

CBSE
Class XII Biology

Time: 3 Hours

Total Marks: 70

General Instructions:

1. All questions are compulsory.
 2. This question paper consists of five sections A, B, C, D and E. Section **A** contains **5** questions of **one** mark each, Section **B** is of **5** questions of **two** marks each, Section **C** is of **12** questions of **three** marks each, Section **D** is of **1** question of **four** marks and Section **E** is of **3** questions of **five** marks each.
 3. There is no overall choice. However, an internal choice has been provided in **one** question of **2** marks, **one** question of **3** marks and all the **three** questions of **5** marks weightage. A student has to attempt only one of the alternatives in such questions.
 4. Wherever necessary, the diagrams drawn should be neat and properly labelled.
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Section A

- | | |
|---|-----|
| 1. What kind of stem does banana have? How do you recognise it? | [1] |
| 2. What is the main function of gel electrophoresis? | [1] |
| 3. What is a plasmid? | [1] |
| 4. Name two lymphoid organs. | [1] |
| 5. Why is <i>Gambusia</i> introduced into drains and ponds? | [1] |

Section B

6. What is syngamy? How does it differ from fertilisation? [2]
7. In a cross between a black and a white guinea pig, all F_1 members are black. But the F_2 generation raised by crossing two such F_1 progeny consists of approximately $\frac{3}{4}$ black and $\frac{1}{4}$ white guinea pigs. [2]
(a) What are the possible genotypes at each level?
(b) What will the offspring be like if two F_2 whites are mated?
8. In a plant, tallness (T) is dominant over dwarfness (t) and red flower character (R) is dominant over white (r). If tall and red flower (heterozygous) for both characters is crossed with dwarf and white flower, then what will be the probability of the offspring? [2]
9. What are the two causes of fever? [2]

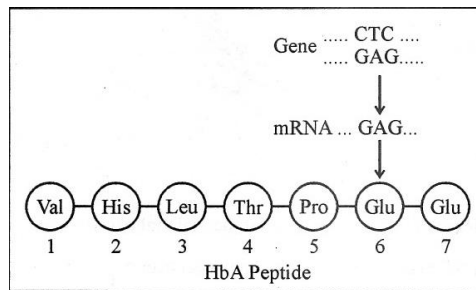
OR

Mention any two symptoms of AIDS.

10. Name two commonly used bioreactors. State the importance of using a bioreactor. [2]

Section C

11. What is the significance of parthenogenesis? [3]
12. What is ovulation? What happens to the Graafian follicles after ovulation? [3]
13. A pea plant with purple flowers was crossed with a plant with white flowers producing 40 plants with only purple flowers. On selfing, these plants produced 470 plants with purple flowers and 162 with white flowers. What genetic mechanisms account for these results? [3]
14. What acts as an inducer in lac operon? How does it switch on the operon? [3]
15. Given below is the representation of the amino acid composition of the relevant translated portion of β -chain of haemoglobin related to the shape of human red blood cells. [3]



- (a) Is this representation indicating a normal human or a sufferer from a certain related genetic disease? Give reason in support of your answer.
- (b) What difference would be noticed in the phenotype of the normal and the sufferer related to this gene?
- (c) Who are likely to suffer more from the defect related to the gene represented-the males, the females or both males and females equally? Why?
16. Name the pathogen, vector and symptoms of the disease Elephantiasis (Filariasis). [3]

OR

Write the source and the effect on the human body of the following drugs:

- (i) Morphine
- (ii) Cocaine
- (iii) Marijuana

- 17.**
- (a) Explain how to overcome inbreeding depression in cattle. [3]
 - (b) List three advantages of inbreeding in cattle.
 - (c) Name an improved breed of cattle.
- 18.** Do eukaryotic cells have restriction endonucleases? Justify your answer. [3]
- 19.** How are red algae more successful to live in deep water? [3]
- 20.** In what ways do urbanisation and increase in population contribute to the population problem? [3]
- 21.** What are the effects of noise pollution? [3]
- 22.** Explain how a hereditary disease can be corrected. Give an example of the first successful attempt made towards correction of such diseases. [3]

Section D

- 23.** Anand, a 14-year-old boy, thinks smoking makes him more energetic and feels like an adult and thus a more responsible citizen. He tries to smoke when he is with his peer group. As a friend, you have to educate him on [4]

- (a) Why he feels more energetic while smoking
- (b) The effects of CO in smoke
- (c) Other ill effects on the body
- (d) What values are reflected here?

Section E

- 24.** Draw a labelled diagram of V.S. of apple and explain the biological importance of fruits. [5]

OR

What are the major functions of male accessory ducts and glands?

- 25.** Describe briefly the mechanism of DNA replication. [5]

OR

Write the full names of the different types of RNA. State only how each type is involved in protein synthesis.

- 26.** State the function of a reservoir in a nutrient cycle. Explain the simplified model of the carbon cycle in nature. [5]

OR

Define the following terms and give one example for each:

- (a) Commensalism
- (b) Parasitism
- (c) Camouflage
- (d) Mutualism
- (e) Interspecific competition

CBSE
Class XII Biology
Solution

Time: 3 hrs

Total Marks: 70

Section A

1. Ans

Banana is an underground modified stem (rhizome). It is a prostrate and swollen stem which grows horizontally under the soil.

It is recognised by its well-marked nodes and internodes. The adventitious roots arise from the lower side.

2. Ans

It is used to separate the fragments of DNA.

3. Ans

It is the extra genetic material in bacteria which can be taken out or injected back. It is self-replicating and carries the genes for sex factor or fertility factor.

4. Ans

Spleen and tonsils

5. Ans

Gambusia is a natural enemy of larva and pupa of mosquitoes as it feeds upon them and thus helps to control the breeding of mosquitoes. So, it is introduced into drains and ponds.

Section B

6. Ans

Syngamy is the fusion of male and female gametes. It results in the formation of a diploid zygote.

The term syngamy means 'fusion of gametes' and describes the event which occurs when two gametes of opposite sexes come close to each other and fuse. However, the term fertilisation encompasses all the associated events which ultimately lead to syngamy.

7. Ans

(a) The genotype at the F1 level will Bb (B - Black, b - white). The genotype at the F2 level will be BB, Bb, Bb, bb.

(b) White is a recessive character, so on mating two F2 whites, the offspring will be all white.

8. Ans

Parents ... Tall and Red \times Dwarf and White

Genes ... TtRr \times ttrr

Gametes ... TR, Tr, tR, tr \times tr

These gametes fuse as follows:

	TR	Tr	tR	tr
tr	TtRr (Tall plant with red flowers)	Ttrr (Tall plant with white flowers)	ttRr (Dwarf plant with red flowers)	Ttrr (Dwarf plant with white flowers)

Result: 1:1:1:1

9. Ans

Causes of fever:

(i) The WBC count of blood increases during inflammation. It generates heat which results in fever.

(ii) Pyrogens or the toxins released by pathogens also generate fever.

OR

Symptoms of AIDS:

(i) Swollen lymph nodes and fever

(ii) Sweating at night and weight loss

10. Ans

Two commonly used bioreactors are batch type and stirred tank bioreactors.

The importance of using bioreactors is

- (i) It provides large volume for cultures. Thus, products are obtained in high quantity.
- (ii) It also provides the optimal conditions for achieving the growth of the desired product such as temperature, pH, vitamins and oxygen.

Section C**11. Ans**

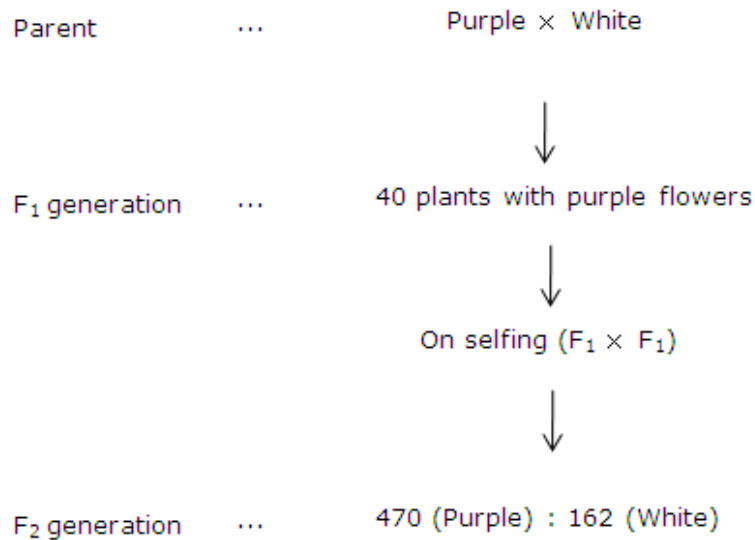
Significance of parthenogenesis:

- (i) It helps in determining the sex of an animal as in honey bee.
- (ii) It overcomes the wastage of energy spent on the processes of mating and fertilisation by an animal.
- (iii) It rapidly increases the number of animals in a population.

12. Ans

Ovulation: It is the process of release of the mature ovum from the ovary in the abdominal cavity. After ovulation, the anterior pituitary gland stops producing FSH but continues to secrete LH, which transforms the ruptured Graafian follicles into the corpus luteum. The corpus luteum secretes progesterone. The uterine glands become complicated, active and more cork screw-shaped for the implantation of the fertilised ovum. If there is no fertilisation, then the corpus luteum undergoes degeneration and progesterone secretion declines leading to a fresh start of the menstruation cycle.

13. Ans



In the F_1 generation, only plants producing purple flowers appeared. This means the purple colour is dominant which does not allow the white colour to express itself. In the F_2 generation, purple and white-coloured flowers were produced in the ratio of 3:1.

Here, the parental character of white again reappeared in about quarter of the progeny. This occurs because of the segregation of genes during gamete formation. This represents the law of segregation and the monohybrid ratio.

14. Ans

Lactose acts as an inducer in the lac operon. The inducer lactose binds to the repressor and forms a complex which remains unable to bind to the operator. RNA polymerase now becomes free to join with the promoter and so the operator comes to the switched on position. This initiates the transcription of the structural genes, producing the three polypeptides (enzymes). These enzymes bring about the metabolism of lactose into glucose and galactose.

15. Ans

- (a) This representation indicates a normal human because glutamic acid is present at the sixth position in the respective amino acid chain.
- (b) In a person who exhibits sickle cell trait, the defect is caused by the substitution of glutamic acid (Glu) by valine (Val) at the sixth position of the β -chain of haemoglobin.
- (c) Both males and females suffer equally because sickle cell anaemia is not a sex-linked disease. It is an autosomal disease and sickle-shaped RBCs will cause equal deficiency of oxygen in both males and females.

16. Ans

Pathogen: Filarial worm (*Wuchereria bancrofti*)

Vector: Culex sp. of female mosquito

Symptoms:

- (i) In acute cases, filarial infection causes fever.
- (ii) Pathogen blocks the lymphatic system and lymph accumulates in other parts of the body, resulting in enlargement of these parts of the body.

OR

- (i) Morphine: It is the main constituent of opium. It is a strong analgesic and has a sedative and calming effect. It suppresses brain functions and relieves intense pain during fractures, burns and surgery.
- (ii) Cocaine: It is obtained from the coca plant (*Erythroxylum coca*). It interferes with the transport of the neurotransmitter dopamine. It has a potent stimulating action on CNS, producing a sense of euphoria and increased energy. Excessive dosage of cocaine causes lack of sleep, loss of appetite and hallucination, ultimately leading to damage of mental functions and insanity.
- (iii) Marijuana: It is obtained from the direct inflorescence and the top leaves of the female plant of *Cannabis sativa*. Marijuana interferes with short-term memory, impairs thoughts and reasoning, changes the perception of time and produces mild euphoria. It lowers the levels of sex hormones, suppresses the immune system and may cause psychosis.

17. Ans

- (a) The selected animals of the breeding population should be mated with superior animals of the same breed but unrelated to the breeding population. This helps in restoring fertility and yield.
- (b) Advantages of inbreeding:
 - (i) It helps in the accumulation of superior genes and the elimination of undesirable genes.
 - (ii) It develops a homozygous pure line in an animal; thus, it increases homozygosity to evolve a pure line in any animal.
 - (iii) It exposes harmful recessive genes for undesirable characters which are eliminated by selection.
- (c) Jersey and Holstein are the improved breeds of cattle which produce a high yield of milk.

18. Ans

No restriction endonucleases are present in eukaryotic cells. All the restriction endonucleases have been isolated from the various strains of bacteria, and they are also named according to the genus and species of prokaryotes. The first letter of the enzyme comes from the genus and the second two letters come from the species of the prokaryotic cell from which the enzyme is isolated. For example, EcoRI comes from *Escherichia coli* RY 13. In EcoRI, the letter 'R' is derived from the name of the strain. Roman numbers following the names indicate the order in which the enzymes were isolated from that strain of bacteria.

19. Ans

Red algae have phycoerythrin, phycocyanin and chlorophyll-a pigments which make them grow successfully in the deep seas. The blue-green region of light can only penetrate the deep sea. Red algae have the capacity to absorb this light for photosynthesis because of the presence of red pigment (phycoerythrin). The other photosynthetic forms cannot survive in the deep sea because they cannot absorb blue-green light in the absence of phycoerythrin.

20. Ans

- (i) Urbanisation and increase in population have forced man to clear the forests and kill more wildlife in order to meet the demand of food and space. These activities in turn have disturbed the food chain and food web of the forest and have caused soil erosion, floods, droughts and change in physical environment.
- (ii) It has created the problem of energy crisis. The rate of consumption of non-renewable resources is enhancing with increasing population. If this rate of consumption continues, then there will be a depletion of non-renewable resources.
- (iii) Because of an increase in population, the number of vehicles and other sound-producing articles (loudspeakers and drums.), the noise pollution is increasing day by day in cities. Constant exposure to loud noise causes deafness, increase in nervous tension and blood pressure and heart troubles.

21. Ans

Effects of noise pollution:

- (i) Constant exposure to loud noise causes deafness and increase in nervous tension and blood pressure.
- (ii) It causes headache, irritability and affects the sensory and nervous system.
- (iii) It causes emotional disturbances.

22. Ans

A hereditary disease can be corrected by gene therapy. Treatment of a genetic disorder by manipulating genes is called gene therapy. The first clinical gene therapy was given in 1990 to a 4-year-old girl with adenosine deaminase (ADA) deficiency.

Gene therapy of ADA deficiency:

- (i) The patient lacks functional T-lymphocytes and therefore fails to fight the infecting pathogens.
- (ii) Lymphocytes are extracted from the patient's bone marrow and a normal functional copy of gene coding for ADA is introduced into these lymphocytes with the help of a retrovirus.
- (iii) The cells so treated are introduced into the patient's bone marrow.
- (iv) The lymphocytes produced by these cells contain functional ADA gene and reactivate the victim's immune system for life.

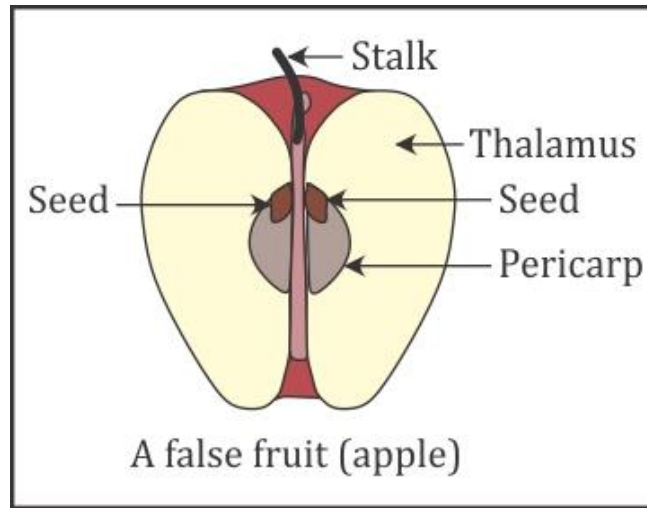
Section D**23. Ans**

- (a) He feels energetic because nicotine raises blood pressure and increases heartbeat. This is not good for his health.
- (b) CO binds to haemoglobin and reduces the concentration of oxygen.
- (c) Other ill effects include cancer of the lungs and throat and emphysema.
- (d) Values:
 - (i) Awareness about health
 - (ii) Consciousness
 - (iii) Critical thinking

Section E

24. Ans

V.S. of apple:



Biological importance of fruits:

- (i) Fruits form a protective covering around the seeds against adverse climatic conditions and animals.
- (ii) Fruits on maturity become coloured, sweet and flavoured to attract the seed-dispersing agents for disposal to distant localities through wind, water and animals.
- (iii) The immature fruits are bitter and possess unpalatable and repelling substances such as tannins and bitter alkaloids to provide chemical defence against animals.
- (iv) The colours of many young fruits resemble the green leaves and so they are not easily spotted by animals.

OR

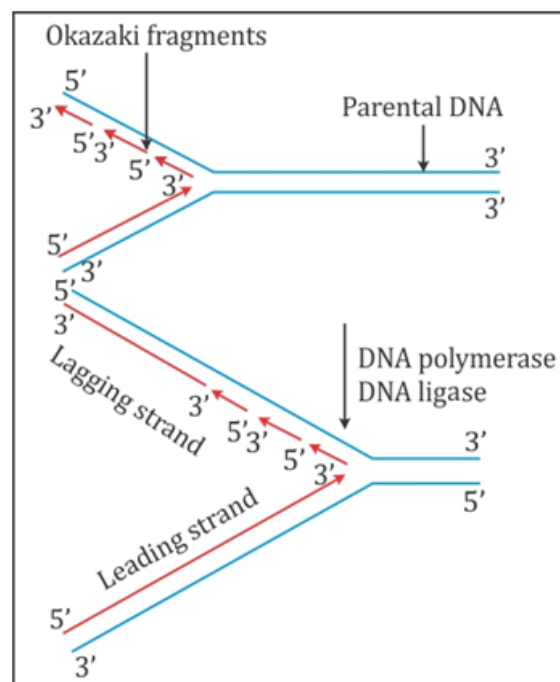
- (i) Seminal vesicles: These are paired, tubular, club-shaped structures situated just above the prostate gland and near the base of the urinary bladder and at the interior of the rectum. The ducts from the seminal vesicles join the posterior part of the vas deferens and form the common ejaculatory duct. The seminal vesicles secrete clear, alkaline, yellowish, viscous fluid and contain globulin, citrate, inositol, fructose and flavins. Fructose provides energy to facilitate the motility of sperms after ejaculation and flavin gives semen a strong fluorescence in ultraviolet light. The secretion of the seminal vesicles constitutes approximately 60% of the ejaculate.
- (ii) Prostate gland: It is the largest auxiliary gland with a chestnut-like shape situated around the 1st part of the urethra below the urinary bladder. It is

surrounded by a thin and dense capsule of fibrous connective tissue and muscle fibres which provides firm palpation to it. It secretes milky, thin and alkaline fluid containing citric acid, bicarbonate ions, lipids and acid phosphatase which gives characteristic seminal order and alkalinity to the ejaculate. It increases the motility of the sperms and neutralises the acidity of urine. It constitutes approximately 5–30% of the ejaculate.

- (iii) Cowper's glands (Bulbourethral glands): These are paired glands situated beneath the bladder and on each side of the urethra into which their ducts open. They are about the size of a pea and form the floor of the pelvis. They secrete clear, white, viscous, alkaline, mucoid lubricant which neutralise the activity of acidic female vaginal secretions and increase the mobility and survival potential of sperms in the genital tract of the female.

25. Ans

- (i) Origin of replication: It is the start point where DNA replication begins at a specific point where intertwined DNA segments start unwinding. In prokaryotic cells, there is a single origin of replication, whereas in eukaryotic cells, there are numerous origins which merge during replication.
- (ii) Unwinding of two DNA strands: It takes place in the presence of helicases which unwind the helix and topoisomerases which break and reseal one strand of DNA. Unwinding of DNA leads to the formation of a Y-shaped structure of the two strands of the DNA duplex. This is known as the replication fork.



- (iii) Synthesis of primer: It is a stretch of RNA formed on the DNA where synthesis of new DNA starts. The DNA-directed RNA polymerase synthesises the primer strands of RNA for leading and lagging strands. New strands grow from the fork, and as replication proceeds, it appears as if the point of divergence at the fork is moving.
- (iv) Synthesis of leading (continuous) strand: The synthesis of the continuous strand (new) of DNA is formed in the 5'–3' direction on the 3'–5' DNA template because of the addition of deoxyribonucleotides at the 3' end of primer RNA. This process occurs in the presence of DNA polymerase and ATP. One new strand is formed in a continuous stretch in the 5'–3' direction and is called the leading strand.
- (v) Formation of lagging (discontinuous) strand: In the second parental strand, the enzyme primase forms the RNA primer. The enzyme DNA polymerase synthesises the DNA in the form of short stretches once again in the 5'–3' direction starting from a RNA primer. These short DNA segments, consisting of numerous nucleotides, are called Okazaki fragments. The Okazaki short segments are joined by the enzyme DNA ligase. This newly synthesised second DNA strand is called the lagging strand because it is formed later on in reference to the first continuous strand.

OR

The full names of the different types of RNA are (i) r-RNA (ribosomal RNA), (ii) m-RNA (messenger RNA) and (iii) t-RNA (transfer RNA). t-RNA has a cloverleaf structure in two dimensions:

- (i) r-RNA: It forms approximately 80% of the total cellular RNA and is a component of the ribosomes. It is a single-stranded molecule but twisted on itself.
Role: It serves to release mRNA from DNA. The ribosomal proteins and the r-RNA form the functional units of ribosomes during protein synthesis.
- (ii) mRNA: It is formed by the DNA template in the nucleus and moves to the cytoplasm within two subunits of ribosomes. It is a complementary strand to one of the DNA strands formed during transcription. It forms 5–10% of the total RNA in a cell. Its length is almost equivalent to the length of protein to be synthesised in the cytoplasm. It has a cap structure at 5' end and poly A tail at the 3' end.
Role: It carries codons which serve as a message tape to be decoded into a protein (amino acids).

(iii) t-RNA: It is the smallest of all the RNA with molecular weight ranging from 25 to 30 thousand Daltons. It is soluble RNA and constitutes 10–12% of the total RNA in the cytoplasm.

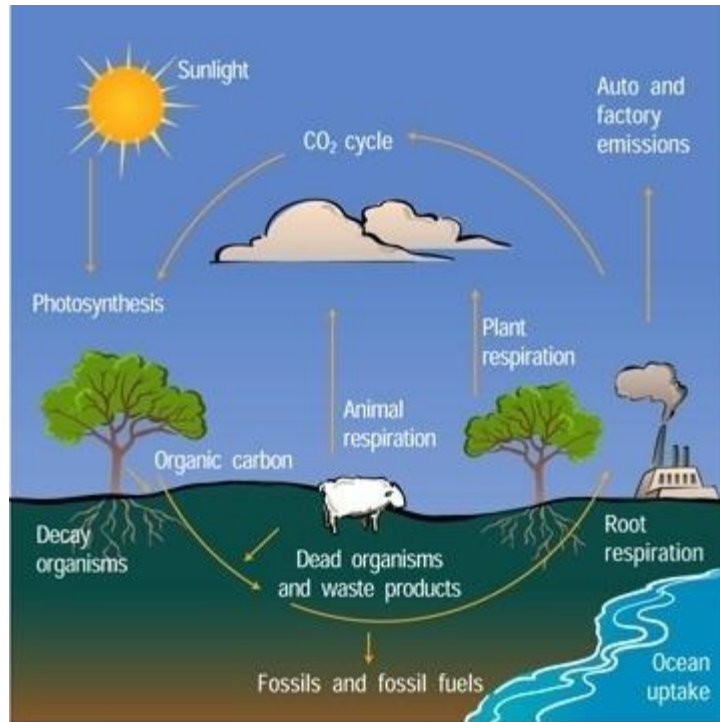
Role: It picks up activated amino acid from the cytoplasm and supplies it to mRNA in the ribosome according to the message expressed by the codon. Each amino acid bears a recognition site, anti-codon site, ribosome attachment site and amino acid attachment site.

26. Ans

The function of the reservoir is to meet the deficit which occurs because of imbalance in the rate of influx and efflux.

Carbon cycle in nature:

- (i) The main source of carbon in the Universe is CO_2 which is dissolved in water and present in air (0.03–0.04%).
- (ii) Plants take up carbon dioxide from the atmosphere and form organic compounds during photosynthesis. These organic compounds are transferred to animals as their food.
- (iii) The carbon dioxide is returned to the atmosphere during respiration, decay and combustion of plants and animals.
- (iv) The organic compounds of plants and animals are buried in the deep soil where they are acted by decomposers to change them in petroleum, coal, oil and carbonate rocks. These substances on combustion release carbon dioxide in the atmosphere.
- (v) Some carbon dioxide is found in dissolved state in water. This gets converted to calcium carbonate in limestone. Weathering and combustion of carbonate-containing rocks or treatment of their minerals give CO_2 .
- (vi) The hot springs and volcanic eruptions also give out CO_2 in the atmosphere.



OR

- (a) Commensalism: It is an interspecific interaction between individuals of two species where one species is benefited and other is not affected. Example: Orchid and mango tree
- (b) Parasitism: It is an interspecific interaction between individuals of two species where generally the small species (parasite) is benefited and the large species (host) is affected. Example: Malarial parasite and human beings
- (c) Camouflage: It is the ability of animals to blend with the surroundings or background, and thus, they remain unnoticed for protection or aggression. Example: Stick insect
- (d) Mutualism: It is an interspecific interaction between individuals of two species where both interacting species are benefited in an obligatory way. Example: Pollination in plants by animals
- (e) Interspecific competition: It is an interspecific interaction between individuals of two species where both interacting species are affected. Example: Monarch butterfly and Queen Monarch