PLUS TWO

BOTANY

GENERAL EDUCATION DEPARTMENT

SAMAGRA SHIKSHA, KERALA

..

Chapters

..

Chapter 1

Reproduction in Organisms

Focus Areas

- Asexual reproduction
- Gametogenesis
- Fertilisation

Reproduction enables species to continue their generations. Reproduction is mainly of asexual and sexual types.Reproduction is a biological process in which an organism gives rise to young ones of its own kind. It enables continuity of life

Reproduction

ASEXUAL REPRODUCTION	SEXUAL REPRODUCTION
● No gametic fusion	● Involves fusion of gametes
● Young ones are morphologically and genetically similar (Clones)	● Chances of variation

Asexual reproduction

Lower organisms reproduce asexually through various methods.

- Binary fission – e.g., *Amoeba,Paramecium*
- Budding-*Yeast, Hydra*
- Zoospores- *Chlamydomonas(*alga), fungi,
- Conidia-*Penicillium*
- Gemmules- *Sponge*
- Fragmentation- *Hydra*

KITE VICTERS CLASS 01

https://youtu.be/DdKQooRdUdw

Reproduction in amoeba

Encystation - during unfavourable conditions amoeba withdraws its pseudopodia and secretes a three layered hard covering or cyst around it.

Sporulation - when favourable conditions return encysted amoeba divides by multiple fission and cyst wall breaks out and the spores are liberated. They grow up into many amoebae.

In certain plants vegetative parts are used for asexual reproduction- **vegetative propagules**

- Rhizome- Ginger
- Stem tuber- Potato
- Bulbil- *Agave*
- Leaf buds- *Bryophyllum*
- Offset- Water hyacinth

KITE VICTERS CLASS 02

https://youtu.be/XQ08zLFb0LQ

Sexual Reproduction

Three phases in the life cycle of a sexually reproducing organism.

1. Juvenile phase/vegetative phase- the stage of growth and maturity in the life of an organism before they can reproduce sexually.
2. Reproductive phase.
3. Senescence / old age.

- Oestrus cycle – cyclic changes during reproduction in non primate mammals.
- Menstrual cycle – cyclic changes during reproduction in primate mammals.
- Seasonal breeders- mammals in wild conditions exhibit reproductive cycle only during favourable seasons.
- Continuous breeders- mammals which are reproductively active throughout their reproductive phase.

Three main events during sexual reproduction are

- **Pre fertilisation**
- **Fertilisation**
- **Post fertilisation**

KITE VICTERS CLASS 03

https://youtu.be/PvHUepZPWL8

PRE- FERTILISATION EVENTS

Gametogenesis- the formation of male and female gametes.

- Isogametes/ Homogametes- Fusing gametes are similar in appearance.
- Heterogametes – male and female gametes are morphologically distinct.

Sexuality in organisms

- Bisexual/homothallic/monoecious – Organisms which possess both the reproductive organs.
- Unisexual/heterothallic/dioecious – Organisms which possess either male or female reproductive organ.
- Staminate flower- unisexual male flower, bearing stamens.
- Pistillate flower- unisexual female flower, bearing pistils.

KITE VICTERS CLASS 04

https://youtu.be/BqhUuP2XYvQ

- Hermaphrodites- bisexual animals that possess both male and female reproductive organs. Egs : Earthworm, sponge, tapeworm, leech

Meiocytes- (gamete mother cell) The cells which undergo meiosis to form gametes. Gametes posses half the number of chromosomes of that in meiocytes.

Name of organism	Chromosome number in meiocyte (2n)	Chromosome number in gamete (n)
Human beings	*46*	*23*
House fly	*12*	—
Rat	—	*21*
Dog	*78*	—
Cat	—	*19*
Fruit fly	*8*	—
Ophioglossum (a fern)	—	*630*
Apple	*34*	—
Rice	—	*12*
Maize	*20*	—
Potato	—	*24*
Butterfly	*380*	—
Onion	—	*8*

FERTILISATION

KITE VICTERS CLASS 05

https://youtu.be/932tlzCEOIk

- Syngamy- fusion of gametes resulting in the formation of zygote.
- Parthenogenesis- development of new organism without fertilisation.
  - e.g., rotifers, honeybees, lizards, turkeys etc
- External fertilisation- syngamy outside the body of the organism.
  - e.g., certain algae, fishes, amphibians etc
  - Disadvantage - offspring are extremely vulnerable to predators

Internal fertilisation – syngamy occurs inside the body of the organism. e.g., Human beings

POST-FERTILISATION EVENTS

KITE VICTERS CLASS 06

https://youtu.be/AhxYnmaU8sA

- Embryogenesis- process of development of embryo from the zygote.
- Oviparous animals- development of zygote completes outside the body of organisms e.g., birds, reptiles
- Viviparous animals- development of zygote occurs inside the body of organisms e.g., mammals

Questions

1. Fill in the blank.

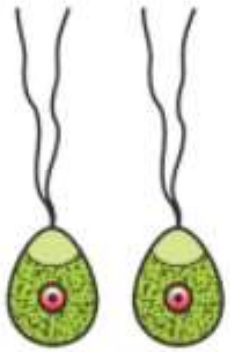
   Morphologically and genetically similar individuals formed as a result of asexual reproduction are termed as..... (1)

2. Match column A with suitable term from column B

A	B
Mode of asexual reproduction	**Examples**
a) Conidia	*Amoeba*
b) Gemmules	Algae
c) Buds	*Penicillium*
d) Zoospores	*Sponge*
	Hydra

4 x ½ = 2

3. Identify the type of gametes in the given diagram and write its peculiarity.



(2)

4. Observe the relationship between the first pair and fill up the second pair.

   Pistillate flower: unisexual flower bearing pistils.

   .....: unisexual flower bearing stamens. (1)

5. Fill up the blanks. (2)

Vegetative Propagules	Example
a)	Ginger
b) Leaf buds	.....
c)	Water hyacinth
d) Stem tuber	.....

6. Name a plant which flowers once in 12 years. (1)

7. Fill in the blank.

   The cyclic changes in non primate animals during reproduction are called..... (1)

8 . Explain encystation and sporulation in amoeba. (2)

9. Differentiate monoecious and dioecious condition in plants. (2)

10. What are hermaphrodites? Give example. (2)

11. Organisms exhibiting external fertilisation show great synchrony between sexes and release a large number of gametes. Why? Write down the major disadvantage of external fertilisation. (2)

12. What are seasonal breeders? (1)

13. Define parthenogenesis. Give two examples (2)

14. Give four examples for vegetative propagules in plants (2)

15. Chromosome number in meiocytes and gametes of some organisms are given in the table given below. Fill in the blank spaces with correct number of chromosomes.

Name of organism	**Chromosome number in meiocytes (2n)**	**Chromosome number in gametes (n)**
Ophioglossum	.....(a).....	630
Apple	34	.....(b).....
Rice	.....(c).....	12
Onion	.....(d).....	8

(2)

Answer key

1. Clone (1)

2.

	A	B	
	Mode of asexual reproduction	**Examples**	
a)	Conidia	*Penicillium*	
b)	Gemmules	*sponge*	
c)	Buds	*Hydra*	
d)	Zoospores	algae	4 x ½ = 2

3. Isogametes/Homogametes (1+1)=2

- fusing gametes similar in appearance

4. Staminate flower (1)

5.

Vegetative Propagules	Example
a) Rhizome	Ginger
b) Leaf buds	*Bryophyllum*
c) Offset	Water hyacinth
d) Stem tuber	Potato

4 x ½ = 2

6. *Strobilanthes kunthiana/ neelakurinji* (1)

7. Oestrus cycle (1)

8. Encystation - during unfavourable conditions amoeba withdraws its pseudopodia and secretes a three layered hard covering or cyst around it.

   Sporulation- when favourable conditions return encysted amoeba divides by multiple fission and cyst wall breaks out and the spores are liberated and they grow into many amoebae. (1+1=2)

9. Monoecious – Organisms which possess both the reproductive organs.

   Dioecious – Organisms which possess either male or female reproductive organ. (1+1=2)

10. Hermaphrodites are bisexual animals that possess both male and female reproductive organs . e.g., Tapeworm/ leech/ *sponge/Earthworm (anyone)* (1+1=2)

11.- To enhance the chances of syngamy in the external medium. (1+1=2)

   The major disadvantage of external fertilisation is that the offspring are extremely vulnerable to predators threatening their survival upto adulthood.

12. Seasonal breeders are mammals in wild conditions which exhibit reproductive cycles only during favourable seasons in their reproductive phase. (1)

13. Parthenogenesis is the process of development of new organism without fertilisation. (1+1=2)

   e.g., rotifers, honeybees, lizards, turkeys (any two)

14. Runner, Rhizome, Sucker, Tuber, Offset, Bulb (any four) (4x½=2)

15.

Name of organism	Chromosome number in meiocytes	Chromosome number in gametes
Ophioglossum	1260	630
Apple	34	17
Rice	24	12
Onion	16	8

(4 x ½ = 2)

Chapter 2

Sexual Reproduction in Flowering Plants

Flower : Reproductive organ of angiosperms

Focus areas

- Structure of microsporangium and pollen grain.
- Megasporangium, megasporogenesis, female gametophyte.
- Pollination
- Double fertilisation
- Embryo-structure
- Fruits

Pre fertilization events

- *Microsporogenesis*
- *Megasporogenesis*
- *Pollination*

KITE VICTERS CLASS 07

https://youtu.be/MWoTUXR82lg

Microsporogenesis

- Formation of microspores(pollen grains).
- Occurs in stamen- the male reproductive organ in flowers.
- Four microsporangium located in a typical anther of stamen.
- Microsporangium surrounded by four wall layers.
  - **Epidermis, endothecium, middle layers and tapetum.**
- Outer three layers protective in function.
- Inner tapetum nourishes the developing pollen grain.
- Sporogenous tissue(PMC) in microsporangium undergoes meiosis and form microspores (pollen grains).

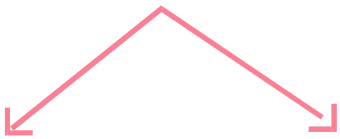
Pollen grain

- Represents the male gametophyte.
- Has two wall layers.
- **Outer exine**- made of sporopollenin.
- Sporopollenin- Most resisitant organic material which can withstand high temperature and strong acids.

- Pollen preserved as fossils due to the presence of sporopollenin.
- Intine (Inner wall)- made of cellulose and pectin.
- Germ pores- apertures in exine where sporopollenin is absent.
- Mature pollen grain contains two cells

KITE VICTERS CLASS 08

https://youtu.be/fzLfAORsBKg

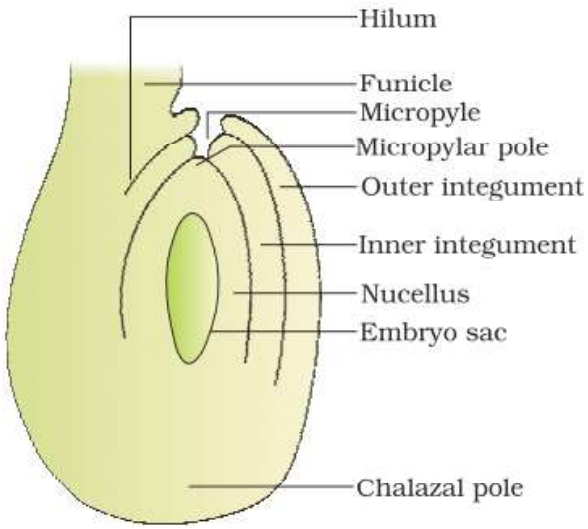


Vegetative cell Generative cell

- Generative cell divides to form two male gametes.
- Pollen grains are rich in nutrients.
- Pollen grain can be stored for years in liquid nitrogen (-196^{0}C).

Megasporogenesis

- Occurs in female reproductive structure- pistil/carpel.
- Megasporangium(ovule) arises from placenta of the ovary.



KITE VICTERS CLASS 09

https://youtu.be/ZxAJr5CqSEc

- Megaspore mother cell of ovule undergoes meiotic division.
- Four megaspores are formed , three degenerate and one develops to female gametophyte-monosporic development of embryo sac.
- Functional megaspore undergoes 3 mitotic division and forms 8 nucleate stage in embryo sac.
- Three nuclei grouped at micropylar end called egg apparatus-consists of two synergids on either sides and egg in the center.
- Two nuclei group in the centre- polar nuclei in the large central cell.

- Three cells in the chalazal end- antipodals.
- Thickenings in synergids are filiform apparatus which guides pollen tube towards synergids.
- Typical angiosperm embryo sac- is 8 nucleated and 7 celled.

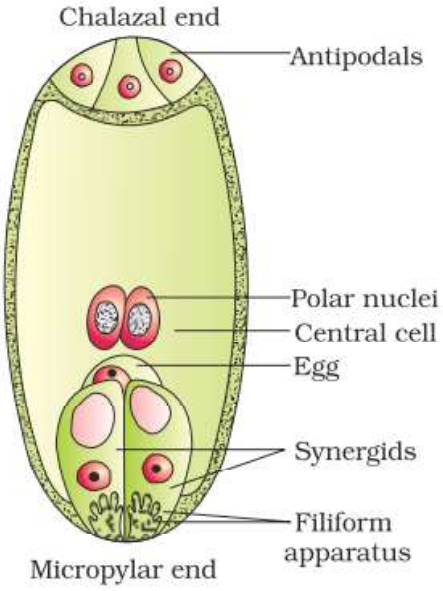


Fig 2.3

Pollination

- Transfer of pollen grains from anther to stigma.
- **Autogamy**- transfer of pollen grain from anther to the stigma of same flower.
  - Chasmogamous flowers- flowers with exposed stigma and stamen.
  - Cleistogamous flowers- flowers which do not open- favours self pollination- produce assured seed set even in the absence of pollinators.

    e.g., *Viola*, *Commelina, Oxalis*
- Geitonogamy- transfer of pollen grains from anther to the stigma of another flower of same plant. This is functionally cross pollination as it a involves pollinating agent.
- Xenogamy- transfer of pollen grains to the stigma of different plants (cross pollination both functionally and genetically).

Agents of pollination

- Wind
- Water
- Insects

KITE VICTERS CLASS 10

https://youtu.be/Lxtf62NAi1c

Wind pollinated flowers - floral features

- Light and non-sticky pollen grains
- Well exposed stamens
- Large and feathery stigma
- Single ovule in each ovary
- Numerous flowers packed into an inflorescence

e.g., : grasses

Water pollinated flowers

- Pollen grains long and ribbon like (e.g., zostera)
- Pollen protected from wetting by mucilaginous covering

Insect pollinated flowers

- Large
- Colourful
- Fragrance/foul odour
- Small flowers arranged in cluster
- Pollen grains sticky

Devices (Mechanisms) to prevent self pollination

- Pollen and pistil at different position
- Pollen and pistil mature at different time
- Self incompatibility
- Unisexual flowers

KITE VICTERS CLASS 11

https://youtu.be/ekPJugwjssY

Artificial hybridization

- Emasculation- removal of anther from bisexual flower buds.
- Bagging- covering flowers with polyethylene bag to prevent contamination by unwanted pollen.

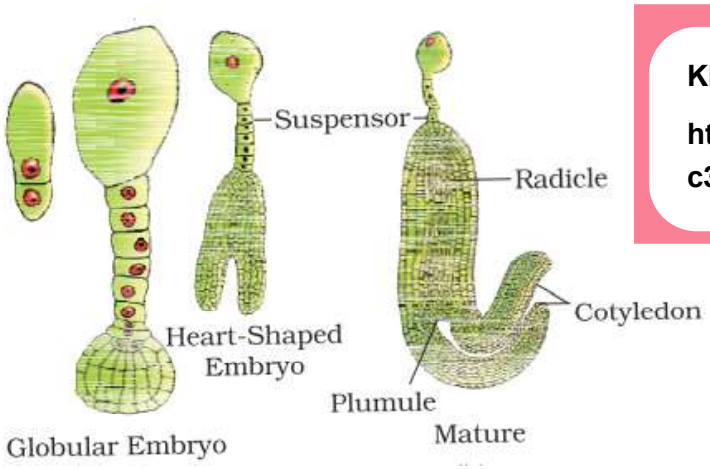
Double fertilisation (involves two fusions)

1) **Syngamy**—> One male gamete(n) + egg(n) ⟶ Zygote(2n)
2) **Triple fusion**—> One male gamete(n) + Polar nuclei (2n) ⟶ PEN (Primary Endosperm Nucleus (3n))

Embryo

- Zygote develops into mature embryo through various stages

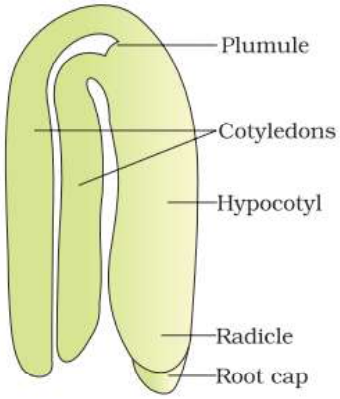
  Proembryo—> globular embryo—> heartshaped embryo—> mature embryo



KITE VICTERS CLASS 12

https://youtu.be/c32fG6/Ve01

Fig 2.4 Stages of embryogeny



Fg. 2.5. Dicot Embryo

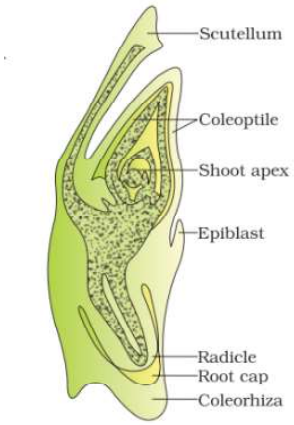


Fig 2.6. Monocot Embryp

SEED

- Perisperm- residual persistent nucellus seen in certain seeds .
  - e.g., Black pepper
- False fruit – Thalamus also contributes to fruit formation.
  - e.g., apple, strawberry, cashew
- True fruit- fruit which develops from the ovary of flowers.
  - e.g., mango, guava
- Parthenocarpic fruits-fruits which develop without fertilisation
  - e.g., banana

KITE VICTERS CLASS 14

https://youtu.be/1c6bofl-0DY

Questions

1 . Fill in the blank.

In flowering plants male gametophyte is represented by _____ (1)

2. Name the homogenous tissue seen in the centre of microsporangium of an young anther. (1)

3. Observe the relationship between the first pair and complete the second pair. (1)

a) Intine: cellulose and pectin

Exine:.....

4. Fill in the blank.

The process of formation of megaspores from megaspore mother cell is..... (1)

5. Pick out the odd one. (1)

antipodals, synergids ,pollen grain, egg, central cell

6. Choose the correct answer and fill up the blank.

The residual persistent nucellus seen in some seeds is ..... (1)

(embryo sac, perisperm, funicle, hilum)

7. Name the single cotyledon situated towards on one side of embryonal axis in the embryo of grasses. (1)

8. A typical microsporangium is surrounded by four wall layers.

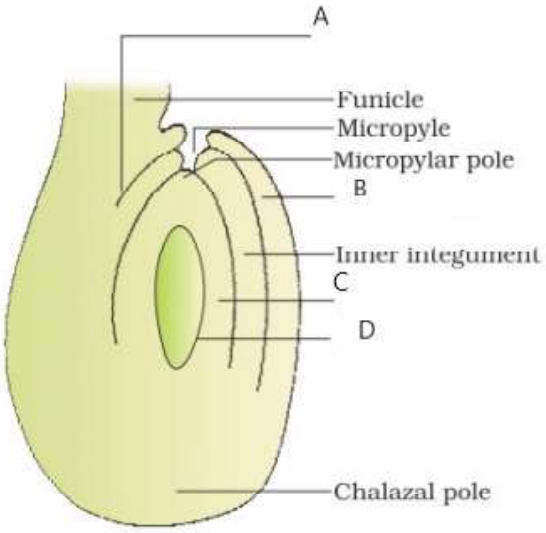
a) Name the wall layers

b) What is the function of the innermost wall layer? (2)

9. Pollen grains are well preserved as fossils. Give reason. (3)

10. Name the two types of cells present in the mature pollen grain. (2)

11. Observe the given diagram of an young ovule. Label the parts A ,B,C and D (2)



12. Synergids have special cellular thickenings . (2)

    a) Name these thickenings.

    b) Write down the role of these thickenings.

13. Define Pollination. What are the three types of pollination? (3)

14. Write any four characteristic of wind pollinated flowers.

15. Listed below are certain featurs of flowers for favouring pollination.
    Pick out the floral features of insect pollinated flowers . (2)

    - Long ribbon shaped pollen
    - Fragrance
    - Well exposed stamen
    - Non-sticky pollen grains
    - Large and colourful
    - Pollen grains sticky
    - Nectar

16. What are cleistogamous flowers? Why cleistogamous flowers are known as invariably autogamous? (2)

17. Emasculation and bagging are two steps in artificial hybridization.

    a) Explain emasculation.

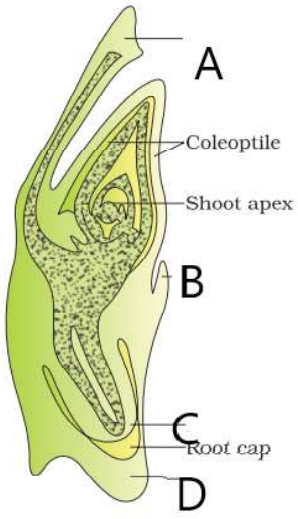
    b) What is the advantage of bagging in artificial hybridization? (2)

18. Sexual reproduction in angiosperms involve double fertilization.

a) Name the two types of fusion involved in double fertilization.

b) Write down the ploidy of the products obtained during double fertilization. (3)

19. Given diagram represents a typical monocot embryo. Label parts A,B,C and D. (2)



20. Differentiate true fruit and false fruit. (2)

21 Define parthenocarpy. Give an example. (2)

Answers

1. Pollen grain (1)
2. Sporogenous tissue (1)
3. Sporopollenin (1)

   Megasporogenesis (1)
4. Pollen grain (1)
5. Perisperm (1)
6. Scutellum (1)
7. a. Epidermis, Endothecium, Middle layers, Tapetum

   b. Inner tapetum nourishes the developing pollen grain ½ x 4 = 2+1=3
8. Sporopollenin can withstand high temperature and strong acids. 1 + 1 = 2

   No enzyme can degrade sporopollenin one of the most resistant organic material known.
9. Vegetative cell and Generative cell 1 + 1 = 2
10. A-Hilum, B- Outer integument, C- Nucellus, D- embryo sac 4 x ½ = 2

11. a. Filiform apparatus

    b. Guides the pollen tubes into the synergid. 1+1 = 2

12. Transfer of pollen grains from the anther to the stigma of a pistil is termed pollination. ½

    Autogamy, Geitonogamy, Xenogamy ½ x 3 = 2

13. Light and non-sticky pollen

    Well exposed stamens

    Large and feathery stigma 4 x ½ = 2

    Single ovule in each ovary

    Numerous flowers packed into an inflorescence (any four)

14. ● Fragrance
    ● Large and colourful
    ● Pollen grains sticky
    ● Nectar 4 x ½ = 2

15. Cleistogamous flowers are flowers which do not open. They are invariably autogamous as there is no chance of cross pollen landing on the stigma. 1 + 1 = 2

16. Emasculation is the removal of anther from bisexual flower buds
    Bagging- prevent contamination of flower by unwanted pollen grains 1 + 1 = 2

17. Syngamy and triple fusion ½ + ½

    Zygote- (2n) ½

    Primary Endosperm nucleus(3n) ½ + ½ = 3

18. A- Scutellum,B- Epiblast,C- Radicle, D-Coleorhiza ½ x 4 = 2

19. False fruits - Thalamus also contributes to fruit formation. 1 + 1 = 2

    True fruits- fruits which develop from the ovary of flowers.

20. Parthenocarpy is development of fruits without fertilisation. 1 + 1 = 2

    Eg: Banana

Chapter 3

Strategies for Enhancement in food production

Enhancement in food production is a necessity to meet the demands of increasing population.

Focus Areas

- Animal husbandry - Dairy farm management, Bee keeping
- Plant breeding - main steps
- Plant breeding for improved food quality, SCP
- Tissue culture

Animal husbandry – practice of breeding and raising livestock.

Dairy farm Management - Management of animals for milk and its products for human consumption.

- Suggestions for successful dairy farm management.
- Selection of good breeds.
- Selection of disease resistant breeds.
- Cattle have to be housed well.
- Scientific method of feeding.
- Cleanliness and hygiene of cattle and handlers while milking, storage and transport of milk.

Bee-keeping (Apiculture)

Maintenance of hives of honey bees for the production of honey and bee wax.

Common honey bee species is *Apis indica*.

- Honey is a medicine and nutritious food.
- Bee wax is used for the preparation of cosmetics and polishes.

Points for successful bee-keeping

- Knowledge of nature and habit of bees.
- Selection of suitable location.
- Catching and hiving of swarms.
- Management of bee hives in different seasons.
- Handling and collection of honey and beewax.

KITE VICTERS CLASS 15

https://youtu.be/2bxZ4kM9doo

Plant Breeding

- Plant breeding is a technique to create desired plant types that are better suited for cultivation, yield and disease resistant.

Main steps in plant breeding

- Collection of variability
- Evaluation and selection of parents.
- Cross hybridisation among the selected parents.
- Selection and testing of superior recombinants.
- Testing, release and commercialisation of cultivars.

KITE VICTERS CLASS 17

https://youtu.be/tav_fOkQzPk

Plant breeding for improved food quality.

- Breeding crops with higher levels of vitamins and minerals or higher protein and healthier fat is called biofortification.

Objectives

i) To improve protein content and quality.

ii) Oil content and quality

iii) Vitamin content

iv) Micronutrient and mineral content.

KITE VICTERS CLASS 19

https://youtu.be/tAMJ_A7Y

e.g.,:- Maize hybrid
Altas 66 - Wheat variety with high protein content.

IARI (Indian Agricultural Research Institute) has released Vitamin A enriched Carrot, Spinach, Pumpkin, Vitamin C enriched bitter gourd, bathua, Fe and Ca enriched bathua and protein rich beans.

SCP (Single Cell Protein)

- SCP is an alternate source of protein for animal and human nutrition.
  e.g., Spirulina, *Methylophilus methylotrophus*, mushroom.

Tissue Culture

It is the method of growing detached plant parts (cell, tissue or organ) in nutrient medium under sterile conditions.

KITE VICTERS CLASS 20

https://youtu.be/tu.be/LetthaNJ2s

Explant – plant part taken for tissue culture.

Totipotency – Capacity to generate a whole plant from any cell / explant.

Micropropagation – Production of thousands of plants in a short time through tissue culture.

Somaclones – Plantlets genetically identical to the original plant.

Meristem culture- helps to produce virus free plants from diseased plants.

Questions

1) Which species of bees is used for the commercial production of honey? (1)

2) A wheat variety, Atlas 66, which has been used as a donor for improving wheat is rich in : (1)

   a) Iron b) carbohydrate

   c) Proteins d) Vitamins

3) Norman E Borlaug is associated with: (1)

   a) White revolution b) Green revolution

   c) Blue revolution d) Silver revolution

4) The idea of tissue culture was originated from the concept of totipotency. Define totipotency and explant. (2)

5) Which part of the plant is best suited for making virus free plants from virus infected plant? (1)

6) Rearrange the following steps of plant breeding in correct sequential order.

   A - Evaluation and selection of parents

   B - Collection of variability

   C - Testing, release and commercialisation of cultivars.

   D - Cross hybridisation among the selected parents.

   E - Selection and testing of superior recombinants (2)

7) Match column A with column B

Column –A	Column-B
a) Somaclone	i) Breeding crops with higher levels of nutrients
b) Micropropagation	ii) Plant grown from hybrid protoplast
c) Somatic hybrid	iii) Produce a large number of plants through tissue culture
d) Biofortification	iv) Plants genetically and morphologically identical to the original plant

Answers

1) Apis indica (1)

2) C- protein (1)

3) B- Green revolution (1)

4) Totipotency is the ability of a single plant cell to produce a complete plant.
Explant is the cell, tissue or organ of the plant to be used in plant tissue culture. (1 + 1 = 2)

5) The apical and axillary Meristem. (1)

6) B, A, D, E and C 4 x½=2

7) a - iv
b - iii
c - ii
d - i 4 x½=2

Chapter 4

Biotechnology : Principles and Processes

In biotechnology, organisms or enzymes from them are used to produce products and processes useful to humans. This involves traditional view and modern molecular biotechnology. That is why EFB (The European Federation of Biotechnology) defines biotechnology as ' the integration of natural science and organisms, cells, parts thereof, and molecular analogues for products and services'.

Focus Area : Points at a glance

Tools of recombinant DNA technology

- Restriction enzymes, Gel electrophore sis.
- Preocess of rDNA technology.
- Amplification of gee of interest using PCR.
- Obtaining the foreign gene product

Restriction Enzymes (Molecular scissors) - Cuts DNA at specific nucleotide sequences.

Restriction Enzymes – Types

Restriction endonuclease

- Cuts at specific positions with in DNA·

Restriction exonuclease

- Removes nucleotides from the ends of the DNA.

Eg. EcoRI

E - Genus name Escherichia

co - Species name coli

R - Strain RY13

I - Order of Isolation

KITE VICTERS CLASS 23

https://youtu.be/lyYMgjVP3bQ

DNA ligase - Enzyme used to join DNA fragments

- Hind II - The first isolated restriction endonuclease

Separation and isolation of DNA fragments

- Technique used for this is gel electrophoresis.
- Negatively charged DNA molecules move towards the anode under an electric field.
- Gel used is *Agarose*.
- Smaller DNA fragments move faster.

KITE VICTERS CLASS 24

https://youtu.be/t2wbfafkj4Q

- Separated DNA fragments are stained with *ethidium bromide* and exposed to UV radiation.
- Extraction of separated bands of DNA from the gel (matrix) is called *elution*.

Processes in rDNA technology

1. Isolation of DNA
2. Fragmentation of DNA by restriction endonuclease.
3. Isolation of desired DNA fragment.
4. Ligation of the DNA into a vector.
5. Transferring the rDNA into the host.
6. Culturing the host cells in a medium
7. Extraction of the desired product.

KITE VICTERS CLASS 25

https://youtu.be/y_2ADctY3YY

Amplification of gene of interest using PCR

PCR – Polymerase Chain Reaction

- Multiple copies of gene of interest can be synthesised in vitro using two sets of primers and DNA polymerase.

Steps in PCR

1. Denaturaction
2. Annealing
3. Extension

KITE VICTERS CLASS 29

https://youtu.be/tu_Cgqs91

- DNA polymerase used in PCR is – Taq polymerase
- Taq polymerase is isolated from the bacterium named Thermus aquaticus.
- This enzyme is thermostable – That is, this enzyme can remain active during the high temperacture.

Obtaining the foreign gene products

Foreign gene product can be obtained in large scale using bioreactors.

- Bioreactors are large vessels in which raw materials are biologically converted into specific products.
- Provides optimal conditions for achieving the desired products.

Bioreactor

Simple stirred tank bioreactor

Sparged stirred – tank bioreactor

Questions

I Objective type questions.

1. Observe the relationship between the first two terms and fill in the blank.
   Restriction enzymes : Cuts DNA; Joins DNA fragments (1)
2. Choose the correct answer.
   Gel used in electrophoresis is :
   A. Chitinase
   B. Agarose
   C. Ethidium bromide
   D. Lysozyme (1)
3. Name the following
   A vessel used to produce foreign gene product in large scale. (1)
4. Fill in the blank
   Enzymes known as molecular scissors are ———— (1)

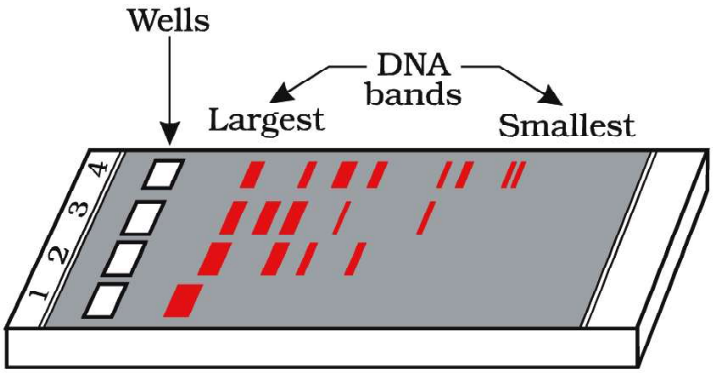
II Short answer type questions (2 scores)

5. Differentiate exonuclease and endonuclease.
6. Name the two types of bioreactors.
7. In PCR a thermostable DNA polymerase enzyme is used.
   a. Name that enzyme.
   b. Name the bacterium from which the enzyme was isolated.
8. DNA fragments can be separated through a technique.
   a. Name the technique.
   b. What is elution?

III Essay type questions (3 scores)

9. Observe the nucleotide sequence given below.
   5^1 ___ GAATTC____ 3^1
   3^1 ____ CTTAAG ____ 5^1
   a. Identify the type of nucleotide sequence given above.
   b. Define this kind of nucleotide sequence.
   c. Name the restriction endonuclease that cuts this nucleotide sequence.

10. Observe the figure given below.



a. Identify the technique.

b. Explain the process of separation of DNA fragments through this technique.

11. Multiple copies of gene of interest can be synthesised through PCR.

a. Expand PCR

b. Write the steps involved in PCR.

c. Name the DNA polymerase enzyme used in PCR.

12. What is a bioreactor? Write down the two types of bioreactors.

Scoring Key

I 1. DNA ligase (1)

2. B (1)

3. Bioreactor (1)

4. Restriction enzymes (1)

II 5.

Exonuclease	Endonuclease
Remove nucleotides from the ends of the DNA	Make cuts at specific positions within the DNA

(1 + 1 = 2)

6. Simple stirred tank bioreactor

Sparged stirred tank bioreactor (1 + 1 = 2)

7. a. Taq polymerase 1

b. *Thermus aquaticus* 1

8. a. Gel electrophoresis 1

b. Extraction of separated bands of DNA from the gel piece 1

III 9. a. Palindromic nucleotide sequence (1)

b. Sequence of base pairs that reads same on the two strands when orientation of reading is kept the same. (1)

c. EcoRI (1)

10. a. Gel electrophoresis

b. Negatively charged DNA molecules move towards the anode through the matrix. (1)

Smaller DNA fragments move faster. (1)

11. a. Polymerase chain reaction (1)

b. Denaturation, Annealing Extension, (½ + ½ + ½)

c. Taq Polymerase (½)

12. Bioreactors are vessels in which raw materials are biologically converted into specific products.

Simple stirred tank (1)

Sparged stirred tank. (1)

Chapter-5

Biotechnology And Its Applications

Focus area

- Biotechnological applications in agriculture, uses of GMOS and Bt cotton, Genetically engineered insulin, gene therapy.

Biotechnological applications in agriculture

Three options that can be thought for increasing food production;

(i) Agro-chemical based agriculture;

(ii) Organic agriculture; and

(iii) Genetically engineered crop-based agriculture

KITE VICTERS CLASS 30

https://youtu.be/Cb7Ekvk

Genetically Modified Organisms (GMO)

Plants, bacteria, fungi and animals whose genes have been altered by genetic engineering are called Genetically Modified Organisms (GMO). GM plants have been useful in many ways.

- GM crops are more tolerant to abiotic stresses (cold, drought, salt, heat).
- Reduced reliance on chemical pesticides.
- They help to reduce post harvest losses.
- They have increased efficiency of mineral usage.
- Enhanced nutritional value of food, eg., golden rice, i.e., Vitamin 'A' enriched rice.

Bt CROPS

- Bt toxin is produced by a bacterium called *Bacillus thuringiensis* (Bt for short).
- Bt toxin gene has been transferred to crop plants to provide resistance to insects without the need for insecticides. Examples are Bt cotton, Bt corn, rice, tomato, potato and soyabean etc.
- The Bt toxin protein exists as inactive protoxins . It is converted into an active form in the alkaline pH of the insect's gut.
- The activated toxin binds to the surface of midgut epithelial cells and create pores that cause lysis of cells and eventually cause death of the insect.
- Bt toxin is coded by a gene named cry. There are a number of them, for example, proteins formed from cryIAc and cryIIAb, control the cotton bollworms, that of cryIAb controls corn borer.

BIOTECHNOLOGICAL APPLICATIONS IN MEDICINE

- Insulin consists of two short polypeptide chains: chain A and chain B, that are linked together by disulphide bridges.
- In mammals insulin is synthesised as a pro-hormone which contains an extra stretch called the C peptide.
- In 1983, Eli Lilly an American company prepared two DNA sequences corresponding to A and B polypeptides of human insulin and introduced them in plasmids of E. coli.
- Chains A and B were produced separately, extracted and combined by creating disulfide bonds to form human insulin.
- The main challenge for production of insulin using rDNA technique was getting A and B chains assembled into a mature form.

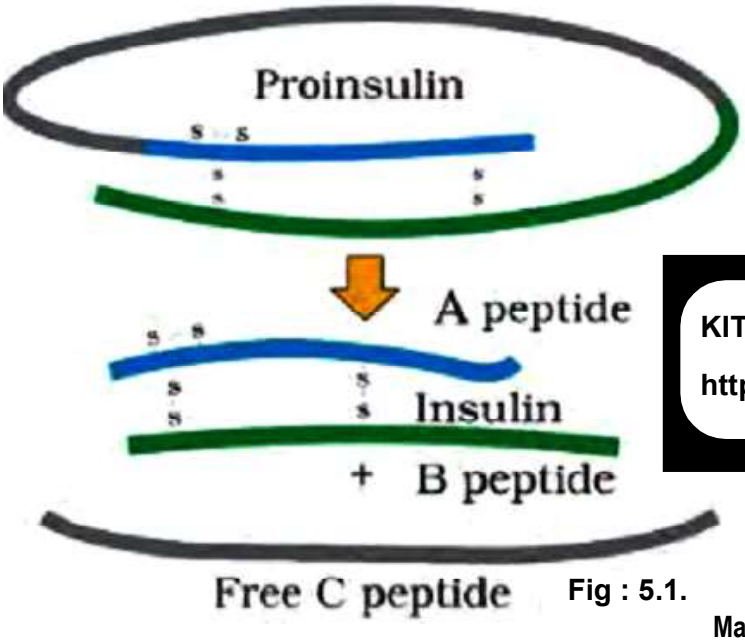


Fig : 5.1.
Maturation of Proinsulin

KITE VICTERS CLASS 30
https://youtu.be/trrViZRn3xo

Gene therapy

- Gene therapy is the method that allows correction of a gene defect that has been diagnosed in a child/embryo.
- It involves delivery of a normal gene into the individual or embryo to take over the function of the non- functional gene.
- The first clinical gene therapy was given to a 4-year old girl with adenosine deaminase (ADA) deficiency.
- ADA deficiency can be cured by bone marrow transplantation or can be treated by enzyme replacement therapy.
- As a first step towards gene therapy, lymphocytes from the blood of the patient are grown outside.

- A functional ADA cDNA is introduced into the lymphocytes, which are subsequently returned to the patient.

KITE VICTERS CLASS 30
https://youtu.be/hIqQrY_gZQE

Questions

1. Suggest the possible options for increasing food production. (3)
2. Expand GMO. (1)
3. Which one among the following is not a feature of GMO's.
   a) GM crops are more tolerant to abiotic stresses. (1)
   b) Increased reliance on chemical pesticides.
   c) They helped to reduce post harvest losses.
   d) They have increased efficiency of mineral usage.
4. Expand Bt in Bt crops. Give two examples for Bt crops. (3)
5. Bt toxin produced by the *Bacillus* does not kill the bacteria. Why?. (2)
6. In 1983, Eli Lilly an American company prepared human insulin through rDNA technology. Write the main steps in this process. (2)

8) Expand ADA. Suggest two methods to treat ADA deficiency. (3)

Answers

1) (i) Agro-chemical based agriculture. (3 x 1 = 3)
   (ii) Organic agriculture.
   (iii) Genetically engineered crop-based agriculture.
2) Genetically Modified Organisms. (1)
3) b) Increased reliance on chemical pesticides. (1)
4) *Bacillus thuringiensis.* (1 + 1 + 1 = 3)

   Eg:- Bt cotton, Bt corn, rice, tomato, potato and soyabean etc. (Any two)

5) Bt toxin protein exists as inactive protoxins. But once an insect ingest the inactive toxin, it is converted into an active form of toxin due to the alkaline pH of the gut. (1 + 1 = 2)

6) - Eli Lilly an American company prepared two DNA sequences corresponding to A and B chains of human insulin

- Introduced them in plasmids of E. coli to produce insulin chains. (4 x ½ = 2)
- Chains A and B were produced separately,
- Chains A and B were extracted and combined by creating disulfide bonds to form human insulin.

7) Adenosine deaminase. (1)

- In some cases ADA deficiency can be cured by bone marrow transplantation.
- In others it can be treated by enzyme replacement therapy. (1 + 1)
- Can also be treated by introducing functional ADA cDNA (using a retroviral vector) into the lymphocytes of the patient. (Any two)

Chapter 6

Organisms and populations

- Ecology is the study of interactions among organisms and between the organisms and their physical (abiotic) environment.

Focus areas

- Adaptations - in organisms of

  deserts

  polar regions

  high altitudes
- Population attributes (Age pyramids, population density)
- Population growth
- Population interactions

  parasitism

  Commensalism

  Mutualism

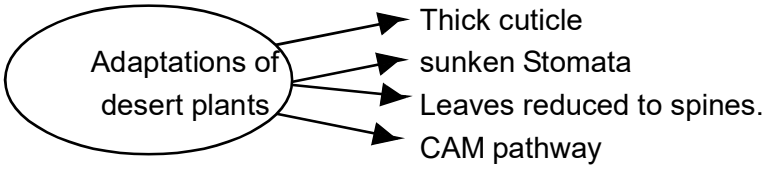
- **Population** : A group of organisms of one species occupying a defined area and usually isolated to some degree from other similar groups.

  Adaptation : Any attribute of the organism (Morphological, physiological, behavioural) that enables the organism to survive and reproduce in its habitats.

Adaptations in Kangaroo rat

- Capable of meeting water requirements through internal fat oxidation.
- Has the ability to concentrate its urine to minimise water loss .

Adaptations of desert plants



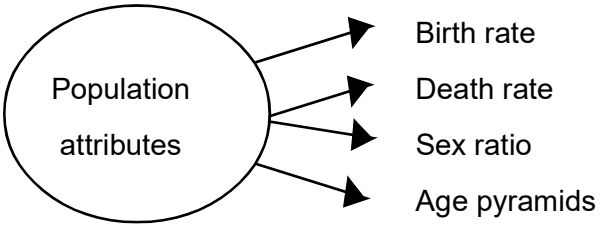
Adaptations (in colder climates)

- Mammals from colder climates generally have shorter ears and limbs to minimise water loss. (Allen's rule)

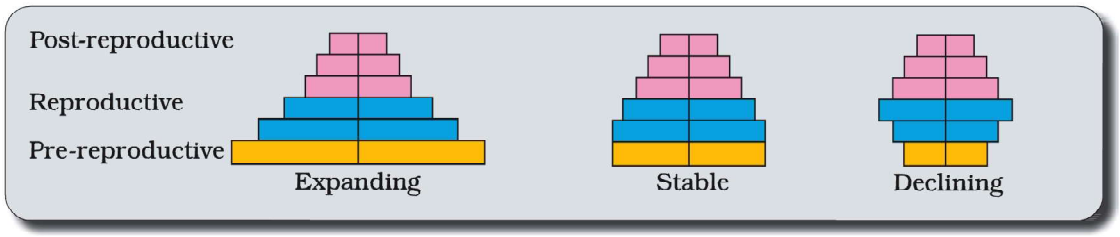
- Aquatic mammals have a thick layer of fat below their skin to reduce loss of body heat – blubber.

Adaptations in high altitudes

- Increased RBC count.
- Decreased binding affinity of haemoglobin
- Increased breathing rate, to compensate low oxygen availability



- Graphical representation of the age distribution of a population.

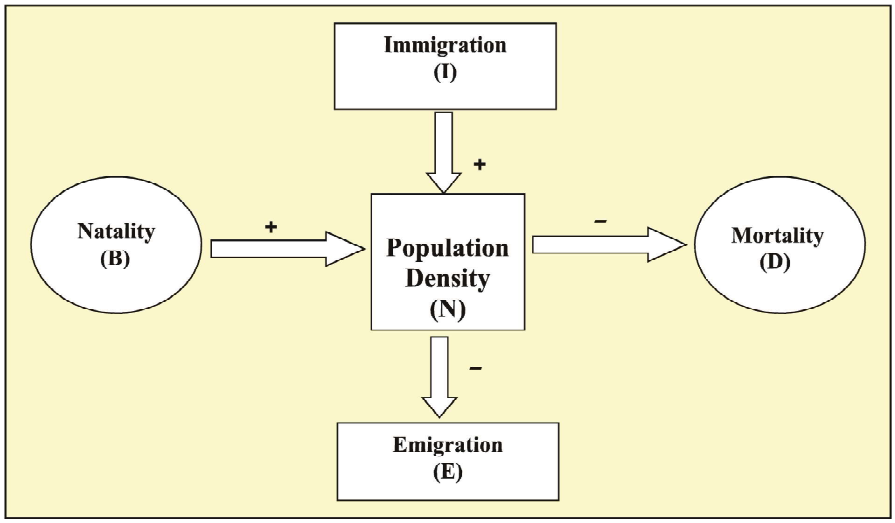


Population density

- Size of the population technically called population density. Number of individuals per unit area.

Population growth

- The size of a population fluctuates due to the changes in 4 basic processes as shown in the flow chart.



- If N is the population density at time t, then its density at time t + 1 is $N_{t+1} = N_t + [(B + I) – (D + E)]$

Population Interactions

- Interspecific interactions arise from the interactions of populations of two different species.
- Interaction may be 1) Beneficial (+)
  2) Detrimental (-)
  3) Neutral (0)

Species A	Species B	Name of Interaction
+	+	*Mutualism*
–	–	*Competition*
+	–	*Predation*
+	–	*Parasitism*
+	0	*Commensalism*
–	0	*Amensalism*

Parasitism

- One species benefited (+) and the other species harmed (-)

  e.g.,: Human liver fluke, it has two intermediate hosts —> Snail and fish

Parasites

Ectoparasites	Endoparasites
Lives on external surface of the host	Inside the host
e.g., Lice on humans, Ticks on dogs, Cuscuta	e.g., Human liver fluke, Malarial parasite

Brood parasitism

- Here parasitic bird lays eggs in the nest of its host and lets the host incubate them. e.g.,. Crow and Cuckoo (Koel)

Commensalism

- One species benefited and the other is neither harmed nor benefited.

  e.g: Orchid and Tree

  Cattle egret and cattle

  Sea anemone and clown fish

Mutualism : Both species are benefited

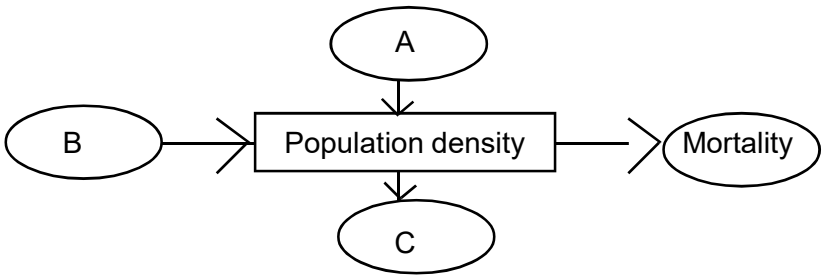
e.g., Lichen

Mycorrhizae

Fig and wasp

Questions

1. Pick out a good example for mutualism from the following pairs.
   A. Lice on humans
   B. Lichen
   C. Sea anemone and clownfish
   D. Ticks on dog (1)
2. Name the special photosynthetic mechanism of desert plants that enable them to close their stomata during day time. (1)
3. Define Allen's rule (1)
4. Aquatic mammals of polar seas have a thick layer of fat to reduce heat loss is called _____ (1)
5. Kangaroo rats in North American deserts have special features to survive in deserts. Write two such features. (2)
6. Distinguish between ectoparasites and endoparasites with examples. (2)
7. Orchid plants growing on tree is a good example of interspecific interactions.
   Identify the interaction and give reasons for your answer. (2)
8. Write any two morphological adaptations of desert plants. (2)
9. People living in high altitudes have a higher RBC count. Why? (2)
10. Observe the flow chart given below.



a) Name the processes in boxes A, B and C.

b) Briefly describe how these processes influence the population density. (3)

Answers

1.	Lichen	1
2.	CAM pathway	1
3.	Mammals from colder climates generally have shorter ears and limbs to minimise heat loss.	1
4.	Blubber	1
5.	Capable of meeting water requirements through internal fat oxidation. Has the ability to concentrate its urine to minimise water loss.	1+1
6.	Lives on external surface of host e.g., Ticks on dogs lives e.g., Human liver fluke inside the host.	1+1
7.	Commensalism - one species benefited and the other species neither benefited nor harmed.	1+1
8.	Thick cuticle, leaves reduced to spines.	1+1
9.	In high altitudes atmosphere pressure is low. To compensate low oxygen availability in high altitudes body produces more RBC	1+1
10.	a) A Immigration	½
	B. Natality	½
	C - Emigration	1
	b) Emigration – Decreases population density	1
	Immigration, natality increases population density	

Chapter 7

Ecosystem

Ecosystem is a functional unit of nature, where living organisms interact among themselves and also with their physical environment. Ecosystem contains abiotic and biotic components. Productivity, decomposition, energy flow and nutrient cycling are the four important components of an ecosystem.

Focus areas

14.2 Productivity

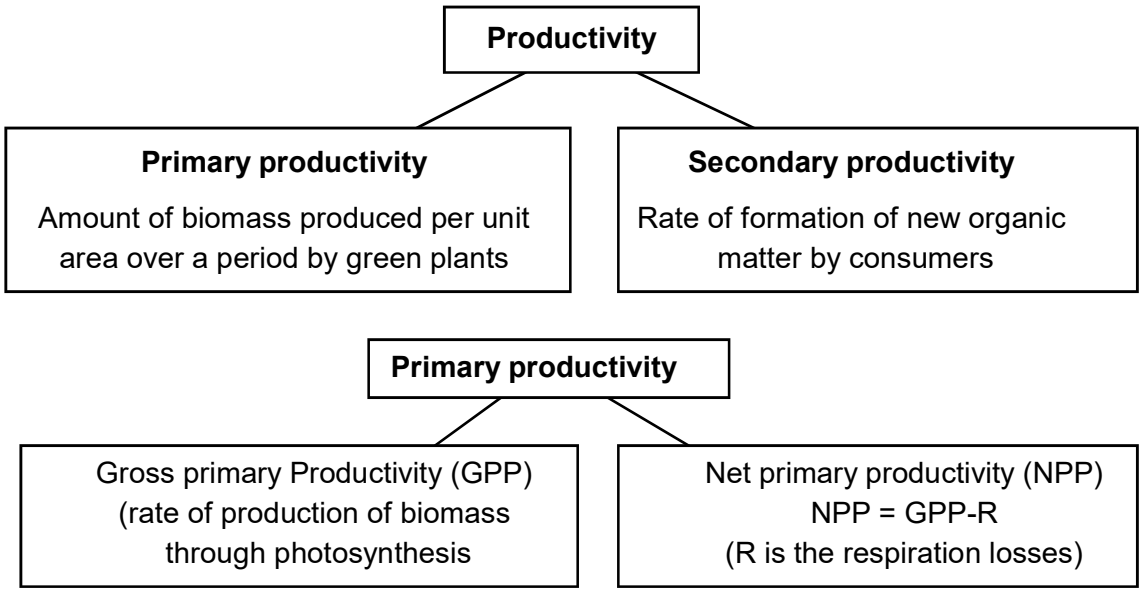
14.3 Decomposition

14.4 Energy flow-food chain, food web and trophic levels.

14.5 Ecological pyramids

14.7 Nutrient cycling – Phosphorus cycle.

Productivity – The rate of production of biomass



Factors affecting productivity

- Plant species of an area.
- Photosynthetic capacity of plants.
- Environmental factors
- Availability of nutrients

Decomposition

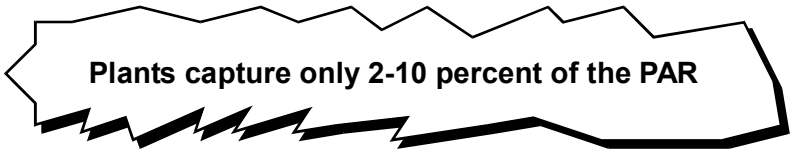
Break down of complex organic matter into inorganic substances.

Steps in decomposition

- Fragmentation
- Leaching
- Catabolism
- Humification
- Mineralisation

Energy flow

Less than 50 percent of solar radiation is PAR (photosynthetically active radiation)



Energy flow in ecosystems takes place through food chain.

Types of food chain

Detritus food chain DFC — Grazing food chain GFC

DFC – begins with dead organic matter

Detritus —> decomposers

Grazing Food chain	-	Begins with plants (producers)
Produces	-	Prepare their own food through photosynthesis (Autotrophs)
Consumers	-	Organisms depend on plants directly or indirectly for their food. (Heterotrophs)

Types of consumers

1. **Primary consumers**

   Feed on plants directly (Herbivores)

   e.g., Deer, goat etc.

2. **Secondary consumers (carnivores)**

   consumers that feed on herbivores. They are also known as primary carnivores (e.g., : Birds, Wolf etc.)

3. **Tertiary consumers**

   Animals that depend on the primary carnivores for food. They are also known as secondary carnivores (Top carnivors).

   (e.g., Lion, Tiger etc)

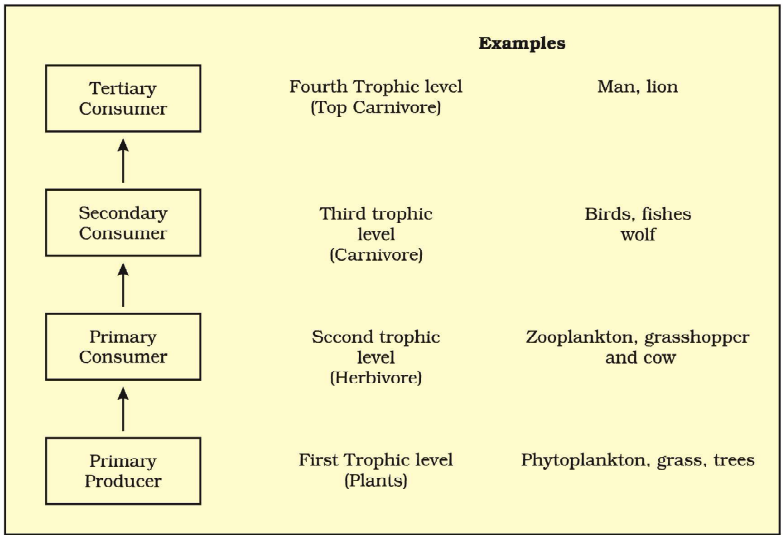
Grazing Food Chain (GFC)

Eg:- Grass → Goat → Man

Producer (Primary consumer) (Secondary consumer)

Trophic level

All organisms occupy a specific place in the food chain based on their source of food called – trophic level.



Food Web

The natural interconnection of food chains

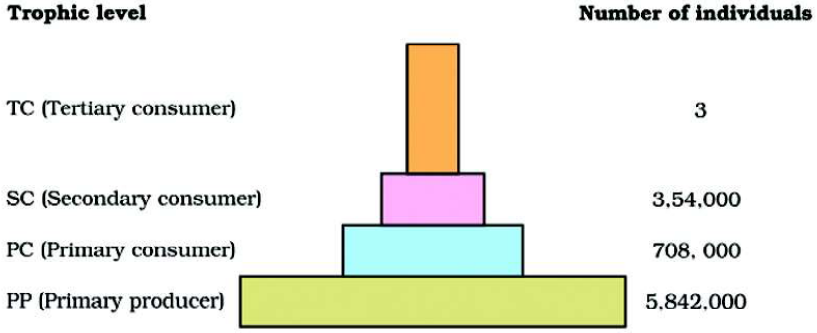
Ecological Pyramids

Graphical representation of relationship of organisms at different trophic levels.

Types of ecological pyramids

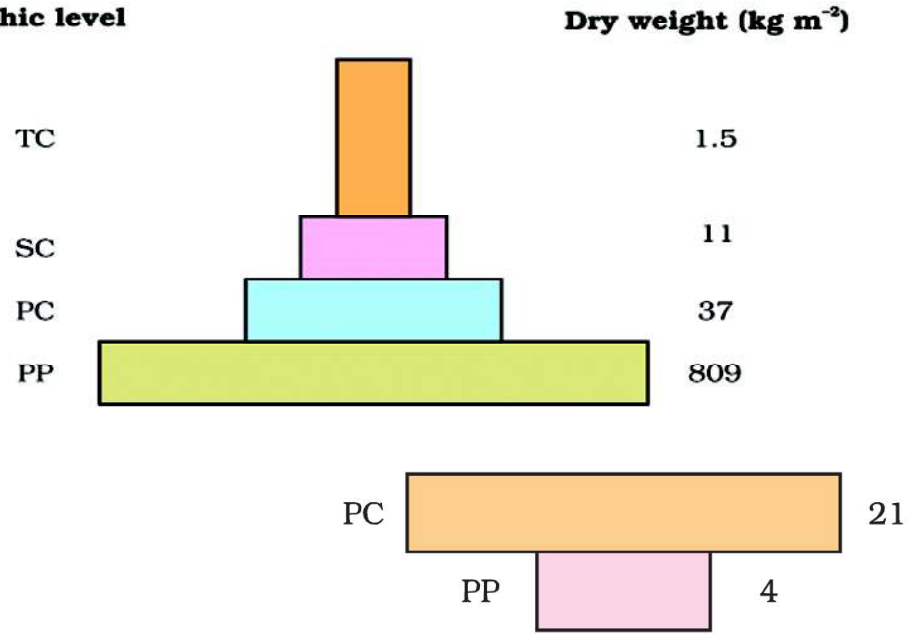
1. Pyramid of number

   Number of organisms at each trophic level.



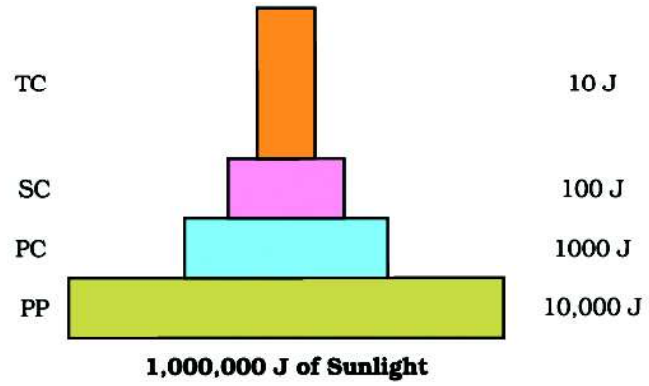
2. Pyramid of biomass

Biomass of organisms at each trophic level.



3. Pyramid of energy

Flow of energy through different trophic levels

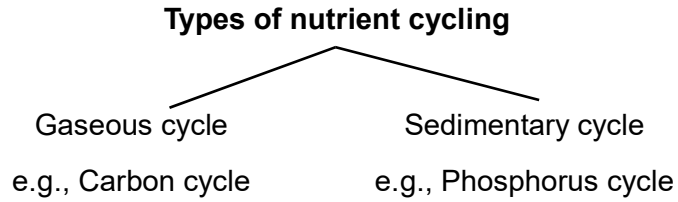


Pyramid of energy is always upright. justify.

When energy flows from a particular trophic level to the next trophic level, some energy is always lost as heat at each step.

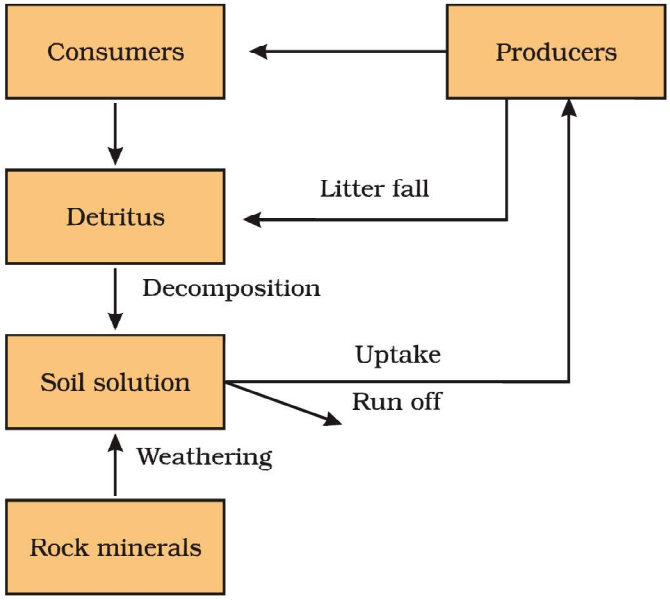
Nutrient cycling

The movement of nutrient elements through the various components of an ecosystem is called nutrient cycling (Biogeochemical cycling).



Phosphorus cycle

- Sedimentary cycle
- Reservoir is earth's crust (Rock)



Questions

I Objective type questions

1. Fill in the blank

   Pyramid of _____ of an aquatic ecosystem is inverted. (1)

2. Choose the correct answer.

   Rate of formation of new organic matter by consumers is called _____ (1)

   A. Primary productivity

   B. Secondary productivity

   C. Gross primary productivity

   D. Productivity

3. Observe the relationship between the first two terms and fill in the blank.

   Gaseous cycle : Carbon cycle; _____ Phosphorus cycle. (1)

4. Name the following

   A food chain that beings with producers. (1)

II Short answer type questions

5. Observe the data given below and construct a pyramid (2)

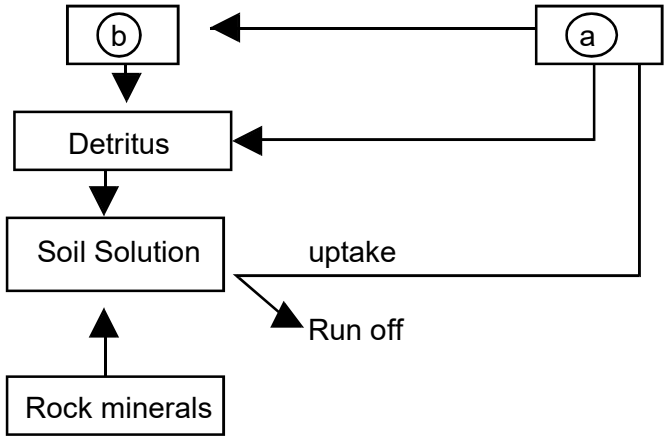
100J
1000J
10J
10000J

6. Pyramid of energy is always upright Justify this statement. (2)
7. Differentiate gross primary productivity and net primary productivity. (2)
8. Construct a food chain using the following organisms.
   Write the trophic level of goat.

   (Goat, Lion, Grass) (2)

III Eassy type questions

9. Write the steps in decomposition. (3)
10. Write the difference between GFC and DFC. Expand GFC and DFC. (3)
11. Name the two types of primary productivity. Write the factors that affect primary productivity (3)
12. Observe the flow chart given below.



   a. Fill in the blank (a), (b)
   a. Name the nutrient cycling.
   c. Name the type of nutrient cycling. (3)

Answers

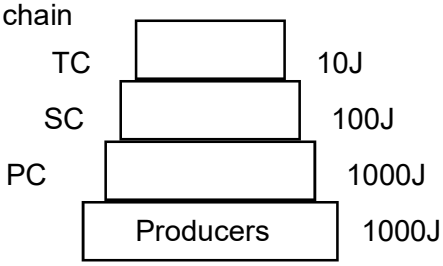
I 1. Biomass 1

2. B 1

3. Sedimentary 1

4. Grazing food chain 1

II 5



(2)

6. When energy flows from a particular trophic level to the next trophic level, some energy is always lost as heat at each step.

7.

Gross primary productivity	Net primary productivity
The rate of production of organic matter during photosynthesis	Gross primary productivity minus respiration losses

8. Grass —> Goat —> Lion (1)

Goat – Second trophic level (1)

III 9. Fragmentation
Leaching
Catabolism
Humification
Mineralisation (3)

10. GFC - Begins with producers / plants
DFC - Begins with detritus
GFC - Grazing food chain
DFC - Detritus Food chain (3)

11. Gross primary productivity

Net primary productivity

- Plant species inhabiting a particular area.
- Photosynthetic capacity of plants (3)
- Environmental factors
- Availability of nutrients (Any two)

12. a a - Producers
b - Consumers

b. Phosphorus cycle

c. Sedimentary cycle

Chapter 8

Environmental Issues

Pollution

Pollution is any undesirable change in physical,chemical or biological characteristics of air, land, water or soil. Agents that bring about such an undesirable change are called as pollutants. In order to control environmental pollution, the Government of India has passed the Environment (Protection) Act, 1986 to protect and improve the quality of our environment (air, water and soil).

Focus Area

- Water pollution and its control, BOD, Algal bloom, Eutrophication.
- Green house effect and global warming.
- Ozone depletion in the stratosphere.
- Deforestation.

Water Pollution

Water (prevention and control of pollution) Act, 1974- to safe guard our water resources.

O.1% of impurities in water makes the water polluted.Impurities include

- Suspended solids.
- Colloidal materials.
- Dissolved materials.

Effects of water pollution

1. **Increase in BOD (Biochemical Oxygen Demand**) — Greater demand of oxygen by decomposers (Bacteria) to decompose bio-degradable organic matter. When BOD increases dissolved oxygen content in water bodies decreases.

Effects of increase in BOD.

- Decrease the amount of dissolved oxygen.
- Causes death of aquatic organisms.

Algal bloom

Presence of large amounts of nutrients in water causes excessive growth of planktonic (free-floating) algae, called algal bloom

Effects of algal bloom

- Imparts a distinct colour to the water in water bodies.
- Decreases water quality.

- Fish mortality.
- Some bloom-forming algae are extremely toxic to human beings and animals.

Eutrophication

Eutrophication is the natural aging of a lake by nutrient enrichment of its water.

Process of eutrophication

- Streams draining into the lake introduce nutrients such as nitrogen and phosphorus.
- As the lake's fertility increases, plant and animal life increases, and organic remains begin to be deposited on the lake bottom.
- Silt and organic debris pile up, the lake grows shallower and warmer.
- Warm-water organisms replaces those that thrive in cold environment.
- Marsh plants appear in the lake. Eventually, the lake is converted into land.

Cultural or accelerated eutrophication

Pollutants from man's activities like wastes from the industries and homes accelerate the aging process of lakes. This is called accelerated eutrophication.

Greenhouse effect

- The greenhouse effect is responsible for heating of Earth's surface and atmosphere.
- Certain gases present in the atmosphere absorb a major fraction of infrared radiation escaping into the outer space and redirects their radiation to the earth's surface. This process is called greenhouse effect.
- Gases that redirects infrared radiation into the earth's surface is called greenhouse gases.

  Examples of greenhouse gases are CO_2, methane, CFCs and N_2O

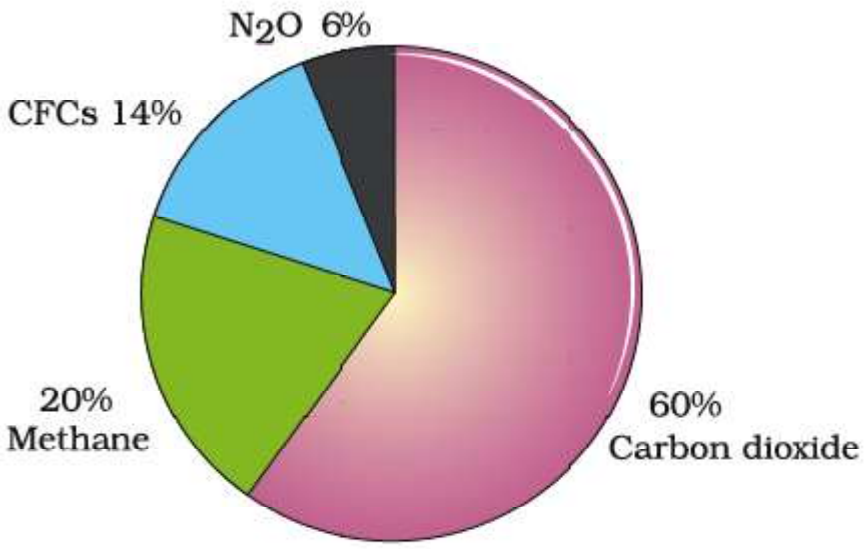


Fig. 8.1 Relative contribution of greenhouse gases to global warning

Global warming

Increase in the concentration of greenhouse gases causes a rise in temperature of the earth's surface at a global level. This is called global warming

Effects of global warming

- Odd climate change
- Increased melting of polar ice caps and Himalayan snow caps.
- Rise in sea level that can submerge many coastal areas.

Measures to control global warming

- Reduce the use of fossil fuel
- Improving efficiency of energy usage
- Reducing deforestation
- Planting trees
- Slowing down the growth of human population
- International initiatives to reduce the emission of greenhouse gases into the atmosphere.

Ozone depletion

- Good ozone is found in the lower part of the stratosphere, and it acts as a shield absorbing ultraviolet radiation from the sun found in the stratosphere.
- Thickness of ozone layer is measured in terms of **Dobson Units (DU)**.
- Ozone is continuously formed by the action of UV rays on molecular oxygen and also degraded into molecular oxygen in the stratosphere.
- Ozone depletion is caused by chlorofluorocarbons (CFCs) released from refrigerants.
- CFCs discharged in the lower part of atmosphere move upward,in the stratosphere UV rays act on CFCs releasing Cl atoms.
- Cl degrades ozone releasing molecular oxygen.
- Ozone depletion is mainly marked over the Antarctic region. This resulted in the formation of a large area of thinned ozone layer, commonly known as ozone hole.

Effects of ozone depletion

- UV-B damages DNA and mutation may occur.
- Causes aging of skin.
- Damage to skin cells and various types of skin cancers.
- Our cornea absorbs UV-B radiation.

- High doses of UV-B causes inflammation of cornea called snow blindness.

Montreal Protocol—Signed at Montreal in Canada in 1987 to control the emission of ozone depleting substances.

Deforestation - Deforestation is the conversion of forested areas to non-forested ones.

Reasons for deforestation

- Agriculture
- Timber
- Firewood
- Cattle grazing

Jhum cultivation

- An agricultural practice that leads to deforestation in north-eastern states of India is **slash and burn agriculture** or **Jhum cultivation**.
- Farmers cut down the trees of the forest and burn the plant remains. The ash is used as fertilizer and the land is then used for farming and cattle grazing.
- The farmers then move on to other areas and repeat this process.

Consequences of deforestation

- Enhanced CO_2 concentration.
- Loss of biodiversity.
- Disturbs hydrologic cycle.
- Causes soil erosion.
- Leads to desertification.

Reforestation

Reforestation is the process of restoring a forest that once existed,but was removed at some point of time in the past.

Chipko Movement – In 1974 local women in Garhwal Himalayas showed bravery in protecting trees from the axe of contractors by hugging them.

Joint Forest Management (JFM) – In 1980 the Government of India introduced this to work closely with the local communities for protecting and managing forest / trees.

Questions

1. Fill in the blank.

   BOD is an effect of _____. (1)

2. Write a sustainable method for disposing human excreta and write its two merits. (2)

3. Write the unit to measure the thickness of ozone. Write the effects of Ozone depletion. (2)
4. Choose the correctly matched pair. (1)
   a. Snow blindness – Air pollution
   b. Algal bloom – Ozone depletion
   c. Eutrophication – Water pollution
5. Greenhouse effect is caused by greenhouse gases. Name the greenhouse gases. (2)
6. Increase in biodegradable matter in aquatic bodies cause BOD. Expand BOD. Write its two effects. (3)
7. Define deforestation. Write its consequences. (3)
8. Global warming is a harmful effect of pollution. Explain how they are related?. (2)
9. List the harmful effects of global warming. Suggest four measures to control global warming. (2)
10. Mention the role of CFCs in ozone depletion. (2)
11. Fill in the blank.

    Thickness of ozone layer is measured in terms of _____. (1)
12. Thin regions of ozone layer permits the entry of UV-B radiations into troposphere. How this affects human beings?. (2)
13. Name the treaty signed in 1987 to control the emission of ozone depleting substances. (1

Answers

1. Water pollution. (1)
2. Ecological sanitation using dry composting toilets. (1)

   Merits –

   Practical and hygienic

   Can be recycled into fertilizer
3. Dobson Units (½+½ = 1)

   Effects

   Damages DNA and causes mutation

   Causes aging of skin

   Damage to skin cells (½ + ½ + ½ + ½ = 2)
4. Eutrophication – Water pollution (1)

5. CO_2, CH_4, N_2O and CFCs. (½ x 4 = 2)

6. Biochemical oxygen demand.

   This causes mortality of fish and other aquatic creatures. Also causes excessive growth of planktonic (free-floating) algae, called an algal bloom. (1+1+1 = 3)

7. Cutting down of trees is called deforestation. (1)

   Consequences-Enhanced CO_2 concentration,loss of biodiversity,disturbs hydrologic cycle,causes soil erosion. (½ x 4 =2)

8. Atmospheric pollution increases the concentration of greenhouse gases in the atmosphere. When the concentration of greenhouse gases increases, atmospheric temperature also increases due to greenhouse effect.

9.
   - Reduce the use of fossil fuel
   - Improving efficiency of energy usage
   - Reducing deforestation
   - Planting trees
   - Slowing down the growth of human population. (½ x 4 = 2)

10. UV rays act on CFCs releasing Cl atoms. Cl degrades ozone releasing molecular oxygen. (1+1 = 2)

11. Dobson unit. (1)

12. UV-B damages DNA and mutation may occur. It causes aging of skin,damage to skin cells and various types of skin cancers. In human eye, cornea absorbs UV-B radiation, and a high dose of UV-B causes inflammation of cornea, called snow-blindness, cataract, etc. Such exposure may permanently damage the cornea. (any four) (2)

13. Montreal protocol. (1)

Sample Question Paper– 2020-21

Biology

Part A (Botany) **Max. Score : 30**

I Questions 1 to 7 carriers 1 score each

1) Given below is a diagram showing a mode of asexual reproduction. Identify the asexual reproductive structure?

2) Both chasmogamous and cleistogamous flowers are present in

a) Jasmine b) Commelina

c) Rose d) Hibiscus

3) Residual, persistant nucellus present in some seed is known as _____

4) Monocot embryo has a thin cotyiedon called _____?

5) Observe the relationship in the first pair and fill up the blank in the second pair.

Cry I Ab : Controls corn borer

Cry I Ac : _____

6) Name the first isolated restriction endonuclease.

7) Name the interaction between crow and cuckoo.

II Question numbers 8 to 26 carriear 2 scores each

8) Define external fertilisation write its disadvantage.

9) March column A with B.

A	B
1) Bulbil	i) Bryophyllum
2) Offset	ii) Sponges
3) Gemmule	iii) Water Hyacinth
4) Leaf buds	iv) Agave

10) Write any three mechanisms in plants to prevent inbreeding.

11) Write the fusions involved in double fertilisation.

12) Write any four measures for successful bee-keeping.

13) Arrange the steps in plant breeding given below in correct order?

A - Evaluation and selection of parents.

B - Collection of variability

C - Testing, release & commercialisation of cultivars.

D - Cross hybridisation among the selected plants.

E - Selection and testing of superior recombinants

14) Expand the short forms given below.

1. PCR
2. ELISA

15) What are the uses of GMOs?

16) Pyramid of energy is always upright justify.

17) What are the steps in decomposition?

18) Define eutrophication and algal bloom.

19) Expand CNG. Why it is considered as better fuel than diesel?

20) Name the four green house gases that contribute to global warming.

21. Name the wall layers of the anther?

22. Expand SCP Define SCP

23. What is a hermaphrodite. Give two examples.

24. Write any four adaptations of desert plants.

25. What are the consequences of deforestation?

26. Differentiate hydrarch and xerarch succession.

III Questions from 27 to 31 carries 3 scores each.

27. Explain the structure of pollen grain.

28. Bt cotton contains gene from a bacterium.

a) Name that bacteria

b) The toxic protein produced by the bacterium does not kill the bacterium. Justify.

29. Define transgenic animals. Write any two biological products obtained from transgenic animals.

30. What is biofortification? Write its objectives.

31. Observe the table given below and fill in the blanks.

Species A	Species B	Name of interaction
+	+	(a)
-	-	(b)
(c)	(d)	Commensalism
(e)	(f)	Predation

Answer

1) Conidia
2) b-commelina
3) perisperm
4) scutellum
5) Cotton bollworm
6) Xind II
7) Brood parasitism
8) Syngamy occurs outside the body of an organism is called external fertilization.
   eg:- amphibian, Algae, fish
   Disadvantages
   i) chances of syngamy is very less
   ii) Attack of predations
9) 1) Bulbil - Agave
   2) Offset - Water hyacinth
   3) Leaf bud - Bryophyllum
   4) Gemmule - Sponge
10) i) Unisexuality
   ii) Dioecious condition
   iii) Stamen and stigma are of different levels.
   iv) Self-sterility or self – incompatibility
   v) Androecium and gynoecium mature at different times.
11) Syngamy
   Triple fusion
12) i) Knowledge of nature and habit of bees.
   ii) Selection of suitable location.
   iii) Catching and hiving of swarms.
   iv) Management of bee hives in different seasons.
   v) Handling and collection of honey and beewax. (any four)
13) B, A, D, E and C
14) PCR - Polymerase Chain Reaction
   ELISA - Enzyme Linked Immuno Sorbent Assay

15) i) Mode crops more tolerant to abiotic stresses
ii) reduced reliance on chemical pesticides.
iii) helps to reduce post harvest losses.
iv) enhanced nutritional value of food.

16. When energy flows from a particular trophic level to the next trophic level, some energy is always lost as heat at each step.

17) Fragmentation
Leaching
Catabolism
Humification
Mineralisation

18. **Eutrophication**

Eutrophication is the natural aging of a lake by nutrient enrichment of its water.

Algal bloom

Presence of large amounts of nutrients in water causes excessive growth of planktonic (free-floating) algae, called algal bloom

19. Compressed Natural Gas

Burns efficiently

Cheaper than petrol or diesel

Cannot be siphoned off by thieves.

Cannot be adulterated

20. CO_2, Methane, CFCs, N_2O

21. Epidermis, Endothecium, Middle layers, Tapetum.

22. SCP – Single Cell Protein. Alternate source of protein for animal and human consumption.

23. Male and female sex organs are present in the same organism.
Leech/Earthworm/Tapeworm, Sponge (Any one).

24. Thick cuticle.

Sunken stomata

CAM Pathway

Some plants have no leaves or reduced to spines.

25. Enhanced CO_2 concentration in the atmosphere

Loss of biodiversity

Disturbs hydrologic cycle.

Causes soil erosion.

26. Hydrarch – Succession in water bodies/wet places

    Xerarch – succession in dry areas

27. Pollen grain has two layers.

    Outer layer is hard and is called exine.

    Exine is made up of sporopollenin.

    Inner layer is intine.

    It is thin and continuous.

    Intine is made up of cellulose and pectin.

    A pollen grain has two cells

    Large cell is vegetative cell.

    Small cell is generative cell.

    (Any six points)

28. a. *Bacillus thuringiensis*

    b. Btoxin protein exists as inactive protoxin.

    When insects ingest the inactive toxin, it is converted into an active form of toxin due to the alkaline pH of the gut which solubilise the crystals.

29. Animal whose DNA is manipulated to possess and express an extra gene

    Alpha – I – antitrypsin

    Alpha – lactalbumin.

30. Breeding crops with higher levels of vitamins, minerals, or higher protein and healthier fats.

    To improve protein content and quality.

    To improve oil content and quality.

    To improve vitamin content.

    To improve macronutrient and mineral content.

31. a) Mutualism.

    b) Competition

    c) + /0

    d) 0/+

    e) +/-

    f) +/-

..

GENERAL EDUCATION DEPARTMENT
SAMAGRA SHIKSHA, KERALA