

SECTION – A

(Q. Nos. 1 - 5 are of one marks each)

1. Give one reason to justify statutory ban on amniocentesis.

Ans. Check/prevent female foeticide.

[1 Mark]

2. Name a human genetic disorder due to the following :

- (a) An additional X-chromosome in a male
(b) Deletion of one X-chromosome in a female

Ans. a) Klinefelter's Syndrome

b) Turner's Syndrome

= $\frac{1}{2} + \frac{1}{2}$
[1 Mark]

OR

State what does aneuploidy lead to.

Individuals with abnormal number of chromosomes / Down's Syndrome / Turner's Syndrome / Klinefelter's Syndrome (or any other correct example)

[1Mark]

3. Mention one example each from plants and animals exhibiting divergent evolution.

Ans. Thorn of Bougainvillea and tendrils of Cucurbita ,
forelimbs of whales , bats, cheetah and humans (all mammals) / vertebrate hearts / vertebrates brains
(Any one) /Any other correct example

= $\frac{1}{2} + \frac{1}{2}$

[1Mark]

4. Name any two physiological barriers that provide innate immunity ?

Ans Acid in Stomach/Saliva in mouth/tears in eyes (Any two)

= $\frac{1}{2} + \frac{1}{2}$

[1 Mark]

OR

Select two disease resistant crop varieties from the list of crop varieties given below:

Himgiri, Pusa Gaurav, Pusa Komal, Pusa A-4

Ans Himgiri; Pusa Komal

= $\frac{1}{2} + \frac{1}{2}$
[1 Mark]

5. Give two reasons as to why a weed such as Calotropis flourishes in abandoned fields.

Ans. Dry hairy seeds help in dissemination / having xerophytic adaptations (thick hair on leaves & stems) / not grazed by animals as it produces poisonous substances / cardiac glycosides (any two)

$\frac{1}{2} + \frac{1}{2} = 1$
[1 Mark]

SECTION B

(Q Nos. 6-10 are of two marks each)

6. Mosses and frogs both need water as a medium for fertilisation. Where does syngamy occur and how is it ensured in both these organisms ?

Ans Frog - External fertilization / in water / outside the body, release of motile gametes / large number of gametes / synchronised maturation of ova and sperms = $\frac{1}{2} + \frac{1}{2}$

Moss - Internal fertilization / inside the body of organism, male gametes are motile / large number of gametes.

= $\frac{1}{2} + \frac{1}{2}$
[2 Marks]

OR

Write the basis of categorising animals as oviparous or viviparous, giving one example of each.

Ans. Egg laying (fertilised or unfertilised), e.g. reptiles / birds / any other correct example = $\frac{1}{2} + \frac{1}{2}$

Give birth to young ones, e.g. majority of mammals / humans / any other correct example = $\frac{1}{2} + \frac{1}{2}$

[2 Marks]

7. (a) You are given castor and bean seeds. Which one of the two would you select to observe the endosperm ?

(b) The development of endosperm precedes that of embryo in plants. Justify.

Ans. (a) Castor = 1

(b) endosperm stores reserve food materials / provides nutrition to the developing embryo = 1

[2 Marks]

8. A segment of DNA molecule comprises of 546 nucleotides. How many cytosine nucleotides would be present in it if the number of adenine nucleotides is 96 ?

Ans. $A + T = C + G$, Given $A = 96$ so $T = 96$, and $A + T = 192$
 Given total Nucleotides = 546
 $G + C = 546 - 192 = 354$ because $G = C$ so $C = 354 / 2$,
 Cytosine = 177

[2 Marks]

9. How is 'somatic hybridization' carried out ? Mention one example of a somatic hybrid.

Ans. Isolation of protoplast by digesting cell wall, Fusion of isolated protoplast of different varieties of plants with desired traits, Formation of hybrid protoplast which is further grown to form to new hybrid plant, e.g Pomato (fusion of potato & tomato)

[2 Marks]

10. How are DNA fragments visualised during gel-electrophoresis ? What is elution ?

Ans. Separated DNA fragments stained with ethidium bromide, followed by exposure to UV radiations, removal of DNA bands from agarose gel, and its extraction from gel is elution

[2 Marks]

11. A corn farmer has perennial problem of corn-borer infestation in his crop. Being environmentally conscious he does not want to spray insecticides. Suggest solution based on your knowledge of biotechnology. Write the steps to be carried out to achieve it.

Ans. Isolation of Bt toxin genes from *Bacillus thuringiensis*, incorporated into corn, toxin coded by gene cry IAb in corn, kills the pests/ pest dies.

[2 Marks]

12. State 'two' observations made by German naturalist, Alexander von Humboldt during his extensive explorations in South American jungles.

Ans. Within a region species richness increases with increasing explored area but only upto a limit, this relation for a wide variety of taxa turns out to be a rectangular hyperbola.

= 1 + 1
 [2 Marks]

OR

If in a population of size 'N' the birth rate is represented as 'b' and the death rate as 'd', the increase or decrease in 'N' during a unit time period 't' will be :

$$\frac{dN}{dT} = (b - d) \times N$$

The equation given above can also be represented as :

$$\frac{dN}{dT} = r \times N \text{ where } r = (b - d)$$

What does 'r' represent ? Write any one significance of calculating 'r' for any population.

Ans r = intrinsic rate of natural increase , it is an important parameter for assessing impacts of any biotic or abiotic factor on population growth . = 1 + 1

[2 Marks]

SECTION C

(Q Nos. 13 - 24 are of three marks each)

13. When and where do tapetum and synergids develop in flowering plants ? Mention their functions.

Ans Tapetum- Microsporogenesis ,Microsporangium(Anther), nourishes the developing pollen grains.

Synergids -Megasporogenesis, Megasporangium(ovule), synergids have filiform apparatus to guide the pollen tube into it. $\frac{1}{2} \times 6$

[3 Marks]

OR

Where are the following structures present in a male gametophyte of an angiosperm ? Mention the function of each one of them.

(a) Germ pore

(b) Sporopollenin

(c) Generative cell

Ans (a) Germ pore- Pollen grain exine , site from where pollen tube emerges .

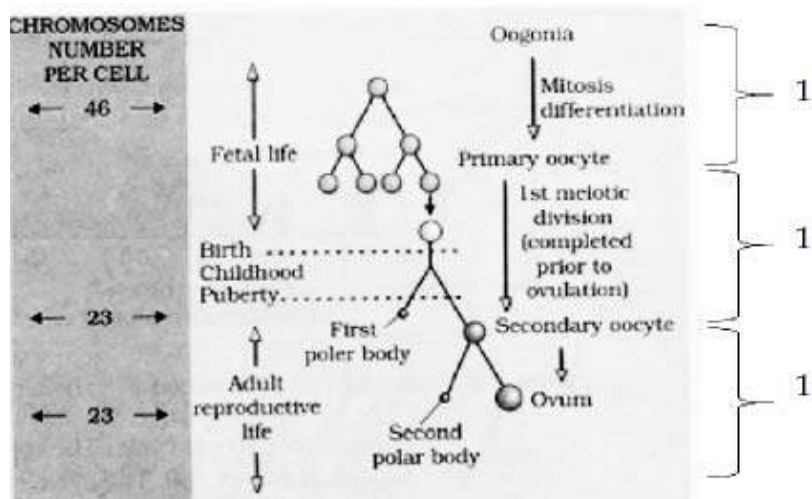
(b) Sporopollenin-Exine of pollengrains , protects the pollen grains from high temperature / and strong acids & alkali / enzymes / adverse condition

(c) Generative Cells - Pollen grains , give rise to two male gametes

$\frac{1}{2} \times 6$
[3 Marks]

14 Construct a flow chart exhibiting sequential events of oogenesis.

Ans

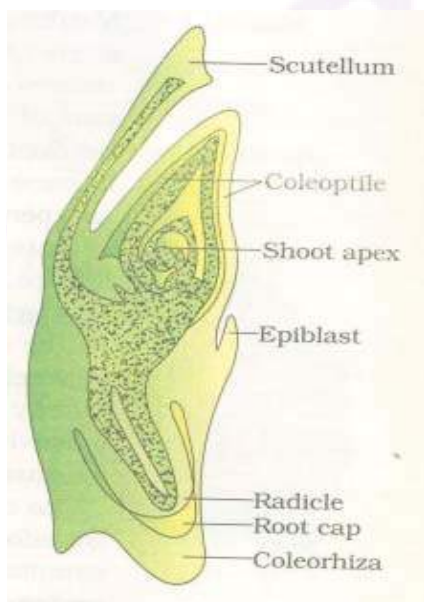


1 × 3

[3 Marks]

15. Draw L.S. of an embryo of grass and label its parts.

Ans



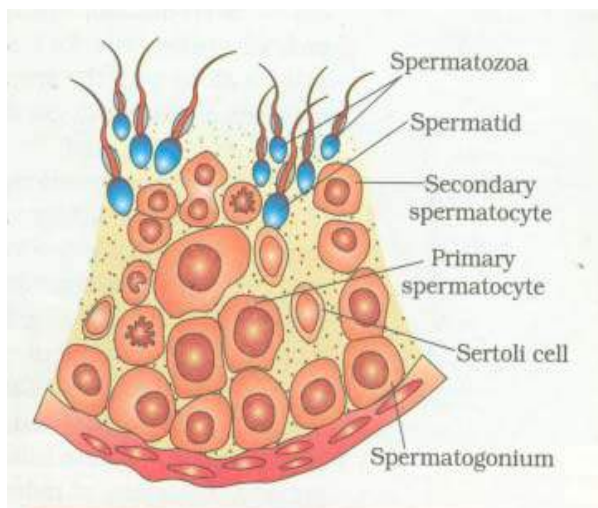
1 × 3

[3 Marks]

(Any Three Correctly Labelled Parts)

OR

Draw a diagrammatic sectional view of a seminiferous tubule (enlarged) in humans and label its parts.



(Any Three Labelled Parts)

= 1 × 3

[3 Marks]

16. (a) How does mutation occur ?

(b) Differentiate between point mutation and frameshift mutation.

Ans (a) Loss(deletion) or gain (insertion / duplication /addition) or change in position of DNA segments / chromosome

= 1

(b) mutation due to change in a single base pair of DNA is point mutation,

=1

Insertion or deletion of one or two bases changes the reading frame from the point of insertion or deletion

= 1

[3 Marks]

17. "Use of heavy isotope of nitrogen by Meselson and Stahl demonstrated semi-conservative mode of replication of a DNA molecule." Explain how did they arrive at this conclusion.

Ans Grown *E.coli* in $^{15}\text{NH}_4\text{Cl}$ for many generations to get ^{15}N incorporated into DNA , then the cells are transferred into $^{14}\text{NH}_4\text{Cl}$, The extracted DNA are centrifuged in CsCl and measured to get their densities , DNA extracted from the culture after one generation (20 minutes) , showed intermediate

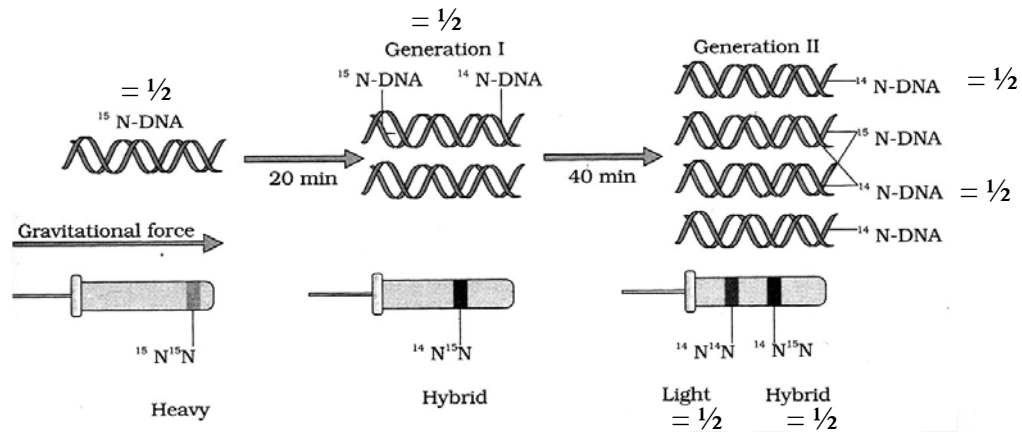
hybrid density, DNA extracted after two generations (40 minutes) showed light DNA and hybrid DNA

$$= \frac{1}{2} \times 6 = 3$$

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A correctly labelled diagrammatic representation in lieu of the above explanation of experiment to be considered

$$= 3$$



[3 Marks]

OR

Explain the mechanism of translation that occurs in the ribosomes in a prokaryote.

Ans Charging of tRNA / aminoacylation of tRNA ,

small subunit of ribosome binds to mRNA (5'end) ,

for initiation the ribosome binds to the mRNA at the start codon (AUG) that is recognised only by initiator tRNA,

In the elongation phase amino acid with tRNA sequentially bind to the appropriate codon on mRNA(forming complimentary base pairs with tRNA anticodon),

Ribosome moves from codon to codon along the mRNA and amino acids are added one by one in the two sites of the large subunit joined by peptide bond ,

Termination occurs when a release factor binds to the stop codon and releases the complete polypeptide.

$$\frac{1}{2} \times 6$$

[3 Marks]

18. According to Darwinian theory of natural selection the rate of appearance of new forms is linked to the life-cycle or the life-span of an organism. Explain with the help of an example.

Ans A colony of bacteria (say A) growing in a given medium has built in variation in terms of ability to utilise a feed component, a change in the medium composition would bring out only that part of the population(say B) that can survive under the new conditions , = 1+1

In due course of time this variant population outgrows the others and appears as new species thus organisms with shorter life-cycle or life-span will undergo evolution faster / for the same thing to happen in fish or fowl would take millions of years as life spans of these animals are in years. =1

[3 Marks]

19. (a) Name the causative agents of pneumonia and common cold.
- (b) How do these differ in their symptoms ?
- (c) Mention two symptoms common to both.

Ans (a) *Streptococcus pneumoniae*/ *Haemophilus influenzae*, Rhinoviruses = $\frac{1}{2} + \frac{1}{2}$

(b) Different symptoms (any two) = $\frac{1}{2} + \frac{1}{2}$

Pneumonia	Common cold
Infects alveoli of lungs	Infects nose & respiratory passage
chills	Sore throat
Lips /fingers may turn grey to black	Hoarseness

(c) Common symptoms (any two) = $\frac{1}{2} + \frac{1}{2}$

Pneumonia	Common cold
Cough	Cough
Headache	Headache

[3 Marks]

OR

- (a) Write the scientific names of the causative agent and vector of malaria, and write its symptoms.
- (b) Name any two diseases spread by *Aedes* sp.

Ans (a) *Plasmodium vivax* / *P. falciparum* / *P. malariae*, vector-Female *Anopheles* mosquito = $\frac{1}{2} + \frac{1}{2}$

Symptoms - chill , high fever = $\frac{1}{2} + \frac{1}{2}$

(b) Dengue, Chikungunya (or any other correct example) = $\frac{1}{2} + \frac{1}{2}$

[3 Marks]

20. (a) Differentiate between inbreeding and outbreeding.

(b) List any three advantages and one important disadvantage of inbreeding practice in animal husbandry.

Ans (a) Inbreeding - Mating of more closely related individuals within the same breed for 4-6 generations.

Outbreeding- Breeding of unrelated animals may be of the same breed, but having no common ancestors for 4-6 generations/ different breeds/ different species. $= \frac{1}{2} + \frac{1}{2}$

(b) Advantages- develops pureline / increase homozygosity, accumulation of superior genes, elimination of less desired genes. $= \frac{1}{2} \times 3$

Disadvantages- Reduces fertility/ causes inbreeding depression. $= \frac{1}{2}$

[3 Marks]

21. Name the most commonly used bioreactor in biotechnology labs. Mention the most essential components this bioreactor must have so as to provide the optimum conditions to the culture medium, resulting in production of large volume of desired product.

Ans Stirring type $= \frac{1}{2}$

agitator system, O_2 delivery system, foam control system, temperature control system, pH control system $\frac{1}{2} \times 5$

[3 Marks]

22. A child is born with ADA-deficiency

(a) Suggest and explain a procedure for possible life-long (permanent) cure.

(b) Name any other possible treatment for this disease.

Ans (a) Gene therapy, lymphocytes from the blood of a patient are grown in a culture outside the body, functional ADA cDNA is introduced into these lymphocytes, these cells are returned to the patient's body at early embryonic stage. $= \frac{1}{2} \times 4$

(b) Bone marrow transplantation, enzyme replacement therapy $\frac{1}{2} + \frac{1}{2}$

[3 Marks]

23. Differentiate between an 'Expanding age pyramid' and a 'Stable age pyramid'. Substantiate your answer with diagrams.

Ans

Expanding age pyramid	Stable age pyramid
Population of pre-reproductive age is greater than population of reproductive age	Population of pre-reproductive age equals to population of reproductive age

$$= \frac{1}{2} + \frac{1}{2}$$



$$1+1$$

[3 Marks]

- 24. Analyse the effects of 'Alien species invasion' on the biodiversity of a given area. Provide two examples.**

Ans Introduction of alien species causes decline or extinction of indigenous species due to tough competition for utilization of resources =1

Examples:

Introduction of Nile perch in lake Victoria led to extinction of more than 200 species of Cichlid fish / Introduction of African cat fish (*Clarias gariepinus*) for aquaculture poses threat to indigenous catfish/ Threat posed to native species by invasive exotic weeds like carrot grass (*Parthenium*) / Lantana and water hyacinth (*Eichhornia*) /Extinction of Abingdon tortoise by introduction of goat.
(any two) 1+1=2

[3 Marks]

SECTION D

(Q. Nos. 25 - 27 are of five marks each)

- 25. Mendel crossed a homozygous pea plant having yellow and round seeds with another pea plant bearing green and wrinkled seeds. He found that in some of the F_2 population new combination of parental characters were observed.**

How will you explain the appearance of a new combination of parental characters in F_2 -offsprings ? Support your answer with the help of Punnett square.

Ans

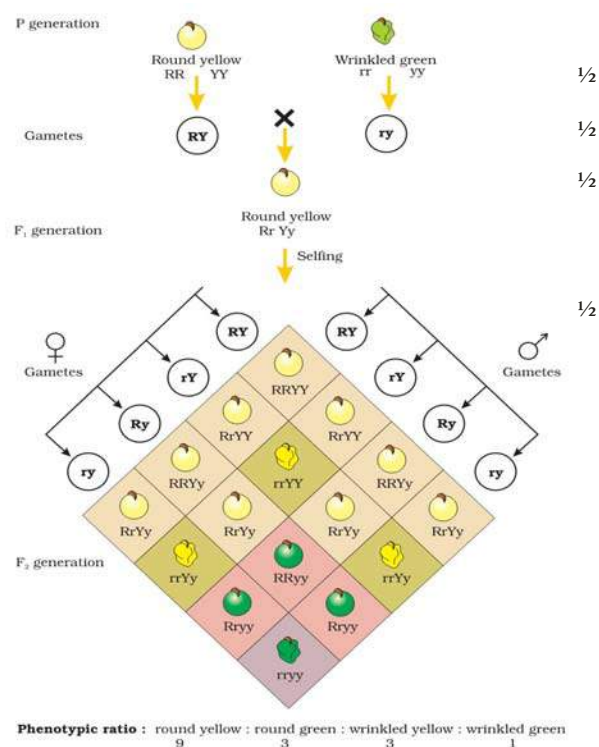


Figure Results of a dihybrid cross where the two parents differed in two pairs of contrasting traits: seed colour and seed shape

2 marks for Punnett Square

When two pairs of traits are combined in a hybrid segregation of one pair of character is independent of the other pair of the characters. = 1

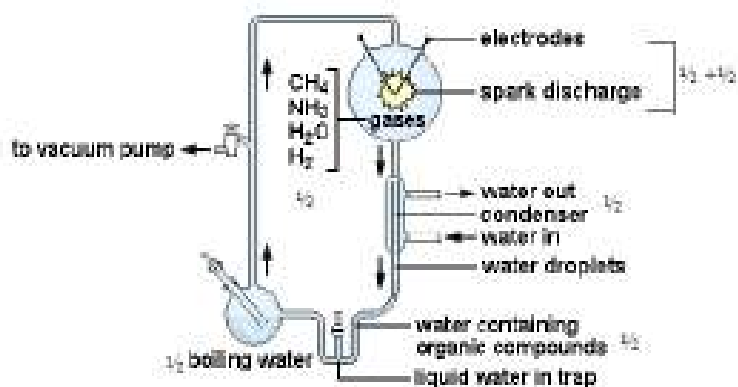
[5 Marks]

OR

Describe S.L. Miller's experiment. Comment on the observations he made and his contribution towards the origin of life on Earth.

Ans High temperature (800°C), high energy radiation, reducing atmosphere created, by electric discharge in a closed flask, containing $\text{CH}_4 + \text{H}_2 + \text{NH}_3$, and water vapours in the experimental setup.

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(Labelling on diagram to be awarded marks in lieu of explanation)

$\frac{1}{2} \times 6 = 3$

Observation and Contribution -

- Formation of amino acids
- The first form of life arose slowly through evolutionary forces from non- living molecules/ abiogenesis.

1+1

[5 Marks]

26. (a) **Differentiate between active and passive immunity.**
- (b) **Comment on the role of vaccination and immunization in keeping human population healthy.**

Ans (a)	Active immunity	Passive immunity
	Production of antibodies on exposure to antigen in host body	Introduction of readymade antibodies to protect against pathogen
	Slow process and takes time to give full effective response	T lymphocyte production is fast and responds quickly by checking growth of pathogen
	Natural infection induces active immunity	Inoculation of pathogen in other organisms synthesizes antibodies which are isolated and used for vaccination

(Any two) 1 + 1

- (b) **Role of vaccination / immunization:**

- Antibodies produced in body against antigen neutralizes pathogenic agents.
- Vaccines also generate memory cell (B and T cells) that recognize quickly on subsequent exposure and controls growth of pathogen with massive production of antibodies
- preformed antibodies/ antitoxin protect our body from deadly microbes like tetanus and against snake venom

1×3 = 3

[5 Marks]

OR

Describe the process of secondary treatment given to municipal waste water (sewage) before it can be released into fresh waterbodies. Mention another benefit provided by this process.

Ans Process of secondary treatment :

Passing of primary effluent into large aeration tank which is constantly agitated mechanically & air is pumped into it that allows vigorous growth of useful aerobic microbes into flocs



Microbes consume major part of organic matter in effluent which significantly reduces BOD



Now effluent is passed into settling tank where flocs are allowed to settle/ sediment called activated sludge



Digestion of activated sludge by anaerobic microbes and effluents from secondary treatment can be released into river/ stream.



Resulted in production of Bio gas (CH_4 , H_2S and CO_2) which can be used as source of energy

1 × 5 = 5

[5 Marks]

- 27. A plastic sack manufacturer in Bengaluru, Ahmed Khan has managed to find an ideal solution to the problem of plastic waste. Explain in five steps the efforts of Ahmed Khan to meet the challenges of solid waste management.**

Ans Developed polyblend- a fine powder of recycled modified plastic 1

Polyblend mixed with bitumen and used to lay roads (in collaboration with R V engineering college and Bangalore city corporation) 1

It enhanced water repellent property of bitumen and increase the road life . 1

Khan offered a price to rag pickers which enhanced their income and improved their livelihood.

1

Thus solid waste management was achieved by removal and proper disposal of plastic waste from the city

1

[5 Marks]

OR

(a) What does an ecological pyramid represent ? State any two limitations that these pyramids have.

(b) Describe an inverted pyramid of biomass with the help of an example.

Ans (a) Ecological pyramids represent the relationship between different trophic levels in terms of number ,biomass or energy

1

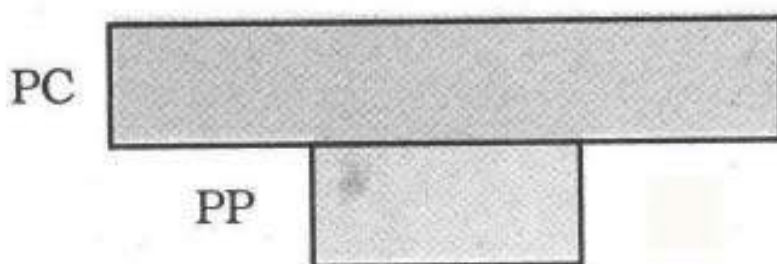
Limitations of pyramid:

It does not takes into account the same species belonging to two or more trophic levels / It assumes a single food chain which almost never exists in nature / It does not accommodate a food web / Saprophytes are not given any place even though they play vital role in the ecosystem.

(any two) $1 \times 2 = 2$

(b) The pyramids of biomass in aquatic ecosystem/ sea is generally inverted

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1

e.g biomass of fishes is much more than biomass of phytoplanktons.

1

[5 Marks]