CBSE Class 12 Biology

Sample Paper 10 (2020-21)

Maximum Marks: 70

Time Allowed: 3 hours

General Instructions:

i. All questions are compulsory.
ii. The question paper has four sections: Section A, Section B, Section C and Section D. There are 33 questions in the question paper.
iii. Section–A has 14 questions of 1 mark each and 02 case-based questions. Section–B has 9 questions of 2 marks each. Section–C has 5 questions of 3 marks each and Section–D has 3 questions of 5 marks each.
iv. There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
v. Wherever necessary, neat and properly labeled diagrams should be drawn.

Section A

1. How many sperms will be produced from 100 primary spermatocytes and how many eggs will be produced from 100 primary oocytes?
2. Why does **Swiss cheese** have big holes?
3. State a difference between a gene and an allele.
4. Name the STDs which can be transmitted through contaminated blood.
5. What is cistron?
6. British geneticist R.C. Punnett developed a graphical representation of a genetic cross called Punnett Square. Mention the possible result of this representation predicted in the genetic cross carried.
7. Write the number of chromosomes body cells of honey bee workers and drone have.
8. How does the infection is different from infestation?
9. How is the presently occuring species extinction different from the earlier mass extinctions?
10. Name the scientists who were credited for showing the role of Penicillin as an antibiotic?

11. **Assertion:** An organism with a lethal mutation may not even develop beyond the zygote stage.
    Reason: All types of gene mutations are lethal.
    a. The assertion is a true statement but the reason is false.
    b. Both assertion and reason are true and the reason is the correct explanation of the assertion.
    c. Both assertion and reason are true but the reason is not the correct explanation of the assertion.
    d. Both assertion and reason are false.

OR

Assertion: The cross between red and white flower bearing snapdragon plants results in a pink coloured flower.
Reason: Incomplete dominance of red and white flower results into pink coloured flower.
    a. Both assertion and reason are correct.
    b. The assertion is correct but the reason is incorrect
    c. The assertion is incorrect but the reason is correct.
    d. Both assertion and reason are incorrect.
12. **Assertion**: The secondary host of *Taenia solium* is a pig.
    Reason: Malarial parasite completes its life cycle in the blood of human beings alone.
    a. The assertion is correct but the reason is wrong
    b. Both assertion and reason are correct
    c. Both assertion and reason are wrong
    d. The assertion is incorrect but the reason is correct.
13. **Assertion:** Each spermatogonium is diploid and contains 46 chromosomes.
    Reason: Some spermatogonia, primary spermatocytes complete the meiotic division to form four haploid cells.
    a. The assertion is correct but the reason is incorrect
    b. Both assertion and reason are correct
    c. Both assertion and reason are incorrect
    d. Assertion is incorrect but reason is correct
14. **Assertion:** *Bacillus thuringiensis* forms protein crystals during a particular phase of

growth.

Reason: These crystals contain a toxic insecticidal protein that kills certain insects.

a. Both assertion and reason are correct
b. Assertion is correct but reason is incorrect
c. Assertion is incorrect but reason is correct
d. Both assertion and reason are incorrect

15. **Read the following and answer any four questions:**

The reproductive cycle in female primates is called the menstrual cycle. One ovum is released during the middle of each menstrual cycle. The cycle starts with the menstrual phase when menstrual flow occurs and it lasts for 3-5 days. The menstrual flow results due to the breakdown of the endometrial lining of the uterus and its blood vessels which form a liquid that comes out through the vagina. The menstrual phase is followed by the follicular phase, the primary follicles in the ovary grow to become a fully mature Graafian follicle. Both LH and FSH attain a peak level in the middle of the cycle. The ovulatory phase is followed by the luteal phase during which the remaining parts of the Graafian follicle transform. During pregnancy, all events of the menstrual cycle stop and there is no menstruation.

i. At what stage of life is oogenesis initiated in a human female?
   a. At puberty
   b. During menarche
   c. During menopause
   d. During embryonic development

ii. Ovulation in the human female normally takes place during the menstrual cycle
   a. at the mind secretory phase
   b. just before the end of the secretory phase
   c. at the beginning of the proliferative phase
   d. at the end of the proliferative phase

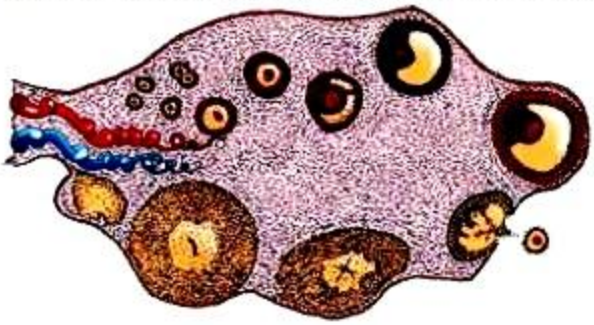
iii. Immediately after ovulation, the mammalian egg is covered by a membrane known as
   a. chorion
   b. zona pellucida
   c. corona radiata
   d. vitelline membrane

iv. Which one of the following events are correctly matched with the time period in a

normal menstrual cycle?

a. Release of egg: 5th day
b. Endometrium regenerates: 5 – 10 days
c. Endometrium secretes nutrients for implantation: 11 – 18 days
d. Rise in progesterone level: 1 – 15 days

v. In the given figure identify the correct sequence



a. Primary follicle, Ovum, Corpus luteum, Graafian follicle
b. Corpus luteum, Graafian follicle, Primary follicle, Ovum
c. Primary follicle, Graafian follicle, Ovum, Corpus luteum
d. Corpus luteum, Primary follicle, Graafian follicle, Ovum

16. **Read the following and answer any four questions:**

Microbes are also used for commercial and industrial production of certain chemicals like organic acids, alcohols and enzymes. Microbes are also used for the production of enzymes. Lipases are used in detergent formulations and are helpful in removing oily stains from the laundry. Bottled fruit juices bought from the market are clearer as compared to those made at home. Streptokinase produced by the bacterium Streptococcus and modified by genetic engineering Another bioactive molecule, cyclosporin A. Statins produced by the yeast has been commercialised used.

i. Monascus purpureus is a yeast commercially used in the production of
   a. citric acid
   b. ethanol
   c. blood cholesterol lowering statins
   d. streptokinase for removing clots from blood vessels

ii. Bacillus thuringiensis is widely used as:
   a. Insecticide
   b. Weedicides
   c. Rodenticide
   d. None of the above

iii. Citric acid is produced by:
   a. Rhizopus
   b. Mucor
   c. Aspergillus niger
   d. Saccharomyces

iv. Cyclosporin A, that is used as
   a. immunosuppressive agent in organ-transplant patients
   b. killing insect
   c. producing antibiotics
   d. none of these

v. **Assertion -** Homemade juice bottle is clearer as compared to bottled fruit juices bought from the market

   Reason - Lactobacillus is a bacterium which produces acetic acid.
   a. Both Assertion and Reason are true and Reason is the correct explanation of the Assertion
   b. Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion
   c. The Assertion is true but the Reason is false
   d. Both the statements are false

Section B

17. Why is CuT (copper T) considered as good contraceptive device to space children?
18. Which of Mendel's law of inheritance is universally acceptable and without exception? State the law.
19. Write any two biochemical/molecular diagnostic procedures for early detection of viral infection. Explain the principle of any one of them.
20. Many proteins are secreted in their inactive form. This is also true of many toxic proteins produced by microorganisms. Explain how the mechanism is useful for the organism producing the toxin?

OR

What happens when Meloidegyne incognitia consumes cells with RNAi gene?

21. If the sequence of coding strand in a transcription unit is written as follows: 5'-ATGCATGCATGCATGCATGCATGC -3' Write down the sequence of m-RNA

22. Following is the sequence of nucleotide in two strands of DNA. Observe the strands and answer the preceding questions. $5' - GAATTC - 3', 3' - CTTAAG - 5'$

    (i) Name the special term used for such an arrangement of nucleotide.

    (ii) Name the special type of enzymes which work / function at this specific points.

    (iii) Name the enzyme, that cut DNA between GA sequence.

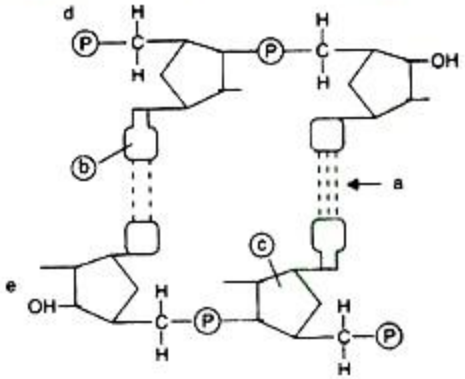
    OR

    Restriction enzymes should not have more than one site of action in the cloning site of a vector. Comment.

23. Justify with the help of an example where a deliberate attempt by humans has led to the extinction of a particular species.
24. Distinguish between the Ectotherms and Endotherms
25. In your opinion, which is the most effective way to conserve the plant diversity of an area?

Section C

26. Describe Mendelian disorders and mention its two types giving suitable examples.
27. Study the given portion of double-stranded polynucleotide chain carefully. Identify a, b, c and the 5' end of the chain.



28. Differentiate between vaccination and immunization. Describe the two types of vaccines with suitable examples?
29. An mRNA strand has a series of codons out of which three are given below:

    (i) AUG (ii) UUU (iii) UAG

    (a) What will these DNA codons be translated into?

    (b) What are the DNA codons that would have transcribed these RNA codons?

30. Explain the relationship between B-lymphocytes and T-lymphocytes in developing an immune response.

OR

i. Name and explain giving reason, the type of immunity provided to the newborn by the colostrum and vaccinations.

ii. Name the type of antibody

   a. present in colostrum.

   b. produced in response to allergens in human body.

Section D

31. Describe the development of dicot embryo.

OR

Differentiate between:

a. hypocotyol and epicotyl

b. coleoptile and coleorrhiza

c. integument and testa

d. perisperm and pericarp

32. Why is Taq polymerase preferred in PCR? Mention the source of this enzyme.

OR

Describe the roles of heat, primers and the bacterium *Thermus aquaticus* in the process of PCR.

33. i. List any four abiotic components that lead to variations in the physical and chemical conditions of habitats.

    ii. Explain the impact of these components on the distribution of organisms in different habitats.

OR

i. Name the population growth pattern the equation $\left\{ \frac{dN}{dt} = rN \right\}$ represents. What does 'r' represent in the equation? Write its importance in population growth.

ii. Explain the principle of carrying capacity by using population Verhulst-Pearl logistic growth curve.

CBSE Class 12 Biology

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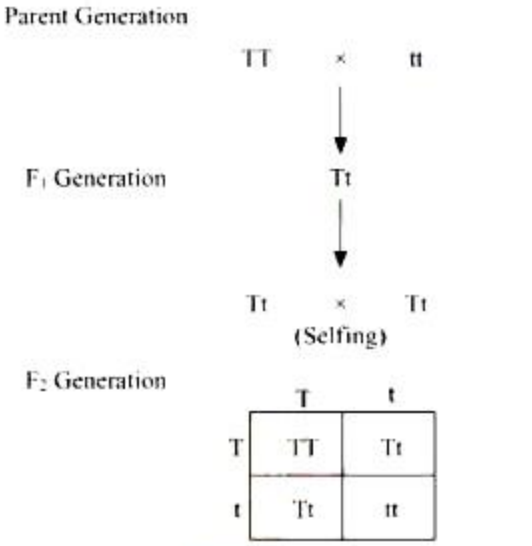
Solution

Section A

1. 400 sperms

   100 ova
2. A bacterium called *Propionibacterium sharmanii* produces a large amount of carbon dioxide during fermentation. This is the reason for big holes in Swiss cheese.
3. A unit of inheritance which is passed down from parent to offsprings through the gametes over successive generations is known as a gene.

   Genes consist of a pair of contrasting forms that are known as alleles.
4. **AIDS** (Acquired Immuno Deficiency Syndrome) is a STD that can be transmitted through contaminated blood.
5. The segment of DNA coding for a polypeptide is known as cistron.
6. Punnett Square was used for Mendelian Monohybrid cross between pure line tall and the dwarf plant will appear as follow:



Result of F_2 generation phenotypic ratio of monohybrid cross is 3:1

7. Honey bee workers : 32 and Drones : 16 chromosomes
8. Infection is the entry of a pathogen inside the host's body, whereas infestation is the presence of pathogens, generally arthropodes on the body surface or on the clothes of a person e.g., louse infestation.

9. Species extinction occurring at present is due to anthropogenic causes whereas the earlier extinction was due to natural causes.
10. Alexander Fleming, Ernst Chain and Howard Florey were the scientists who were credited for showing the role of Penicillin as an antibiotic.
11. (a) The assertion is a true statement but the reason is false.
    Explanation: An organism with the lethal mutation may not even develop beyond the zygote stage due to change in the gene but all kinds of mutations are not lethal. The mutation is the main source of variation essential for evolution.

OR

(a) Both assertion and reason are correct.
Explanation: In Snapdragon flower, a cross between true-breeding white and red coloured flower produces a pink coloured flower in F1generation. This happens due to incomplete dominance of alleles over the other.

12. (a) The assertion is correct but the reason is wrong
    Explanation: *Taenia solium* completes its life cycle in humans as the definitive host and pigs as intermediate hosts. It is transmitted to pigs through human feces or contaminated fodder, and to humans through uncooked or undercooked pork.
    The malarial parasite completes their life cycle in two hosts human beings and female anopheles mosquito.
13. (a) The assertion is correct but the reason is incorrect
    Explanation: Each spermatogonium is a diploid cell and contains 23 pairs of chromosomes. Some spermatogonia, called primary spermatocytes complete the first meiotic division to form two haploid cells. So, the assertion is correct but the reason is incorrect.
14. (a) Both assertion and reason are correct
    Explanation: *Bacillus thuringiensis* bacterium forms protein crystals during a particular phase of growth. The crystal of toxic protein has insecticidal protein. This protein gets activated in an alkaline medium in the gut of insects and kills them.
15. i. (d) During embryonic development
    ii. (d) at the end of the proliferative phase
    iii. (c) corona radiata
    iv. (b) Endometrium regenerates: 5 – 10 days

v. (c) Primary follicle, Graafian follicle, Ovum, Corpus luteum

16. i. (c) blood cholesterol lowering statins
    ii. (a) insecticides
    iii. (b) Aspergillus niger
    iv. (a) Immunosuppressive agent in organ-transplant patients
    v. (d) Both the statement are false

Section B

17. Copper releasing IUDs (CuT, Multiload 325) - These increase phagocytosis of sperms within the uterus and release copper ions which suppress sperm motility and fertilising capacity of sperm. Therefore, CuT (copper T) considered as a good contraceptive device to space children.
18. When sperm and egg unite at fertilization, each contributes its allele, restoring the paired condition in the offspring. This is called the **Law of Segregation**.
    Mendel also found that each pair of alleles segregates independently of the other pairs of alleles during gamete formation
19. - **Name of biochemical/molecular diagnostic tests for viruses:**
        - **ELISA** - Enzyme-Linked Immunosorbent Assay
        - **PCR** – Polymerase Chain Reaction
    - **Principle of ELISA -** It is based on antigen-antibody interaction. Infection by a pathogen can be detected by the presence of antigens or by detecting the antibodies synthesized against the pathogen.
20. When the toxin is present in an inactive form, it doesn't harm the organism which produces the toxin. For example; *B. thuringiensis* produces an insecticidal toxin that does not kill this bacterium. This toxin becomes active when it enters the alkaline pH of the gut of an insect and the insects killed in the process.

OR

When Meloidogyne incognita (parasite) consumes cells with RNAi gene, parasite cannot survive and this prevents infestation. The introduced RNAi gene DNA forms both sense and anti-sense RNA. Two strands being complementary to each other bend and form ds RNA, leading to RNAi. Thus, the mRNA of nematode is silenced and the parasite cannot survive there.

21. If the coding strand in a transcription unit is 5'– ATGCATGCATGCATGCATGCATGCATGC-3'

Then, it is known that the sequence of mRNA is same as the coding strand of DNA. However, in RNA, thymine is replaced by uracil. Hence, the sequence of mRNA will be 5' – AUGCAUGCAUGCAUGCAUGCAUGCAUGC-3'

22. (i) Palindromes
    (ii) Restriction endonucleases
    (ii) EcoRI
    (iv) Sticky / overhanding strands

OR

Presence of more than one recognition site on vector will generate many fragment of DNA; which will complicate the matter. Hence, restriction enzymes should have, one recognition site at the vector.

23. Overexploitation of natural resources or overhunting of animals has led to the extinction of particular species, e.g Steller's sea cow and passenger pigeon.
    Other examples of human-driven extinction include habitat fragmentation and invasion of alien species.

24.
- Ectotherms warm their bodies by absorbing heat from the surrounding environment, whereas Endotherms produce heat by their metabolic activities.
- Ectotherms have large variations in normal body temperatures while endotherms maintain their body temperature in a fairly constant value.
- Most invertebrates, fishes, reptiles, and amphibians are ectotherms while all the mammals and bird are endotherms.
- The body temperature of ectotherms changes with the surrounding temperature changes, while that of endotherms does not change much with the surrounding temperature changes.
- Ectotherms mainly use behavioral control mechanisms to control their body, whereas endotherms use both internal physiological control mechanisms and behavioral ones.
- Endotherms can remain active over a wide range of environmental conditions than ectotherms. Therefore, the geological distribution and ecological distribution of endotherms are higher than ectoderms.
- Number of species of ectotherms is higher than that of endotherms.
- To maintain the body temperatures in a constant value, endotherms require much

more food than ectotherms of equivalent size.

25. The most effective way to conserve the plant diversity of an area is to create biosphere reserve. This helps to protect an entire area and also preserve the plant species. Natural resources are used in sustainable manner which prevents damage to ecosystem.

Section C

26. Mendelian disorders are determined by mutation in the single gene and transmitted to the offspring as per Mendelian principles.
    The pattern of inheritance of such Mendelian disorders can be traced in a family by Pedigree analysis. The Mendelian disorders are of two main types:
    (i) Gene Mutations in sex chromosomes. Examples: Sickle cell anaemia and Phenylketonuria.
    (ii) Gene mutations in sex chromosomes. Example: Haemophilia.
27. a. Hydrogen bonds
    b. Purine base
    c. Pentose sugar (Deoxyribose)
    d. 5' end of the chain - d
28. **Vaccination** is the phenomenon of injection of killed or inactivated microbe to trigger the immune system to produce antibodies against a particular disease. Vaccination is the process of administering vaccines. Diseases can be prevented by vaccination. During vaccination inactivated or weakened microbes called as vaccines are introduced into the body. They trigger the production of antibodies. When disease-carrying microbes enter our body, self-protecting proteins called antibodies fight against the invader.
    Immunisation is the protection of individuals from communicable diseases by administration of a suspension of dead micro-organisms. This is the stimulation of immune system in the body to produce memory cells which further can detect disease causing pathogens and immediately eliminate them before causing the disease.
    Generally vaccines are of two types:
    (a) Attenuated Vaccines: They are prepared from live organisms (generally pathogen is made weak to make it non virulent).
    Examples : BCG and influenza vaccine.
    (b) Killed Vaccines: They are prepared by killing the pathogenic organisms by heat or UV rays.
    Examples: Polio and Rabies vaccines.

29. (a) (i) AUG signals the synthesis of polypeptide (start signal) and codes for the amino acid methionine

(ii) UUU codes for phenylalanine

(iii) UAG do not specify any amino acid and hence is called nonsense codon. It signals the termination of polypeptide chain (stop signal)

(b) TACAAAATC

30. The primary and secondary immune responses are carried out with the help of two special types of lymphocytes present in our blood, i.e., B-lymphocytes and T-lymphocytes. The B-lymphocytes produce an army of proteins in response to pathogens into our blood to fight with them. These proteins are called antibodies. The T -cells themselves do not secrete antibodies, but help B cells to produce them.

OR

i. The immunity provided to the newborn by colostrum and vaccinations is called passive immunity. This is because both in colostrum and vaccines the antibodies conferred are not produced by own body, but are rather transferred passively to the recipient's body. Such as IgA antibodies pass through milk (colostrum) to infants and provides passive immunity against infection.

ii. a. The type of antibody present in colostrum is IgA.

b. IgE is produced in response to allergens in the human body.

Section D

31. **Embryo Formation in Dicot plants is as follows:**

i. The zygote divides by a transverse wall into the basal suspensor cell and the terminal embryo cell. Further divisions in this two-celled structure give rise to a filament of cells called the proembryo.

ii. The suspensor pushes the developing embryo deep into the food-laden endosperm. The terminal cell of the suspensor, towards the micropylar end, gets enlarged and functions as haustorium to absorb the food materials. The lowermost cell of the suspensor, adjacent to the embryo cell is known as hypophysis. It forms the apex of the radicle.

iii. The embryo cell divides by two vertical and one transverse division to form the eight-celled globular embryo.

iv. The four-terminal cells give rise to the plumule and two cotyledons, while the four

basal cells from the hypocotyl and the radicle.

v. The developing embryo appears heart-shaped and finally forms a mature embryo.

vi. The embryo axis possesses the plumule at the apical end which gives rise to the shoot, and the radicle at the basal end, which develops into the root system.

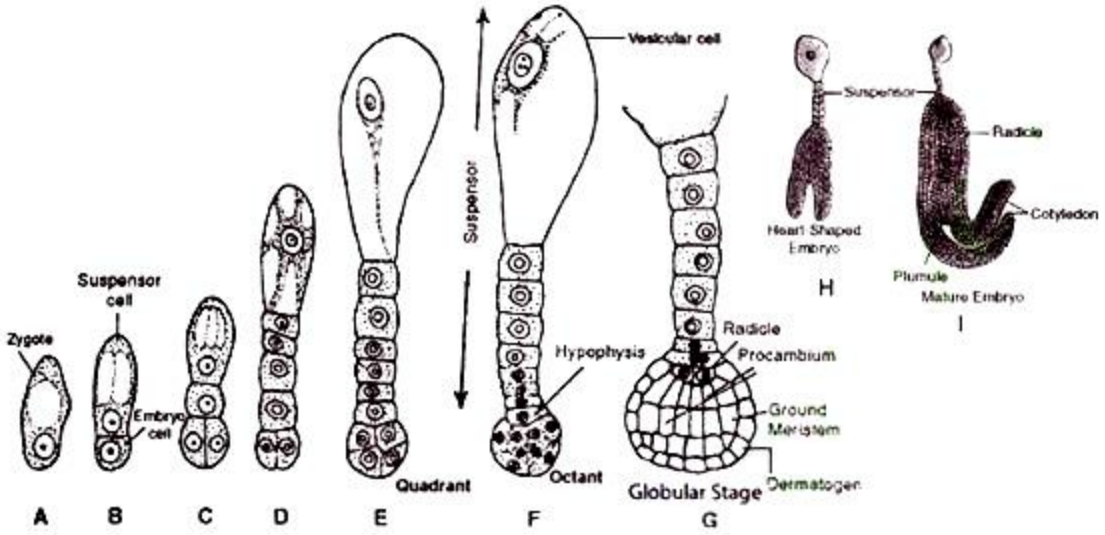


Figure: Embryo development in Dicot plants

OR

a. Hypocotyl - The portion of embryonic axis between the radical and cotyledon
Epicotyl - The portion of embryonic axis between the plumule and cotyledon

b. Coleoptile - It is a conical protective sheath over the plumule in monocot seeds.
Coleorrhiza - It is a protective sheath over the radical and root tip.

c. Integument is the covering of ovule, while testa is the outer seed coat developed from the outer integuments.

d. Perisperm is the residual persistent nucellus, while the pericarp is the fruit wall derived from the ovary wall.

32. **Role of Heat -** In PCR (in vitro), the DNA strands are separated by heating them at 95°C for 2 minutes. Heating causes the breakdown of H-bonds between the bases of two strands leading to their unwinding.
Role of Primers - Primers are short lengths of DNA about 20bp long that are required to start DNA polymerisation in PCR. The primers hybridise to their complementary sequence on the DNA strands at 40-50°C temperature and help in DNA polymerisation.
Role of *Thermus aquaticus* - An enzyme called Taq polymerase is isolated from

Thermus aquaticus. Since this bacterium thrives in temperature as high as 95°C, this enzyme can also tolerate high temperature without undergoing denaturation. Therefore, this enzyme is used in PCR instead of normal DNA polymerase.

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33. i. Temperature, water, light and soil are the abiotic components that lead to variations in the physical and chemical conditions of habitats.

ii. a. Temperature influences the kinetics of enzymes and thereby the metabolism and other physiological functions of the organisms. Organisms may be eurythermal which can tolerate a wide range of temperature and stenothermal that can tolerate only a narrow range of temperature.

b. Water is important to sustain life and productivity and distribution of plants is dependent on water. Freshwater forms cannot thrive in seawater and vice-versa.

c. Light influences photosynthesis of plants. It also influences the flowering in plants and timing of foraging, reproduction and migratory activities of animals Aquatic plants occupy different depths depending on their pigments and the light available.

d. Soil influences vegetation by the water holding capacity, topography and its composition.

OR

i. The logistic growth pattern is represented by equation $\left\{ \frac{dN}{dt} = rN \right\}$.

Here 'r' represents the intrinsic factor a rate of natural increase. Since, the growth for most of the organisms's population becomes limiting due to limited resources, this logistic growth pattern provides a realistic model for study of population growth.

ii. The Verhulst-Pearl logistic growth curve is explained by $\frac{dN}{dt} = rN\left(\frac{K-N}{K}\right)$ where, K represents the carrying capacity. It can be referred to as nature's limit of natural resources that a habitat provides to its individuals of a growing population, beyond which there is no growth in that particular habitat.