

Sample Paper 9

Biology (044)

Class XII Session 2022-23

Time: 3 Hours

Max. Marks: 70

General Instructions:

- All questions are compulsory.
- The question paper has five sections and 33 questions. All questions are compulsory.
- Section—A has 16 questions of 1 mark each; Section—B has 5 questions of 2 marks each; Section—C has 7 questions of 3 marks each; Section—D has 2 case-based questions of 4 marks each; and Section—E has 3 questions of 5 marks each.
- 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.
- Wherever necessary, neat and properly labeled diagrams should be drawn.

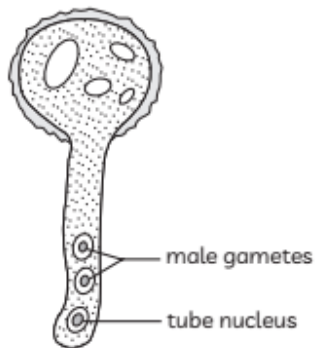
SECTION - A

16 Marks

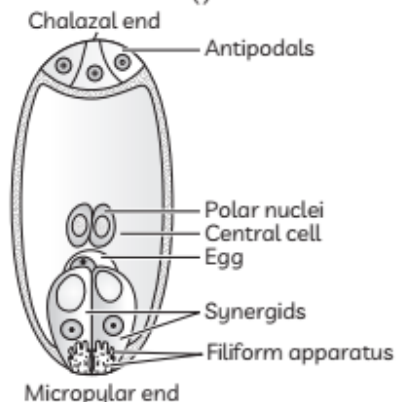
1. Identify the smallest flower:

- (a) *Rafflesia* (b) *Wolffia*
(c) Lotus (d) Sunflower 1

2. Identify the incorrect match for (i) and (ii):



(i)



(ii)

	(i)	(ii)
(a)	It is 3-celled	It is 7-celled
(b)	All cells are functional	Antipodals and one of the two synergids do not perform any function.
(c)	It has a single phase of growth	It has two phases- pre and post fertilization.
(d)	Derived from the microspore.	Derived from a megaspore.

1

3. Identify the incorrect statement:

- (a) Oxytocin released from posterior pituitary gland.
(b) Prolactin is released from the posterior lobe of the pituitary gland.
(c) LH is responsible for ovulation.
(d) FSH causes the development of graafian follicles. 1

4. Which of the following is not an example of homologous organs?

- (a) Mouth parts of insects
(b) Human arm and forelimb of cow

- (c) Thorn of Bougainvillea and tendrils of cucurbits
(d) Trunk of an elephant and hand of chimpanzee. 1

5. What are the possibilities of blood group of father, when the child's group is 'A' and blood group of mother is 'A'?

- (a) A, B, AB, O (b) AB, O
(c) A, B (d) B, O 1

6. Identify the incorrect difference between aneuploidy and polyploidy.

	Aneuploidy	Polyploidy
(a)	More common in humans	Rare in humans
(b)	Abnormal number of chromosomes. Can be extra or fewer	Usually more than 2 in a diploid organism.
(c)	Types include: monosomy, trisomy.	Types include triploidy, hexaploidy etc.
(d)	Triploid and tetraploid types are lethal	Leads to chromosomal disorders.

1

7. Dinesh studied genetic codes in his class recently but he has some doubts. Predict the effect if, the codon UAU coding for an amino acid at the 25th position of a polypeptide of 50 amino acids, is mutated to UAA.

- (a) A polypeptide of 24 amino acids
(b) A polypeptide of 20 amino acids
(c) Termination is done
(d) None of the above 1

8. Identify the incorrect difference between pro-insulin and mature insulin.

- (a) Insulin consists of two short polypeptide chains: chain A and chain B.
(b) Pro-insulin contains an extra stretch called the C peptide which is not present in the mature insulin.
(c) Two chains are linked together by peptide linkages.
(d) Like a pro-enzyme, the pro-hormone also needs to be processed before it becomes a fully mature and functional hormone. 1

9. is the commonly used vector for cloning genes into higher organisms.

- (a) Retrovirus
(b) Adenovirus
(c) Both (a) and (b)
(d) None of the above 1

10. Which of the following forests is more vulnerable to invasion by outside animals and plants?

- (a) Temperate
(b) Mangroves
(c) Tropical evergreen
(d) Evergreen forests 1

11. What do *Lantana*, *Eichhornia*, and *African catfish* have in common?

- (a) All are Indian endangered species.
(b) All are key stone species.
(c) All are mammals that can be found in India.
(d) None of the species are native to India or in danger of extinction. 1

12. Match the following:

	Column (I)	Column (II)
(A)	Dodo	(i) Africa
(B)	Thylacine	(ii) Africa
(C)	Steller's sea cow	(iii) Australia
(D)	Quagga	(iv) Mauritius

- (a) (A)-(i), (B)-(iii), (C)-(ii), (D)-(iv)
(b) (A)-(iv), (B)-(iii), (C)-(i), (D)-(ii)
(c) (A)-(i), (B)-(iv), (C)-(ii), (D)-(iii)
(d) (A)-(i), (B)-(iv), (C)-(iii), (D)-(ii) 1

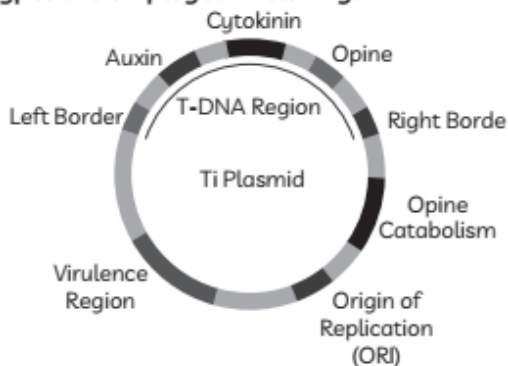
Question No. 13 to 16 consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

- (a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true and R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

13. Assertion (A): Primary transcripts in eukaryotes are non-functional.

Reason (R): Methyl guanosine triphosphate is attached to 5' – end of hnRNA. 1

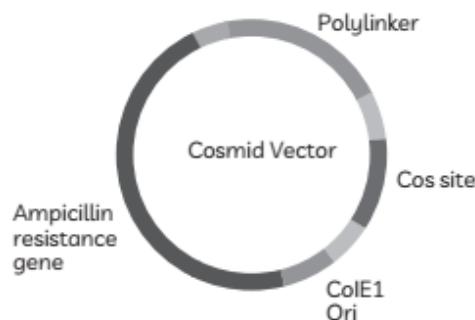
14. Vectors are DNA molecules that serve as molecular carriers. They facilitate the replication of the DNA of interest by bringing it into the host cell. Three different vector types are employed in cloning:



(i) Plasmid Vector



(ii) Bacteriophages Vector



(iii) Cosmids

Assertion (A): *E. coli* having pBR322 with DNA insert at BamHI site cannot grow in medium containing tetracycline.

Reason (R): Recognition site for BamHI is present in tet^R region of pBR322. 1

15. Assertion (A): A community with more species is more stable than that with less species.

Reason (R): More the number of species, lesser the variation in the total biomass production year after year. 1

16. Assertion (A): Keshav was experiencing high fever and chills from last few days.

Reason (R): Haemozoin is released from ruptured R.B.C.'s in case of *Plasmodium* infection. 1

SECTION - B

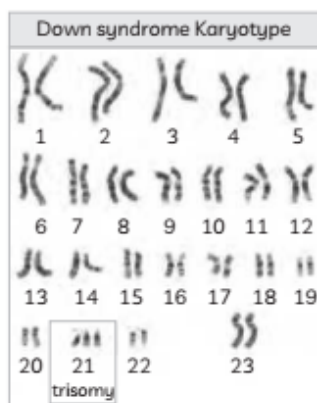
10 Marks

17. State the composition and principle of oral pills as a contraceptive measure taking the example of the medicine shown in the image.



2

18. Karyotype of a child look like this:



Identify the disorder and state the symptoms which are likely to be exhibited in this case. 2

19. Explain four advantages of mycorrhizal association to plants. 2

20. Explain the method to increase the competency of the bacterial cell membrane to take up recombinant DNA?

OR

Bioreactors are also known as fermenters in the food industry because they are primarily used for fermentation. A fermentor is essentially a particular kind of bioreactor that is used for fermentation. In this case, the products are complex and made up of numerous different biomolecules. Kefir, kombucha, and beer are a few examples of products that have undergone fermentation. What are bioreactors? How are large volumes of cultures maintained and processed in them. 2

21. Explain the role of enzymes in the extraction of DNA from *Rhizopus* in its purest form. 2

SECTION - C

21 Marks

22. A fully developed foetus initiates its delivery from the mother's womb. Justify the statement. 3

23. How would you find out the genotype of a pea plant with violet flowers? Explain with the help of Punnett's square showing crosses. 3

24. Define flocs and state their importance in biological treatment of waste water. 3

25. Give reasons:

- (A) Spleen is a major lymphoid organ.
- (B) Contact inhibition is an important property of normal human cells.

OR

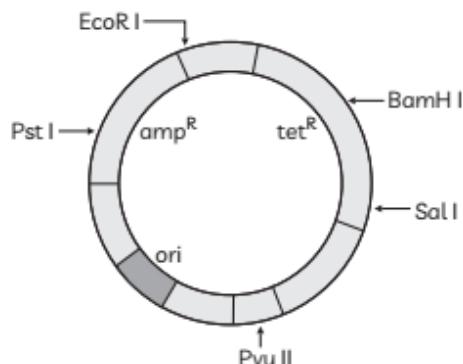
Give reasons:

- (A) BOD is an important indicator of water pollution.
- (B) Biofertilisers form an important part of the organic farming. 3

26. (A) Describe the levels of biodiversity.

(B) Define the term co-extinction. 3

27.

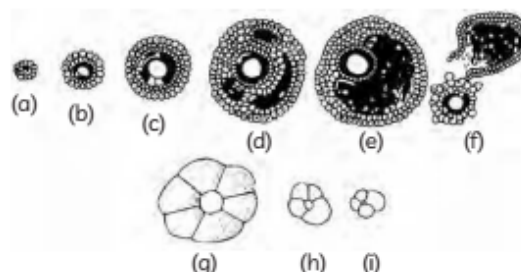


(A) What is the name of the plasmid shown above?

(B) Name any two selectable markers.

(C) Which portion of the figure is responsible for the copy number of the linked DNA? 3

28. The following is the illustration of the sequence of ovarian events "a" to "i" in a human female:



(A) Identify the figure that illustrates:

(i) corpus luteum

(ii) ovulation

(B) Name the pituitary hormone that influences corpus luteum formation.

(C) What is the difference between (d) and (e)? 3

SECTION - D

8 Marks

(Q. No. 29 and 30 are case based questions. Each question has subparts with internal choice in one subpart.)

29. Ecological Indicators

The presence of dragonflies can reveal changes in the water ecosystems more quickly than studying other animals or plants. In fact, from the nymph to the adult stage, the dragonfly has a significant, positive ecological impact. Dragonfly eggs are laid and hatched in or near water, so their lives impact both water and land ecosystems. Once hatched, dragonfly nymphs can breathe underwater which enables them to eat mosquito larvae, other aquatic insects and worms, and even small aquatic vertebrates like tadpoles and small fish and in the air. Adult dragonflies capture and eat adult mosquitoes.

Community wide mosquito control programs that spray insecticides to kill adult mosquitoes also kill dragonflies.



- (A) Name two diseases less likely to occur in a region with plenty of dragonflies are 1
- (B) Which is the most effective stages in the life cycle of dragonfly that eradicate mosquitoes? 1
- (C) What kind of approach is used for biological control includes. 1

OR

How do dragonflies indicate positive ecological impact as. 2

30. Earlier this year the Supreme Court heard arguments about the legality of collecting DNA from individuals arrested for, but not yet convicted of, felony offenses. Currently twenty-eight states and the federal government collect DNA samples at arrest for serious crimes. The specific case heard by the Supreme Court (*Maryland v. King*), involved a man who was arrested in 2009 for assault. A DNA sample was taken at the time of arrest and entered into the CODIS (DNA fingerprint) database. Eventually the charges were reduced to a misdemeanor, which doesn't warrant DNA collection. However, his DNA fingerprint remained in the database and was later found to match that of a suspect from a 2003 unsolved rape case. King was eventually convicted of that rape. His attorneys argued that the original DNA collection was unconstitutional and therefore not admissible as evidence.

A crime has been committed, and there is evidence left at the scene from which DNA was isolated and subjected to a fingerprint analysis. There are three suspects in the case. The results of the DNA fingerprinting are shown alongside.



Source: <https://www.nature.com/scitable/forums/genetics-generation/case-study-in-dna-fingerprinting-104026907/>

- (A) Of the three suspects, which is/are excluded based on the DNA fingerprint data? What is the basis for your answer? 1
- (B) Who developed the technique of DNA fingerprinting? 1
- (C) Write the mechanism of DNA fingerprinting. 2

OR

What is VNTR?

2

SECTION - E

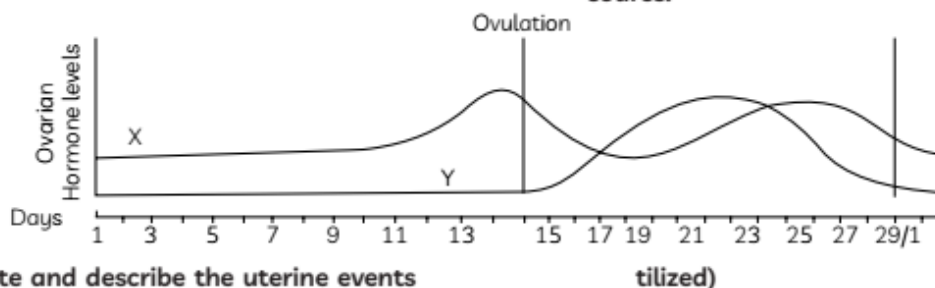
15 Marks

31. Many women in rural areas prefer to use their clothes as pads during menstruation, but they currently have no access to any. The important thing is that they need something that other people can easily provide. Cotton pads or anything else that might shield them from the embarrassment they might

experience if they have to spend some time living in tents can be of assistance to them.

Study the given graph related with menstrual cycle in females:

- (A) Identify ovarian hormones X and Y mentioned in the graph and specify their source.

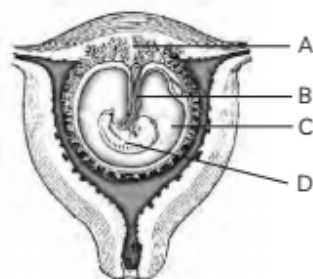


- (B) Correlate and describe the uterine events that take place according to the ovarian hormone levels X and Y mentioned in the graph on:
- 6 - 15 days
 - 16 - 25 days
 - 26 - 28 days (when ovum is not fer-

tilized)

OR

A pregnant women used to visit her doctor regularly. The following figure shows the foetus within her uterus. On the basis of the given figure, answer the questions that follow:



- (A) In the above figure, choose and name the correct part (a, b, c or d) that act as a temporary endocrine gland and substantiate your answer. Why is it also called the functional junction?
- (B) Mention the role of b in the development of the embryo.
- (C) Name the fluid surrounding the developing embryo. How is it misused for sex-determination?
32. Evaluate the suitability of DNA and RNA as genetic material and justify the suitability of

the one that is preferred as an ideal genetic material.

OR

Explain the mechanism of DNA replication as suggested by Watson and Crick.

33. Identify and name the disease in which the patient's cells show the following phenomenon.



State its possible causes and explain any three methods to accurately detect the pathological and physiological changes that take place due to the disease in living tissues.

OR

A patient had tested positive to ELISA Test. Identify the disease and the pathogen responsible, give reasons for the reduced/weak immunity of the patient and trace the path, spread and effects of this pathogen in the human body.

SOLUTION

SECTION - A

1. (b) *Wolfia*

Explanation: *Rafflesia* is the largest flower and *Wolfia* is the smallest flower.

2. (c) (i) It has a single phase of growth; (ii) It has two phases- pre and post fertilization.

Explanation: Figure (i) shows male gametophyte and figure (ii) shows female gametophyte. Female gametophyte has two phases-pre and post fertilization. Male gametophyte has a single phase of growth.

3. (b) Prolactin is released from the posterior lobe of the pituitary gland.

Explanation: Prolactin is released from the anterior lobe of the pituitary gland.

4. (d) Trunk of an elephant and hand of chimpanzee.

Explanation: Trunk of an elephant and hand of chimpanzee is an example of analogous organs.

5. (a) A, B, AB, O

Explanation: There are all the possibilities of father to have blood groups i.e. A, B, AB, O.

6. (d) Aneuploidy: Triploid and tetraploid types are lethal; Polyploidy: Leads to chromosomal disorders.

Explanation: Aneuploidy leads to chromosomal disorders and triploid and tetraploid types can also be lethal in polyploidy.

7. (a) A polypeptide of 24 amino acids

Explanation: A polypeptide of 24 amino acids will be formed as UAA is a stop codon which will prevent further translation.



Related Theory

→ UAA, UAG, UGA are stop or terminator codons.

8. (c) These are linked together by peptide linkages.

Explanation: The two chains of insulin are linked together by disulphide bridges. The mature hormone is the post-translational product of pro-insulin.

9. (c) Both (a) and (b)

Explanation: Retrovirus/ Adenoviruses/ Papilloma virus/Cauliflower mosaic virus/ Tobacco mosaic virus virus are some commonly used vectors which are used for cloning genes into higher organisms.

10. (c) Tropical evergreen

Explanation: The tropical forests are immensely rich in flora and fauna. They provide all the necessary requirements for survival in bulk to the organisms. Hence, an invasive species can easily multiply and become a threat to the native species in these forests.

11. (d) None of the species are native to India or in danger of extinction.

Explanation: There are no endangered or native species of *Lantana*, *Eichhornia* (water hyacinth), or African catfish (*Clarias gariepinus*) in India. They are all foreign (or exotic) species that are invasive and have a negative effect on native species, causing extinction.

12. (b) (A)-(iv), (B)-(iii), (C)-(i), (D)-(ii)

Explanation: Correct matches are:
Dodo-Mauritius, Thylacine-Australia, Steller's sea cow-Africa, Quagga-Africa.



Related Theory

- Steller's sea cow from Africa, very large aquatic mammal, which is now extinct.

13. (b) Both A and R are true and R is not the correct explanation of A.

Explanation: The primary transcripts contain both the exons and the introns and introns are non-functional. Hence, it is subjected to a process called splicing where the introns are removed and exons are joined in a defined order. That explains why the primary transcripts are non-functional.

Also, hnRNA undergoes additional processing called as capping and tailing. In capping an unusual nucleotide (methyl guanosine triphosphate) is added to the 5'-end of hnRNA. In tailing, adenylate residues (200-300) are added at 3'-end in a template independent manner. It is the fully processed hnRNA, now called mRNA, that is transported out of the nucleus for translation.

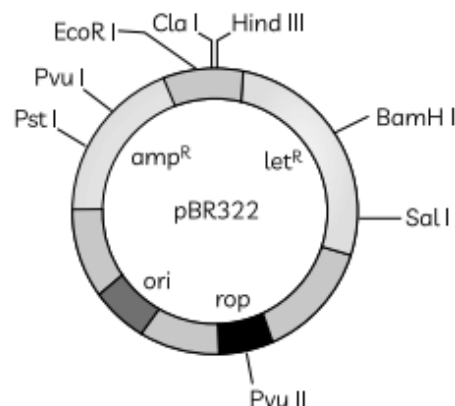


Related Theory

- In eukaryotes, the monocistronic structural genes have interrupted coding sequences – the genes in eukaryotes are split. The coding sequences or expressed sequences are defined as exons. Exons are said to be those sequences that appear in mature or processed RNA. The exons are interrupted by introns. Introns or intervening sequences do not appear in mature or processed RNA.

14. (a) Both A and R are true and R is the correct explanation of A.

Explanation: In the diagram shown below, you can see the various recognition sites in pBR322 along with site for BamHI in the region for tet^R resistance. pBR322 has recognition sites for several commonly used restriction enzymes. Recognition site for BamHI is present in tet^R region i.e., region responsible for tetracycline resistance. When an insert is added at the BamHI recognition site the gene for tetracycline resistance becomes non-functional and the recombinant bacteria with plasmid pBR322 that has DNA insert at BamHI lose tetracycline resistance.



15. (a) Both A and R are true and R is the correct explanation of A.

Explanation: A stable community should not show too much variation in productivity from year to year; it must be either resistant or resilient to occasional disturbances (natural or man-made). David Tilman's long-term ecosystem experiments using outdoor plots attested weight to the aforementioned argument. Tilman found that plots with more species showed less year-to-year variation in total biomass. He also showed that in his experiments, increased diversity contributed to higher productivity.



Related Theory

- Paul Ehrlich's rivet popper hypothesis also lent weight to the link between species richness and ecosystem stability. He proposed-Let's suppose that in an airplane (ecosystem) all parts are joined together using thousands of rivets (species). If every passenger travelling in it starts popping a rivet to take home (causing a species to become extinct), it may not affect flight safety (proper functioning of the ecosystem) initially, but as more and more rivets are removed, the plane becomes dangerously weak over a period of time. Furthermore, which rivet is removed may also be critical. Loss of rivets on the wings (key species that drive major ecosystem functions) is obviously a more serious threat to flight safety than loss of a few rivets on the seats or windows inside the plane.

16. (a) Both A and R are true and R is the correct explanation of A.

Explanation: *Plasmodium*, a protozoan is responsible for a disease called malaria. It enters the human body as sporozoites through the bite of infected female *Anopheles* mosquito. The parasites attack the red blood cells (RBCs) resulting in their rupture. The rupture of RBCs

can lead to the release of haemozoin, which is responsible for the chill and high fever recurring every three to four days.



Related Theory

- Different species of *Plasmodium* (*P. vivax*, *P. malaria* and *P. falciparum*) cause different types of malaria.
- Malignant malaria caused by *Plasmodium falciparum* can lead to death of the individual.

SECTION - B

17. The composition of oral pills comprises: either progesterone alone or progesterone–estrogen combination

Saheli is a non-steroidal preparation. It inhibits ovulation and implantation. It also alters the quality of cervical mucus to prevent/ retard the entry of sperms.

18. **Disorder:** Down's Syndrome

Symptoms: The affected individual is short statured with small round head; has furrowed tongue; partially open mouth; Palm is broad with characteristic palm crease; Physical, psychomotor and mental development is retarded.



Related Theory

- The cause of Down's syndrome is the presence of an additional copy of the chromosome number 21 (trisomy of 21). This disorder was first described by Langdon Down (1866).

19. The fungal symbiontin in mycorrhizal associations with plants:

- (1) absorbs phosphorus from soil and passes it to the plant.
- (2) provides resistance to root-borne pathogens,
- (3) enhances tolerance to salinity and drought,
- (4) induces an overall increase in plant growth and development.

20. The recombinant DNA can be forced into the bacterial cell treated with divalent cations and incubating it with recombinant DNA on ice. This is to be followed by placing it briefly at 42°C (heat shock), and then putting it back on ice. This process would enable the bacteria to take up the recombinant DNA.



Related Theory

- There are more ways to introduce alien DNA into host cells. In a method known as micro-injection, recombinant DNA is directly injected into the nucleus of an animal cell. In another method for plants, cells are bombarded with high velocity micro-particles of gold or tungsten coated with DNA in a

method known as biolistic or gene gun. And the last method uses 'disarmed pathogen' vectors, which when allowed infecting the cell, transferring the recombinant DNA into the host.

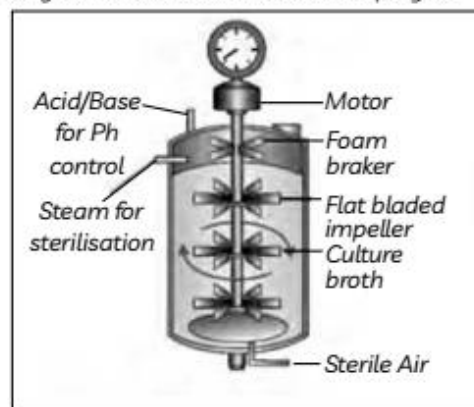
OR

Bioreactors are vessels in which raw materials are biologically converted into specific products such as enzymes using microbial, plant, animal or human cells. A bioreactor provides the optimal conditions for achieving the desired product by providing optimum growth conditions like temperature, pH, substrate, salts, vitamins and oxygen.

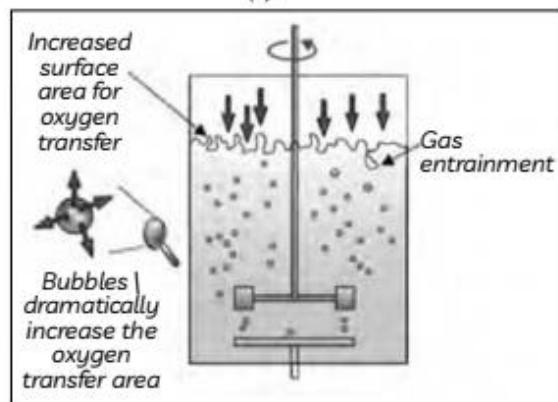


Related Theory

- Commonly used bioreactors- (a) Simple stirred-tank bioreactor; (b) Sparged stirred-tank bioreactor through which sterile air bubbles are sparged.



(a)



(b)

21. The extraction of DNA from *Rhizopus* in its purest form can be done by treating the fungal cells with enzymes such as chitinase which will dissolve the cell wall. The RNA can be removed

by treatment with ribonuclease whereas proteins can be removed by treatment with protease. Other molecules can be removed by appropriate treatments thereby purifying DNA.

SECTION - C

22. (A) (1) The signals for parturition originate from the fully developed foetus and the placenta which induce mild uterine contractions called foetal ejection reflex.
(2) This triggers the release of oxytocin from the maternal pituitary.
(3) Oxytocin acts on the uterine muscle and causes stronger uterine contractions, which in turn stimulates further secretion of oxytocin.
(4) The stimulatory reflex between the uterine contraction and oxytocin secretion continues resulting in stronger and stronger contractions.
(5) Parturition is induced by a complex neuroendocrine mechanism involving cortisol, oestrogens and oxytocin.
(6) This leads to expulsion of the baby out of the uterus through the birth canal – parturition.

after the infant is delivered, the placenta is also expelled out of the uterus.

Mammary glands differentiate during pregnancy and secrete milk after child-birth. The new-born baby is fed milk by the mother (lactation) during the initial few months of growth.

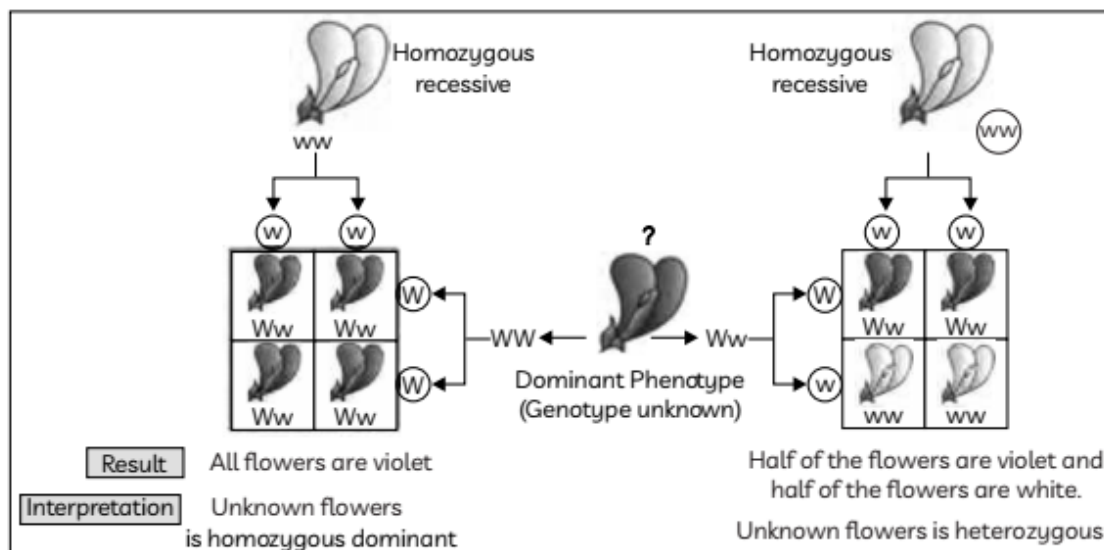
The placenta facilitates the supply of oxygen and nutrients to the embryo and also removal of carbon dioxide and excretory or waste materials produced by the embryo. The placenta is connected to the embryo through an umbilical cord which helps in the transport of substances to and from the embryo. Placenta also acts as an endocrine tissue and produces several hormones like human chorionic gonadotropin (hCG), human placental lactogen (hPL), estrogen, progesterone, etc.

23. We will perform a test cross in which the pea plants here showing a dominant phenotype (and whose genotype is to be determined) is crossed with the recessive parent instead of self-crossing. The progenies of such a cross can easily be analysed to predict the genotype of the test organism. The results of genotype through a test cross where violet colour flower (W) is dominant over white colour flower (w) is shown here:



Related Theory

- The average duration of human pregnancy is about 9 months which is called the gestation period. Soon



Related Theory

- The genotypic ratios can be calculated using mathematical probability, by simply looking at the phenotype of a dominant trait, but it is not possible to know the genotypic composition. That is, for example, whether a tall plant from F_1 or F_2 has TT or Tt composition, cannot be predicted. Therefore, to

determine the genotype of a tall plant at F_2 , Mendel crossed the tall plant from F_2 with a dwarf plant. He called it a test cross.

24. Flocs are masses of semi-decayed organic matter along with decomposer microbes which are surrounded by slime. They separate the organic matter from waste water.

Importance of flocs in biological treatment of waste water:

- (1) Flocs settle down in secondary tanks and take part in the formation of sludge.
- (2) They can be used as inoculum in biological treatment of waste water as well as source of biogas and manure.



Related Theory

- Flocs are masses of bacteria associated with fungal filaments to form mesh like structures.
- Secondary treatment of the sewage involves the primary effluent being 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. 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 oxidised by bacteria. The sewage water is treated till the BOD is reduced.

25. (A) Spleen is a large bean-shaped organ. It mainly contains lymphocytes and phagocytes. It acts as a filter of the blood by trapping blood-borne micro-organisms. Spleen also has a large reservoir of erythrocytes.
- (B) Normal cells show a property called contact inhibition by virtue of which contact with other cells inhibits their uncontrolled growth. Cancer cells appear to have lost this property. As a result of this, cancerous cells just continue to divide giving rise to masses of cells called tumors.

OR

- (A) BOD refers to the amount of the oxygen that would be consumed if all the organic matter in one liter of water were oxidised by bacteria. The BOD test measures the rate of uptake of oxygen by micro-organisms in a sample of water and thus, indirectly, BOD is a measure of the organic matter present in the water. The greater the BOD of waste water, more is its polluting potential.
- (B) Biofertilisers are organisms that enrich the nutrient quality of the soil. The main sources of biofertilisers are bacteria, fungi and cyanobacteria. They can enrich the nutrient content of the soil without any harmful effect and thus offer a great alternative to chemical fertilisers. Hence, they play a key role in organic farming.



Related Theory

- Cyanobacteria are autotrophic microbes widely distributed in aquatic and terrestrial environments many of which can fix atmospheric nitrogen, e.g. *Anabaena*, *Nostoc*, *Oscillatoria*, etc. In paddy fields, cyanobacteria serve as an important biofertiliser. Blue green algae also add organic matter to the soil and increase its fertility.

26. (A) Different levels of biodiversity are:

- (1) **Genetic diversity:** It refers to the variation of genes within species. Genetic diversity occurs at the molecular level. Example: *Rouwalia Vomitoria*.

Ecosystem diversity: it refers to the different landforms, each of which supports different and specific vegetation.

- (2) **Species diversity:** It refers to the variety of species within a particular region. For example: Western Ghats have greater amphibian species diversity than Eastern Ghats.

- (B) The term "co-extinction" describes when an animal or plant species becomes extinct along with another species on which it depends. For instance, when a fish species becomes extinct, all of the parasites that were obligately connected with it also go extinct.

27. (A) pBR322

- (B) Ampicillin and tetracycline
(C) Ori (origin of replication)

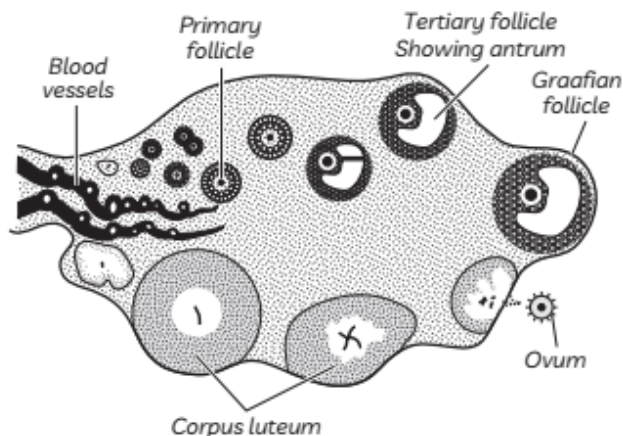
28. (A) (i) Corpus luteum is illustrated by 'g'.

(ii) Ovulation is illustrated by 'f'.

- (B) Luteinising hormone influences its formation.
(C) 'd' is the developing tertiary follicle and 'e' is the matured tertiary follicle.



Related Theory



SECTION - D

29. (A) Malaria and yellow fever
(B) Nymph and adult
(C) Dragonfly eggs, once hatched, gives rise to dragonfly nymphs who can breathe underwater enabling them to eat mosquito larvae, other aquatic insects and worms, and even small aquatic vertebrates like tadpoles and small fish. Adult dragonflies capture and eat adult mosquitoes. So, the pests are being killed by conserving or introducing their natural enemies.

Chemical control or Insecticides can kill them both, along with the introduction of unwanted chemicals into the ecosystem.

OR

Dragonfly nymphs can breathe underwater enabling them to eat mosquito larvae, other aquatic insects and worms, and even small aquatic vertebrates like tadpoles and small fish. Adult dragonflies capture and eat adult mosquitoes. So, the pests are being killed by conserving or introducing their natural enemies. Hence, they reduce the diseases spread through these vectors.

30. (A) 1 and 2 are excluded because the DNA doesn't match the crime scene.
(B) Alec Jeffreys

- (C) The steps in the DNA fingerprinting process are as follows:

- (1) A DNA sample that will be examined must first be gathered.
- (2) Using the lysis process, DNA is then extracted from the sample.
- (3) The DNA fragment is cut at a particular place by a specific restriction enzyme.
- (4) Gel electrophoresis is used to separate DNA fragments into different sizes.
- (5) NaOH solution is then added to the gel containing the DNA fragments. DNA will become single-stranded as a result of this.
- (6) The single-stranded DNA is transferred from the gel to the nitrocellulose membrane using the Southern blotting method.

OR

The repeating DNA sequences at a designated locus are known as VNTRs, or the Variable Number of Tandem Repeats. The repetitions are grouped and pointed in the same general direction. Replication and recombination faults allow for the addition or deletion of certain repetitions. Alleles with various amounts of repetitions are created as a result.

SECTION - E

31. (A) X - Estrogen secreted by growing follicles;
Y - Progesterone secreted by corpus luteum.
(B) Uterine events that take place according to the ovarian hormone levels X and Y on:
(i) 6-15 days: Endometrium of the uterus regenerates by proliferation under the influence of estrogen.
(ii) 16-25 days: Under the influence of progesterone the endometrium of the uterus is maintained for implantation of fertilised ovum and other events of pregnancy.
(iii) 26-28 days (when ovum is not fertilized): in the absence of fertilisation, corpus luteum degenerates which causes disintegration of endometrium leading to menstruation, marking a new cycle.



Related Theory

→ The cycle starts with the menstrual phase, when menstrual flow occurs and it lasts for 3-5 days. The menstrual flow results due to breakdown of endometrial lining of the uterus and its blood vessels which forms liquid that comes out through vagina. Menstruation only occurs if the released ovum is not fertilised. Lack of menstruation may be indicative of pregnancy.

OR

- (A) Part labeled (a) - Placenta. It acts as an endocrine tissue as it produces several hormones like human chorionic gonadotropin (hCG), human placental lactogen (hPL), estrogens, progestogens, etc. It is also called the functional junction because it facilitates the supply of oxygen and nutrients to the embryo and removes carbon dioxide and excretory/waste materials produced by the embryo.
(B) The placenta is connected to the embryo through an umbilical cord (b) which helps in the transport of substances to and from the embryo.

- (C) Amniotic fluid; a foetal sex determination test is based on the chromosomal pattern of the cells in the amniotic fluid surrounding the developing embryo.

32. Evaluation of DNA and RNA on the basis of the properties of the genetic material:

- (1) It should be able to generate its replica (Replication): As per the rule of base pairing and complementarity, both the nucleic acids (DNA and RNA) have the ability to direct their duplications.

- (2) The genetic material should be chemically and structurally stable enough not to change with different stages of life cycle, age or with change in physiology of the organism.

Presence of 2'-OH group and uracil make RNA more reactive and structurally less stable than DNA. Therefore, DNA is a better genetic material than RNA.

- (3) It should provide the scope for slow changes (mutation) that are required for evolution: Both DNA and RNA are able to mutate. In fact, RNA being unstable, mutates at a faster rate. Consequently, viruses having RNA genome and having shorter life span mutate and evolve faster.

- (4) It should be able to express itself in the form of 'Mendelian Characters': RNA can directly code for the synthesis of proteins, hence can easily express the characters. DNA, however, is dependent on RNA for synthesis of proteins. The protein synthesising machinery has evolved around RNA.

- (5) The above discussion indicates that both RNA and DNA can function as genetic material, but DNA being more stable is preferred for storage of genetic information

OR

Mechanism of DNA replication suggested by Watson and Crick:

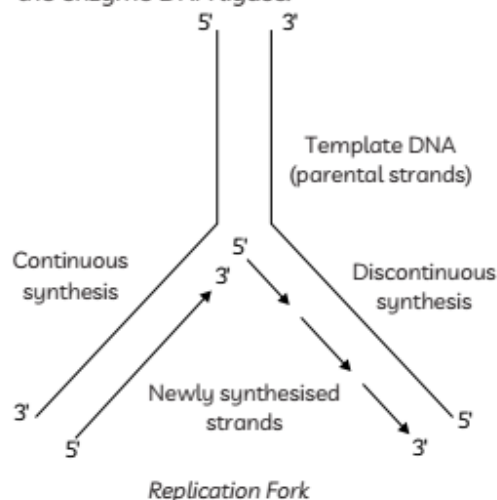
- (1) The two strands of DNA would separate and act as a template for the synthesis of new complementary strands. After the completion of replication, each DNA molecule would have one parental and one newly synthesised strand. This scheme was termed as semiconservative replication of DNA.
- (2) In living cells, such as *E. coli*, the process of replication requires a set of catalysts (enzymes). The main enzyme is referred to as DNA-dependent DNA polymerase, since it uses a DNA template to catalyse the polymerisation of deoxynucleotides.

- (3) Furthermore, energetically replication is a very expensive process. Deoxyribonucleoside triphosphates serve dual purposes. In addition to acting as substrates, they provide energy for polymerisation reaction.

- (4) For long DNA molecules, since the two strands of DNA cannot be separated in its entire length (due to very high energy requirement), the replication occurs within a small opening of the DNA helix, referred to as replication fork.

- (5) The DNA-dependent DNA polymerases catalyse polymerisation only in one direction, that is $5' \rightarrow 3'$.

- (6) Consequently, on one strand (the template with polarity $3' \rightarrow 5'$), the replication is continuous, while on the other (the template with polarity $5' \rightarrow 3'$), it is discontinuous. The discontinuously synthesised fragments are later joined by the enzyme DNA ligase.

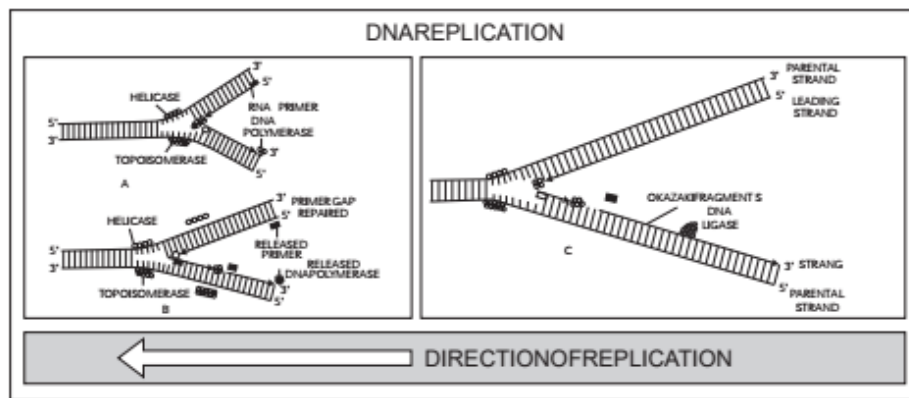


- (7) The DNA polymerases on their own cannot initiate the process of replication.
- (8) There is a definite region in *E. coli* DNA where the replication originates, such regions are termed as origin of replication.
- (9) In eukaryotes, the replication of DNA takes place at S-phase of the cell-cycle.
- (10) The replication of DNA and cell - division cycle should be highly coordinated. A failure in cell division after DNA replication results into polyploidy.



Related Theory

→ DNA replication requires the parental double helix in an unwound stage to make its internal bases available for replication. This is done by the enzyme helicase. Unwinding of DNA results in formation of a Y-shaped replication fork.



- ➔ **Primase** carries out the formation of the **PRIMER** strand. Once the primer strand is formed, DNA replication happens in 5'→3' direction. During synthesis of a new strand, deoxyribonucleotides are added only to the 3'OH end.

The exposed single strands are stabilised by SSB or the single strand binding protein. The SSB's hold open the strands to form replication fork.

- ➔ **Single strand binding proteins (SSB's)** stabilise the DNA strands to form the replication fork.

During DNA replication, synthesis of one of the daughter strand along the lower parental strand takes place in the form of short pieces. This strand is called the **lagging strand** and the short pieces of DNA fragments synthesised here are called the **Okazaki fragments**. **DNA ligase** joins the Okazaki fragments in the lagging strand.

33. Disease: Cancer

Probable Causes:

- (1) Physical/ Environmental: Exposure to X-rays/gamma rays/UV rays;
- (2) Chemicals/Nicotine in tobacco/other carcinogens
- (3) Biological: Viral oncogenes/Mutations

Detection and diagnosis:

- (1) Cancer detection is based on biopsy and histopathological studies of the tissue; blood and bone marrow tests for increased cell counts in the case of leukemias.
- (2) Techniques like radiography (use of X-rays), CT (computed tomography) and MRI (magnetic resonance imaging) are very useful to detect cancers of the internal organs.
- (3) Antibodies against cancer-specific antigens are also used for detection of certain cancers.
- (4) Techniques of molecular biology can be applied to detect genes in individuals with inherited susceptibility to certain cancers.



Related Theory

- ➔ **Contact inhibition:** Normal cells have a property called contact inhibition. In this property the uncontrolled growth of cancerous cells is restricted as a result of contact with other normal cells.

Due to the loss of contact inhibition, cancerous cells continue to divide giving rise to tumors. Tumors are of two types: benign and malignant.

OR

Disease: AIDS (Acquired Immuno Deficiency Syndrome)

Pathogen: Human Immuno deficiency virus (HIV).

Reason: Due to decrease in the number of helper T lymphocytes, the person starts suffering from infections that could have been otherwise overcome such as those due to bacteria especially *Mycobacterium*, viruses, fungi and even parasites like *Toxoplasma*.

The path of this pathogen and its spread and effect on the human body:

- (1) After getting into the body of the person, the virus enters into macrophages where RNA genome of the virus replicates to form viral DNA with the help of the enzyme reverse transcriptase.
- (2) This viral DNA gets incorporated into host cell's DNA and directs the infected cells to produce virus particles.
- (3) The macrophages continue to produce virus and in this way acts like a HIV factory.
- (4) Simultaneously, HIV enters into helper T-lymphocytes (TH), replicates and produce progeny viruses.
- (5) The progeny viruses released in the blood attack other helper T-lymphocytes. This is repeated leading to a progressive decrease in the number of helper T lymphocytes in the body of the infected person.
- (6) During this period, the person suffers from bouts of fever, diarrhoea and weight loss.

Related Theory

→ AIDS means Acquired Immuno deficiency syndrome. It is caused by the human immuno deficiency virus or HIV. HIV virus is a member of a group of viruses called retrovirus.

