CBSE Sample Paper -02 (solved)
Class 12 Biology

General Instructions:

(i) All questions are compulsory.

(ii) This question paper consists of four Sections A, B, C and D. 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 and 1 question of four mark and Section D is of 3 questions of five marks each.

(iii) 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.

(iv) Wherever necessary, the diagrams drawn should be neat and properly labelled.

Section-A

1. What is the number of chromosome in human zygote?
2. What is totipotency?
3. What are palindromic sequences?
4. What is Allen's rule?
5. How do define NPP?

Section B

6. Write the transcription product sequence for
   a) 5' ATGCACTGATCCAA 3'
   b) 3'GTACGTACGTAC 5'
7. Complete the table

Cross	ratio
Monohybrid	----------
----------	1: 2: 1

8. What are the types of acquired immunity?
9. Which microbe converts milk to curd?
10. Give some examples of diseases and their insect vectors.

OR

What are the different methods of breeding?

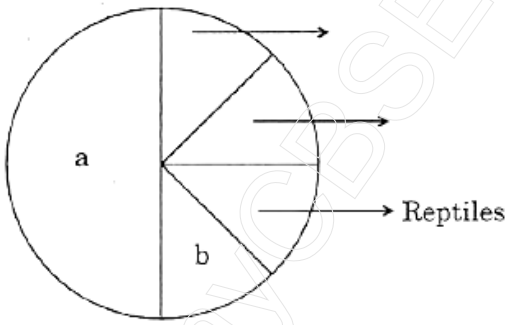
Section C

11. List the salient features of DNA double helix model.
12. What is the fate of the product of fertilization in humans?
13. How was the genetic code elucidated?
14. $p^2 + 2pq + q^2 = 1$ Explain this equation.
15. What are the different levels at which gene regulation can be achieved?
16. What are the primary lymphoid organs?
17. Explain gene therapy with an example.
18. Diagrammatically represent the replication of retrovirus.
19. How have cry proteins been utilized?

OR

Explain carbon cycle with diagram.

20. Explain two reasons for loss of biodiversity.
21. Give some adaptations of desert plants to survive the heat.
22. What does the picture represent?



23. **In art class the teacher asked Sunita to mix green and yellow paint and report on the combined colour formed. Sunita could not find green colour in his box and was scolded by the teacher who found it lying right in front. Suddenly Vijay realized that Sunita was not able to identify red colour and reported the matter to the teacher who was of the opinion that he lacked colour concept. After school was over, Vijay reported this matter to Sunita's parents.**

a) What values did Vijay possess?

b) Did Sunita lack knowledge of colours? If not, give the biological reason for the same.

c) Give the technical term for this type of inheritance. Explain with a typical example.

Section D

24. Explain with diagram the experiment that proved that DNA is the genetic material.

OR

Explain pollination by wind and water.

25. Give the journey of sperm formation with diagram. What are the hormones involved?

OR

Explain the technique of fingerprinting with diagram.

26. What is parasitism? What are the types?

OR

What are ecosystem services?

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Answers

Section A

1. 46.
2. Capacity of generating a whole plant from cell/explants is called totipotency.
3. In DNA is a sequence of base pairs on the two strands that reads the same when orientation of reading is kept same.
   5' GAATTC 3'
   3' CTTAAG 5'.
4. Mammals from colder climates generally have shorter ears and limbs to minimise heat loss. This is known as Allen's rule.
5. NPP is Net Primary Productivity.
   The external appearance of an organism is called phenotype.
   GPP - R = NPP.
   Where GPP is Gross Primary Productivity
   R is Respiration losses.

Section B

6. The transcription product sequence is
   a. 3' TACGTGACTAGGTT 5'.
   b. 5' AUGCACUGAUCCAA 3'
7. Monohybrid 3:1
   Incomplete dominance 1:2:1
8. Antibody mediated immunity or humoral immune response by the production of antibodies against antigens.Cell mediated immunity initiated by T lymphocytes.
9. Micro-organisms such as *Lactobacillus* and others commonly called **lactic acid bacteria (LAB)** grow in milk and convert it to curd. During growth, the LAB produce acids that coagulate andpartially digest the milk proteins. A small amount of curd added to the fresh milk as inoculum or starter contain millions of LAB, which at suitable temperatures multiply, thus converting milk to curd.

10. Malaria - female Anopheles mosquito

Dengue or Chikungunya -Aedes mosquito.

OR

Different methods of breeding are:

a. Inbreeding,

b. Out breeding

c. Out crossing

d. Cross breeding and

e. Interspecific hybridization

Section C

11. The salient features of the Double-helix structure of DNA are as follows:

(i) It is made of two polynucleotide chains, where the backbone is constituted by sugar-phosphate, and the bases project inside.

(ii) The two chains have anti-parallel polarity. It means, if one chain has the polarity 5′–>3′ , the other has 3′–>5′ .

(iii) The bases in two strands are paired through hydrogen bond (H-bonds) forming base pairs. Adenine forms two hydrogen bonds with Thymine from opposite strand and vice-versa. Similarly, Guanine is bonded with Cytosine with three H-bonds. As a result, always a purine comes opposite to a pyrimidine. This generates approximately uniform distance between the two strands of the helix.

(iv) The two chains are coiled in a right-handed fashion. The pitch of the helix is 3.4 nm (a nanometre is one billionth of a metre, that is 10-9 m) and there are roughly 10 bp in each turn. Consequently, the distance between a bp in a helix is approximately equal to 0.34 nm.

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

12. The product of fertilization is the zygote.

The mitotic division starts as the zygote moves through the isthmus of the oviduct called cleavage towards the uterus and forms 2, 4, 8, 16 daughter cells called blastomeres. The

embryo with 8 to 16 blastomeres is called a morula. The morula continues to divide and transforms into blastocyst as it moves further into the uterus. The blastomeres in the blastocyst are arranged into an outer layer called trophoblast and an inner group of cells attached to trophoblast called the inner cell mass. The trophoblast layer then gets attached to the endometrium and the inner cell mass gets differentiated as the embryo. After attachment, the uterine cells divide rapidly and cover the blastocyst. As a result, the blastocyst becomes embedded in the endometrium of the uterus. This is called implantation and it leads to pregnancy.

13. A genetic code is that which directs the sequence of amino acids during synthesis of proteins. The chemical method developed by HarGobind Khorana was instrumental in synthesizing RNA molecules with defined combinations of bases (homopolymers and copolymers). Marshall Nirenberg's cell-free system for protein synthesis finally helped the code to be deciphered. Severo Ochoa enzyme (polynucleotide phosphorylase) was also helpful in polymerizing RNA with defined sequences in a template independent manner (enzymatic synthesis of RNA).

    The salient features of genetic code are as follows:

    a. The codon is triplet. 61 codons code for amino acids and 3 codons do not code for any amino acids, hence they function as stop codons.
    b. One codon codes for only one amino acid, hence, it is unambiguous and specific.
    c. Some amino acids are coded by more than one codon, hence the code is degenerate.
    d. The codon is read in mRNA in a contiguous fashion. There are no punctuations.
    e. The code is nearly universal: for example, from bacteria to human UUU would code for Phenylalanine (phe).
    f. AUG has dual functions. It codes for Methionine (met) , and it also act as initiator codon.

14. The frequency of occurrence of alleles of a gene or a locus can be measured. This frequency is supposed to remain fixedand even remain the same through generations. This is the Hardy-Weinberg principle. This principle says that allele frequencies in a population are stable and is constant from generation to generation. The gene pool (total genes and their alleles in a population) remains a constant. This is called genetic equilibrium. Sum total of

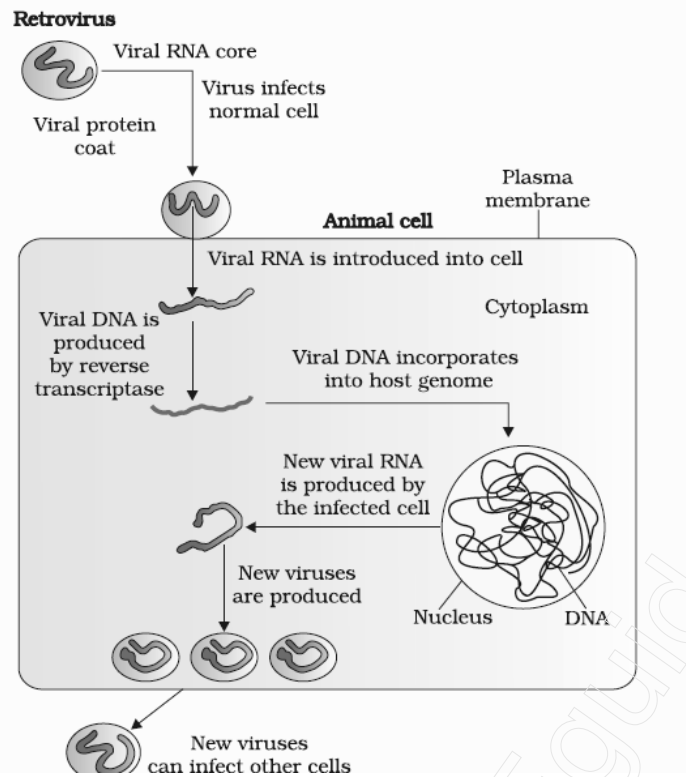
all the allelic frequencies is 1. Individual frequencies, for example, can be named p, q, etc. In a diploid, p and q represent the frequency of allele *A* and allele *a*.

The frequency of *AA* individuals in a population is simply p2. The probability that an allele A with a frequency of p appear on both the chromosomes of a diploid individual is simply the product of the probabilities, i.e., p2. Similarly of aa is q2, of Aa 2pq. Hence, p2+2pq+q2=1. This is a binomial expansion of (p+q)2

15. Gene regulation could be exerted at
    i. Transcriptional level (formation of primary transcript).
    ii. Processing level (regulation of splicing).
    iii. Transport of mRNA from nucleus to the cytoplasm.
    iv. Translational level.
16. The primary lymphoid organs are **bone marrow** and **thymus** where immature lymphocytes differentiate into antigen-sensitive lymphocytes.
    i. The bone marrow is the main lymphoid organ where all blood cells including lymphocytes are produced.
    ii. The thymus is a lobed organ located near the heart and beneath the breastbone. The thymus is quite large at the time of birth but keeps reducing in size with age and by the time puberty is attained it reduces to a very small size.
    iii. Both bone-marrow and thymus provide micro-environments for the development and maturation of T-lymphocytes.
17. Gene therapy is a collection of methods that allows correction of a gene defect that has been diagnosed in a child/embryo. Here genes are inserted into a person's cells and tissues to treat a disease. Correction of a genetic defect involves delivery of a normal gene into the individual or embryo to take over the function of and compensate for the non-functional gene.

    The first clinical gene therapy was given for adenosine deaminase (ADA) deficiency. The disorder is caused due to the deletion of the gene for adenosine deaminase. In some children ADA deficiency can be cured by bone marrow transplantation; in others it can be treated by enzyme replacement therapy, in which functional ADA is given to the patient by injection. Both of these approaches are not completely curative.

18.



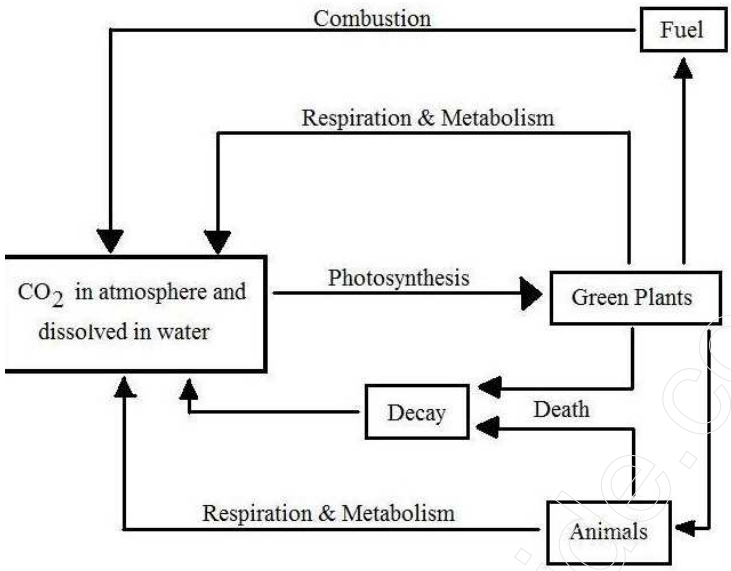
19. The Bt toxin is coded by a gene named cry. The proteins encoded by the genes *cryIAc*and *cryIIAb*control the cotton boll worms that of *cryIAb* control corn borer.

*B. thuringiensis*forms protein crystals during a particular phase of their growth. Thesecrystals contain a toxic insecticidal protein. The Bt toxin protein exist as inactive *protoxins*butonce an insect 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.The activated toxin binds to the surface of midgut epithelial cells and create pores that cause cell swelling and lysis and eventually cause death of the insect.

OR

Carbon cycling occurs through atmosphere, ocean and through living and dead organisms.A considerable amount of carbon returns to the atmosphere as CO2 through respiratory activities of the producers and consumers. Decomposers also contribute substantially to CO2 pool by their processing of waste materials and dead organic matter of land or oceans. Some amount of the fixed carbon is lost to sediments and removed from circulation.

Burning of wood, forest fire and combustion of organic matter, fossil fuel, volcanic activity are additional sources for releasing CO_2 in the atmosphere.



20. The reasons for loss of biodiversity are:

Habitat loss and fragmentation: The degradation of many habitats by pollution also threatens the survival of many species. When large habitats are broken up into small fragments due to various human activities, mammals and birds requiring large territories and certain animals with migratory habits are badly affected, leading to population declines.

Co-extinctions: When a species becomes extinct, the plant and animal species associated with it in an obligatory way also become extinct. When a host fish species becomes extinct, its unique assemblage of parasites also meets the same fate. Another example is the case of a coevolved plant-pollinator mutualism where extinction of one invariably leads to the extinction of the other.

21. The adaptive features that desert plants have are:

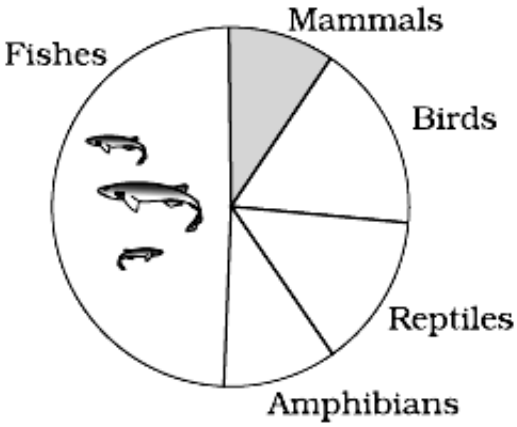
i. Thick cuticle on their leaf surfaces.

ii. Their stomata arranged in deep pits to minimize water loss through transpiration.

iii. Special photosynthetic pathway (CAM) that enables their stomata to remain closed during day time.

iv. Some plants like *opuntia*, have no leaves – they are reduced to spines–and the photosynthetic function is taken over by the flattened stems.

22.



23.

a. Vijay was alert, curious, clever and a responsible child.

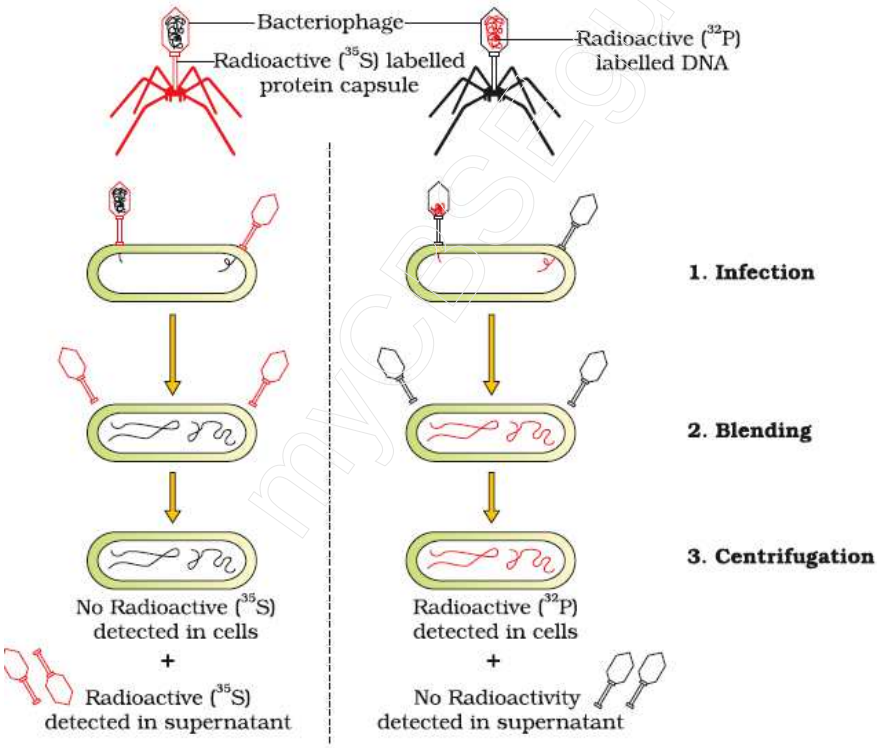
b. According to the teacher Sunita lacks the concept of colours. But when he could not identify red colour, it proved to be a case of colour blindness. It is a sex linked inherited disorder.

c. This is a human disease which causes the loss of ability to differentiate between red colour and green colour. The gene for this red-green colour blindness is present on X chromosome. Colour blindness is recessive to normal vision.

If a colour blind man (XcY) marries a girl with normal vision (XX), the daughters would have normal vision but would be carrier, while sons would also be normal. If the carrier girl (heterozygous for colour blindness, XcX) now marries a colour blind XcY the offspring would show 50% females and 50% males. Of the females, 50% would be carrier for colour blindness and the rest 50% would be colour blind. Of the males, 50% would have normal vision and the 50% would be colour blind.

Section D

24. Hershey and Chase grew some viruses on a medium that contained radioactive phosphorus and some others on medium that contained radioactive sulfur. Viruses grown in the presence of radioactive phosphorus contained radioactive DNA but not radioactive protein because DNA contains phosphorus but protein does not. Similarly, viruses grown on radioactive sulfur contained radioactive protein but not radioactive DNA because DNA does not contain sulfur. Radioactive phages were allowed to attach to E. coli bacteria. Then, as the infection proceeded, the viral coats were removed from the bacteria by agitating them in a blender. The virus particles were separated from the bacteria by spinning them in a centrifuge. Bacteria which were infected with viruses that had radioactive DNA were radioactive, indicating that DNA was the material that passed from the virus to the bacteria. Bacteria that were infected with viruses that had radioactive proteins were not radioactive. This indicates that proteins did not enter the bacteria from the viruses. DNA is therefore the genetic material that is passed from virus to bacteria



OR

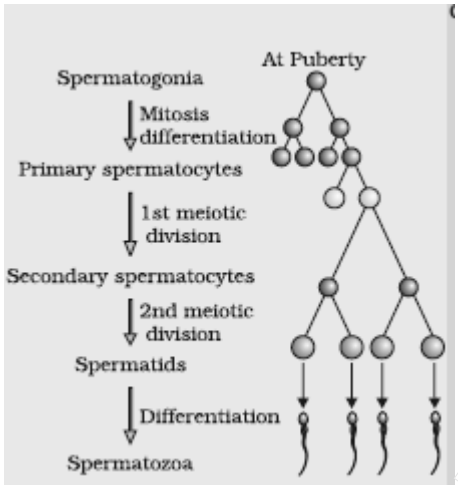
Pollination by wind-

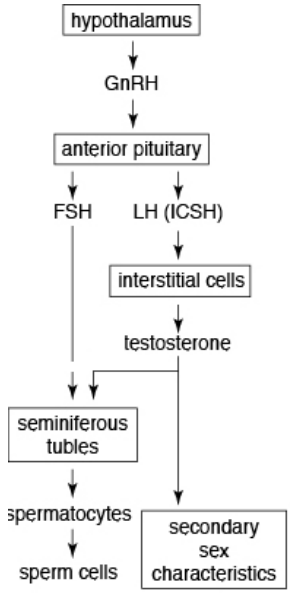
a. Requires that the pollen grains are light and non-sticky so that they can be transported in wind currents.
b. Possess well-exposed stamens so that the pollens are easily dispersed into wind currents.
c. Large and feathery stigma to easily trap air-borne pollen grains.
d. Have a single ovule in each ovary and numerous flowers packed into an inflorescence.
e. Quite common in grasses.

Pollination by water-

a. Quite rare in flowering plants and is limited to mostly monocotyledons.
b. Water is a regular mode of transport for the male gametes among the lower plant groups such as algae, bryophytes and pteridophytes.
c. Some examples of water pollinated plants are *Vallisneria*and *Hydrilla*which grow in fresh water and several marine sea-grasses such as *Zostera*.
d. In *Vallisneria,* the female flower reach the surface of water by the long stalk and the male flowers or pollen grains are released on to the surface of water. They are carried passively by water currents (; some of them eventually reach the female flowers and the stigma.
e. In sea grasses, female flowers remain submerged in water and the pollen grains are released inside the water.
f. Pollen grains in many such species are long, ribbon like and they are carried passively inside the water; some of them reach the stigma and achieve pollination. In most of the water-pollinated species,pollen grains are protected from wetting by a mucilaginous covering.

25. In testis, the immature male germ cells (spermatogonia) produce sperms by spermatogenesis that begins at puberty. The spermatogonia (sing. spermatogonium) present on the inside wall of seminiferous tubules multiply by mitotic division and increase in numbers. Each spermatogonium is diploid and contains 46 chromosomes. Some of the spermatogonia called primary spermatocytes periodically undergo meiosis. A primary spermatocyte completes the first meiotic division (reduction division) leading to formation of two equal, haploid cells called secondary spermatocytes, which have only 23 chromosomes each. The secondary spermatocytes undergo the second meiotic division to produce four equal, haploid spermatids. The spermatids are transformed into spermatozoa (sperms) by the process called spermiogenesis. After spermiogenesis, sperm heads become embedded in the Sertoli cells, and are finally released from the seminiferous tubules by the process called spermiation.





OR

DNA fingerprinting involves

- identifying differences in some specific regions in DNA sequence called as repetitive DNA, because in these sequences, a small stretch of DNA is repeated many times.
- These repetitive DNA are separated from bulk genomic DNA as different peaks during density gradient centrifugation.
- The bulk DNA forms a major peak and the other small peaks are referred to as satellite DNA.
- Depending on base composition (A : T rich or G:C rich), length of segment, and number of repetitive units, the satellite DNA is classified into many categories, such as micro-satellites, mini-satellites etc.

- These sequences normally do not code for any proteins, but they form a large portion of human genome.
- These sequence show high degree of polymorphism and form the basis of DNA fingerprinting.

The technique involves the steps

- isolation of DNA,
- digestion of DNA by restriction endonucleases,
- separation of DNA fragments by electrophoresis,
- transferring (blotting) of separated DNA fragments to synthetic
- membranes, such as nitrocellulose or nylon,
- hybridisation using labelled VNTR probe, and
- detection of hybridised DNA fragments by autoradiography

26. Parasitism is an interspecies relationship in which one organism gets benefitted and the other is harmed.

Parasites evolve special adaptations such as the loss of unnecessary sense organs, presence of adhesive organs or suckers to cling on to the host, loss of digestive system and high reproductive capacity. The life cycles of parasites are often complex, involving one or two intermediate hosts or vectors to facilitate parasitisation of its primary host. The human liver fluke (atrematode parasite) depends on two intermediate hosts (a snail and a fish) to complete its life cycle. The malarial parasite needs a vector (mosquito) to spread to other hosts.

Parasites that feed on the external surface of the host organism are called ectoparasites. The most familiar examples of this group are the lice on humans and ticks on dogs. Many marine fish areinfested with ectoparasitic copepods. *Cuscuta*, a parasitic plant that is commonly found growing on hedge plants, has lost its chlorophyll and leaves in the course of evolution. It derives its nutrition from the host plant which it parasitizes.

Endoparasites are those that live inside the host body at different sites (liver, kidney, lungs, red bloodcells, etc.). The life cycles of endoparasites are more complex because of their extreme specialisation.

Their morphological and anatomical features are greatly simplified while emphasising their reproductive potential.

Brood parasitismin birds – the parasitic bird lays its eggs in the nest of its host and lets the hostincubate them. During the course of evolution, the eggs of the parasitic bird have evolved to resemble the host's egg in size and colour to reduce the chances of the host bird detecting the foreign eggs and ejecting them from the nest.

OR

Healthy ecosystems are the base for a wide range of economic, environmental and aesthetic goods and services. The products of ecosystem processes are named as **ecosystem service**.

For example healthy forest ecosystems

a. Purify air and water.
b. Mitigate droughts and floods.
c. Cycle nutrients.
d. Generate fertile soils.
e. Provide wildlife habitat.
f. Maintain biodiversity.
g. Pollinate crops.
h. Provide storage site for carbon.
i. Provide aesthetic, cultural and spiritual values.

Out of the total cost of various ecosystem services, the soil formation accounts for about 50 per cent, and contributions of other services like recreation and nutrient cycling, are less than 10 per cent each. The cost of climate regulation and habitat for wildlife are about 6 per cent each.