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.

Section A

1. Mention the function of trophoblast in human embryo. [1]

2. Why is whisky more intoxicating than beer? [1]

3. What is microinjection? [1]

4. What is the function of ADA? [1]

5. Why are transplanted organs sometimes rejected? [1]

Section B

6. What is the significance of sporopollenin? [2]

7. Among the following genotypes: [2]

AA, I^AI^B, aa, Bb, I^Bi, Aa, rr, BB, ii

(i) Which are heterozygous and which are homozygous?

(ii) Which of the genotypes have the same phenotypes (the capital letter stands for dominance)?

8. How is DNA better genetic material than RNA? [2]

9. Name the vectors and enzymes used in recombinant DNA technology. [2]

10. How does the cell-mediated immune system work when our body is infected? [2]

OR

In which ways have the study of biology helped us to control infectious diseases?

Section C

11. How is the progeny formed from asexual reproduction different from those formed by sexual reproduction? [3]

12. What are the similarities between spermatogenesis and oogenesis? [3]

13. How is elongation carried on during protein synthesis in a cell? [3]

14.

(a) Explain adaptive radiation with the help of a suitable example.

(b) Cite an example where more than one adaptive radiation has occurred in an isolated geographical area. Name the type of evolution your example depicts and state why it is so named. [3]

15. Why is pedigree analysis done in the study of human genetics? State the conclusions which can be drawn from it. [3]

16. Give the pathogen, mode of transmission and symptoms of the disease Ascariasis. [3]

OR

(a) Name the stage of *Plasmodium* which gains entry into the human body.

(b) Trace the stages of *Plasmodium* in the body of female *Anopheles* after its entry.

(c) Explain the cause of periodic recurrence of chill and high fever during malarial attack in humans.

17. Explain the efforts to improve health, hygiene and milk yield of cattle in a diary farm. [3]

18. Name the genes responsible for making Bt cotton plants resistant to bollworm attack. How do such plants attain resistance against bollworm attacks? Explain. [3]

19. Expand PCR. Mention its importance in biotechnology. [3]

20. What is the significance of the slope of regression in a species–area relationship? [3]

21. How do humans maintain constant body temperature in summer and winter? [3]

22. Explain diagrammatically the phosphorus cycle. [3]

Section D

23. Read the below passage and answer the questions which follow:

Sahil was not getting good yield from his fields, but his neighbours used to apply fertilisers to get higher yields for their crops. He consulted an agricultural scientist, living in the neighbouring town, to suggest some cheap and eco-friendly method to boost crop production. The scientist suggested that he use biofertilisers. [4]

(i) What are biofertilisers?
(ii) Name any two biofertilisers.
(iii) Why did the scientist advise Sahil to use biofertilisers?
(iv) Why are cyanobacteria considered useful in paddy fields?

Section E

24. Describe briefly the structure of the mammary gland. [5]

OR

What is spermiogenesis? Write the various changes which occur during this process?

25. Describe in brief the process of transcription. [5]

OR

Give the salient features of the double helix structure of DNA.

26.

(a) What is El Nino effect? Explain how it accounts for biodiversity loss.

(b) Explain any three measures which you as an individual would take to reduce environmental pollution. [5]

OR

What are positive interactions in a biotic community? Give their kinds. Explain any one of them.

CBSE
Class XII Biology
Solution

Time: 3 hrs **Total Marks: 70**

Section A

1. **Ans**
   Trophoblast gets attached to the endometrium and forms part of the placenta.

2. **Ans**
   Beer is produced without distillation, while whiskey is produced after distillation; hence, it is more concentrated and pure.

3. **Ans**
   It is the introduction of foreign genes into plant or animal cells using micropipettes.

4. **Ans**
   It is necessary for the immune system to function.

5. **Ans**
   The transplanted organs are sometimes rejected because the immune system recognises the 'non-self' organ.

Section B

6. Ans

Sporopollenin is a complex substance of an oxidative polymer of carotenoids which make the exine of the pollen grain. It is the most resistant to biological materials which helps in fossilisation of pollen grains.

7. Ans

(i) Heterozygous: I^AI^B, Bb, I^Bi, Aa
Homozygous: AA, aa, r, BB, ii

(ii) AA and Aa have the same phenotype; BB and Bb have similar phenotype.

8. Ans

DNA is better genetic material than RNA:

(i) DNA is chemically less reactive and structurally more stable as compared to RNA.

(ii) The two strands separated by heating come together when appropriate conditions are provided. But the –OH′ group present at every nucleotide in RNA is a reactive group and makes RNA labile and easily degradable.

(iii) The presence of thymine at the place of uracil confers additional stability to DNA.

(iv) DNA and RNA are able to mutate. RNA, being unstable, mutates at a faster rate.

9. Ans

Enzymes used in recombinant DNA technology are

(i) Restriction endonuclease which cut DNA into short pieces.

(ii) DNA ligase which joins segments of DNA.

(iii) Vectors used in this technique are
(a) Plasmids
(b) Viruses (phages)

10. Ans

The cell-mediated immune system is carried out by highly specialised cells. The immune system recognises the 'non-self' and 'self'. The foreign molecules are called antigens. When such an antigen enters the body, cell-mediated cytotoxicity and antibody-mediated mechanisms produce enough antibodies in the host which form complexes with the donor tissue.

OR

Study of biology has helped to control infectious diseases in the following ways:

(i) The use of vaccines and immunisation programmes has enabled us to completely eradicate a deadly disease such as small pox.

(ii) The use of antibiotics and various other drugs has effectively treated many infectious diseases.

Section C

11. Ans

In asexual reproduction, progeny arise from the somatic cells of the parent body and remain identical to their parents (clones). All the divisions occurring during asexual reproduction are mitotic and no variations are observed in the offspring.

In sexual reproduction, the offspring is produced from the germinal cells of the parent body and show variation because of genetic recombination. Meiotic division occurs during gametogenesis and mitotic division occurs at the time of zygote formation. The offspring remains better adapted to environmental conditions.

12. Ans

Similarities between spermatogenesis and oogenesis:

(i) Both processes occur in three phases—multiplicative phase, growth phase and maturation phase.

(ii) Both processes lead to the formation of haploid gametes.

(iii) In the multiplicative phase, mitotic division in both processes differentiates the primordial germ cells of the testes and ovaries into gametogonia (spermatogonia and oogonia).

13. Ans

Process of elongation:

(i) The t-RNA loaded with corresponding amino acid (anti-codon on t-RNA) binds with the matching codon in the mRNA at the A site in the presence of GTP.

(ii) A peptidyl transferase forms a peptide bond between the carboxyl (–COOH) group of the first amino acid at the P site and the amino ($-NH_2$) group of the second amino acid at the A site.

(iii) The t-RNA at the P site removes the GTP, and t-RNA bound at the A site carries a dipeptide.

(iv) The linkage between methionine and its t-RNA at the P site is broken. The uncharged t-RNA gets removed from the P site.

(v) The t-RNA carrying a polypeptide chain moves from the A to the P site leaving the A site vacant.

14. Ans.

(a) Evolution of different species in a given geographical area starting from a point and literally radiating to the other areas of geography is called adaptive radiation. Example: Several marsupials, each different from other, evolved from an ancestral stock, but all within the Australian island.

(b) Darwin's finches of the Galapagos Islands is an example where more than one adaptive radiation has occurred in an isolated geographical area. They had common ancestors but now have different types of modified beaks according to their food habits. He differentiated thirteen species of finches and grouped them into main types—large ground finches, cactus ground finches feeding on cacti, vegetarian tree finches, insectivorous tree finches, warbler finches and tool using or woodpecker finches.

This type of evolution is called divergent evolution because in this process the new species produced is diverged from a single ancestral form and is adapted to new invaded habitats.

15. Ans

Pedigree analysis is done in the study of human genetics as

(i) It helps genetic counsellors to guide couples about the possibility of having children with genetic defects such as haemophilia.

(ii) It indicates that Mendel's principles are also applicable to human genetics with some modifications found out later such as quantitative inheritance, sex-linked characters and other linkages.

Pedigree analysis is the study of pedigree for the transmission of a particular trait and finding the possibility of the absence or presence of that trait in homozygous or heterozygous state in a particular individual.

16. Ans

Pathogen: Roundworm (Ascaris) – an intestinal parasite
Mode of transmission: Contaminated water, vegetables and fruits
Symptoms: Internal bleeding, muscular pain, fever, anaemia and blockage of the intestinal passage

OR

(a) Plasmodium enters a human body at the sporozoite stage through the bite of an infected female Anopheles mosquito.

(b) Life Cycle of Plasmodium:

(i) Plasmodium sporozoites enter the human body through the bite of a female Anopheles mosquito.

(ii) First, the parasites undergo asexual reproduction when they enter the liver cells and then attack the RBCs resulting in their rupture.
(iii) The rupture of RBCs produces a toxic element called haemozoin which is responsible for the chill and high fever for 3–4 days.
(iv) When a female Anopheles mosquito bites an infected person, the parasites enter the mosquito's body and multiply forming the sporozoites which multiply sexually.
(v) These sporozoites are stored in the salivary glands of the mosquito and are released when a healthy person is bitten by this mosquito.
(vi) When these mosquitoes bite a human, the sporozoites are introduced into the body of the human.

Thus, plasmodium requires two hosts—man and mosquito—to complete its life cycle. The female Anopheles mosquito acts as the vector.

(c) Haemozoin is a toxic element released when RBCs get ruptured. This is responsible for the chill and high fever for 3–4 days.

17. Ans

The efforts to improve health, hygiene and milk yield of cattle in a diary farm are
(i) Selection of good breeds of dairy farm animals with high yielding potential
(ii) Selection of disease-resistant breeds
(iii) Sufficient water and feed are to be provided so that animals are properly nourished
(iv) Animals should be kept in a clean place under shade or in an open area free from dirt and pollution
(v) Regular inspections with proper record keeping
(vi) Regular visits by a veterinary doctor should be made mandatory

18. Ans

The gene responsible for making Bt cotton plant resistant to bollworms is cry IAC and cry II AB. These genes are secreted in the form of protein crystals during a particular phase of their growth and contain insecticidal proteins which exist in the inactive form. When an insect ingests the inactive toxin, it gets converted to the active form in the gut under alkaline conditions. This solubilises the crystals and the active toxin binds to the surface of epithelial cells and creates pores which cause cell swelling and lysis, causing the death of the insect.

19. Ans

PCR stands for polymerase chain reaction. In this reaction, multiple copies of the gene or DNA of interest are synthesised *in vitro* using two sets of primers and the enzyme DNA polymerase.

Importance in biotechnology:

(i) PCR is used to detect the viral or bacterial pathogen in the body when the disease symptoms have not appeared; it is done by amplification of DNA using the polymerase enzyme.

(ii) It is used to detect HIV in patients suspected with AIDS.

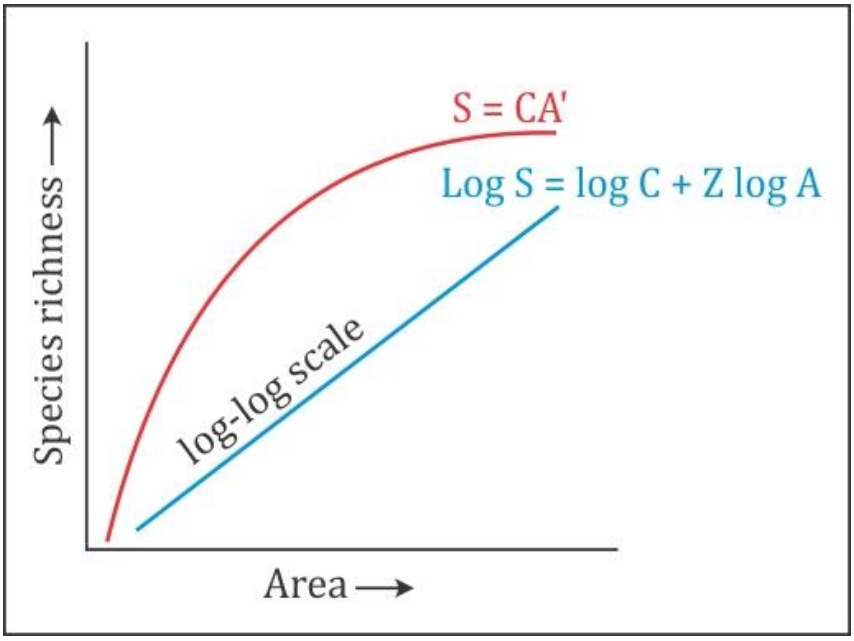
(iii) It is used to detect gene mutations in persons suspected with cancer.

20. Ans

Within a region, the species richness increases with increasing explored area but only up to a limit. The relationship between species richness and area for a wide variety of taxa turns out to be a rectangular hyperbola. On a logarithmic scale, the relationship is a straight line.

$$\log S = \log C + Z \log A$$

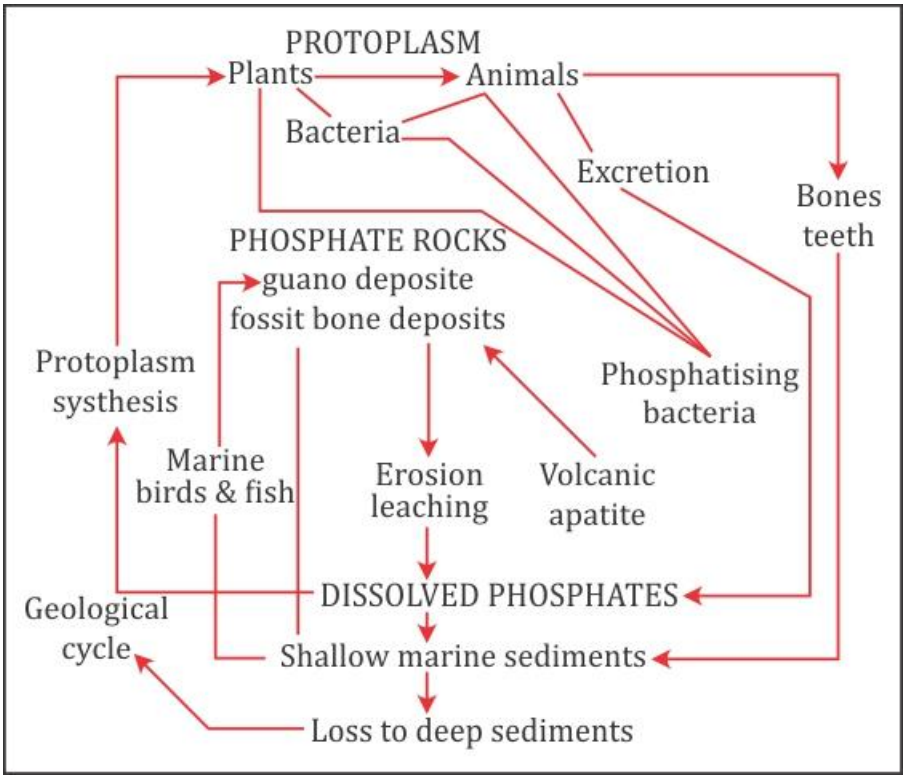
The value of Z lies in the range of 0.1–0.2 regardless of the taxonomic group or the region. If the species–area relationship is for very large areas like the entire continent, the slope of the line will be much steeper (Z values in the range of 0.6–1.2).



21. Ans

Humans maintain a constant body temperature of 37°C. In summer, the outside temperature is more than the body temperature. In this condition, humans sweat profusely. This brings down the body temperature (cooling) when the sweat evaporates. Similarly, in winter, the outside temperature is much lower than 37°C. In this condition, the skin contracts to conserve body heat and to raise the body temperature.

22. Ans



Section D

23. Ans

(i) Biofertilisers are the microorganisms which bring about soil nutrient enrichment, maximise ecological benefits and minimise environmental hazards.

(ii) *Nostoc* and *Anabaena*

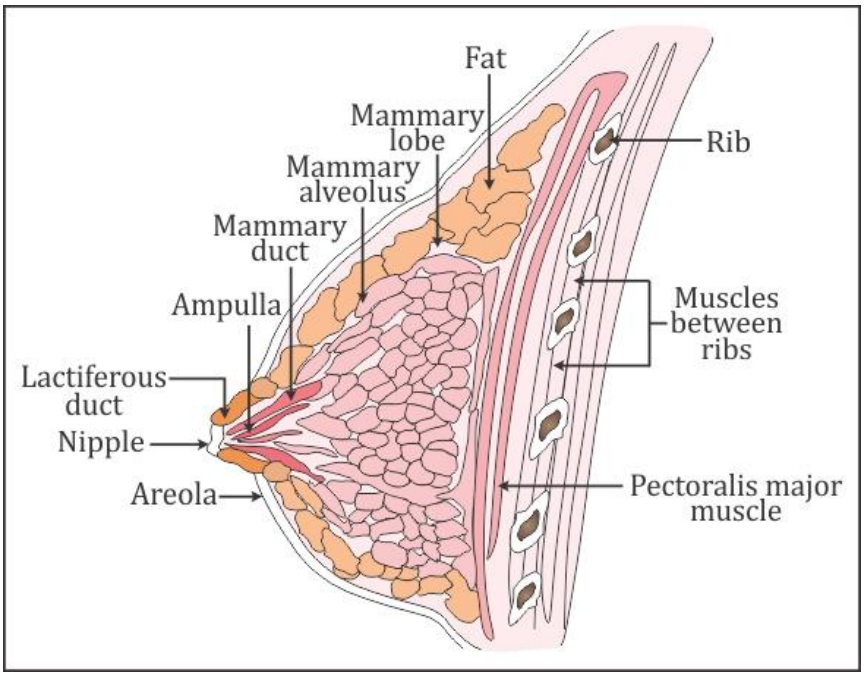
(iii) The scientist was concerned about a clean environment, and therefore, he suggested that Sahil use an eco-friendly technique.

(iv) Cyanobacteria are considered useful in paddy fields because these organisms grow well in symbiotic association with other plants or as free-living individuals on the surface of moist soil or under waterlogged conditions.

Section E

24. Ans

Each mammary gland consists of 15–25 lobules of the compound tubule-alveolar type. Each lobe is separated from the others by dense connective and adipose tissues and represents a gland. The cells of alveoli secrete milk which is stored in the cavities (lumens) of alveoli. The alveoli open into mammary tubules. The tubules of each lobe join to form a mammary duct. Several mammary ducts join to form a wider mammy ampulla which is connected to a lactiferous duct through which milk reaches out. The excretory lactiferous ducts emerge independently in the nipple, which has 15–25 openings, each about 0.5 mm in diameter.



OR

Spermiogenesis: It is the process where spermatids undergo a series of complex changes resulting in the development of mature spermatozoa.

The following changes occur during spermiogenesis:

(i) The spherical nucleus of the spermatid changes to an elongated structure because of the loss of water from it. DNA becomes concentrated; RNA and nucleolus reduce to minimum.

(ii) The Golgi apparatus becomes granular and then coalesces into a large globule called the acrosomal vesicle. This vesicle gets attached to the outer portion of the nuclear membrane of the head of the sperm and forms the acrosomal cap.

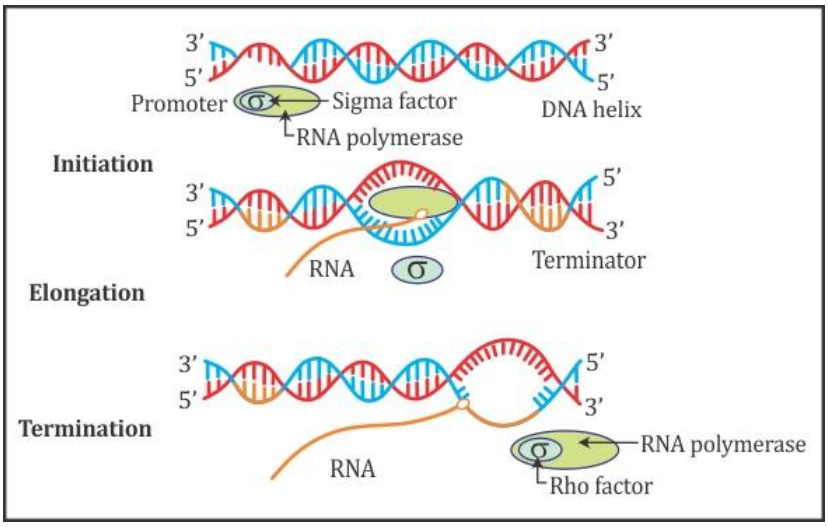
(iii) Centrioles migrate to the opposite end of the spermatid and form the proximal and distal centriole in the neck region of the sperm.
(iv) The distal centriole forms the axial filament of the slender tail.
(v) The mitochondria of the spermatid migrate and form the mitochondrial spiral (nebenkern) around the axial filament in the middle piece of sperm.
(vi) The cytoplasm of the spermatid is lost except a thin, condensed sheath around the tail of the sperm (manchette).

After spermatogenesis, sperm heads become embedded in the Sertoli cells and are finally released from the seminiferous tubules by the process called spermiation.

25. Ans

Transcription: It is the formation of an mRNA strand on a DNA strand in the nucleus. The mechanism of mRNA synthesis is analogous to DNA replication where only one of the two strands (sense strand) acts as a template. The formation of mRNA takes place in the 5′–3′ direction, so the sequence of nucleotides on the DNA template (sense strand) must be in the 3′–5′ direction.

This process involves unwinding of DNA and transcription starts at a specific point called the promoter region. DNA-dependent RNA polymerase enzyme binds to the 'Pribnow box' at the promoter region and starts transcription. RNA polymerase contains a detachable subunit called the sigma (σ) factor. It helps the enzyme to bind firmly to DNA. The RNA core polymerase (minus sigma factor) moves down the DNA at a faster pace and this continues to synthesise a new RNA chain. It requires the building blocks of uracil (U), adenine (A), cytosine (C) and guanine (G). The base sequence in DNA decides the base sequence in mRNA as A pairs with U and G pairs with C. The mRNA is synthesised on the DNA template in the 5′–3′ direction, and so, successive nucleotides are attached at the 3′–OH end of the growing mRNA strand. So, the information of DNA coded in the sequence of bases of the cistron is transcribed to mRNA. This process continues until it reaches the terminator sequence in the sense DNA strand (3′–AAAAAAT–5′). At this point, another protein particle, the rho (ρ) factor, forms a complex with RNA polymerase. This causes the enzyme to go off the DNA track, and thus, new mRNA is released. Many mRNA are synthesised in rapid succession along the cistron. The completed mRNA moves away from the nucleus and binds to a group of ribosomes in the cytoplasm.



OR

Features of the double helix structure of DNA:

(i) It is made of two polynucleotide chains where the backbone is constituted by sugar–phosphate and the base projects inside.

(ii) The two chains run in anti-parallel directions. One chain has the polarity 5′–3′ and the other has 3′–5′.

(iii) The bases in the two strands are paired through hydrogen bonds (H bonds). Adenine forms two hydrogen bonds with thymine from the opposite strand and *vice versa*. Similarly, guanine is bonded with cytosine with three H bonds.

(iv) The two chains are coiled in a right-handed fashion. The pitch of the helix is 3.4 nm, and there are roughly ten base pairs in each turn. The distance between a base pair in a helix is approximately equal to 0.34 nm.

(v) The plane of one base pair stacks over the other in the double helix. This, in addition to the H bonds, confers stability of the helical structure.

26. Ans

(a) Increase in greenhouse gases has resulted in the rise of atmospheric temperature. The temperature of the Earth has risen by 0.6°C in the 20^{th} century, most of it during the last three decades. This rise in temperature is leading to deleterious changes in the environment and results in odd climatic changes like the El Nino effect. This leads to increased melting of polar ice caps and Himalayan snow caps. The moisture-carrying capacity of air will increase. Precipitation will increase at higher latitudes both in summer and in winter. Frequency of droughts and floods will increase. Threat to human health will increase in tropical and subtropical countries because of changed ranges of disease vectors and water-borne pathogens.

The El Nino effect will result in a rise in sea levels which can submerge many coastal areas. When these coastal areas are submerged, the biodiversity found there will be lost because of loss of habitat for organisms.

(b) Measures to reduce environmental pollution as an individual:

(i) We should plant more trees to decrease the increasing amount of carbon dioxide in the atmosphere.
(ii) We should reduce consumption of fossil fuels.
(iii) Tall chimneys should be installed and used to reduce the concentration of pollutants at the surface of the Earth.
(iv) Proper disposal of biodegradable and non-biodegradable wastes.
(v) Discourage the use of plastic bags, pesticides, herbicides and fungicides.

OR

Positive interactions or beneficial interactions are population interactions in which one or both participating species are benefited. These include scavenging, commensalism, protocooperation, mutualism and interdependence of plants and animals.

Mutualism is the relationship between two organisms where both are benefited for food, shelter and substratum for attachment. It may or may not involve close physical association between the individuals of pairs of species. It is a functional association, not merely of living together. It may be obligate, i.e. the species are completely dependent on each other, or facultative, i.e. one species may survive even in the absence of the partner species.

Example: Mycorrhiza is the mutualistic relationship between fungi and the roots of higher plants. The fungi help in the mineral nutrition of the plant with which they are associated and in turn obtain carbohydrates from the plant.