CBSE Sample Paper -02
Class 12 Biology
(Questions)

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.

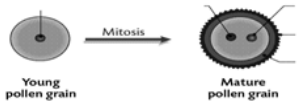
(iv) Wherever necessary, the diagrams drawn should be neat and properly labelled.

Section A

1. Identify the types of immunization in case of injection of readymade antibodies for a tetanus case.
2. What are Homologous organs?
3. What are palindromic sequences?
4. What is Allen's rule?
5. How do define NPP?

Section B

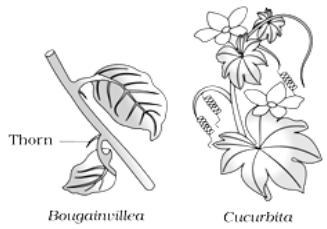
6. Label the parts in the diagram below.



7. Complete the table

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

8. What does the diagram signify?



9. What are the parts of the fallopian tube?
10. What is out crossing?

    OR

    What is succession?

Section C

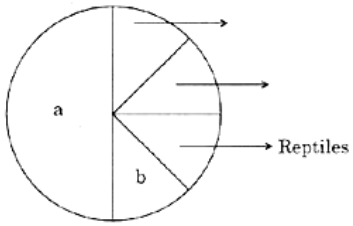
11. Draw a labeled diagram of a human sperm.
12. What is the principle of Genetic equilibrium?
13. List the salient features of DNA double helix model.

    OR

    Explain the parts of an ovule with a diagram.
14. Explain convergent evolution with examples.
15. What do you mean by withdrawal syndrome? Write the side effects of the use of anabolic steroids in males.
16. Explain gene therapy with an example.
17. A mixture of DNA fragments have to be separated based on size. How is this achieved?
18. How have cry proteins been utilized?
19. Explain carbon cycle with diagram.

    OR

    Explain 2 reasons for loss of biodiversity.
20. When is insulin fully functional?
21. Give some adaptations of desert plants to survive the heat.
22. What does the picture represent?



23. **During Primary art classes the teacher asked Parthiv to mix green and yellow paint andreport on the combined colour formed. Parthiv could not find green colour in his box andwas scolded by the teacher who found it lying right in front. Suddenly Vijay realized thatParthiv was not able to identify red colour and reported the matter to the teacher whowas of the opinion that he lacked colour concept. After school was over, Vijay reportedthis matter to Parthiv's parents.**

a) What values did Vijay possess?

b) Did Parthiv 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 the processes that follow implantation of blastocyst in the uterus.

OR

Explain pollination by wind and water.

25. Explain sickle cell anemia and its inheritance as a pedigree chart.

OR

Explain the technique of fingerprinting with diagram.

26. What is parasitism? What are the types?

OR

What are ecosystem services?

CBSE Sample Paper -02 (solved)

Class 12 Biology

Answers

Section A

1. Passive immunization.
2. The same structure developed along different directions due to adaptations to different needs. This is divergent evolution and these structures are homologous. Homology indicates common ancestry.
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.
5. GPP- R = NPP.

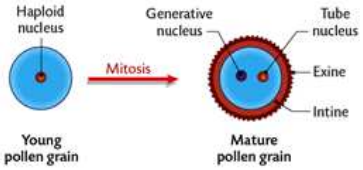
   Where GPP is Gross Primary Productivity

   R is Respiration losses

   NPP is Net Primary Productivity.

Section B

6. Parts or young pollen grain and mature pollen grain



7. Monohybrid 3:1

   Incomplete dominance 1:2:1
8. Homologous structures- The same structure developed along different directions due to adaptations to different needs. This is **divergentevolution** and these structures are **homologous**. Homology indicates common ancestry. The thorn and tendrils of *Bougainvillea* and *Cucurbita* represent homology.

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Class 12 Biology

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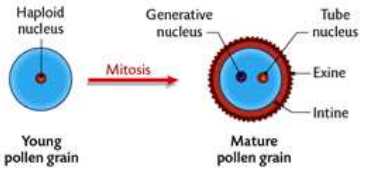

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9. Infundibulum with fimbriae, Ampulla, Isthmus that joins with the uterus.

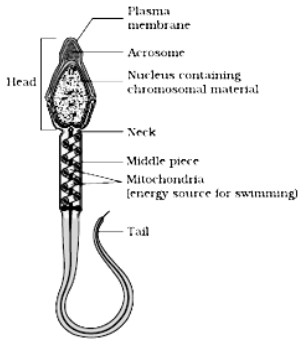
10. The practice of mating of animals within the same breed, but having no common ancestors on either side of their pedigree up to 4-6 generations. The offspring of such a mating is known as an out-cross.

OR

The gradual and fairly predictable change in the species composition of a given area is called Ecologicalsuccession. Eg.hydrarch and xerarch succession.

Section C

11.



12. Hardy-Weinberg 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 pq, 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 q^2, of Aa2pq. Hence, $p^2+2pq+q^2=1$. This is a binomial expansion of $(p+q)^2$. When frequency measured, differs from expected values, the difference (direction) indicates the extent of evolutionary change. Disturbance in genetic equilibrium, or Hardy-Weinberg equilibrium, i.e. change of frequency of alleles in a population would then be interpreted as resulting in evolution.

13. 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.

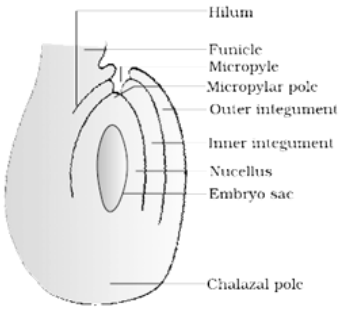
ii. The two chains have anti-parallel polarity. It means, if one chain has the polarity 5′–>3′ , the other has 3′–>5′ .

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.

OR



The ovule is a small structure attached to the placenta by means of a stalk called **funicle**. The body of the ovule fuses with funicle in the region called **hilum.**.Each ovule has one or two protective envelopes called **integuments.** Integuments encircle the ovule except at the tip where a small opening called the **micropyle**is organised. Opposite the micropylar end, is the **chalaza**, representing the basal part of the ovule. Enclosed within the integuments is a mass of cells called the **nucellus**. Cells of the nucellus have abundant reserve food materials. Located in the nucellus is the **embryo sac** or **female gametophyte.**

14. **Convergent evolution** - evolution of different structures for the same function and hence having similarity. The similar habitat that has resulted in selection of similar adaptive features in different groups of organisms but toward the same function.

Examples are the eye of the octopus and of mammals, the flippers of Penguins and Dolphins.

Sweet potato (root modification) and potato (stem modification)

Similarities in proteins and genes performing a given function among diverse organisms give clues to common ancestry.

15. The tendency of the body to manifest a characteristic and unpleasant withdrawal syndrome if regular dose of drugs/alcohol is abruptly discontinued. This is characterised by anxiety, shakiness, nausea and sweating, which may be relieved when use is resumed again. In some cases, withdrawal symptoms can be severe.

    The use of anabolic steroid in sports is to increase muscle strength and bulk and to promote aggressiveness and as a result increase athletic performance. In males the side effects of anabolic steroids include acne, increased aggressiveness, mood swings, depression, reduction of size of the testicles, decreased sperm production, potential for kidney and liver dysfunction, breast enlargement, premature baldness, enlargement of the prostate gland, and premature closure of the growth centres of the long bones may result in stunted growth

16. 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.

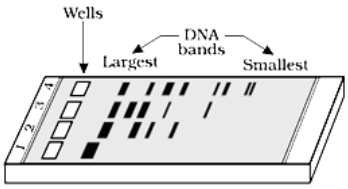
    The first clinical gene therapy was given for adenosine deaminase (ADA) deficiency. The disorder is caused due to the deletion of the gene for adenosine deaminase. In some children ADA deficiency can be cured by bone marrow transplantation; in others it can be treated by enzyme replacement therapy, in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

    Gene therapy includes

    - Lymphocytes from the blood of the patient are grown in a culture outside the body.
    - A functional ADA cDNA (using a retroviral vector) is then introduced into these lymphocytes, which are subsequently returned to the patient.
    - As these cells are not immortal, the patient requires periodic infusion of such genetically engineered lymphocytes.

- If the gene isolate from marrow cells producing ADA is introduced into cells at early embryonic stages, it could be a permanent cure.

17.



The cutting of DNA by restriction endonucleases results in the fragments of DNA. These fragments can be separated by a technique known as **gel electrophoresis**. Since DNA fragments are negatively charged molecules they can be separated by forcing them to move towards the anode under an electric field through a medium/matrix. Nowadays the most commonly used matrix is agarose which is a natural polymer extracted from sea weeds. The DNA fragments separate (resolve) according to their size through sieving effect provided by the agarose gel. Hence, the smaller the fragment size, the farther it moves.

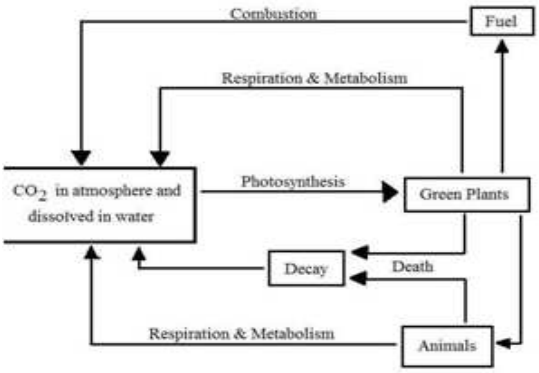
The separated DNA fragments can be visualised only after staining the DNA with a compound knownasethidium bromide followed by exposure to UV radiation. The separated bands of DNA are cut out from the agarose gel and extracted from the gel piece. This step is known as elution. The DNAfragments purified in this way are used in constructing recombinant DNA by joining them with cloning vectors.

18. The Bt toxin is coded by a gene named cry. The proteins encoded by the genes *cryIAc*and*cryIIAb*control the cotton bollworms that of *cryIAb*controls 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.

19. The movement of nutrient elements through the various components of an ecosystem is called **nutrient cycling** or **biogeochemical** cycles.

Nutrient cycles are of two types: (a) **gaseous** and (b) **sedimentary.**



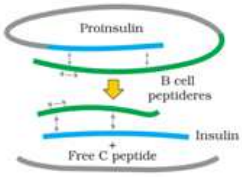
Carbon cycling occurs through atmosphere, ocean and through living and dead organisms. A considerable amount of carbon returns to the atmosphere as CO2 through respiratory activities of the producers and consumers. Decomposers also contribute substantially to CO2 pool by their processing of waste materials 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.

OR

The reasons for loss of biodiversity

- **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.

20.

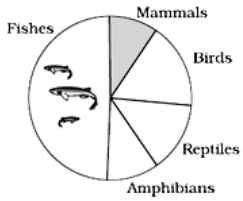


Insulin is synthesised as a pro-hormone (like a pro-enzyme, the pro-hormone also needs to be processed before it becomes a fully mature and functional hormone) which contains an

extra stretch called the C peptide. This C peptide is not present in the mature insulin and is removed during maturation into insulin.

21. Many desert plants have
    - a thick cuticle on their leaf surfaces
    - have their stomata arranged in deep pits to minimise water loss through transpiration.
    - special photosynthetic pathway (CAM) that enables their stomata to remain closed during day time.
    - 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 Parthiv 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 wouldhave normal vision but would be carrier, while sons would also be normal **Cross (a)**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 themales, 50% would have normal vision and the 50% would be colour blind.

Section D

24. 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 interdigitated with each other and jointly form a structural and functional unit between developing embryo (foetus) and maternal body called placenta.

The placenta facilitates the supply of oxygen and nutrients to the embryo and also removal of carbon dioxide and excretory/waste materials produced by the embryo. The placenta is connected to theembryo through an umbilical cord which helps in the transport of substances to and from the embryo.

Immediately after implantation, the inner cell mass (embryo) differentiates into an outer layer called ectoderm and an inner layer called endoderm. A mesoderm soon appears between the ectoderm and the endoderm. These three layers give rise to all tissues (organs) in adults. The inner cell mass contains certain cells called stem cells which have the potency to give rise to all the tissues and organs.

The human pregnancy lasts 9 months.In human beings, after one month of pregnancy, the embryo's heart is formed. By the end of the second month of pregnancy, the foetus develops limbs and digits. By the end of 12 weeks (first trimester), most of the major organ systems are formed, for example, the limbs and external genital organs are well developed.

The first movements of the foetus and appearance of hair on the head are usually observed during the fifth month. By the end of 24 weeks (second trimester), the body is covered with fine hair, eye-lidsseparate, and eyelashes are formed. By the end of nine months of pregnancy, the foetus is fully developed and is ready for delivery.

Hormones involved-

- Placenta
  human chorionic gonadotropin (hCG),
  humanplacentallactogen(hPL),
  estrogens, progestogens, etc. In the later
- Ovary
  Relaxin
- Other hormones
  estrogens, progestogens, cortisol, prolactin, thyroxine, etc., are increased severalfolds in the maternal blood.

Increased production of these hormones is essential for supporting the fetal growth, metabolic changes in the mother and maintenance of pregnancy.

OR

Pollination by wind-

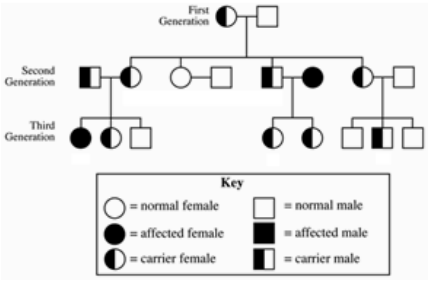
- requires that the pollen grains are light and non-sticky so that they can be transported in wind currents.
- possess well-exposed stamens so that the pollens are easily dispersed into wind currents,
- large and feathery stigma to easily trap air-borne pollen grains.
- have a single ovule in each ovary and numerous flowers packed into an inflorescence
- Quite common in grasses.

Pollination by water

- quite rare in flowering plants and is limited to mostly monocotyledons.
- water is a regular mode of transport for the male gametes among the lower plant groups such as algae, bryophytes and pteridophytes.
- Some examples of water pollinated plants are *Vallisneria*and*Hydrilla*which grow in fresh water and several marine sea-grasses such as *Zostera*.
- 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.
- In seagrasses, female flowers remain submerged in water and the pollen grains are released inside the water.
- 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. <u>Sickle cell anemia</u>

- is an autosome linked recessive trait that can be transmitted from parents to the offspring when both the partners are carrier for the gene (or heterozygous).
- The disease is controlled by a single pair of allele, HbA and HbS.
- Out of the three possible genotypes only homozygous individuals for HbS (HbSHbS) show the diseased phenotype.
- Heterozygous (HbAHbS) individuals appear apparently unaffected but they are carrier of the disease as there is 50 per cent probability of transmission of the mutant gene to the progeny, thus exhibiting sickle-cell trait.

- 

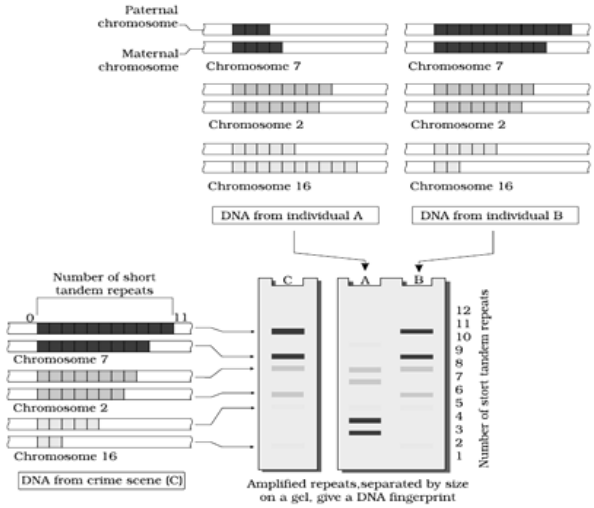
The defect is caused by the substitution of Glutamic acid (Glu) by Valine (Val) at the sixth position of the beta globin chain of the haemoglobin molecule.

- The substitution of amino acid in the globin protein results due to the single base substitution at the sixth codon of the beta globin gene from GAG to GUG.
- The mutant haemoglobin molecule undergoes polymerisation under low oxygen tension causing the change in the shape of the RBC from biconcave disc to elongated sickle like structure.

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 labelledVNTR 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.

Endoparasitesare 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

- purify air and water,
- mitigate droughts and floods,
- cycle nutrients,
- generate fertile soils,
- provide wildlife habitat
- maintain biodiversity,
- pollinate crops,
- provide storage site for carbon
- 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.