CBSE Sample Paper -04 (solved)

Class 12 Biology

General Instructions:

(i) All questions are compulsory.

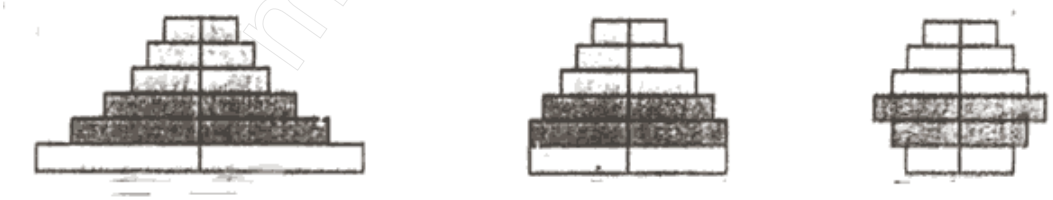
(ii) This question paper consists of four Sections A, B, C and D. Section A contains 5 questions of one mark each, Section B is of 5 questions of two marks each, Section C is of 12 questions of three marks each and 1 question of four mark and Section D is of 3 questions of five marks each.

(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 coleorhiza?
2. What is the advantage of use of biotechnology in molecular biology over traditional pathological tests?
3. What are cleistogamous flowers?
4. How is *Agrobacterium tumefaciens* considered useful?
5. Which attribute of human population do the following figures represent?



Section B

6. What are the basic steps involved in genetically modifying an organism?
7. Explain the four types of barriers of Innate immunity

8. What do you mean by inbreeding depression? How this problem should be solved during animal breeding?

OR

Write with examples, how use of microbes helps us to make different types of cheese with specific texture & flavors?

9. S strain ⟶ Inject into mice ⟶ ----------

   ---------- ⟶ Inject into mice ⟶ Mice live

   Complete the diagram above. What was this experiment about and who performed it?

10. What may be the reasons for low productivity of ocean?

Section C

11. Discuss the barrier methods for contraception.
12. An individual has genotype with an extra chromosome 21.
    a) What is this disorder called?
    b) What will be the physical appearance?
13. Discuss the role of microbes in sewage treatment.
14. What is DNA fingerprinting? On what principle does it work? Mention its two applications.

OR

Explain Miller's experiment to prove the 'theory of chemical origin of life' as proposed by Oparin and Haldane.

15. Differentiate between spermatogenesis and oogenesis with a diagram.
16. What are the advantages of GM plants?
17. What do you understand by the term bio-pesticide? Name and explain the mode of action of a popular bio-pesticide
18. Represent schematically the life cycle of malarial parasite.
19. Compare and contrast: isogamy and anisogamy. With examples.
20. Answer the following.
    a) Expand IUT.

b) In which part of the female reproductive system the 8 called embryo will be transferred during test tube baby programme.

21. Haploid content of human DNA is 3.3 x10 ^{9} bp and the distance between 2 consecutive bp is 0.34 x 10 $^{-9}$. What is the length of the DNA molecule?

22. Explain convergent evolution with examples.

23. Rakhi and her parents were watching a TV serial in the evening. During a commercial break, an advertisement flashed on the screen which was promoting use of sanitary napkins. Rakhi was still watching the TV. The parents got embarrassed and changed the channel. Rakhi objected to her parents' behavior and explained the need for these advertisements.

a) What values did the parents show?

b) Briefly describe the phases of a menstrual cycle.

Section D

24. Plant breeding programmes are carried out in a systematic way worldwide. Explain the five main steps in breeding a new genetic variety.

OR

a) Why are CO_2, CH_4, N_2O etc known as green house gases?

b) Why is CNG better than Diesel?

25. a) Explain primary productivity and the factors that influence it.

b) Describe how oxygen and chemical composition of detritus control decomposition.

OR

What are chromosomal disorders?

26. Draw schematically a single polynucleotide strand (with at least three nucleotides). Provide labels and directions.

OR

What are the post pollination events? Explain it.

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Answers

Section A

1. In embryos of monocots the root cap and radicle are enclosed in an undifferentiated sheath called coleorhizae.
2. Using conventional methods of diagnosis (serum and urine analysis, etc.) early detection is not possible. Using biotechnology methods it is possible to detect a disease and start treatment at an early stage.
3. Self pollinating flowers in which stamens and pistil are in close proximity.
4. The tumor causing gene in the bacteria can be substituted with gene of interest and introduced into plants.
5. The figures represent the age pyramids of human population as
   Expanding
   Stable and
   Declining

Section B

6. Three basic steps in genetically modifying an organism are
   i. Identification of DNA with desirable genes.
   ii. Introduction of the identified DNA into the host.
   iii. Maintenance of introduced DNA in the host and transfer of the DNA to its progeny.
7. Innate immunity consist of four types of barriers. These are:
   i. Physical barriers: Skin on our body is the main barrier hich prevents entry of the micro-organisms.
   ii. Physiological barriers: Acid in the stomach, saliva in the mouth, tears from eyes– all prevent microbial growth.

iii. Cellular barriers: Certain types of leukocytes (WBC) of our body like polymorpho-nuclear leukocytes (PMNL-neutrophils) and monocyte.

iv. Cytokine barriers: Virus-infected cells secrete proteins called interferons which protect non-infected cells from further viral infection.

8. Continued inbreeding, especially close inbreeding, usually reduces fertility and even productivity. This is called inbreeding depression. Whenever this becomes a problem, selected animals of the breeding population should be mated with unrelated superior animals of the same breed. This usually helps restore fertility and yield.

OR

Different varieties of cheese are known by their characteristic texture, flavor and taste, the specificity coming from the microbes used. For example, the large holes in 'Swiss cheese' are due to production of a large amount of CO_2 by a bacterium named *Propionibacterium sharmanii*. The 'Roquefort cheese' are ripened by growing a specific fungi on them, which gives them a particular flavor.

9. S strain ⟶ Inject into mice ⟶ Mice live

S strain Inject into mice ----------

(Heat killed) + R strain (live)

The experiment was Griffith's Transformation experiment and was to prove that DNA is the genetic material.

10. Low productivity of ocean is due to following reasons:

i. Lack of light.

ii. High salinity.

iii. High pressure and

iv. Waves and tides.

Section C

11. In **barrier** methods, ovum and sperms are prevented from physically meeting with the help of barriers. Such methods are available for both males and females.

Condoms are barriers made of thin rubber/ latex sheath that are used to cover the penis in the male or vagina and cervix in the female, just before coitus so that the ejaculated semen would not enter into the female reproductive tract. This can prevent conception.

Diaphragms, cervical caps and **vaults** are also barriers made of rubber that are inserted into the female reproductive tract to cover the cervix during coitus. They prevent conception by blocking the entry of sperms through them cervix. They are reusable.

Spermicidal creams, jellies and foams are usually used along with these barriers to increase their contraceptive efficiency.

Intra Uterine Devices (IUDs). These devices are inserted by doctors or expert nurses in the uterus through vagina. These Intra Uterine Devices are presently available as the non-medicated IUDs (e.g., Lippes loop), copper releasing IUDs (CuT, Cu7, Multiload 375) and the hormone releasing IUDs (Progestasert, LNG-20). IUDs increase phagocytosis of sperms within the uterus and the Cu ions released suppress sperm motility and the fertilising capacity of sperms. The hormone releasing IUDs, in addition, make the uterus unsuitable for implantation and the cervix hostile to the sperms.

12. An individual has genotype with an extra chromosome 21.
    a) The disorder is called Down's syndrome or trisomy of 21.
    b) The affected individual is short statured with small round head, furrowed tongue and partially open mouth. Palm is broad with characteristic palm crease. Physical, psychomotor and mental development is retarded.

13. Treatment of waste water is done by the heterotrophic microbes naturally present in the sewage. This treatment is carried out in two stages:

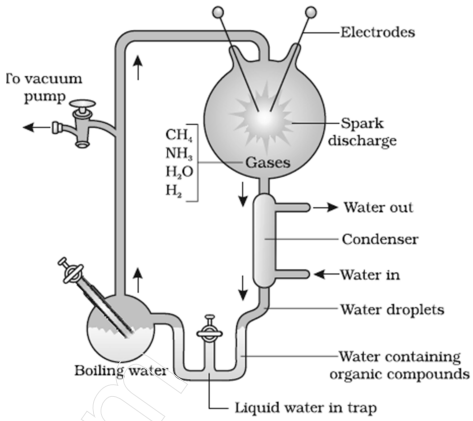
Primary treatment: These treatment steps basically involve physical removal of particles – large and small – from the sewage through filtration and sedimentation. These are removed in stages; initially, floating debris is removed by sequential filtration. Then the grit (soil and small pebbles) are removed by sedimentation. All solids that settle form the primary sludge, and the supernatant forms the effluent. The effluent from the primary settling tank is taken for secondary treatment.

Secondary treatment or Biological treatment : The primary effluent is passed into large aeration tanks where it is constantly agitated mechanically and air is pumped into it. This

allows vigorous growth of useful aerobic microbes into flocs (masses of bacteria associated with fungal filaments to form mesh like structures). While growing, these microbes consume the major part of the organic matter in the effluent. This significantly reduces the BOD (biochemical oxygen demand) of the effluent. BOD refers to the amount of the oxygen that would be consumed if all the organic matter in one liter of water were oxidized by bacteria. The sewage water is treated till the BOD is reduced.Once the BOD of sewage or waste water is reduced significantly, the effluent is then passed into a settling tank where the bacterial 'flocs' are allowed to sediment. This sediment is called activated sludge. A small part of the activated sludge is pumped back into the aeration tank to serve as the inoculum. The remaining major part of the sludge is pumped into large tanks called anaerobic sludge digesters. Here, other kinds of bacteria, which grow anaerobically, digest the bacteria and the fungi in the sludge. During this digestion, bacteria produce a mixture of gases such as methane, hydrogen sulphide and carbon dioxide. These gases form biogas and can be used as source of energy as it is inflammable.

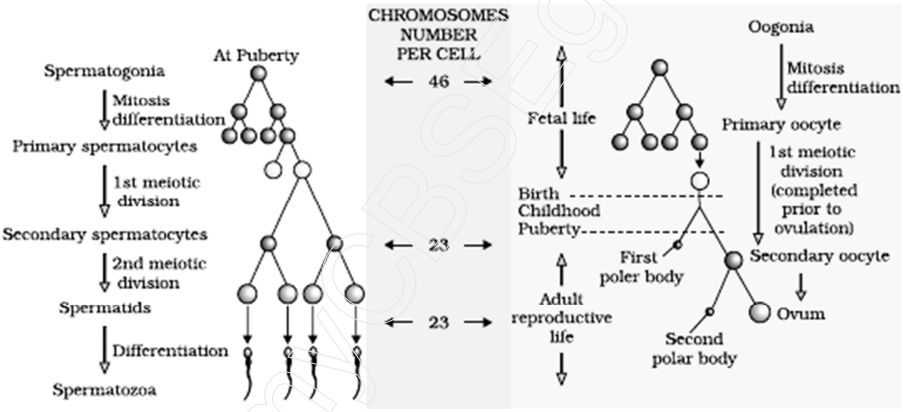
14. DNA fingerprinting involves identifying differences in some specific regions in DNA sequence called as repetitive DNA, because in these sequences, a small stretch of DNA is repeated many times. These repetitive DNA are separated from bulk genomic DNA as different peaks during density gradient centrifugation. 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. Since DNA from every tissue (such as blood, hair-follicle, skin, bone, saliva, sperm etc.), from an individual show the same degree of polymorphism, they become very useful identification tool in forensic applications. Further, as the polymorphisms are inheritable from parents to children, DNA fingerprinting is the basis of paternity testing, in case of disputes.

OR



Oparin and Haldane proposed that the first form of life could have come from pre-existing non-living organic molecules (e.g. RNA, protein, etc.) and that formation of life was preceded by chemical evolution, i.e., formation of diverse organic molecules from inorganic constituents. The conditions on earth were – high temperature, volcanic storms, reducing atmosphere containing CH4, NH3, etc. Miller created similar conditions in a laboratory scale. He created electric discharge in a closed flask containing CH4, H2, NH3 and water vapaur at 8000C. He observed formation of amino acids. In similar experiments others observed, formation of sugars, nitrogen bases, pigment and fats. Analysis of meteorite content also revealed similar compounds indicating that similar processes are occurring elsewhere in space

15. Difference between spermatogenesis and oogenesis



16. Plants , bacteria, fungi and animals whose genes have been altered by manipulation are called Genetically Modified Organisms (GMO). GM plants have been useful in many ways. Genetic modification has:

i. Made crops more tolerant to abiotic stresses (cold, drought, salt,heat).

ii. Reduced reliance on chemical pesticides (pest-resistant crops).

iii. Helped to reduce post harvest losses.

iv. Increased efficiency of mineral usage by plants (this prevents early exhaustion of fertility of soil).

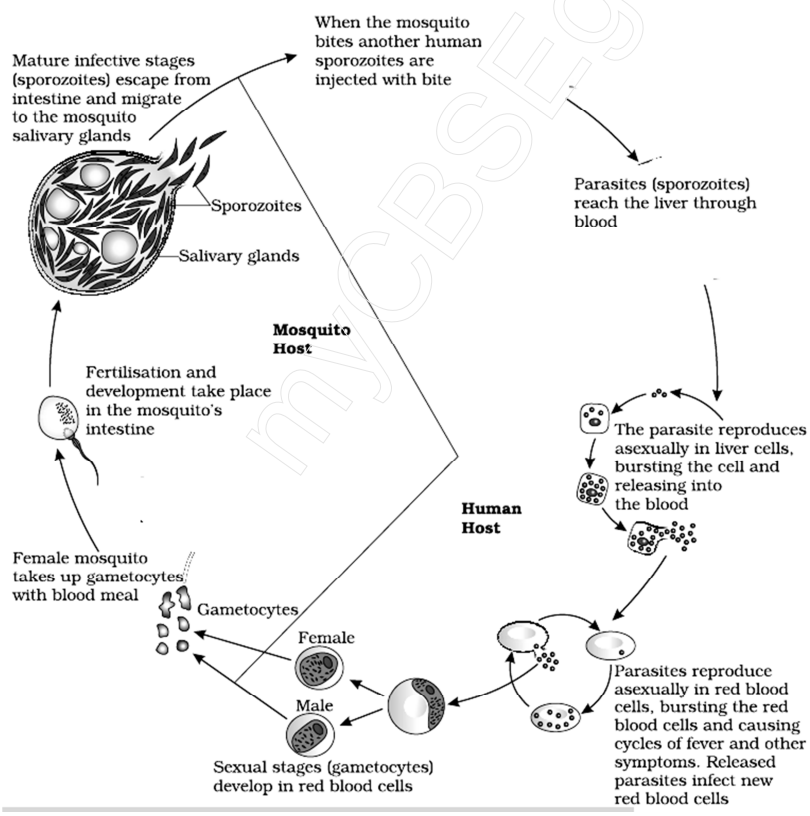
v. Enhanced nutritional value of food, e.g., Vitamin 'A' enriched rice.

vi. Create tailor-made plants to supply alternative resources to industries, in the form of starches, fuels and pharmaceuticals.

17. There is a method of controlling pests that relies on natural predation rather than introduced chemicals.

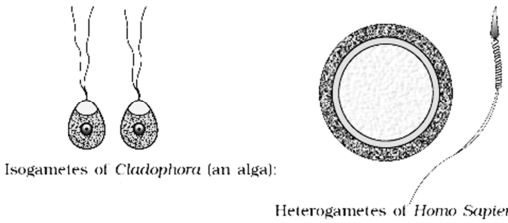
An example of microbial bio-control agents that can be introduced in order to control butterfly caterpillars is the bacteria *Bacillus thuringiensis* (often written as Bt). These are available in sachets as dried spores which are mixed with water and sprayed onto vulnerable plants such as brassicas and fruit trees, where these are eaten by the insect larvae. In the gut of the larvae, the toxin is released and the larvae get killed. The bacterial disease will kill the caterpillars, but leave other insects unharmed. Because of the development of methods of genetic engineering in the last decade or so, the scientists have introduced B. thuringiensis toxin genes into plants. Such plants are resistant to attack by insect pests. Bt-cotton is one such example

18. The life cycle of malarial parasite.



19. In some algae the two gametes are so similar in appearance that it is not possible to categories them into male and female gametes. They are hence called homogametes or isogametes.

In a majority of sexually reproducing organisms the gametes produced are of two morphologically distinct types and are thus heterogametes or anisogametes. In such organisms the male gamete is called the antherozoid or sperm and the female gamete is called the egg or ovum



Isogametes of *Cladophora* (an alga):

Heterogametes of *Homo Sapiens* (Human beings)

20.

(a) IUT is Intra Uterine transfer. The 8 celled embryo developed by In-vitro fertilization or ICSI is transferred in this technique.

(b) The 8 celled embryo is transferred to the uterus.

21. Haploid content is 3.3×10^{9}

Therefore, diploid content is 6.6×10^{9}

Distance between bp is 0.34×10^{-9}

Therefore length is diploid content x distance between bp

$6.6 \times 10^{9} \times 0.34 \times 10^{-9} = 2.24$ m.

22. Respect for nature, scientific attitude with a vision of the future is called as convergent evolution.

We should conserve Biodiversity since it provides us:

i. Main source of food.

ii. Source of economically important fibers (cotton, flax, hemp, jute etc).

iii. Plant products (gum, resin, dye, fragrance, waxes, wool, leather, honey, lac, pearl, ivory, silk, horns).

iv. Drugs and medicine.

v. Sports and recreation.

vi. Aesthetic value.

vii. Cultural value.

viii. Scientific research.

ix. Eco system services.

23.

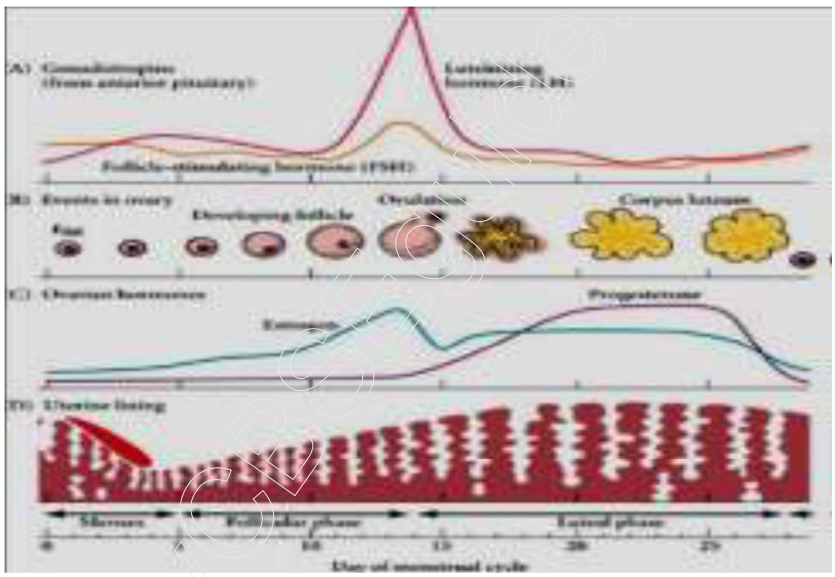
a. The parents were traditional but understood the need for such advertisements. They showed maturity and openness later.

b. i) Menstrual phase

ii) Proliferative phase

iii) Secretory phase.

c.



Section D

24. Plant breeding is the purposeful manipulation of plant species in order to create desired plant types that are better suited for cultivation, give better yields and are disease resistant

The main steps in breeding a new genetic variety of a crop are –

(i) **Collection of variability**: Genetic variability is the root of any breeding programme. In many crops pre-existing genetic variability is available from wild

relatives of the crop. Collection and preservation of all the different wild varieties, species and relatives of the cultivated species (followed by their evaluation for their characteristics) is a pre-requisite for effective exploitation of natural genes available in the populations. The entire collection (of plants/seeds) having all the diverse alleles for all genes in a given crop is called germplasm collection.

(ii) **Evaluation and selection of parents**: The germplasm is evaluated so as to identify plants with desirable combination of characters. The selected plants are multiplied and used in the process of hybridization. Pure lines are created wherever desirable and possible.

(iii) **Cross hybridization among the selected parents**: The desired characters have very often to be combined from two different plants (parents), for example high protein quality of one parent may need to be combined with disease resistance from another parent. This is possible by cross hybridizing the two parents to produce hybrids that genetically combine the desired characters in one plant. This is a very time-consuming and tedious process since the pollen grains from the desirable plant chosen as male parent have to be collected and placed on the stigma of the flowers selected as female parent. Also, it is not necessary that the hybrids do combine the desirable characters; usually only one in few hundred to a thousand crosses shows the desirable combination.

(iv) **Selection and testing of superior recombinants**: This step consists of selecting, among the progeny of the hybrids, those plants that have the desired character combination. The selection process is crucial to the success of the breeding objective and requires careful scientific evaluation of the progeny. This step yields plants that are superior to both of the parents. These are self-pollinated for several generations till they reach a state of uniformity , so that the characters will not segregate in the progeny.

(v) **Testing, release and commercialization of new cultivars**: The newly selected lines are evaluated for their yield and other agronomic traits of quality, disease resistance, etc. This evaluation is done by growing these in the research fields and recording their performance under ideal fertiliser application irrigation, and

other crop management practices. The evaluation in research fields is followed by testing the materials in farmers' fields, for at least three growing seasons at several locations in the country, representing all the agroclimatic zones where the crop is usually grown. The material is evaluated in comparison to the best available local crop cultivar – a check or reference cultivar.

OR

a) The greenhouse effect is a naturally occurring phenomenon that is responsible for heating of Earth's surface and atmosphere.

Clouds and gases reflect about one-fourth of the incoming solar radiation, and absorb some of it but almost half of incoming solar radiation falls on Earth's surface heating it, while a small proportion is reflected back. Earth's surface re-emits heat in the form of infrared radiation but part of this does not escape into space as atmospheric gases (e.g., carbon dioxide, methane, etc.) absorb a major fraction of it. The molecules of these gases radiate heat energy, and a major part of which again comes to Earth's surface, thus heating it up once again. This cycle is repeated many a times. The above-mentioned gases – carbon dioxide and methane – are commonly known as greenhouse gases because they are responsible for the greenhouse effect.

b) CNG burns most efficiently, unlike petrol or diesel, in the automobiles and very little of it is left unburnt. Moreover, CNG is cheaper than petrol or diesel, cannot be siphoned off by thieves and adulterated like petrol or diesel.

25.

(a) Primary productivity is defined as the amount of biomass or organic matter produced per unit area over a time period by plants during photosynthesis. It is expressed in terms of weight (g –2) or energy (kcal m–2). The rate of biomass production is called productivity. It is expressed in terms of g –2 yr –1 or (kcal m–2) yr–1 to compare the productivity of different ecosystems. It can be divided into **gross primary productivity** (GPP) and net primary productivity (NPP). Gross primary productivity of an ecosystem is the rate of production of organic matter during photosynthesis. A considerable amount of GPP is utilised by plants in respiration.

Gross primary productivity minus respiration losses (R), is the net primary productivity (NPP).

GPP – R = NPP

Net primary productivity is the available biomass for the consumption to heterotrophs (herbivores and decomposers). Secondary productivity is defined as the rate of formation of new organic matter by consumers.

Primary productivity depends on the plant species inhabiting a particular area. It also depends on a variety of environmental factors, availability of nutrients and photosynthetic capacity of plants. Therefore, it varies in different types of ecosystems

(b) Decomposition is an oxygen-requiring process. The rate of decomposition is controlled by chemical composition of detritus and climatic factors. In a particular climatic condition, decomposition rate is slower if detritus is rich in lignin and chitin, and quicker, if detritus is rich in nitrogen and water-soluble substances like sugars. Temperature and soil moisture are the most important climatic factors that regulate decomposition through their effects on the activities of soil microbes. Warm and moist environment favour decomposition whereas low temperature and anaerobiosis inhibit decomposition resulting in buildup of organic matter.

OR

The chromosomal disorders are caused due to absence or excess or abnormal arrangement of one or more chromosomes. Failure of segregation of chromatids during cell division cycle results in the gain or loss of a chromosome(s), called aneuploidy.

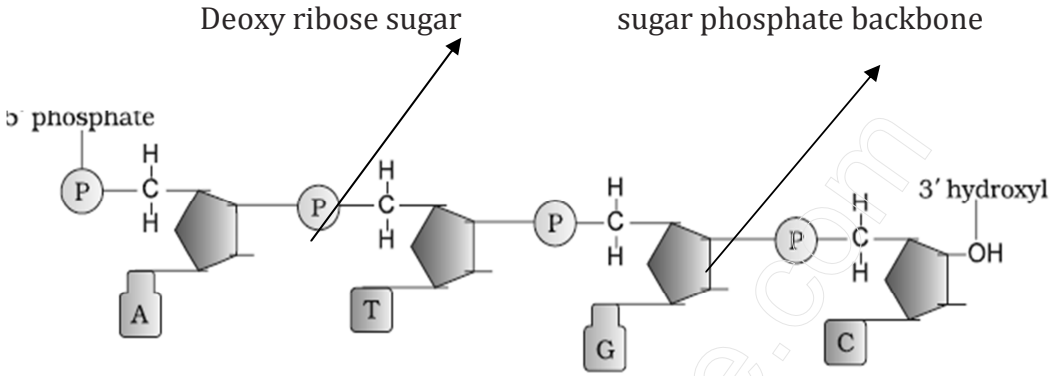
Failure of cytokinesis after telophase stage of cell division results in an increase in a whole set of chromosomes in an organism and is called polyploidy.

Sometimes, either an additional copy of a chromosome may be included in an individual or an individual may lack one of any one pair of chromosomes. These situations are known as trisomy or monosomy of a chromosome, respectively. Such a situation leads to very serious consequences in the individual. Down's syndrome, Turner's syndrome, Klinefelter's syndrome are common examples of chromosomal disorders.

Down's Syndrome: The cause of this genetic disorder is the presence of an additional cop of the chromosome number 21 (trisomy of 21).

Klinefelter's Syndrome: This genetic disorder is also caused due to the presence of an additional copy of X-chromosome resulting into a karyotype of 47, XXY.

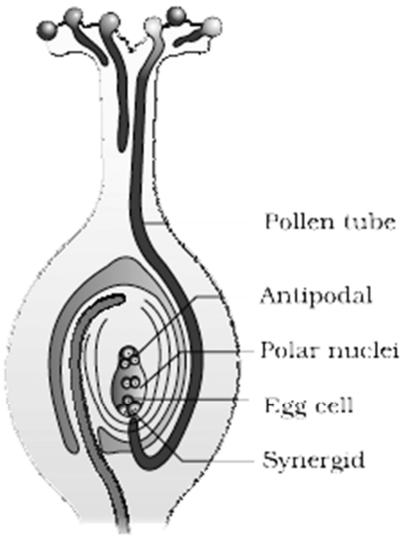
26.



Adenine Thymine guanine cytosine

The polynucleotide DNA.

OR



Longitudinal section of a flower showing growth of pollen tube

Following compatible pollination, the pollen grain germinates on the stigma to produce a pollen tube through one of the germ pores. The contents of the pollen grain move into the pollen tube. Pollen tube grows through the tissues of the stigma and style and reaches the ovary. In plants, where the pollen grains are shed at the two celled stage, the generative cell divides and forms the two male gametes during the growth of pollen tube in the stigma. In plants which shed pollen in the three-celled condition, pollen tubes carry the two male gametes from the beginning. Pollen tube, after reaching the ovary, enters the ovule through the micropyle and then enters one of the synergids through the filiform apparatus. filiform apparatus present at the micropylar part of the synergids guides the entry of pollen tube. All these events are together referred to as pollen-pistil interaction.