CBSE Class 12 Biology

Sample Paper 08 (2020-21)

Maximum Marks: 70

Time Allowed: 3 hours

General Instructions:

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

Section A

1. At what stage is the mammalian embryo implanted in the uterus?
2. Why is a secondary treatment of water in sewage treatment plant called biological treatment?
3. A garden pea plant produced round green seeds. Another of the same species produced wrinkled yellow seeds. Identify the dominant traits.
4. Correct the following statements:

   Are all sexually transmitted diseases completely curable ?

5. Name the two initiating codons.
6. Name the disorder with the following chromosome complement.
   i. 22 pairs of autosomes + XXY
   ii. 22 pairs of autosomes + 21st chromosome + XY.
7. Give the phenotypic ratio of a dihybrid cross in garden pea.

8. Which form of E. histolytica serves for transmission of the parasite?
9. Why Western Ghats in India have been declared as biological hotspot?
10. How has the discovery of antibiotics helped mankind in the field of medicine?
11. **Assertion:** An organism with a lethal mutation may not even develop beyond the zygote stage.

    Reason: All types of gene mutations are lethal.

    a. The assertion is a true statement but the reason is false.
    b. Both assertion and reason are true and the reason is the correct explanation of the assertion.
    c. Both assertion and reason are true but the reason is not the correct explanation of the assertion.
    d. Both assertion and reason are false.

OR

Assertion: The cross between red and white flower bearing snapdragon plants results in a pink coloured flower.

Reason: Incomplete dominance of red and white flower results into pink coloured flower.

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

12. **Assertion:** A person who has received a cut and is bleeding needs to be given anti-tetanus treatment.

    Reason: Anti-tetanus injection provides immunity by producing antibodies for tetanus.

    a. The assertion is a true statement but the reason is false
    b. Both Assertion and Reason are true and the Reason is the correct explanation of the Assertion
    c. Both Assertion and Reason are true and the Reason is not the correct explanation of the Assertion
    d. Both Assertion and Reason are false
13. **Assertion:** Just after implantation, the embryo (inner cell mass) differentiates into ectoderm, mesoderm, and endoderm.

Reason: These three layers give rise to all tissues and organs in adult human beings.

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

14. **Assertion:** *Bacillus thuringiensis* forms protein crystals during a particular phase of growth.

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

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

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

After implantation, finger-like projections appear on the trophoblast called chorionic villi which are surrounded by the uterine tissue and maternal blood. The chorionic villi and uterine tissue become integrated with each other and jointly form a structural and functional unit between the developing embryo (foetus) and maternal body. Placenta also acts as an endocrine tissue and produces several hormones. At pregnancy, the levels of other hormones like estrogens, progestogens, cortisol, prolactin are increased several folds in the maternal blood. Increased production of these hormones is essential for supporting the fetal growth, metabolic changes in the mother. The average duration of human pregnancy is about 9 months which is called the gestation period. Parturition is the delivery of the foetus. Parturition is induced by a complex neuroendocrine mechanism.

i. Which of the following hormones is not secreted by the human placenta?
    a. hCG
    b. Estrogens
    c. Progesterone
    d. LH
ii. The placenta facilitate
    a. the supply of oxygen
    b. supply of nutrients to the embryo
    c. also removal of carbon dioxide and excretory/waste materials produced by the

embryo

d. all of these

iii. The signals for parturition originate from

a. fully developed fetus

b. the placenta

c. both (i) and (ii)

d. none of these

iv. In human adult females oxytocin

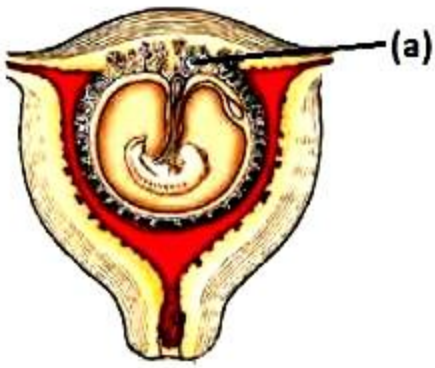
a. stimulates the pituitary to secrete vasopressin

b. causes strong uterine contractions during parturition

c. is secreted by the anterior pituitary

d. stimulates the growth of mammary glands

v. Identify (a) in the given figure.



a. placenta villi

b. yolk sac

c. cavity of center

d. embryo

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

Biocontrol refers to the use of biological methods for controlling plant diseases and pests. In modern society, these problems have been tackled increasingly by the use of chemicals by use of insecticides and pesticides. In agriculture, there is a method of controlling pests that relies on natural predation rather than introduced chemicals. A key belief of the organic farmer is that biodiversity furthers health. Thus, the use of biocontrol measures will greatly reduce our dependence on toxic chemicals and pesticides. An important part of the biological farming approach is to become familiar with the various life forms that

inhabit the field, predators as well as pests, and also their life cycles, patterns of feeding, and the habitats that they prefer. A biological control being developed for use in the treatment of plant disease is the fungus Trichoderma. Dragonflies are also used to get rid of a certain organism.

i. Biofertilisers are the living organisms which
   a. bring about soil nutrient enrichment
   b. maximise the ecological benefits
   c. minimise the environmental hazards
   d. all of these

ii. Which one of the following can be used as biofertiliser in the cotton field?
   a. Azolla-Anabaena
   b. Streptococcus
   c. Azospirillum
   d. Azotobacter chroococcum

iii. Dragonflies are used to get rid of
   a. mosquitoes
   b. aphids
   c. butterfly caterpillars
   d. Both (a) and (b)

iv. A microbial biocontrol agent that can be used to control butterfly caterpillars is
   a. Trichoderma polysporum
   b. Streptococcus
   c. Bacillus thuringiensis
   d. mycorrhiza

v. **Assertion** - Trichoderma harzianum has proved to be a useful microorganism for biological control of soil-borne plant pathogens

   Reason - Dragonflies are useful to get rid of aphids and mosquitoes
   a. Both Assertion and Reason are true and Reason is the correct explanation of the Assertion
   b. Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion
   c. Our Assertion is true but the Reason is false
   d. Both the statements are false

Section B

17. Lactational Amenorrhea is a method of contraception. Justify. What is the maximum effectiveness of this method in terms of period/duration?
18. A person has to perform crosses for the purpose of studying inheritance of a few traits / characters. What should be the criteria for selecting the organisms?
19. State the role of DNA ligase in biotech.
20. How is a mature, functional insulin hormone different from its prohormone form?

OR

What happens when *Meloidogyne incognita* consumes cells with RNAi gene?

21. How would lac operon operate in *E. coli* growing in a culture medium, where lactose is present as a source of sugar?
22. Explain palindromic nucleotide sequence with the help of a suitable example.

OR

What is a palindrome sequence? Explain with the help of an example.

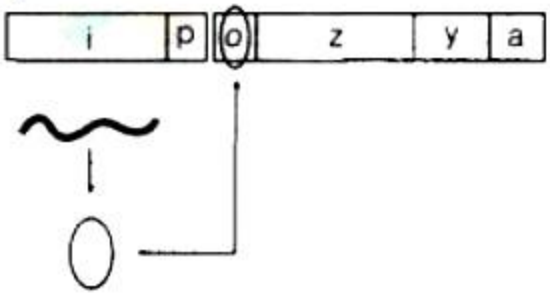
23. Where would you expect more species biodiversity in tropics or in polar regions? Give reasons in support of your answer.
24. i. What is r in the population equation given below?

    $\frac{dN}{dt} = rN$

    ii. How does the increase and the decrease in the value of r affect the population size?
25. Why certain regions have been declared as biodiversity 'hot spots' by environmentalists of the world? Name any two 'hot spot' regions of India.

Section C

26. Does the environment modify the phenotype? Give examples.
27. Given below is a schematic representation of a lac operon. Answer the following questions:



i. Identify i and p.

ii. Name the inducer for this operon.

iii. Explain the function of inducer for this operon.

28. Write a short note on vaccination.

29. i. Differentiate between unambiguous and degenerate codons.

ii. Write two functions of the codon AUG.

30. A person shows unwelcome immunogenic reactions while exposed to certain substances.

i. Name this condition.

ii. What common term is given to the substances responsible for this condition?

iii. Name the cells and the chemical substances released which cause such reactions.

OR

Prevention is better than cure is an apt slogan to safeguard adolescents from drug abuse. List any 6 steps that could be taken in this regard.

Section D

31. Describe the process of megasporogenesis in angiosperms until 8 nucleate stage.

OR

Given below is a table depicting the type of pollination in different plants

Type of pollination	Plants	Structure involved
(a)	Wheat	Bud
(b)	Primrose	Dihetrostyle

i. Name the type of pollination (a) and (b) in the above table.

ii. Write the two advantages of (b) over (a) type of pollination. What is the significance of pollination?

32. Write any four ways used to introduce a desired DNA segment into a bacterial cell in recombinant technology experiments.

OR

Illustrate the design of a bioreactor. Highlight the difference between a flask in your laboratory and a bioreactor which allows cells to grow in a continuous culture system.

33. Study the table given below and answer the questions that follows

Species A	Species B	Name of interaction
(+)	(+)	A
(-)	(-)	B
(+)	(-)	C
(-)	(0)	D

(+) = Beneficial interaction

(-) = Detrimental interaction

(0) = Neutral interaction

Identify A, B, C and D in the given table and explain any three of them with the help of an example each.

OR

i. How did Hardy-Weinberg explain that allelic frequencies in a population are stable and are constant from generation to generation?

ii. Why does genetic equilibrium gets disturbed in a population? Give reason.

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Solution

Section A

1. Blastocyst stage
2. Secondary treatment is also called biological treatment because it uses organisms natural organisms and detritus feeders.
3. Round and yellow.
4. Some of the sexually transmitted diseases are curable if they are detected early and treated properly. AIDS is still an incurable disease.
5. AUG and GUG are the two initiating codons.
6. i. Klinefetter's Syndrome
   ii. Down's syndrome
7. The phenotypic ratio of a dihybrid cross in garden pea is 9 : 3 : 3 : 1.
8. Tetranucleate cyst
9. Western Ghats have been declared as biological hotspot due to its rich biodiversity and rich environment. Many endemic species of amphibians, reptiles and fishes are found in these regions.
10. Antibiotics have created a revolution in treatment of diseases. Many infectious diseases which were incurable earlier can now be treated with antibiotics. Antibiotics have helped in saving millions of life.
11. (a) The assertion is a true statement but the reason is false.
    Explanation: An organism with the lethal mutation may not even develop beyond the zygote stage due to change in the gene but all kinds of mutations are not lethal. The mutation is the main source of variation essential for evolution.

OR

(a) Both assertion and reason are correct.

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

12. (a) The assertion is a true statement but the reason is false

    Explanation: If a person has received a cut and is bleeding needs to be given anti-tetanus treatment. Anti-tetanus injection contains preformed antibodies to initiate a quick response.

13. (a) Both assertion and reason are correct

    Explanation: After implantation, embryo differentiates into the outer layer called ectoderm, middle layer mesoderm, and inner layer endoderm. These three layers form all tissues or organs of human beings.

14. (a) Both assertion and reason are correct

    Explanation: *Bacillus thuringiensis* bacterium forms protein crystals during a particular phase of growth. The crystal of toxic protein has insecticidal protein. This protein gets activated in an alkaline medium in the gut of insects and kills them.

15. i. (d) all of these
    ii. (c) both (a) and (b)
    iii. (d) LH
    iv. (b) causes strong uterine contractions during parturition
    v. (a) placenta villi

16. i. (d) all of these
    ii. (d) Azotobacter chrococcum
    iii. (b) mosquitoes
    iv. (c) Bacillus thuringiensis
    v. (b) Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion

Section B

17. i. Ovulation and menstrual cycle do not occur during the period of intense lactation following parturition. Therefore, as the mother breastfeeds, chances of conception are nil.
    ii. It is effective only up to a maximum period of six months following parturition.

18. For this type to study, the organism should meet following criteria:
    i. There must be easily identifiable sets of contrasting characters.
    ii. Life cycle of the organism should be short enough so that study can be conveniently completed within a couple of years.
    iii. Hybridization should be easy to induce in the organism.

19. DNA ligase is an enzyme that repairs irregularities or breaks in the backbone of double-stranded DNA molecules. It has important role in the process of DNA replication and DNA repair.

    It has three general functions:

    - It seals repairs in the DNA,
    - it seals recombination fragments, and
    - it connects Okazaki fragments (small DNA fragments formed during the replication of double-stranded DNA).

    DNA ligase functions by forming a bond between the end of a "donor" nucleotide and the end of an "acceptor" nucleotide. hence it is also known as molecular glue.

20. Insulin in its pro-hormone form is not active and it needs to be mature to become the functional insulin. The prohormone form of insulin contains an extra stretch of a polypeptide called C peptide. When insulin becomes mature, it is devoid of C peptide.

OR

When *Meloidogyne incognita* (parasite) consumes cells with RNAi gene, the parasite cannot survive and the infection is prevented. It is mainly because introduced DNA forms both sense and anti-sense RNA. These two strands being complementary to each other form dsRNA. This dsRNA binds and prevents the translation of nematode mRNA. Thus, the mRNA of the nematode is silenced and the parasite cannot survive there. This produces Meloidogyne incognita resistant tobacco plants.

21. When lactose is present in a medium having *E. coli*, it will act as a substrate for enzyme β-galactosidase and switches on the operon. Hence, it is also termed as an inducer. It inactivates repressor by binding to it and allows RNA polymerase access to the promoter.
22. The palindromic nucleotide sequence is the sequence of base pairs m DNA that same on both the complementary strands of DNA, with same orientation of reading.
    For example,
    5'-GAATTC-3'
    3'-CTTAAG-5'

OR

Palindromic nucleotide sequences in the DNA are group of letters that form the same words when read both forward and backward. For example, the following sequence reads the same on the two strands in 5'→ 3' direction as well as 3'→ 5' direction.

5' - GAATTC - 3'

3' - CTTAAG - 5'

Significance These sequences act as recognition sites which are recognised by specific restriction endonucleases.

23. Biodiversity is more in tropical latitudes than in temperate followed by polar regions. The reasons are:
    i. More solar radiation is available in the tropical region. This leads directly to more productivity and indirectly to greater species diversity.
    ii. The environment of tropics is less seasonal and relatively more constant and predictable, which encourages niche specialization and species diversity.
24. i. r is an intrinsic factor assessing impacts of a biotic and abiotic factor on population growth.
    ii. When r increases, population size increases, while a decrease in r decreases the population size.
25. - Regions having very high levels of species richness and high degree of endemism are declared as biodiversity hot spots by environmentalists. Such identification helps in the planning, management and conservation of the species.
    - The two biodiversity hot spots of India are Indo-Burma and Himalayan regions.

Section C

26. Yes, Phenotype can be modified by environment though genotype establishes the boundaries within which the environment can modify the phenotype. For example, a fair coloured individual can have tanned colouration due to excessive exposure to the sun. Differences are observed in the phenotypic appearance of a child, adolescent, mature and aged person through the genotype remains the same throughout life.
27. i. i-Regulatory gene, p-Promoter gene.
    ii. The Inducer is lactose.
    iii. **Functions of Lactose**
        a. Enters the cell and binds to the repressor and inactivates it.
        b. As a result, repressor cannot bind to the operator. This allows RNA polymerase to have access to the promoter and transcription proceeds.

28. **Vaccination**: Vaccination is a technique to develop immunity without inducing actual infection. It is based on the property of 'memory' of the immune system. Weakened (attenuated) or dead pathogens are injected into a person to be immunized against that pathogen's active form. The pathogen administered through a vaccine is unable to cause the disease but is sufficient to stimulate the formation of antibodies by activating the host's immune system that recognizes the antigens. Thus, a vaccinated person develops immunity against the pathogen without contracting the disease. The vaccines also generate memory- B and T-cells that recognize the pathogen quickly on subsequent exposure and massively produce antibodies quickly thus dominating over the pathogen. This method comes under active immunization.

29. i. Differences between unambiguous and degenerate codons are

Unambiguous	**Degenerate**
No ambiguity for a particular codon. For example, GGA is an ambiguous codon, it codes for glycine as well as glutamic acid.	Code is degenerate for a particular amino acid.
A particular codon will always code for the same ammo acid, where it is found.	One amino acid is coded by more than one codon, e g. phenylalanine has two codons, i.e UUU and UUC.

ii. AUG is a codon with dual functions. It codes for the amino acid methionine (met) and also acts as an initiator codon.

30. i. Allergy

ii. Allergens is the term given to the substances responsible for this condition.

iii. Mast Cells-Histamine, Serotonin is the cells which cause allergy.

OR

Six steps that could be taken to prevent adolescents from drug alcohol abuse are as follows:

i. A child should not be pushed unduly to perform beyond his/her limits in studies, sports or any other activities.

ii. Educating and counselling him/her to face problems and stresses and accept disappointments and failures as part of life.

iii. Parents and teachers can identify the danger signs and take appropriate steps to diagnose the malady and underlying causes.

iv. Help should be taken from qualified psychologists and psychiatrists.

v. Parents and teacher should become more supportive.

vi. The help of close friends and relatives can also be taken.

Section D

31. Mass of parenchymatous cells named as nucellus differentiates into primary archesporial cells. This archesporial cell divide by periclinal division to form Parietal cell (it is outer) and inner sporogenous cell. Sporogenous cell directly acts as Megaspore Mother Cell (MMC) with denser cytoplasm and a prominent nucleus which undergo meiosis (Megasporogenesis) to form four haploid megaspores know as megaspore tetrad. Out of these three micropylar megaspores degenerate while chalazal megaspores further grow to form female gametophyte i.e. Embryosac. such growth is known as monosporic development.

Functional megaspore divides by three free mitotic divisions to form 8-nucleate, or 7-celled embryo-sac (known as female gametophyte). The development of haploid megaspore from megaspore mother cell is called megasporogenesis.

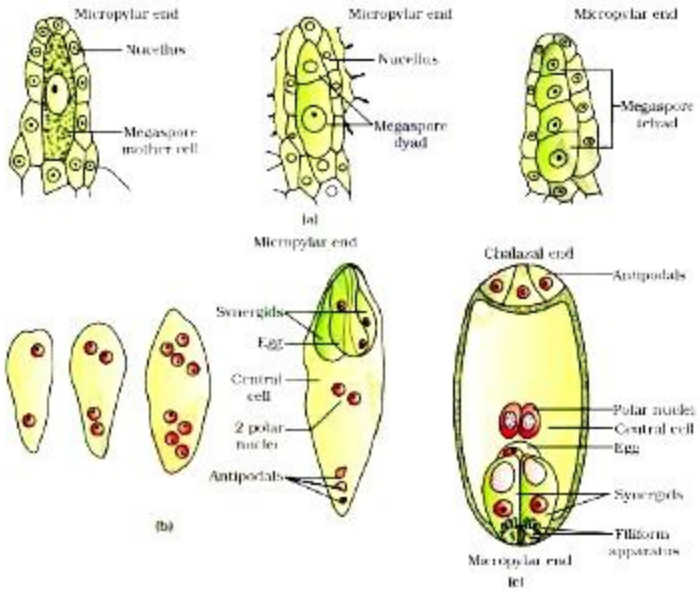


Figure: Different stages in the development of embryo-sac from a megaspore

OR

i. (a) Self-pollination

(b) Cross-pollination

ii. The advantages of Cross-pollination are as follows:
   a. It introduces genetic recombinations and hence variations in the progeny.
   b. The plants produced through cross-pollination are more resistant to diseases.

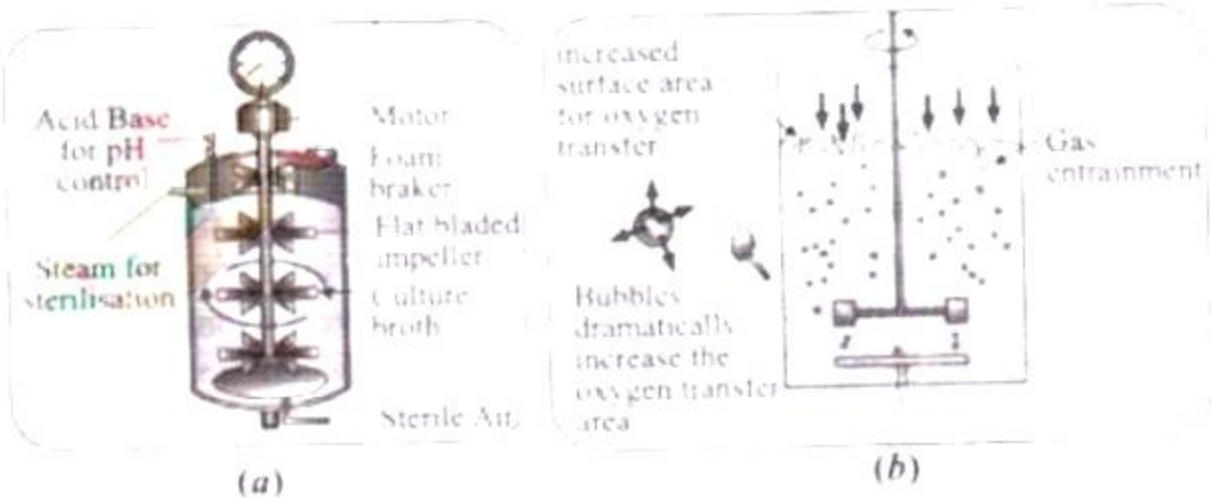
Significance of pollination

Pollination is a means of taking the male gametophyte for its growth near the female gametophyte.

It can be manipulated to produce pure lines as well as desired varieties.

32. Four-ways of introducing the desired DNA segment into a bacterial cell are as follows:
   i. **Competent host (For transformation with recombinant DNA):**
      a. For transformation, bacterial cells are treated with a specific concentration of calcium which increases the efficiency with which DNA enters the bacterium through pores in its cell wall.
      b. Cells with recombinant DNA are incubated on ice, followed by placing them briefly at 42°C (heat shock) and then putting them back into ice.
      This enables the bacteria to take up recombinant DNA.
   ii. **Micro-injection:** Recombinant DNA is directly injected into the nucleus of an animal cell.
   iii. **Biolistic or Gene gun:** Plant cells are bombarded with high-velocity micro-particles of gold or tungsten coated with DNA.
   iv. **"Disarmed pathogen" vectors:** (Ti- plasmid); retroviruses which when allowed to infect the cell, transfer the recombinant DNA into the host.

OR



   a. Simple stirred-tank bioreactor;

b. Sparged stirred-tank bioreactor through which sterile air bubbles are sparged.

Structure of Bioreactor:

i. It is a cylindrical structure with a curved base.
ii. A stirrer is present for even mixing and oxygen availability throughout the reactor.
iii. There is an agitator system, an oxygen delivery system, a foam control system, a temperature control system, etc.
iv. There is a sampling port through which small volumes of culture can be taken out periodically.

A flask in a laboratory cannot be used for producing recombinant DNA on a large scale. Unlike a bioreactor; a flask can not be used to grow culture continuously.

33. A-Mutualism B-Competition
C-Predation D-Amensalism

Mutualism It is an interaction, where both species derive benefit from the interaction, e.g lichens.

Competition It is an interaction, where both species suffer due to similar requirement of resources, that are limited, e.g. in some South American lakes, visiting flamingoes and resident species compete for the common food.

Predation It is an interaction between two species in which one species (parasite) depends on the other species (host) for food and shelter and in the process damages the host, i.e. one is benefitted and other harmed, e.g. tiger and the deer.

Amensalism It is an interaction, where one species is harmed, while other is neither benefitted nor harmed. Penicillium produces the toxin penicillin which kills other pathogen, but it itself does not get affected.

OR

i. Hardy-Weinberg proposed the genetic equilibrium principle. It says that the allele frequencies in a population are stable and constant from generation to generation. The gene pool remains constant. Sum total of all the allelic frequencies is 1. The Hardy-Weinberg principle is applicable only under the following conditions:
   a. **No Mutation:** There should not be either gene or chromosomal mutation.
   b. **No Gene Migration:** There must be no exchange of genes (gene flow) between the populations. All genes must have an equal chance of being passed to the next

generation.

c. **No Genetic Drift:** Genetic drift refers to a change in the population of alleles in the gene pool by chance. The population must be very large and no genetic drift should occur.
d. **Random Mating**: The population must reproduce sexually and mating must be random.
e. **No Natural Selection Pressure:** There must be no natural selection pressure with respect to the alleles under study.

According to the Hardy-Weinberg equilibrium Principle, gene frequencies will remain constant if all the above five conditions are met. Constant gene frequencies over several generations indicate that evolution is not taking place. Changing gene frequencies would indicate that evolution is in progress. In other words, evolution occurs when the genetic equilibrium is not constant.

ii. Genetic equilibrium gets disturbed in a population because of five factors including gene migration or gene flow, genetic drift, mutation, genetic recombination and natural selection.