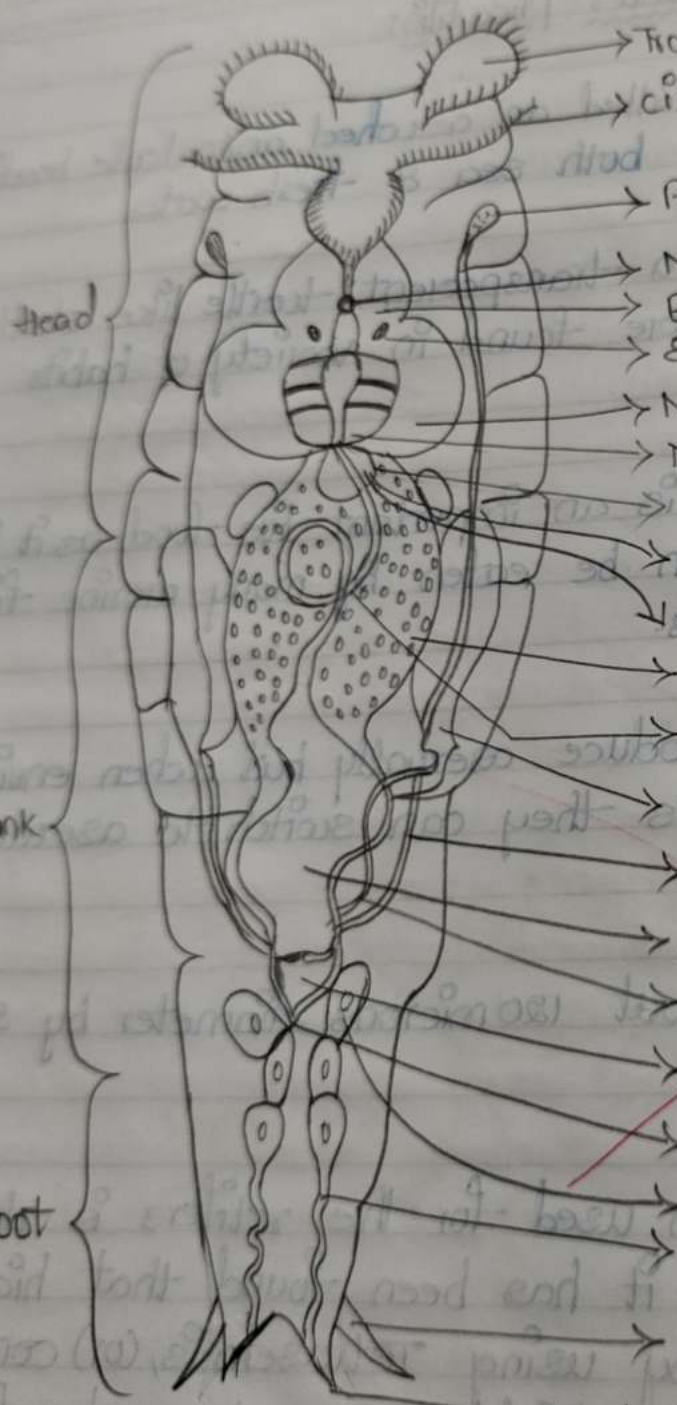
⇒ This generally reproduce asexually but when environmental stress appears they can switch to asexual mode of reproduction.

⇒ The body size is about 120 microns diameter by 250 microns long.

⇒ The food most often used for the rotifers is Namoch loropsis oculata, but it has been found that higher yields are obtained by using Tetraselmis, (or) combinations of these with chlatoms yeast can be fed as a supplemental food but it often has to be enhanced with nutrients & vitamins & it can rapidly pollute the culture.

Teacher's Signature _____

phylum :- Rotifera
class :- Bdelloidea
order :- philodinidae



Expt. No.

(b) Phil

⇒ Philodina
-dont in
⇒ Body is
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(b). Philodina (Wheel animal cule):

⇒ Philodina is a typical rotifer found exceedingly abundant in the marine waters.

⇒ Body is composed of a short anterior head, long, thick middle trunk & short, narrow, posterior foot.

⇒ Trunk is composed of wide, long, middle region of the body & first two annuli of tapered posterior body ending in anus.

⇒ Food extends posteriorly from the trunk & is the region of body posterior to the anus, tapers posteriorly & have four annuli.

⇒ The posterior annulus of the foot bears a pair of dorsal spurs & four small, sticky toes.

⇒ The body is encircled by about 16 circumferential rings (or) annuli.

⇒ Anteriorly head bears conspicuous & characteristic array of cilia arranged in two rings to form retractile corona.

⇒ The anterior using is composed of large cilia is the trochus divided into right & left circles of cilia, each of which constitute a trochal disk.

⇒ Posterior to the corona, the dorsal midline of head bears a slender, sensory dorsal antenna.

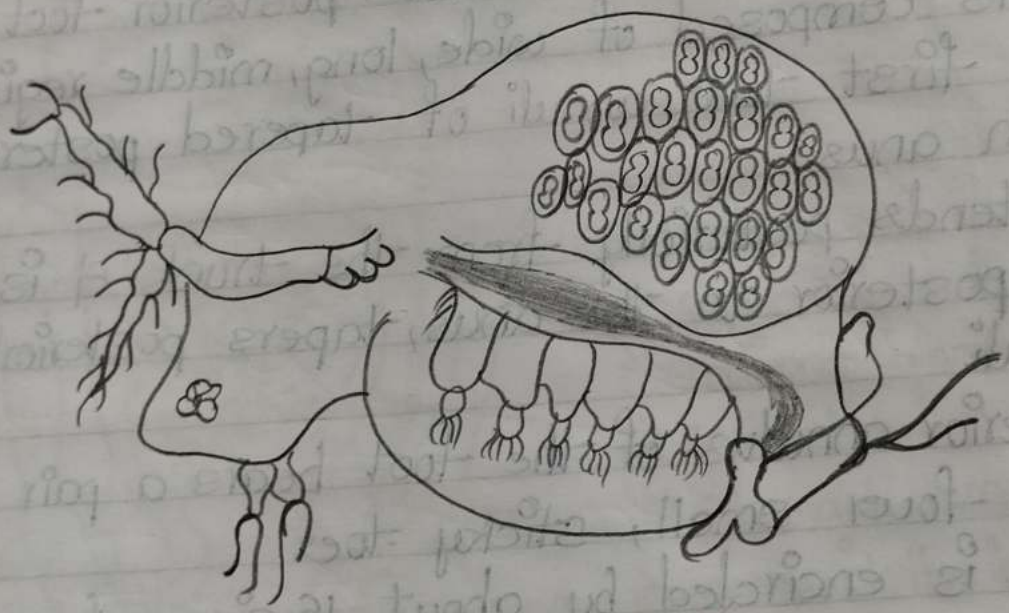
⇒ The annuli allow the body to shorten by telescoping.

⇒ Both longitudinal & circular muscles are not arranged in distinct layers.

⇒ The large retrocerebral apparatus secreting mucus opens dorsally on head.

Teacher's Signature _____

phylum:- Arthropoda
class:- crustacea
order:- cladocera



Maina Micrura

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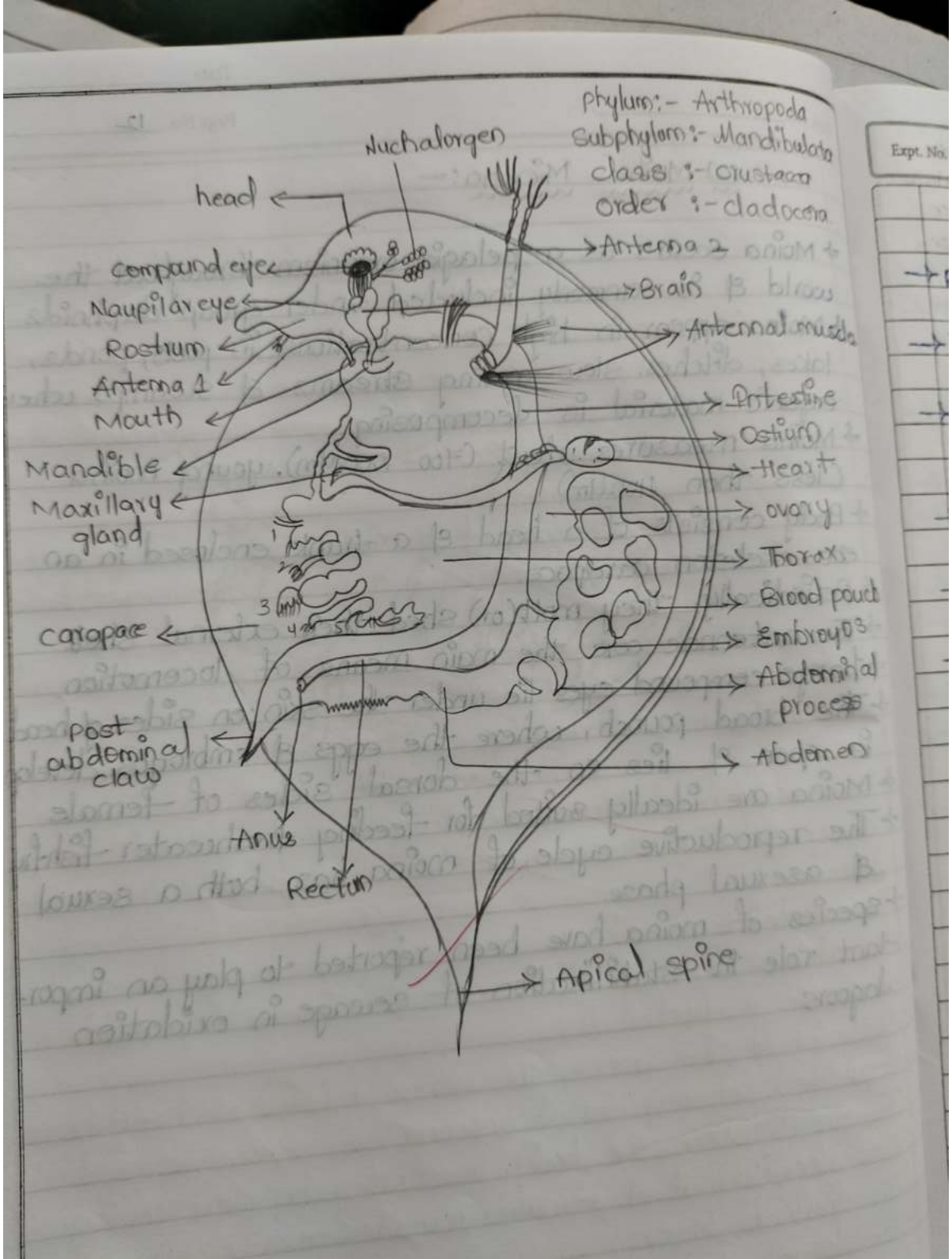
(c) Moina Micrura:-

⇒ Moina occurs as a pelagic organism throughout the world & is commonly included under group daphnids
⇒ Moina appear in high concentrations in pools, ponds, lakes, ditches, slow-moving streams & swamps where organic material is decomposing.
⇒ Moina measures about (700-1000μm). young moina (less than 400μm)
⇒ Body consists of a head & a trunk enclosed in an exo-skeleton carapace.
⇒ Periodically, they molt (or) shed their external shell
⇒ The antennae are the main means of locomotion.
⇒ Large compound eyes lie under the skin on sides of head
⇒ The broad pounch, where the eggs & embryos develop is open & lies on the dorsal sides of female
⇒ Moina are ideally suited for feeding freshwater fishfry
⇒ The reproductive cycle of moina has both a sexual & asexual phase.
⇒ species of moina have been reported to play an important role in stabilization of sewage in oxidation lagoons.


phylum:- Arthropoda
Subphylum:- Mandibulata
class:- Crustacea
order:- cladocera
Nuchalorgen
head
compound eye
Naupilar eye
Rostrum
Antenna 1
Mouth
Mandible
Maxillary gland
caropace
post abdominal claw
Anus
Rectum
Antenna 2
Brain
Antennal muscle
Intestine
Ostium
Heart
ovary
Thorax
Brood pouch
Embryos
Abdominal process
Abdomen
Apical spine
1
2
3
4
5

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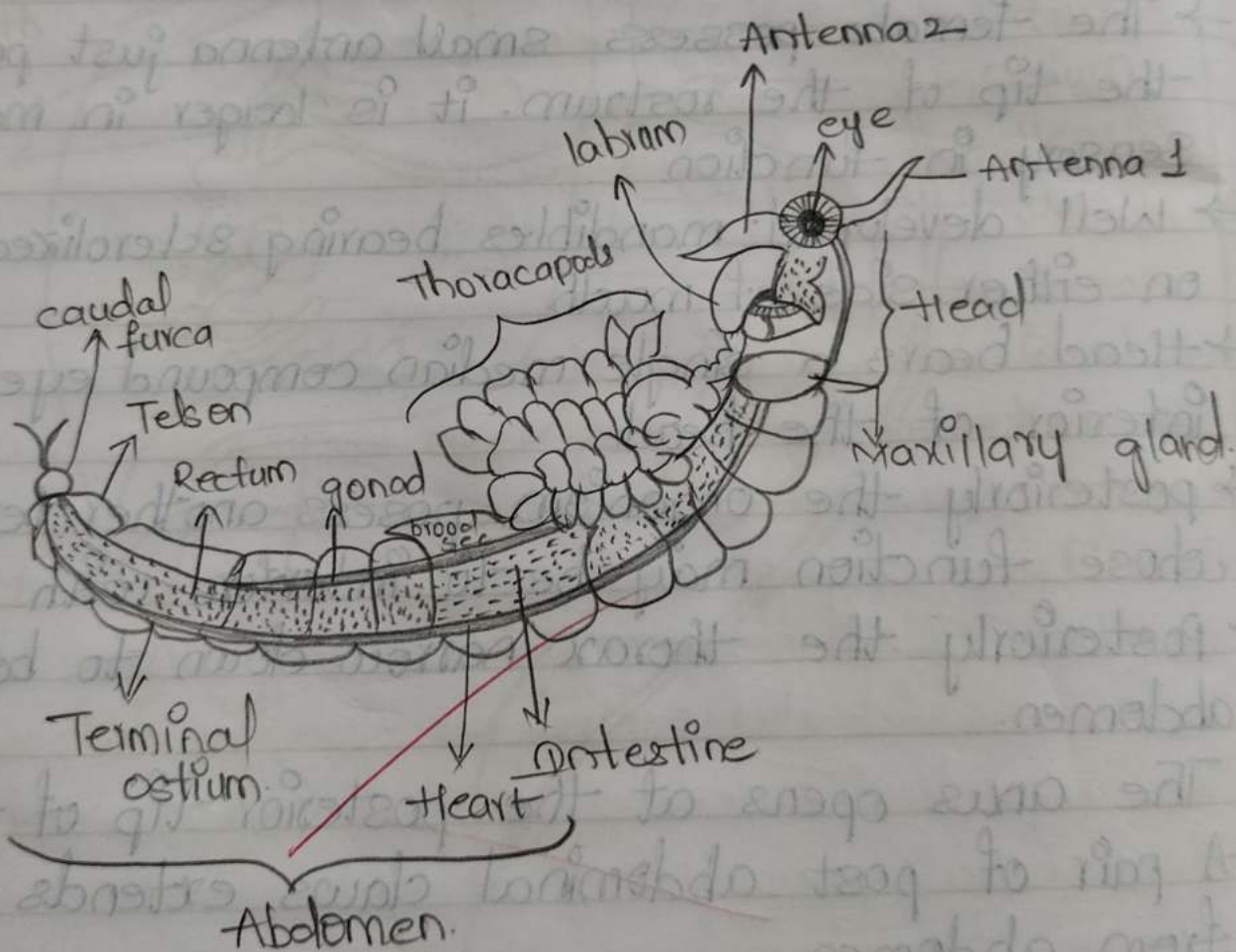
(d). Daphnia Magna (Water flea):

→ Body is divided into an anterior head, middle thorax & posterior abdomen.
→ The head on its ventral side extends into a period rostrum (or) beak.
→ The female possess small antenna just posterior to the tip of the rostrum. it is longer in males & is sensory in function
→ Well developed mandibles bearing sclerolized teeth like on either side of mouth
→ Head bears a single median compound eye in the interior of the head.
→ posteriorly the organism posess another terminal spine whose function may be to interfere with predation.
→ Posteriorly the thorax narrow down to become the abdomen.
→ The anus opens at the posterior tip of the abdomen
→ A pair of post abdominal claws extends posteriorly from abdomen.
→ A pulsatile vesicle is located in antero-median part of the body.
→ Brain is formed of a pair of nerve ganglia.
→ Gonads are located ventral to the intestine
→ Broad pouch with developing eggs is present towards the postero dorsal side of the body

Teacher's Signature

phylum:- Arthropoda
Sub- phylum:- Mandibulata
class :- crustacea
Order : Anostraca



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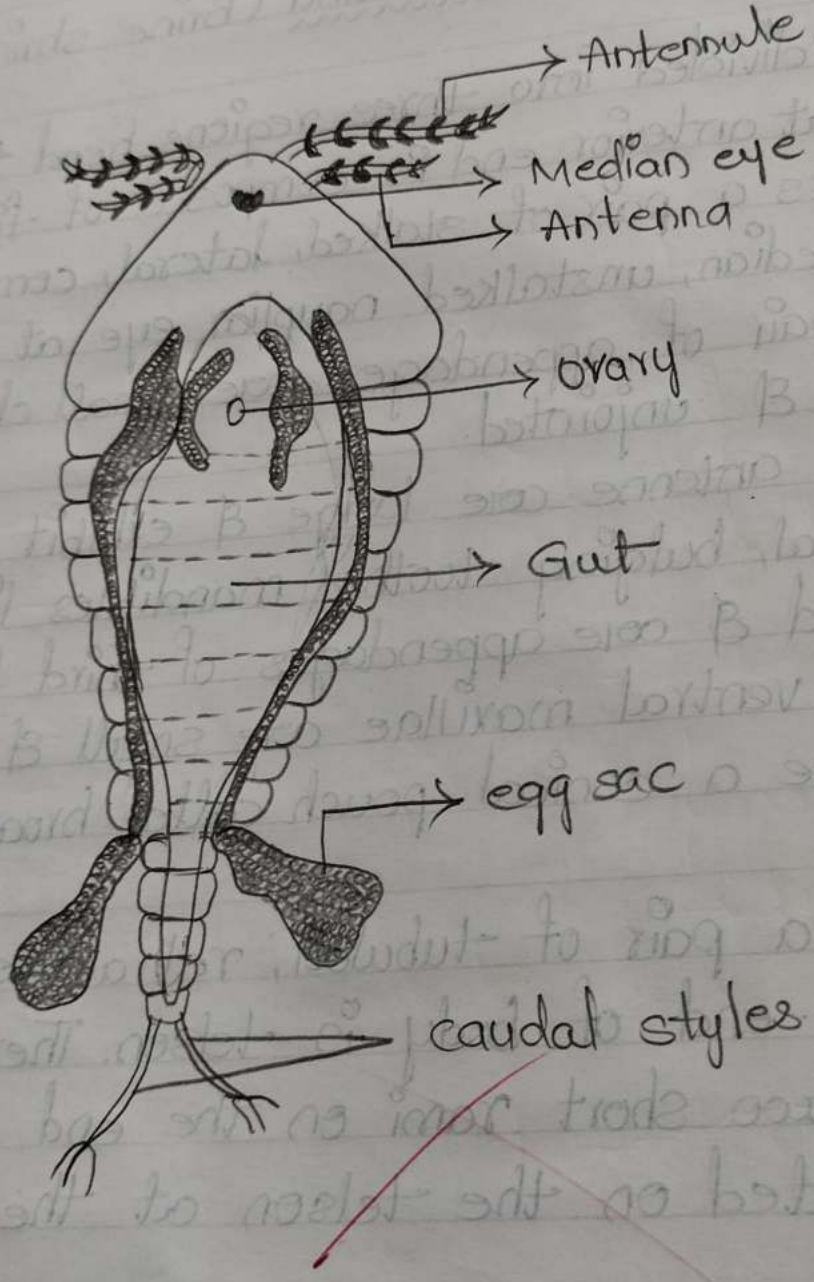
(e). Artemia Franciscana (Brine shrimp):

→ Body is divided into three regions. head thorax & abdomen.
→ The head at anterior end is composed of fire-fused segments. It bears a pair of stalked, lateral, compound eyes & a single median, unstalked nauplior eye at the anterior end.
→ The first pair of appendages are small chemosensory, uniramous & unjointed.
→ The second antenne are large & exhibit sexual dimorphism
→ The two, oval, bulging toothed mandibles lies on either side of head & are appendages of third head segment.
→ Mouth is on ventral maxillae are small & different to see.
→ Females have a conical pouch called broadsac containing eggs.
→ Males bear a pair of tubular, retractile penes.
→ The posterior end of body is telson. There is caudal furca with two short rami on the end of the telson
→ Anus is located on the telson at the base of caudal furca.
→ The adult excretory organs are two maxillary glands (or) cural glands, in the segment of the second maxillae.

Teacher's Signature _____

phylum :- Arthropoda
class : crustacea
order : copepoda



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(F). cyclops (copepods):

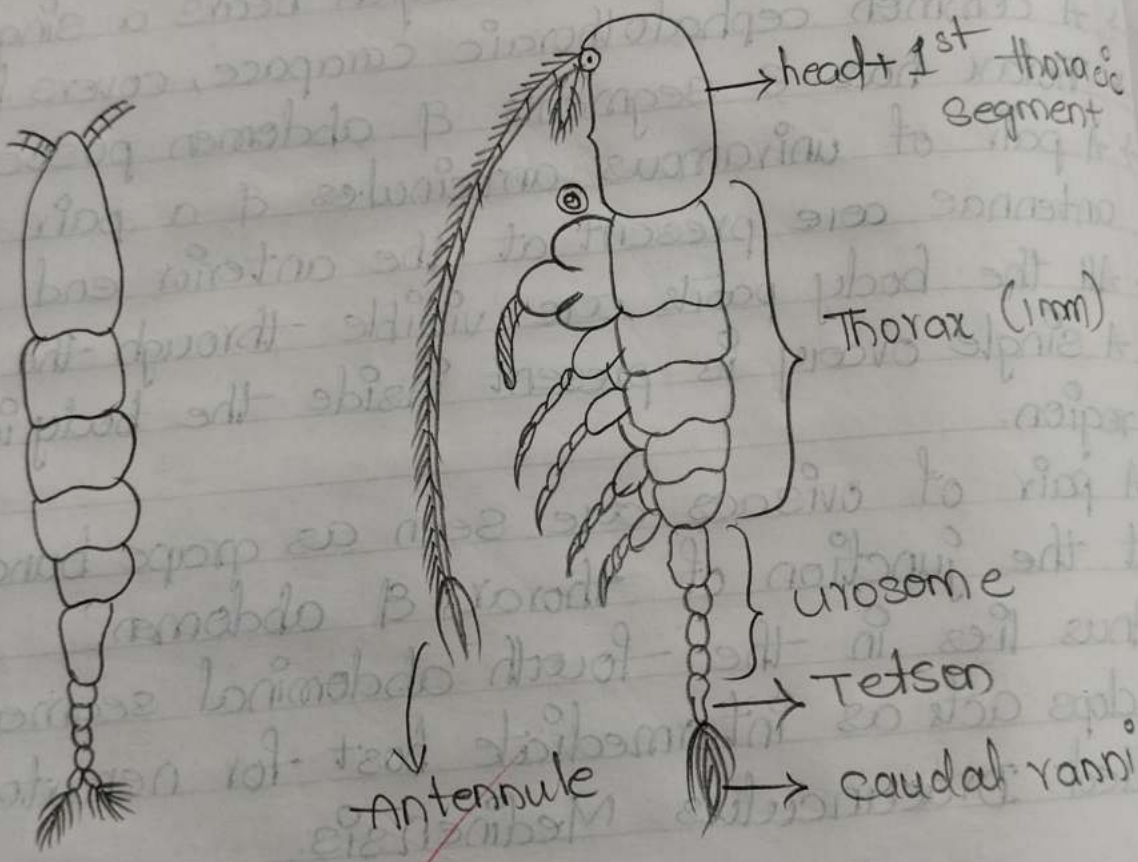
→ It is fresh water living microscopic planktonic organism.
→ Anterior broad cephalic region bears a single median eye.
→ A common cephalothoraic carapace, covers head & thorax.
→ Thorax has 6 segments & abdomen posses 6 segments.
→ A pair of uniramous antennules & a pair of biramous antennae are present at the anterior end of head.
→ All the body parts are visible through the transparent body.
→ A single ovary is present inside the body in cephalothoraic region.
→ A pair of ovisacs are seen as grape bunches attached at the junction of thorax & abdomen.
→ Anus lies in the fourth abdominal segment.
→ cyclops acts as intermediate host for nematode parasite called Dracunculus Medinensis.

* Identification points:

→ oval & transparent body with elongated abdomen single median eye, a pair of antennules & antennae, grape bunch like eggs sacs, a pair of caudal styles at the posterior end.

Teacher's Signature _____

phylum :- Arthropoda
sub-phylum :- Mandibulata
class :- crustacea
order :- copepoda



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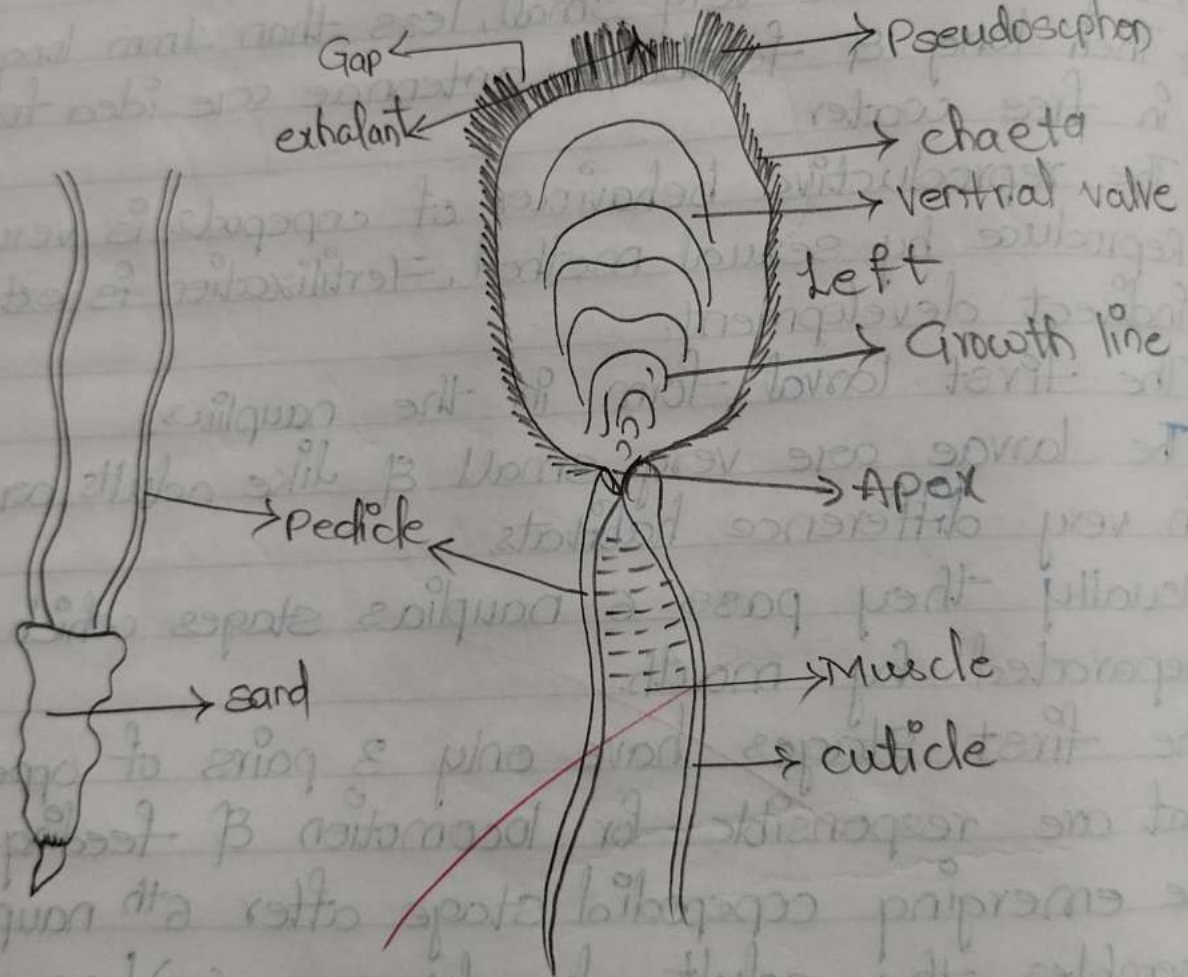
(g) Calanus pacificus:

→ Calanus is a crustacean found almost everywhere.
→ The cephalosome, a sheild over head & some thoraic segments.
→ Organisms are very small, less than 1mm long.
→ Their long & feathered antennae are idea for drifting in free water.
→ The reproductive behaviour of copepods is very diverse.
→ Reproduce by sexual method. Fertilization is external with indirect development.
→ The first larval form in the nauplius.
→ The larvae are very small & like adults are from in very difference habitats.
→ Usually they pass 6 nauplias stages which are separated by mauth.
→ The first stages have only 3 pairs of appendages that are responsible for locomotion & feeding.
→ The emerging copepodid stage after 6th naupliar stage resembles the adult already more (or) less
→ After the fifth mault adulthood is reached & reproductive can takes place.

phylum :- Brachiopoda
subphylum :- Laphophorata
class :- Inarticulata
order :- Lingulida



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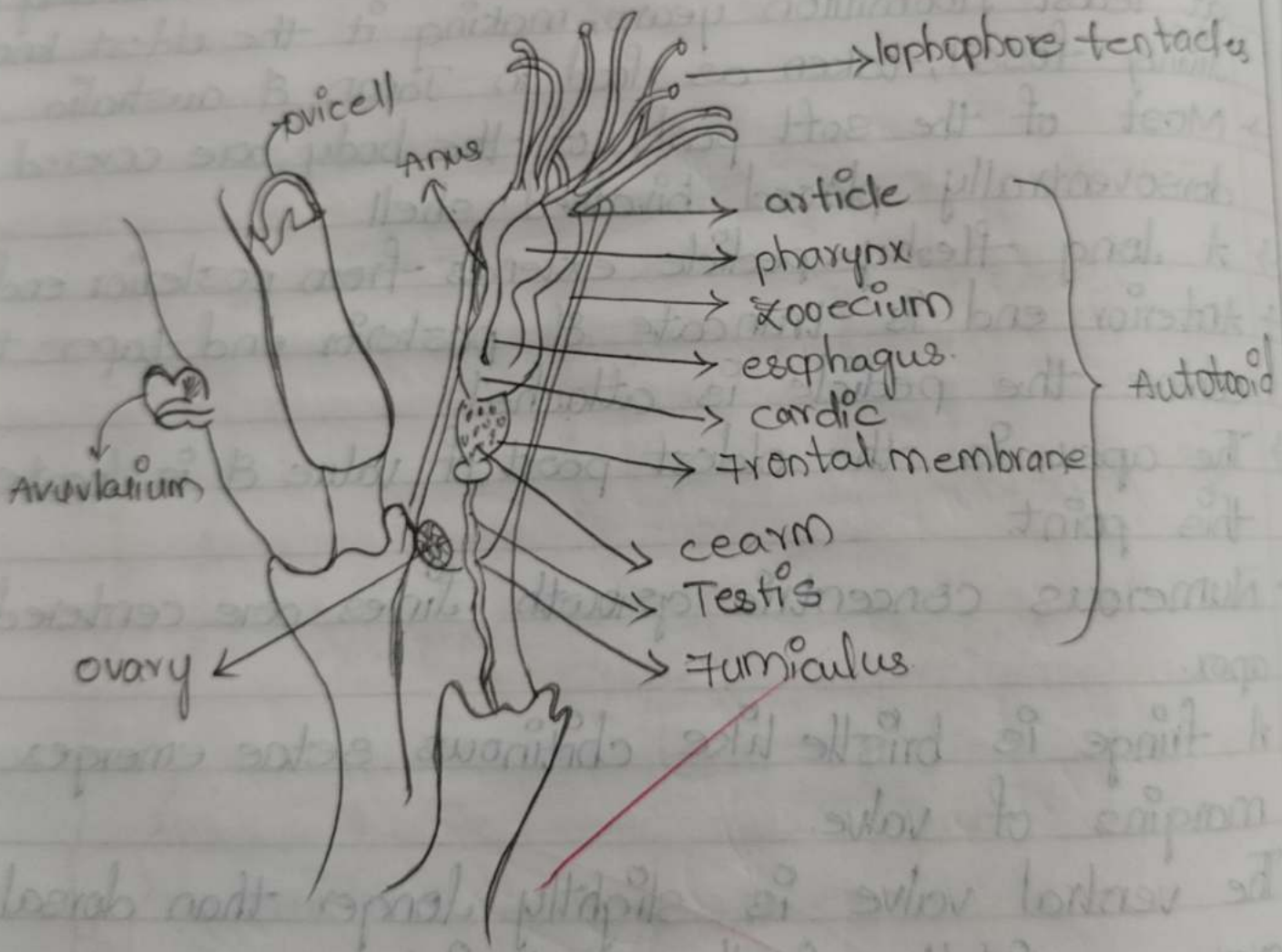
(b). Lingula (Inarticulate Brachiopod):

→ Lingula is known unchanged, from fossils extending back at least 400 million years, making it the oldest known living fossil, taken as food in Japan & australia.
→ Most of the soft parts of the body are covered by dorsoventrally placed bivalved shell.
→ A long fleshy pedicle extends from posterior end of shell where the pedicle is attached.
→ Anterior end is truncate & posterior end tapers to point.
→ The apex is the oldest part of valve & is located on this point.
→ Numerous concentric growth lines are centered on the apex.
→ A fringe is bristle like chitinous setae emerges from margins of valve.
→ The ventral valve is slightly longer than dorsal & extends over so slightly further anteriorly.
→ Observe the dorsal, ventral, posterior, right & left sides of the shell & note the bilateral symmetry of the shell.
→ The pedicle is a long muscular extension of the body used to anchor the animal in its burrow.
→ Pedicle secretes a glue like mucus that adheres to sediment in the bottom of burrow thereby temporary anchoring the animal.

phylum: Bryozoa
sub-phylum: Lophophorata
class: Gymnolaemata
order: Cheilostomata



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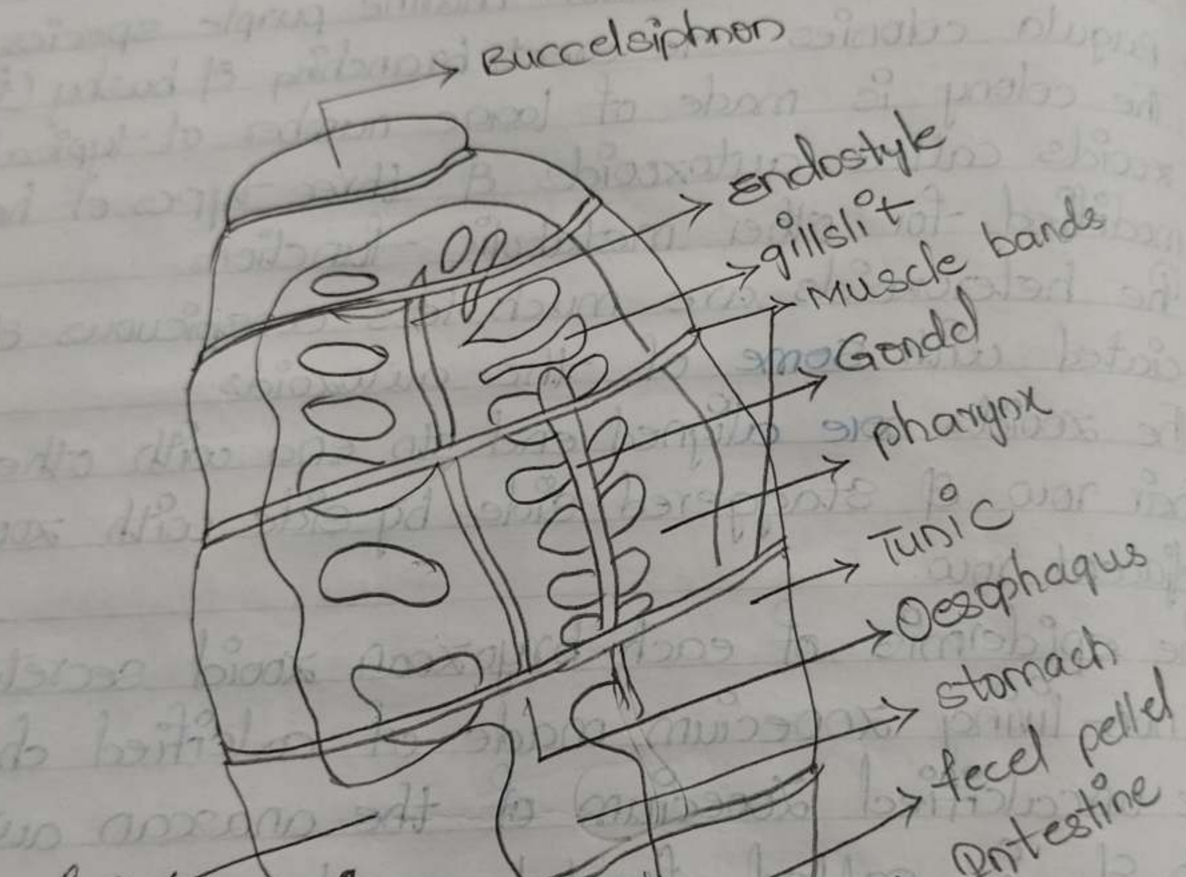
(i). Bugula Neritina:

→ It is a most common marine purple species.
→ Bugula colonies are erect, branching & bushy (fruticose).
→ The colony is made of large number of typical feeding zooids called autozooids & three types of heterozoids modified for other metabolic functions.
→ The heterozoids are much less conspicuous & are associated with some of the autozoids.
→ The zooids are aligned end to end with other zooids in their row & staggered side by side with zooids in adjacent row.
→ The epidermis of each bryozoan zooid secretes & inhabits a non-living zooecium made of calcified chitin.
→ The uncalcified zooecium of the anascan autozooids is thin & is called frontal membrane.
→ The frontal membrane of Bugulae has the shape of deep 'V' (or) 'U' & covers one side of zooecium.
→ Many autozooids bear hemispherical ovicells (or) ooecia at their distal (or) free end.
→ The cilia on two sides of each tentacle are lateral cilia.

phylum: chrodata
sub-phylum: urochordata
class: Thaliacea
order: Dolidida



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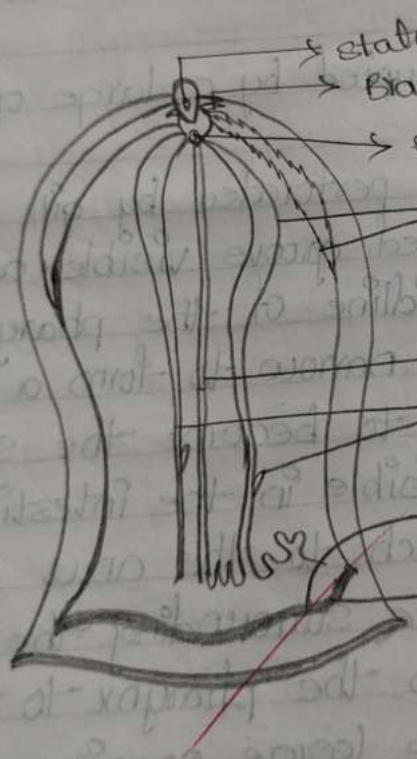
(i). Doliolum:

→ Doliolum zooids are transparent & are stained with anido black.
→ Barrel shaped doliolids are covered on outside by thin elastic tunic.
→ The anterior end is occupied by a large opening the buccal siphon.
→ The pharyngeal wall is perforated by gill slits.
→ The endostyle is ciliated groove visible as longitudinal line on the ventral midline of the pharynx.
→ Posteriorly the pharynx narrow to form a short oesophagus which quickly dialates to become the stomach.
→ Fecal pellets may be visible in the intestine. The intestine leads from the stomach to the anus.
→ Atrium is a coater space surrounding the pharynx & extending posteriorly from the pharynx to the atrial siphon.
→ The atrial siphon is the large opening at posterior end of body.
→ The body is encircled with eight clearly visible muscle bands are helping in swimming.
→ The hemaphroditic gonad is visible as an elogate sac by the side of posterior pharynx & opens into atrium.

phylum: Acnidaria (Ctenophora)
class: Nuda
order: Beroidea



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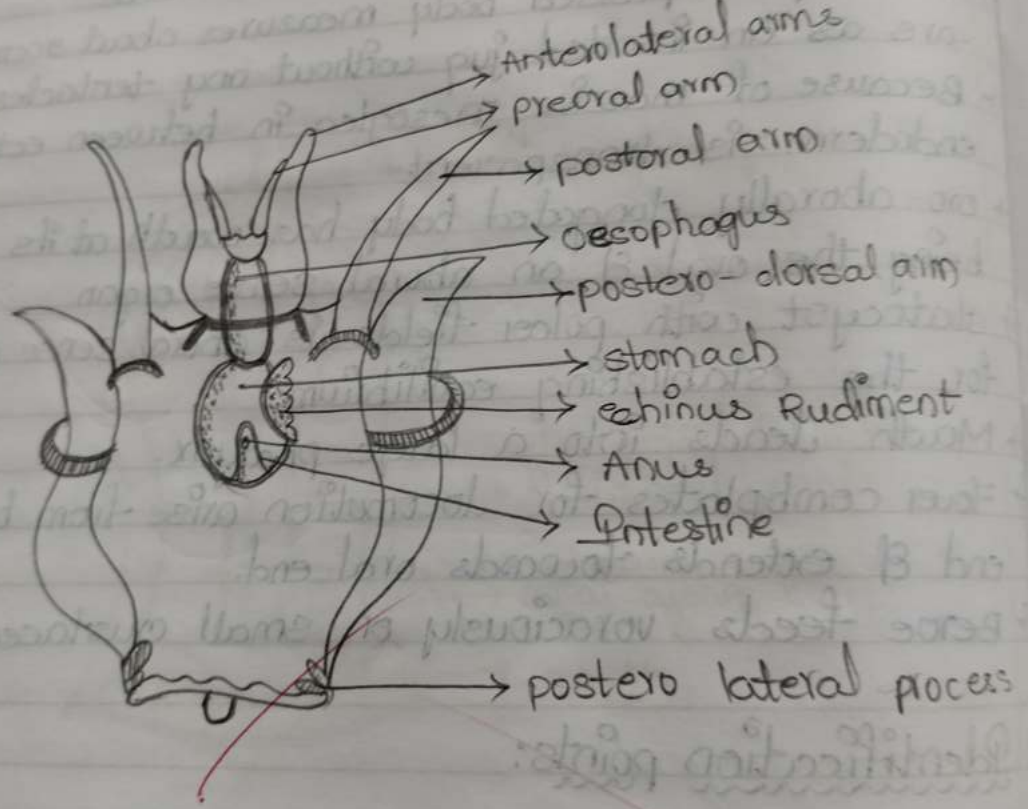
(K). Beroe:

-> Beroe commonly lives in cold water seas.
-> Laterally compressed body measures about 10cm at apex -ars as an inverted jug without any tentacles.
-> Because of massive mesoglea in between ectoderm & endoderm is transparent
-> oro-aborally elongated body has mouth at its bottom being the oval & an aboral sense organ.
-> statocyst with polar fields is aboral sense organ meant for the establishing equilibrium.
-> Mouth leads into a large pharynx.
-> Four combplates for locomotion arise from base of aboral end & extends towards oral end.
-> Beroe feeds voraciously on small crustaceans

* Identification points:

Transparent jug like body, network like canal system, aboral sense organ, four combplates over the body for locomotion, mouth at the bottom of organism.

Phylum:- echinodermata
class:- echinoidea



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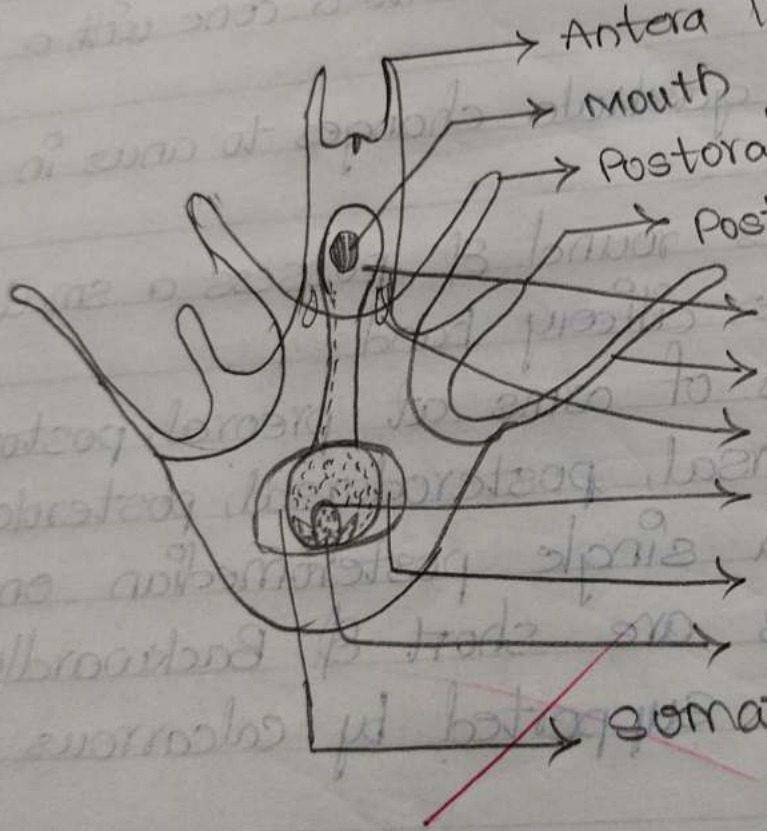
(1). Echinopluteus larva:

→ Seen in the life cycle of echinoids (or) sea urchins as a free scimming one.
→ Gastrula elongates to form into a cone with a broad base.
→ Blastopore of the gastrula changes to anus in the larva.
→ Apical end becomes round & possess a small preoral lobe with a single ciliary band.
→ Body has 6 pairs of arms at preoral, postoral, anterolateral, anterodorsal, posterodorsal, posterolateral positions besides a single posteromedian one.
→ Posterolateral arms are short & Backwardly directed.
→ All the arms are supported by calcarious roads & help in locomotion.

phylum: echinodermata
class: ophiuroidea



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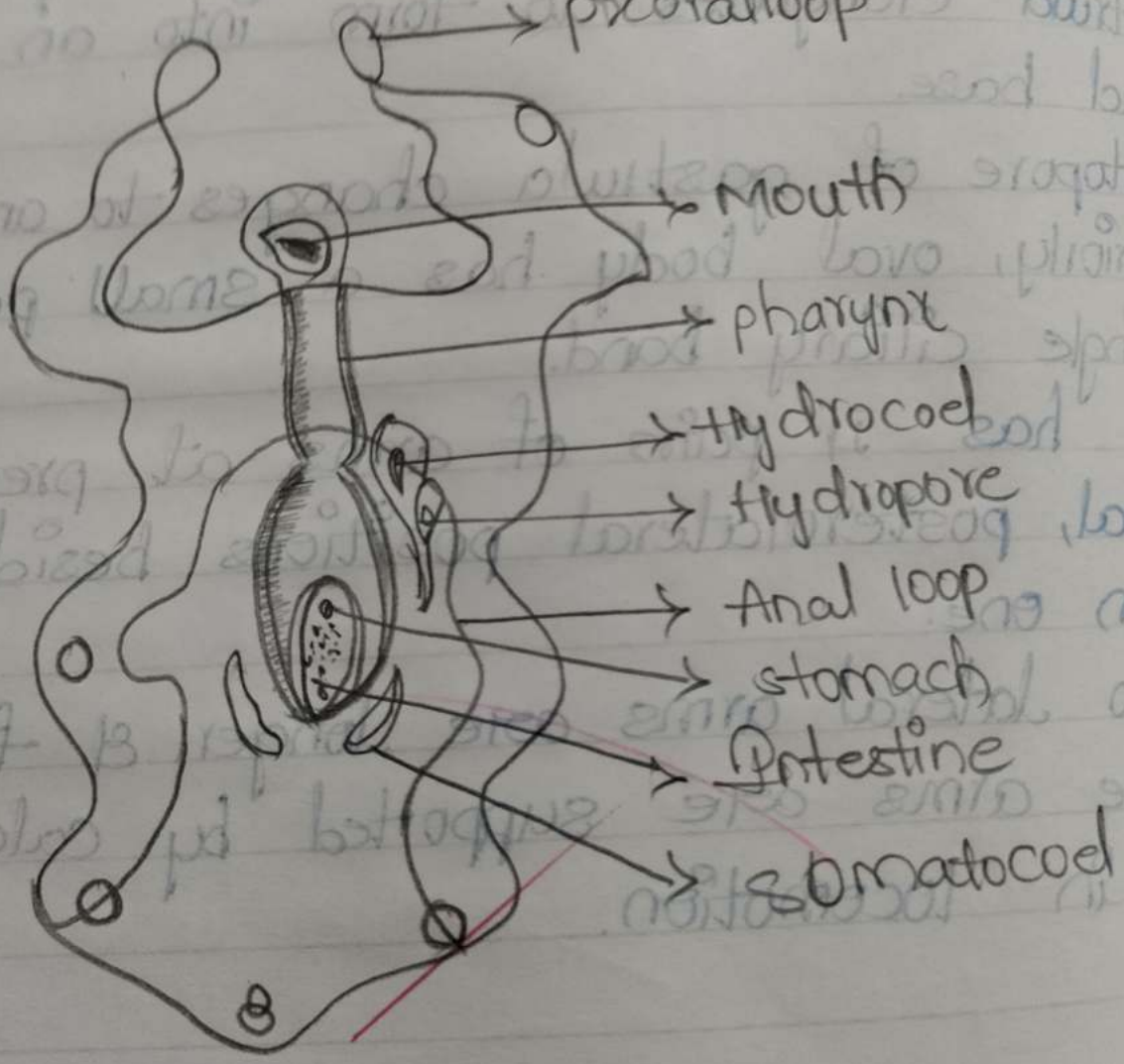
(m). Ophiopluteus larva:

→ Seen in the life cycle of brittle stars (or) ophiuroids (Echinodermata) as a free swimming one.
→ Gastrula elongates to form into an oval body with broad base.
→ Blastopore of gastrula changes to anus in the larva.
→ Anteriorly, oval body has a small peroral lobe with a single ciliary band.
→ Body has 11 pairs of arms at preoral, anterolateral, postoral, posterolateral positions besides a single posterior medium one.
→ Postero lateral arms are longer & forwardly directed.
→ All the arms are supported by calcareous rod & helps in locomotion.

Phylum: Echinoderma
Order: Holothuria



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(D). Auriculoria larva:

→ Seen in the life cycle of holothurians (or) sea cucumbers

→ Transparent, free swimming larva leading pelagic existence

→ Released after the formation of coelomic pouches & archenteron.

→ Preoral lobe is well developed having mouth at its centre.

→ A single ciliated band is formed into preoral & post oral loops ciliated band has flagellated cells

→ Ectoderm at the anterior & forms a thick sensory apical plate.

→ Arms are supported by calcareous star shaped bodies, spheres & wheels.

→ Measures about 0.5 to 1.0mm.

Kingdom:- Animalia
phylum:- chordata
class:- Aves
sub:- Neognathae
Order:- guiformes

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: ENDANGERED SPECIES :

(a) Great Indian Bustard [Ardeotis nigriceps]:

→ Bustard birds are found in India & are confined mostly to the bird regions of Rajasthan, Gujarat & the ahmednagar district of Maharastra.

→ A large bird with a horizontal body bare legs giving it an ostrich like appearance.

→ It is one of the heaviest of the flying birds.

→ The deep buff coloured wings with black sides a conspicuous black crested crown, an outstreched white neck & the white under parts are the distinguish features of this bird.

→ Today very few birds survive & the species is on brink of the extinction.

→ It is declared critically endangered by hunting & loss of its habitat consisting of large expanses of dry grassland.

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kingdom: Animalia
phylum: chordata
class: Mammalia
order: carnivora
family: Felidae

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(b). Asiatic Lion (panthera leo persica)

→ The Asiatic lion also known as sher.
→ This beautiful indian wild big cat is found in the Gir forest in kathiawar of Gujarat.
→ It is mainly preys on cattle, deer, pig & other herbi-vores by making a short, high speed charge upto 80km per hour.
→ It is becoming extinct because of excessive hunting, habitat destruction, decline in natural pery & human prey & human interference.
→ Lions weight about 150-250kg & measure between 1.7 - 2.5m, with a tail of 70-100 cm in the length.
→ They are carnivorous & feed an deer, antelope, wild boar buffalo.
→ Asiatic lions are slightly smaller with thicker elbow tufts & a longer tail tuft.
→ Asiatic lion has a longitudinal fold of skin running along the belly. Their ears are always visible.

Kingdom: Animalia
phylum : chordata
class : Mammalia
order : cetacea
family: platinistidae

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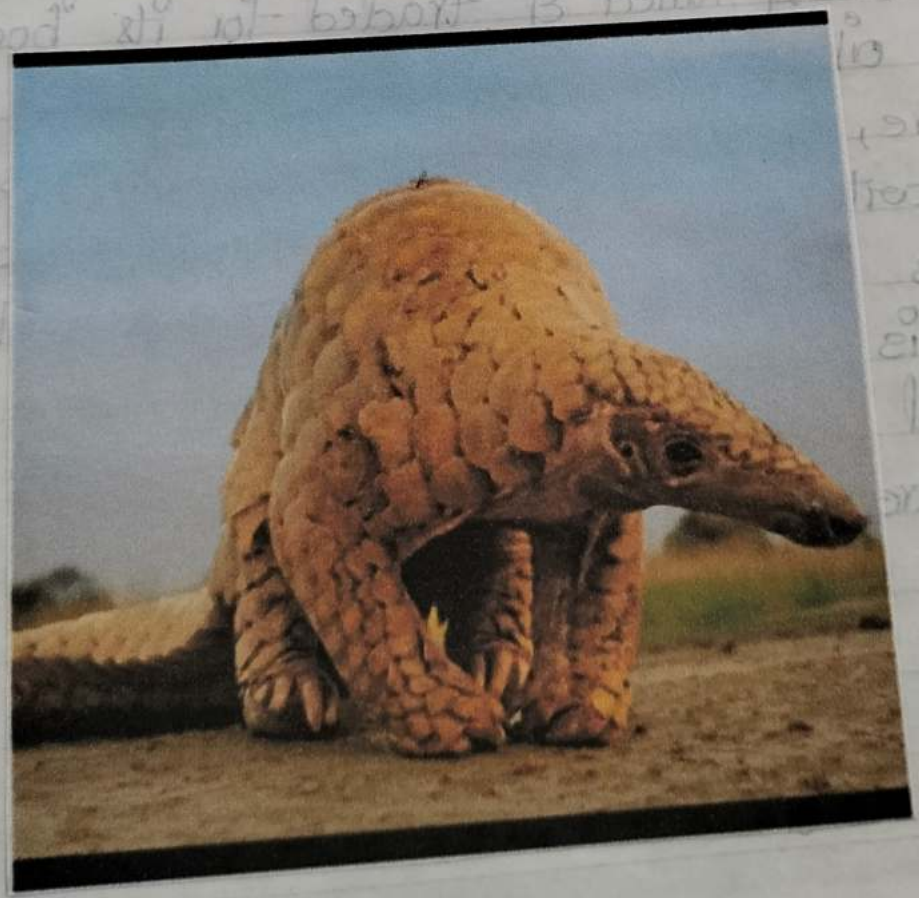
(c). Gangetic Dolphin (Platanista Gangetica):

→ This animal is considered as the health indicator of the fresh water ecosystems.
→ It is recently been recognized by government of India as its National Aquatic animal.
→ Major threat to this animal is the habitat loss & pollution of fresh water aquatic systems
→ It is beeng killed & traded for its body parts especially fat & oil.
→ Therefore, hunting & trade of the species (or) its body parts & derivatives is completely banned.
→ It has a smooth body surface without hair.
→ Snout is elongated & flat. It can filter the food material from weeK.
→ These are friendly & can easily be tamed.



Kingdom: Animalia
phylum: chordata
class: Mammalia
order: pholidata
family: Manidae

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(d). The Indian Gray pangolin [Manis crassicaudata]:

→ The animal is identified by the presence of large, overlapping scales on the body acting as armour.
→ The massive, scaled armour is not seen on belly & on the inner side of the legs.
→ The animal can roll over itself into a ball as a means self-defense against carnivorous predators.
→ It can mimic the surroundings by changing its colour. Mostly it is gray to brown through red.
→ It is an insectivore feeding on ants & termites, digging them out of mounds & logs using its long claws of the equally long fore limbs.

Kingdom: Animalia
phylum: chordata
class: Mammalia
order: carnivora
family: ursidae

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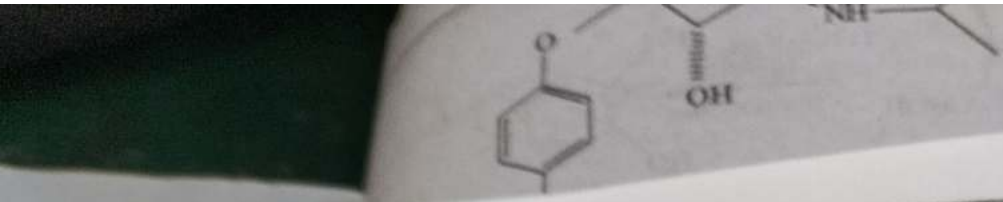
(e). Sloth Bear (Melursus Ursinus):

→ common habitats include grasslands, forests & dense brush lands. They are found in India, Bangladesh srilanka, bhutan & Nepal.
→ The sloth bear has thick shaggy black to brown colored fur.
→ The sloth bear has a distinct white (or) gold coloured v (or) u-shaped pattern on its chest.
→ Its favourite food is termites, insects & grubs.
→ The sloth bear will use its excellent sense of smell to locate food.
→ The area around it muzzle & eyes are cream coloured.
→ Long muzzle, tongue & clauses are useful for getting its food.
→ It is an excellent but slow tree climber.
→ Males weigh around 285 to 300pounds while females weigh 125 to 200 pounds.
→ It also feeds on leafy plants, fruits, nuts, rooted vegetables, honey & rodents.
→ Its head resembles a domesticated dog.
→ Life span is estimated to be 20 to 30 years in the wild.



Kingdom: Animalia
phylum: chordata
class: Mammalia
order: Artiocactyla
Family: Boridae

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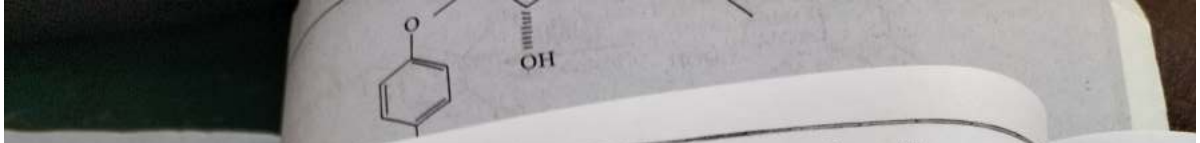
(f). Indian Bison (Bos gaurus):

→ Gaur are said to look like wooden buffalo at the front & domestic cattle at the back.
→ Males have a highly muscular robust body (1000-1500kg) while females are substantially smaller (700-1000kg).
→ There is a dewlap under the chin extending between the front legs.
→ The gaur has a high convex ridge on the forehead between horns
→ The upper part of head, from above eyes to nape of neck is ashy grey, the muzzle is pale coloured.
→ The lower part of legs are pure white (or) tan.
→ The pale green coloured curving horns are found in both seas.
→ Wild gaur feed mainly on grasses, herbs, shrubs & trees with high preference for leaves.
→ Gaur was very saught after animal by hunters for its massive head & horns.
→ The largest populations are found today in India.



kingdom: Animalia
phylum: - chordata
class: Mammalia
order: Perissodactyla
-family: Rhinocerotidae

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(9). Indian Rhinoceros (Rhinoceros unicorns):

→ Indian Rhinos are in parts of north eastern India & nepal.

→ Illegal poaching for their horns & habitat destruction are the major threats to their survival.

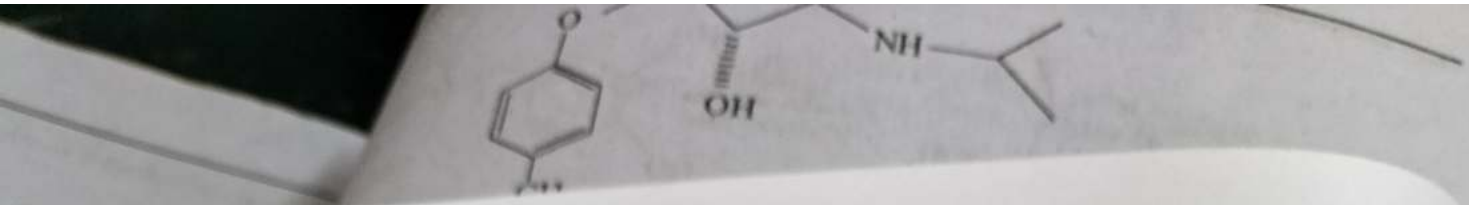
→ They inhabit protected swampy & grassland environments.

→ They browse & graze on various types of grasses, leaves aquatic plants & fruits.

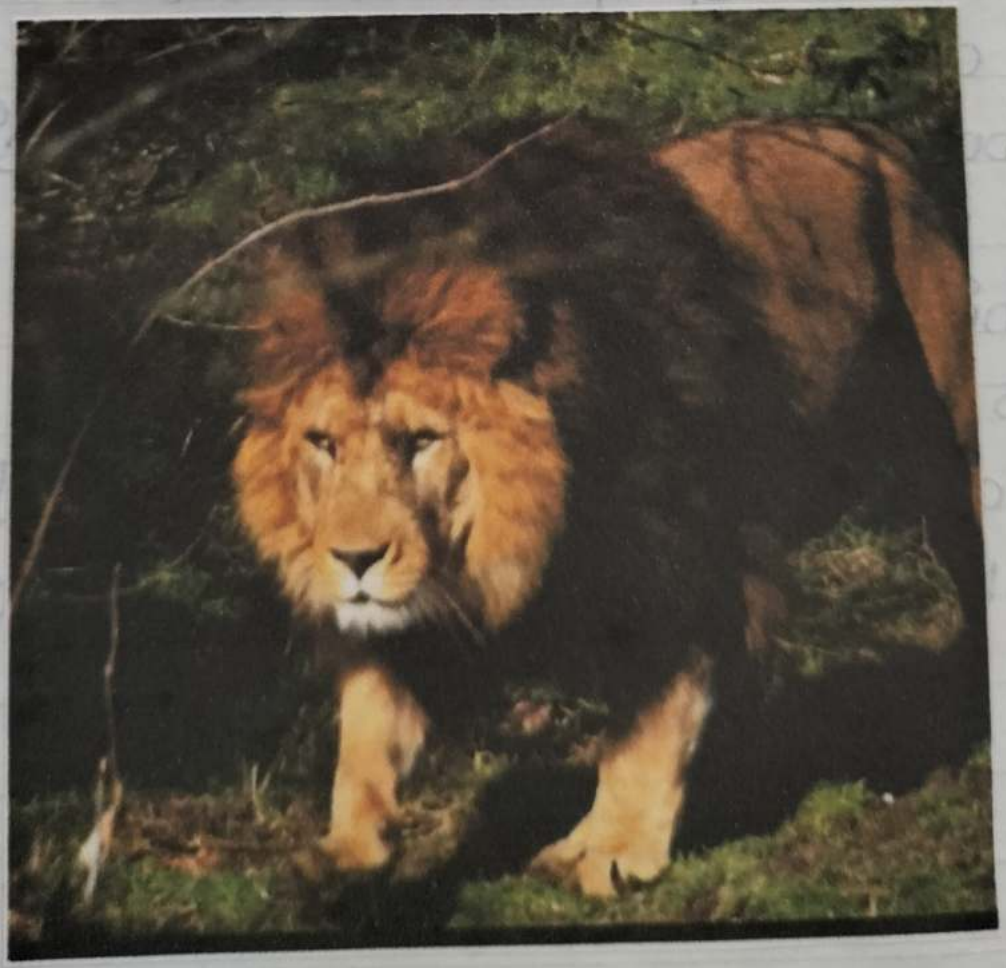
→ Their body is covered by a thick, silver-brown skin having numerous folds.

→ The rhino's horns made of keratin reaches a length of 12 to 15 inches. They have very little body hair.

→ Males are about 6 feet height at the shoulder & about 14 feet long. They weight about 3500 pounds.



Kingdom: Animalia
phylum: chordata
class: Mammalia
order: carnivora
family: Felidae



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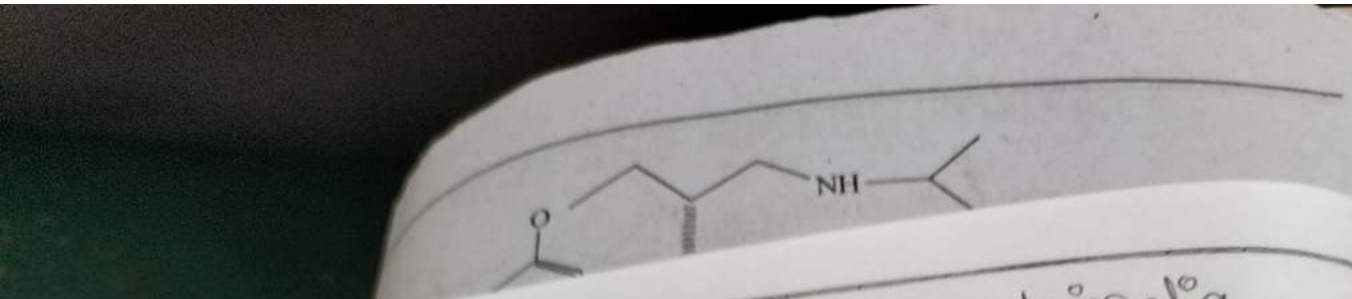
(b). Tiger (panthera Tigris):

→ Tiger belonging to the largest of the cat species.
→ They reach the length 11 feet & weight about 300 kilograms.
→ One can easily recognize tiger through the dark stripes over the orange red fur.
→ The tiger is dangerous to it, prey, with its significant large teeth & long chains.
→ Tigers originate from the asian continent.
→ Tigers usually prefer living & hunting alone. still they are very social & need large areas in which to live & hunt.
→ Tigers inhabit the forests of asian countries, turkey & russia.
→ Bengal tiger has been chosen as our country's national animal.
→ Its classification is similar to that of lion.



Kingdom: Animalia
phylum: chordata
class: Mammalia
order: carnivora
family: Ailuridae

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(i). Indian Red panda (Ailurus fulgens):

→ Panda is also called cat bear, commonly panda red fox, fox bear, lesser panda, small panda & ye.
→ Panda is slightly bigger than domestic cat & can climb trees easily.
→ It grows to a length of 50-60cm & weight between 4.5 to 6.2kg.
→ It has a long tail which is nearly 30 to 60cm.
→ The upper part of body is covered with long & soft reddish brown fur.
→ The lower part of the body is covered with black fur.
→ Pandas are nocturnal animals & sleep during the day time over the branches & hallows of trees.
→ They offer to stay alone rather than room in groups.
→ The staple diet of Indian panda consists of bamboo, berries fruits, mushrooms, roots, acrons, lichen, grasses young birds, eggs, small rodents & insects.
→ In India, the red panda is found in the wildlife

*> Pond Ecosystem *

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6. Pond ecosystem local polluted Area:

Introduction to pond ecosystem:

Definition of a pond: Ecosystem is the basic of functional unit of ecology dealing with both the living & non living factors of the environment. These factors influence the properties of each other. Both are necessary for the maintenance of life in the environment.

A pond as an ecosystem: Usually ponds are the shallow water bodies surrounded on all sides by soil having a depth of 12-15 feet sun rays can penetrate to bottom of pond thus permitting the existence & growth of flora & fauna there. Generally fresh water pond ecosystem with interacting communication of aquatic organisms is common.

Eg:- tanks, streams, lakes, ditches etc, come under this category.

The functional components of a pond ecosystem as:

i) Abiotic components of a pond ecosystem:

The abiotic environment of a pond includes both physical & chemical materials.

Different organisms obtain their nourishment from abiotic substances.

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→ These are formed as a result of various physical factors & chemical reactions occuring in the nature.
→ Besides water in large quantities, small quantities of oxygen, hydrogen, nitrogen, carbondioxide, salt of calcium potassium & sodium are present in soluble in pond water.
→ Large quantities of these elements are held in reserve solid form in the bottom sediments of the pond & in the body tissues of the organisms.
→ Physical factors like solar energy in the form of sunlight day length & temperature, substratum & other climatic conditions influence & regulate the functions of the pond ecosystem.

ii) The biotic components of pond ecosystem consists of

Producers: The producers are green plants producing food materials using solar energy, CO_2 & water. The larger rooted & floating vegetation, the macrophytes.

Eg:

Marginal emergent plants like, Typha, Ipomea, submerged plants like hydrilla, utricularia, trapa, Nymphea etc surface floating plants like pista, lemna wolffia eicchornia, salvinia etc.

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→ The microscopic floating phytoplankton: phytoplanktoons are available upto a depth of water where light penetrates.
Eg: filamentous alga like ulothrix, Anabena, oedogonium spirogyra, oscillatoria, & minute floating plants like microcystis, volvox, eudorina etc.

Consumers: consumers are heterotrophs depending for their nutrition on other organisms. Zooplanktons are the primary consumers feeding on phytoplankton. They include rotifers like Branechinous, Asplaneha, lingula crustaceans like cyclops, dilepteus, stenocypris etc. secondary consumers are netic animals feeding on primary consumers such as insects, bettles & fishes from the secondary consumers as they feed on Zooplanktons Bethic animals like snakes, big fishes live together to constitute tertiary consumers.

Decomposers: Most of the decomposers of pond ecosystem are saprophytes but some parasites are also found Bacteria, fungi like Aspergillus cladosporium, Rhizopus, Alternaria, fusarium saprolegia etc. They clean the enviroment & supply raw materials to the produce.

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Energy flow in pond ecosystem: sun is prime source of energy to any ecosystem. This is utilized by both phytoplankton & mesophytes to produce food by photosynthesis. This food passes through the organism of food chain & food web. some of the energy also reaches either as excetory products (or) as organic waste. Producers, primary, secondary & tertiary consumers & the decomposers consume energy in the form of food & reach the environment then they die.

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Study of a local polluted Area:

Any slum (or) a place having unhygienic conditions (or) a place where.

i) pollutants are common (or)

ii) a pond having unusable water (or)

iii) an industry where pollutants are released into the environment.

→ They can prepare a report on the polluted area along with photographs, for guidance one such polluted area is presented here with.

An Industrial Area: Any industrial are will definitely release the air, water, terrestial & solid wastes pollutants either directly (or) indirectly into the environment. Air pollution is caused by co from fuel combustion from vehicles & engines, Ground-level ozone, lead(pb) from smelters (metal refineries) & other metal industries & battery manufacturing Nitrogen dioxide (NO_2) from fuel combustion & water burning particulate Matter (PM) formed through chemical reactions, fuel combustion, industrial process, farming & unpaved roads or during constructions.

Terrestrial pollution: It is caused by plastics, sewage, dust particulate matter, organic & inorganic chemicals coming from agricultural land & industries solid wastes etc.

surface & ground water pollution: It is caused by hazardous chemicals released from the industries as efficients, nutrients, fertilizers, pesticides, oil spills, plastics can cause serious health problems. Besides these common problems from sound pollution, rise in temperature of water due to thermal pollution.

Prevention, Monitoring & solution: Government of itself & through the help of self help groups non-governmental organizations, student volunters & press should take up mass awareness programmers. Besides it can pass & exact stinct laws for implementation by the establishing industries in the begining itself. In many big cities, monitoring equipment has been installed at many points in the city authorities read them regularly to check the quality of air. Reduce the pollutants from the domestic & automotive usage to the extent possible wise & judicial usage of energy.

*> Zoo Geography *>

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Zoo Geographical Regions:

a) Palaearctic Region & its fauna:

This region enjoys high rate of fluctuations both in temperature & in rainfall. Hence it supports temperature & good fauna. It includes polar artic region. This region has 11 sub-regions

i) European sub-region: Northern & central Europe black sea & caucasus are included in it. It inhabits 35 families of vertebrates.

ii) Mediterranean sub-region: Remaining parts of europe, africa & arabian portions are included in its 18 families of vertebrates are included in it.

iii) Siberian sub-region: Northern asia, himalayas are included in it. 9H families of vetebrates are included in it. 9H families of vertebrates are included in it.

iv) Manchurian Sub-region: Mangolia, Japan, korea & manchurian are included in it. Fauna of region is represented by.

Fishes: Paddle fishes in china, cyprinus, Anabas & sucker fish (Echenis)

Amphibians: Frogs like discoglassus, bufo, hyla salamanders like proteus, megalobatrachus.

Reptiles: Snakes like natrix, dasypeltis, Typhiops, true pit vipers, colubrids lizards like monitor, tortoise like testudo.

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Birds: Birds like hawks, cukoos, rails, finches, crows parrots are absent. Birds like upupa & pastor are specific

Mammals: camel, deer, wolf, horse, pig, hedgehog like mammoths, fruits bats, panthera tecos, deer bearers, dog, squirels, Rabbits, Mice, bats, Hyaena, great panda. Myogale is the only one genus of mammal specific to this region.

*) North-American Region *

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(b) Neoarctic region & its fauna:

The region above tropics of north america is neoarctic region. Towards north is includes new found land the arctic archipelago & greeland. This region is known is "Head quaters of wodeles".

i) Neoarctic region shows great variations in climatic conditions.

ii) In the north greenland, frozen ice is seen.

iii) Range of mountains extended from north to south.

iv) In the south coast of north america deserts are present in this region is divided into 4 sub-regions

1. California sub region: A part of north america, nevada, cascade ranges part of british, columbia, nearly 86 families of vertebrates are represented here.
2. Rocky mountain sub-region: Mountains of east california.
3. Alleghasy sub region: Rocky mountains region, lakes of eastern parts of USA.
4. Canadian sub region: Remaining parts of north america & greenland. Fauna of the region includes.

Fishes: Cat fishes, goopika, paddle fishes & aplin-dants.

Amphibians: Amphiuma, salamander, bufo, Hyla & Rana.

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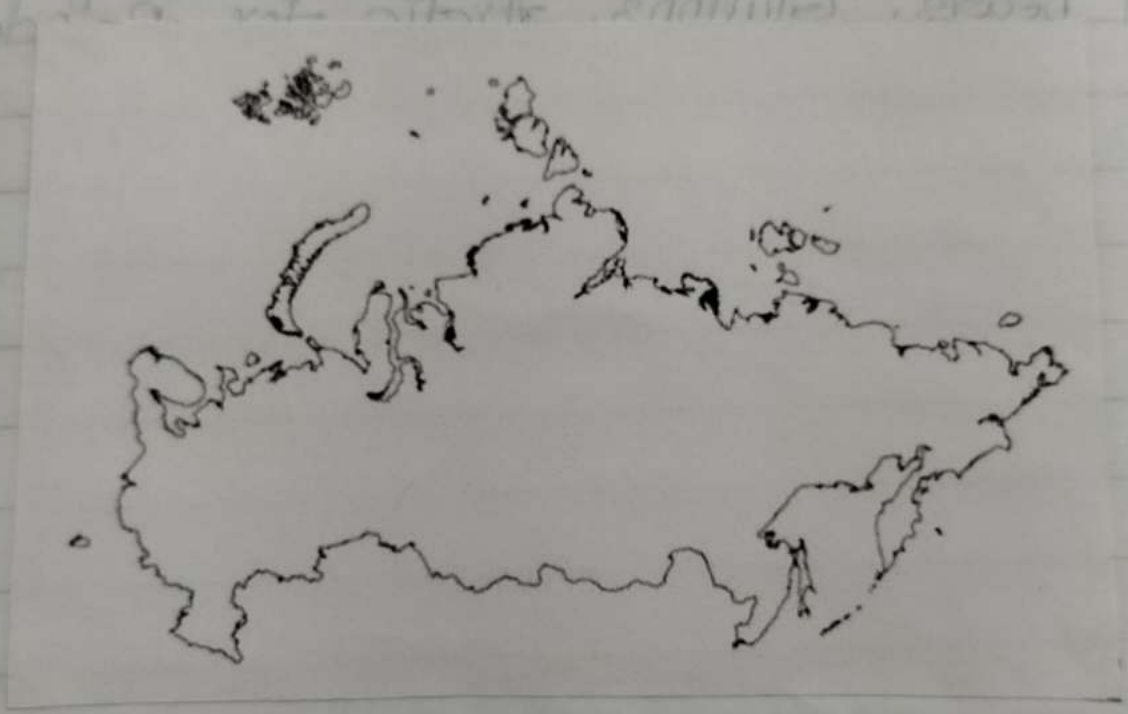
Reptiles: Musk turtle, Trionyx, Emydines, vipers like pipturophis, causphis & chilomeniscus, Alligators

Birds: pelicans, heron, humming birds, woodpecker fly catches making birds, larks & sand-pipers

Mammals: squirrels, Moles, rabbits, cats, deers, bears, weasels, opposum, vampires, Free-tailed bats, bison, polar bears, Gluttons, Arctic-fox, Reinder & armadillo



*) Neotropical Region

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c. Neotropical Region [Birds continent]:

This region includes S. America, central america, mexico & the west Indias.

climate: Mostly tropical but temperature zones are also present at the southern part of south america. varied environmental conditions facilate luxuriant evergreen forests of amazon, deserts, grassy plains of argentina, Andes mountains & rivers. This is divided into 4 sub-regions.

1. chillian sub region: West coast of south america. It contains andes mountain ranges, bolivea, peru, argentina.
2. Brazelian sub-region: Tropical forests of south america, evergreen forests & plains, rivers.
3. Mexican sub-region: North of isthmus of panama is called mexican sub region with sub. Tropical condition & the Rocky mountains.
4. West Indies sub region: West indies, islands except trinidad & tobago having mountains. This sub-region has poorly represented vertebrate fauna is poor.

fishes: Fresh water fishes, cat fishes, trygonids, edible fishes, lepidosiren.

Amphibians in Neotropical Region: Frogs like pipa pipa, buto, hyla, Rana etc caecelians likes siphonophis, Rainotrema, urodeles are very few.

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Reptiles: The reptiles of the sub-region will resemble those of ethiopian & oriental zone. crocodiles, alligator turtles, mudterrapins, tortoises. Heiodermidae, Andidae, cryptosauridae etc, are special to these region, coral snakes, pit vipers, typhlops

Birds in Neotropical regions: Avian fauna of this region is striking & peculiar. Hence south america is called Bird continent. Rhea americana, Tinamus, ducks, pigeons, parrots, swifts, wood pecker's, kingfishers, storks, flamas & oil birds, Ant threshers, tree creepers oil birds are special & endemic to this region only.

Mammals in Neotropical regions: American monkey, blood sucking bats, armadillos, Tapiers, Hapalidae, cebidae etc. families of neo world monkeys, armadillos sloths ant eaters, didelphis etc, lamas, deer, rabbits squirrels.

This region is not represented by carp fishes Hayeans, Hedge-hog & native horses.

* Africa Region *

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d. Ethiopian Region:

In this realm africa, sahara desert, southern part of arabia, madagascar islands are included. This region has extensive sahara desert on its north side & thick forests on the west. Rest of africa shows green land. This ethiopian region was divided into 4 sub-region.

1. East African sub-region: This region includes tropical africa & arabia are present, because of high temperature desert conditions are available. Sahara desert is included in the region. In this region desert animals are included Giraffee, Zebra, camel, ostrich etc, are common.

2. West African sub-region: This region shows thick forest River congo is included in this region. It shows peculiar fauna.

3. South African sub-region: This southern part of the african continent is included in this region. It shows peculiar fauna.

4. Malagasy sub-region: It includes madagascar & near by islands. This islands was separated from the main land after the development of lemurs. Its fauna shows dissimilarity with the fauna of the main land

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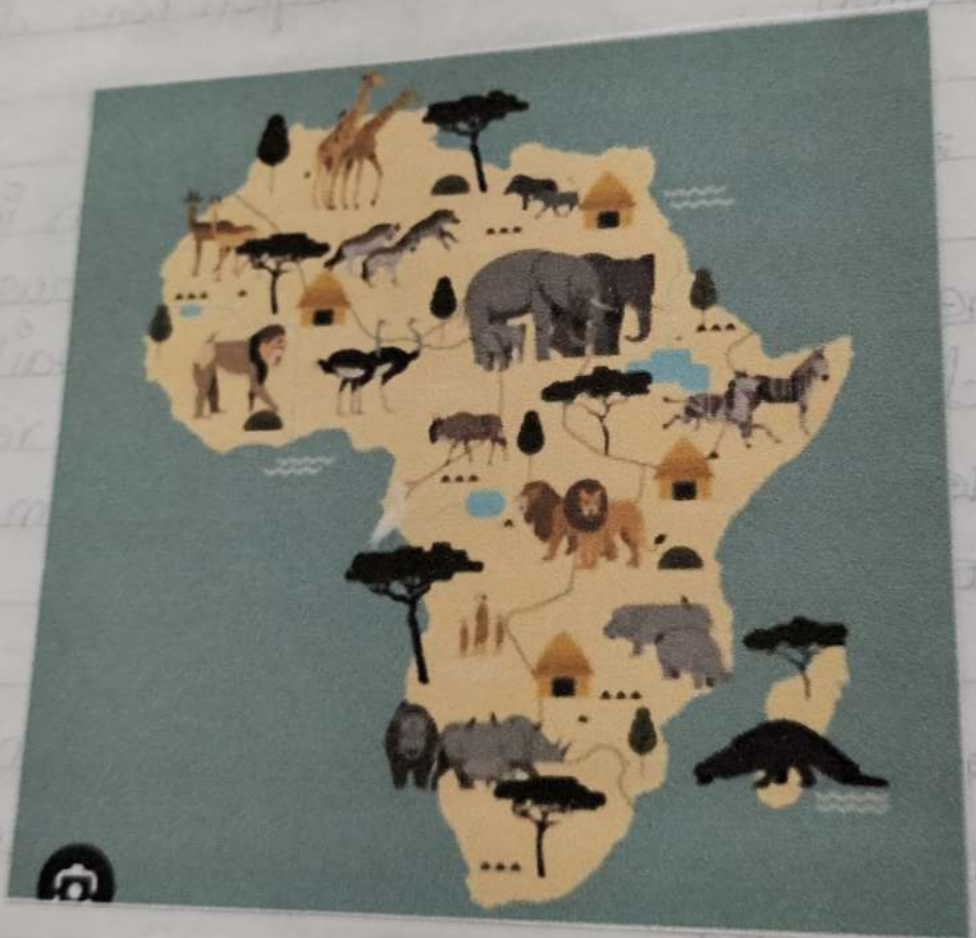

*) Ethiopian Region of Flora & Fauna

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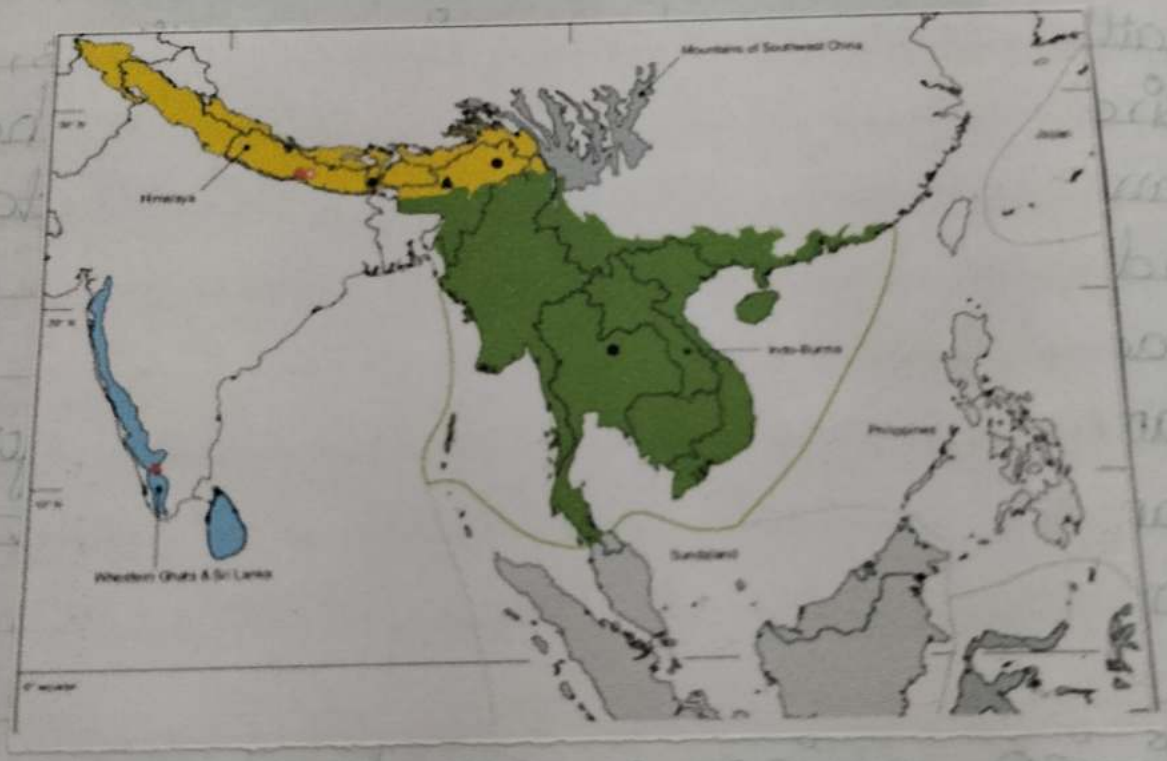
Fishes: Fish fauna is diverse. Protopterus shoaka, lung fishes, cat fishes, cyprinids & electric fishes
Amphibians: cicalians, in abudance, Anura, Rhacophorus, byla, microphyla, Xenopus.

Tailed amphibians are absent:

Reptiles: chamaelon, crocodiles, testudo, trionyx, gecko, rattle snakes, cobras, vipers, pythons, typhlops
Birds: Two toed ostrich, horn bills, heron, pigeons, parrot, cuckoos, storks, & finches etc. some exclusive birds of this region are ostriches, pittedae, hammer headed birds & mouse birds etc.
Mammals: Aye eye, galeopithicus, gorilla gorilla, chim panjee, gibbon, equs equs, elephant panthera tigers, panthera less, Assienomyx, camelus, equs asinus

Ethiopian region mammals show resemblances with mammalian fauna of oriental region because they had land connection previously.



* Oriental Region *

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5. Oriental Region:-

This region includes Indian sub-continent, ceylon, burma & philippines, formosa Himalayas are present towards north. On the west of its arabian sea. No physical boundary towards North. south east corner. This region includes 11 sub regions. This region shows tropical & temperature zones. In the north east asia rain forest is present while a desert is present while a desert is present of the west. The remaining part shows plains & rivers. varied climatic conditions supports rich fauna & flora.

1. Indian sub-region: It includes North India & central point. it starts from the root of himalaya & extend upto malabar cost. This region shows plains & deserts it shows temperature & tropical conditions
2. ceylonian sub-region: It includes srilanka
3. Indo-china sub-region: It includes china & south of Palaearctic region.
4. Indo-Malayan sub-region: It includes malayan peninsula & surrounding islands. This region supports 132 families of fauna gibbon, rhinoceros, badger, broad bills etc. are very common in this region

Fauna of oriental Region: The fauna of oriental region shows resemblances that of ethiopian region, Hence some zoogeographists have attempted to place

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ethiopian & oriental regions in palaeo tropical region.

Fishes: Oriental fishes fauna is dominated by carps & cat fishes, notopterus, Anabas, syngnathus, cyprinus etc.

Amphibians: only one genus of uodela, Tylototriton, verru-cosus is exclusive. Besides, anuarans & apodans are more. Rana species, hyla, Rhacophorous, bufo members of discoblastidae, Ichthyophis, uaerityphlus Gegenophis etc

Reptiles: Lizards, snakes, turtles & crocodiles, gavialis, Gecko, chamelon, varanus, python, typhlops, Testudo, cobra etc, In this region xenopeltidae, uopetidae forms are exclusive.

Birds: Honey guides, wood pecker, horn bill, pea-cock etc.

*) Australian Region *)

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(f). Australian Region:

Australian region includes australia, New zealand, New guinea & nearby islands in the pacific ocean. Wallace includes celebas islands in australian region. But now-a-days it was kept in oriental region Australia -n region is divided into 4 sub-regions.

(i). Australian sub Region:

It includes australian & Tasmania. This region is loca-ted towards south west of pacific ocean. since the part is repeated from the main land by a big strech of ocean, it shows tropical & temperature climate.

ii) Austromalayan sub-region: This region includes malay-an carchepelago islands, new guinea, solmon island etc, crowned pigeons, river, turtles are commen Dendrolagus dasyurus etc, marsupials are present.

iii) Polymesian sub-region: This region includes polyme-sian islands. In this region fauna is poor. Tooth build pigeons are common.

Animal map

** Zoogeography of Australian Region *

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Rats & Bats are common:

=Fauna— Many zoogeography workers thought that australia & america might have connected by a land mass. This landmass is called "Gondwana land mass" After sometime this gondwana landmass was sub merged. Australia is seperated. Hence australian fauna become isolated.

Mammals: Ornithorbynchus, macropus, dasypus, paramdes dendrologus, pteropus, echinda, latus ratus, equs equs equs asinus, sus.

Reptiles: Newzealand snakes are absent but has sphenodon, varanus, trionyx, testudoelegans, caretta, chamaeleon calotes versicolor, mabuya etc.

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