

CBSE
Class XII Biology (Theory)
Board Paper 2012 - Delhi - (Set 3)

Time: 3 hrs

Total Marks: 70

General Instruction:

1. All questions are compulsory.
 2. This question paper consists of four Sections A, B C and D. Section A contains 8 questions of one mark each, Section B is of 10 questions of two marks each, Section C is of 9 questions of three marks each, and Section D is of 3 questions of five marks each.
 3. 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 weight age. A student has to attempt only one of the alternatives in such questions.
 4. Wherever necessary, the diagrams drawn should be neat and properly labelled.
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SECTION A

1. Mention the difference between the Spermiogenesis and spermiation. [1]
2. A garden pea plant (A) produced inflated yellow pod, and another plant (B) of the same species produced Constricted green pods. Identify the dominant traits. [1]
3. What is an interaction called when an orchid grows on a mango plant? [1]
4. Write the names of two semi-dwarf and high yielding rice varieties developed in India after 1966. [1]
5. Write what do phytophagous insects feed on. [1]
6. Mention the unique feature with respect to flowering and fruiting in bamboo species. [1]
7. How does smoking tobacco in human lead to oxygen deficiency in their body? [1]
8. State the significance of biochemical similarities amongst diverse organism in evolution. [1]

SECTION B

9. Explain the work carried out by Cohen and Boyer that contributed immensely in biotechnology. [2]
10. [2]
(a) State the difference between meiocyte and gamete with respect to chromosome number.
(b) Why is a whiptail lizard referred to as parthenogenetic?
11. Draw a neat labelled sketch of a replicating fork of DNA. [2]
12. Some organisms suspend their metabolic activities to survive in unfavourable conditions. Explain with the help of any four examples. [2]
13. [2]
(a) State the role of DNA ligase in biotechnology.
(b) What happens when *Meloidegryne incognitia* consumes cells with RNAi gene?
14. Where is sporopollenin present in plants? State its significance with reference to its chemical nature. [2]
15. Mention the importance of Lactic acid bacteria to humans other than setting milk into curd. [2]
- OR**
- How do methanogens help in producing biogas?
16. [2]
(a) Name the Protozoan parasite that causes amoebic dysentery in humans.
(b) Mention two diagnostic symptoms of the disease.
(c) How is this disease transmitted to others?
17. [2]
(a) Highlight the role of thymus as a lymphoid organ.
(b) Name the cells that are released from the above mentioned gland. Mention how they help in immunity.
18. Why do Clown fish and sea anemone pair up? What is this relationship called? [2]

SECTION C

19. [3]
(a) Construct a complete transcription unit with promotor and terminator on the basis of the hypothetical template strand given below:



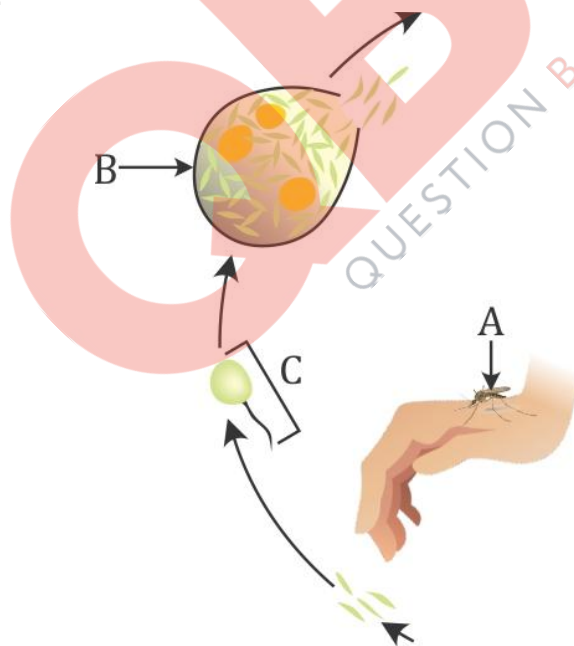
- (b) Write the RNA strand transcribed from the above transcription unit along with its polarity.

OR

How are the structural genes inactivated in lac operon in E. Coli? Explain.

20. Write the function of each of the following: [3]
(a) Seminal vesicle
(b) Scutellum
(c) Acrosome of human sperm.

21. Study a part of the life cycle of malarial parasite given below. Answer the questions that follows: [3]

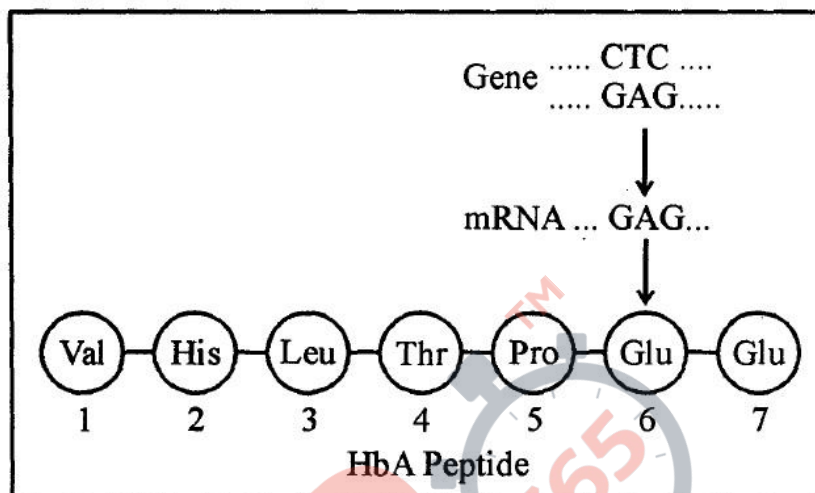


- (a) Mention the roles of 'A' in the life cycle of the malarial parasite.
(b) Name the event 'C' and the organ where this event occurs.
(c) Identify the organ 'B' and name the cells being released from it.

22. Draw a schematic sketch of pBR 322 plasmid and label the following in it: [3]
(a) Any two restriction sites.
(b) Ori and rop genes.
(c) An antibiotic resistant gene.

23. State the theory of Biogenesis. How does Miller's experiment support this theory? [3]

24. Given below is the representation of amino acid composition of the relevant translated portion of β -chain of haemoglobin, related to the shape of human red blood cells. [3]



(a) Is this representation indicating a normal human or a sufferer from certain related genetic disease? Give reason in support of your answer.

(b) What difference would be noticed in the phenotype of the normal and the sufferer related to this gene?

(c) Who are likely to suffer more from the defect related to the gene represented - the males, the females or both males and females equally? And why?

25. [3]

(a) Why are the colourful polysterene and plastic packagings used for protecting the food, considered an environmental menace?

(b) Write about the remedy found for the efficient use of plastic waste by Ahmed Khan of Bangalore.

26. Name of the genes responsible for the making Bt cotton plants resistant to bollworm attack. How do such plants attain resistance against bollworm attacks? Explain. [3]

27. Name of the two different categories of microbes naturally occurring in sewage water. Explain their role in cleaning sewage water into usable water. [3]

SECTION D

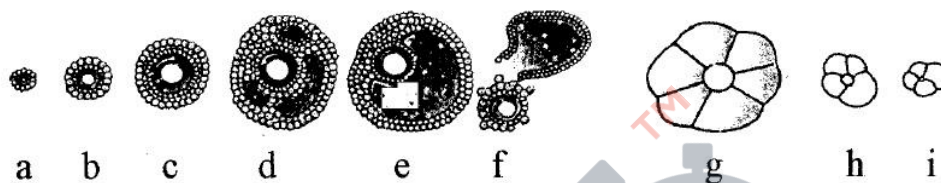
28. Explain the carbon cycle with the help of a simplified model. [5]

OR

Explain how does:

- (a) A primary succession starts on a bare rock and reach a climax community?
- (b) The algal bloom eventually choke the water body in an industrial area?

29.The following is the illustration of the sequence of ovarian events (a-i) in a human female. [5]



- (i) Identify the figure that illustrates ovulation and mention the stage of oogenesis it represents.
- (ii) Name of the ovarian hormone and the pituitary hormone that have caused the above mentioned event.
- (iii) Explain the changes that occur in the uterus simultaneously in anticipation.
- (iv) Write the difference between the 'c' and 'h'.
- (v) Draw a labeled sketch of the structure of a human ovum prior to fertilization.

OR

How does the megaspore mother cell develop into 7-celled, 8 nucleate embryo sac in an angiosperm? Draw a labeled diagram of a mature embryo sac.

30.Name the scientists who proved experimentally that DNA is the genetic material. Describe their experiment. [5]

OR

- (a) List the three different allelic forms of gene 'I' in humans. Explain the different phenotypic expressions, controlled by these three forms.
- (b) A woman with blood group 'A' marries a man with blood group 'O'. Discuss the possibilities of the inheritance of the blood groups in the following starting with "yes" or "no" for each:
 - (i) They produce children with blood group "A" only.
 - (ii) They produce children some with "O" blood group and some with "A" blood group.

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SOLUTION**

Time: 3 hrs

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SECTION A

- 1. Ans.** Spermiogenesis is the process where spermatids undergo a series of complex changes resulting in the development of mature spermatozoa, whereas spermiation is the release of sperms from the seminiferous tubules of the testes.
- 2. Ans.** Inflated yellow seeds are dominant over constricted green seeds.
- 3. Ans.** This interaction is called commensalism.
- 4. Ans.** Jaya and Ratna
- 5. Ans.** Phytophagous insects feed on plant sap and other parts of the plant.
- 6. Ans.** Bamboo plants flower only once after a long time, usually after 50-100 years. They produce a large number of fruits and then die.
- 7. Ans.** Smoking of tobacco releases carbon monoxide in the body, thereby depleting the oxygen content which is bound to the haemoglobin.
- 8. Ans.** Living organisms exhibit a large degree of biochemical similarities which provide several evidences of common ancestry and evolution of different groups of organisms.

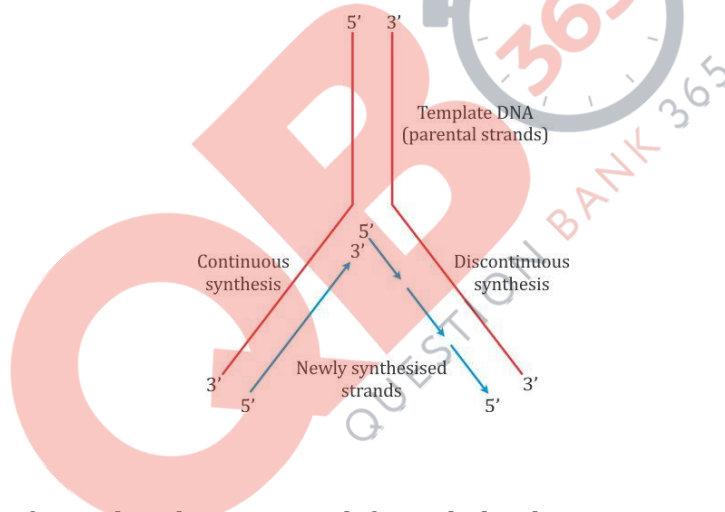
SECTION B

9. Ans. In 1972, Stanley Cohen and Herbert Boyer introduced a piece of gene containing foreign DNA into the plasmid of *E. coli*. They invented the technique of DNA cloning, which allowed genes to be transplanted between different biological species. Boyer had discovered a restriction enzyme which cut DNA strands at specific positions, allowing them to be connected to other DNA. Combining these techniques allowed them to invent genetic engineering, to choose the genes to transplant and to choose the position to clone them.

10. Ans.

- (a) The chromosome number is haploid in gametes, whereas there is a diploid set of chromosomes in meiocytes (gamete mother cells).
- (b) Whiptail lizard is said to be parthenogenetic because the female gamete undergoes development to form new organisms without fertilisation.

11. Ans.



12. Ans.

- (i) Cysts formed in bacteria and fungi help them to survive in unfavourable conditions and germinate in favourable conditions.
- (ii) Higher plants, seeds and vegetative structures germinate to form new plants under favourable temperature and moisture conditions, thereby reducing the metabolic activity.
- (iii) Animals stay at favourable conditions by going into hibernation during winter and aestivation during summer. For example, bears go into hibernation and snails go into aestivation.
- (iv) Many zooplankton are known to enter diapause, a stage of suspended development under unfavourable conditions.

13.Ans.

- (a) DNA ligase enzyme helps in joining the two ends of fragments, having the same kind of sticky ends.
- (b) *Meloidogyne incognita* is a nematode which infects the roots of tobacco plant. If *Meloidogyne incognita* consumes cells with the RNAi gene, the DNA forms sense and antisense RNA in the host cells. These two RNAs, being complementary to each other, form a double-stranded RNA which binds to and prevents the translation of the mRNA of the nematode. The parasite could not survive in a transgenic host expressing specific interfering RNA and dies. The transgenic plant therefore gets protected from the parasite.

14.Ans. Sporopollenin is found in the cell wall of plant spores and the exine of pollen grains. It is a complex substance of an oxidative polymer of carotenoids. It is the most resistant to biological materials which helps in fossilisation of pollen grains.

15.Ans.

- (a) Lactic acid bacteria play a very beneficial role in checking disease-causing microbes in the stomach.
- (b) It normalises acidity.

OR

Methanogens such as *Methanobacterium* grow anaerobically on the excreta of cattle and produce a large amount of methane gas which is the main component of biogas. CO₂ and H₂ are also produced along with methane gas.

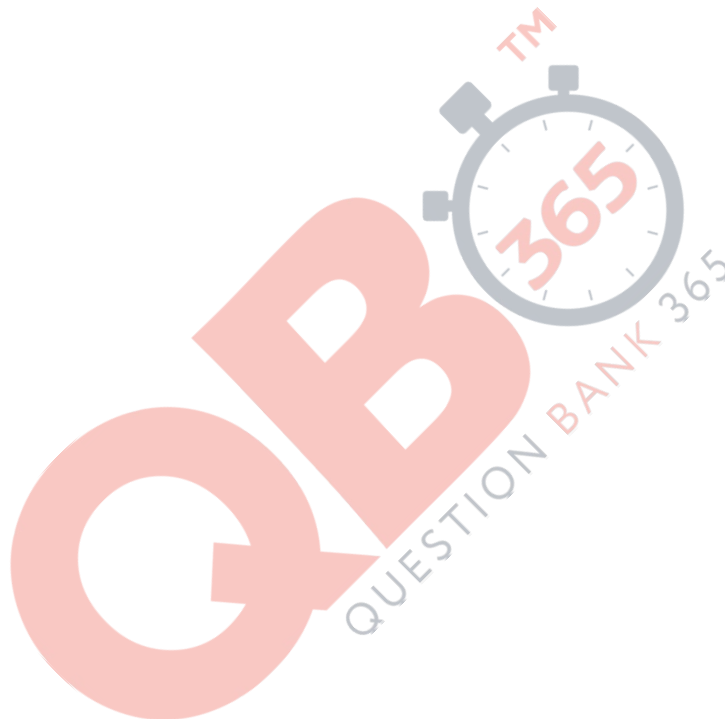
16.Ans.

- (a) *Entamoeba histolytica* causes amoebic dysentery in humans (amoebiasis).
- (b) Two diagnostic symptoms of this disease are
 - (i) Constipation and abdominal pain
 - (ii) Stools with excessive mucus and blood clots
- (c) Amoebiasis is transmitted through dirty drinking water and food contaminated by faecal matter.

17.Ans.

- (a) In the thymus, immature lymphocytes differentiate into antigen-sensitive lymphocytes. After maturation in the thymus, they migrate to secondary lymphoid organs.
- (b) The cells released from the thymus are called T-lymphocytes. These lymphocytes are responsible for cell-mediated immunity which defends the body against virus, fungi and some bacteria which enter the host cells. Helper T-cells stimulate B-cells to produce antibodies, and killer T-cells migrate to the site of infection.

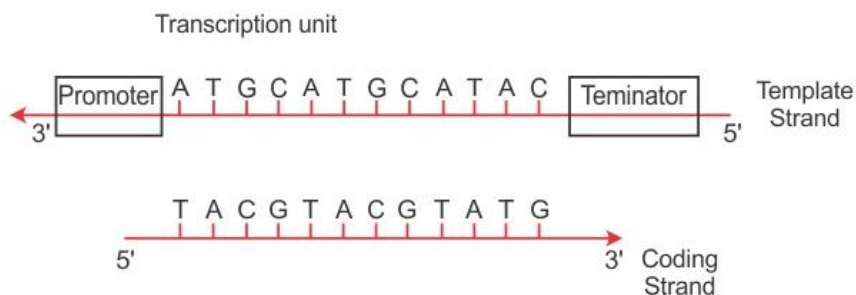
18.Ans. The clown fish protects itself from predators by attaching itself to the body of sea anemone which possesses stinging tentacles. The sea anemone does not get any benefit from the clown fish. This interaction is called commensalism as one species is benefited, whereas the other species is neither harmed nor benefited.



SECTION C

19.Ans.

(a)



(b) The RNA strand transcribed from the above transcription unit:



OR

Lactose acts as an inducer in lac operon. It binds to the repressor and forms a complex, inducer-repressor, which remains unable to bind the operator. The RNA polymerase now becomes free to join with the promoter and the operator is switched on. This initiates the transcription of the structural genes, producing the three polypeptides.

In the absence of lactose, no inactivation of repressor occurs, and hence, the repressor binds to the operator region of the operon, thus preventing RNA polymerase from transcribing the operon. This inactivates the production of structural genes in *E. coli*.

20.Ans.

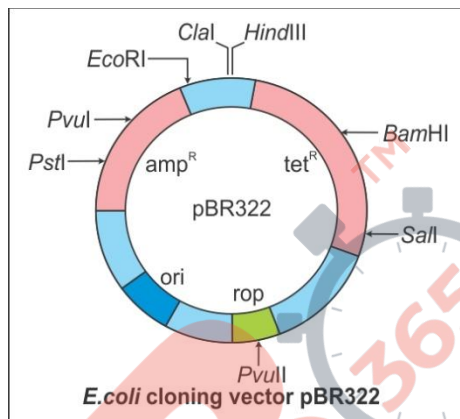
- (a) The seminal vesicle constitutes seminal plasma which is rich in fructose, calcium and enzymes. It helps facilitate the motility of sperms.
- (b) The scutellum is the cotyledon of the monocot seed and acts as a passage for the movement of nutrients from the endosperm to the developing embryo.
- (c) The acrosome of the human sperm contains hydrolytic enzymes which help in the penetration of the egg during fertilisation.

21.Ans.

- (a) A represents female Anopheles mosquito which acts as a vector for plasmodium.
- (b) Event C represents the process of fertilisation which takes place inside the intestine of the mosquito.
- (c) Organ B is the salivary gland of the mosquito and the cells removed are sporozoites.

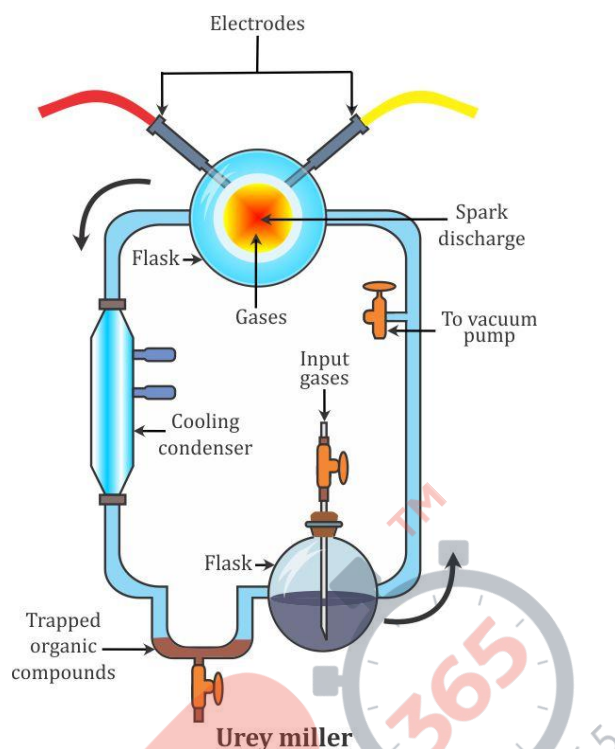
22. Ans.

- (a) Two restriction sites – BamHI and PvuII
- (b) *Ori* and *rop* genes – *Ori* is the site of origin of replication. *Rop* codes for the proteins involved in the replication of the plasmid.
- (c) Antibiotic-resistant genes – amp^R and tet^R



Schematic sketch of plasmid pBR322

23. Ans. The theory of biogenesis was proposed by Louis Pasteur. He proposed that all living things arise from pre-existing life. These cells further originated from organic compounds. So, life could have come from non-living matter and these were formed from inorganic constituents. Urey and Miller in 1953 demonstrated that the electrical discharges or heat energy can form the complex organic substances from the mixture of water (H_2O), methane (CH_4), ammonia (NH_3) and hydrogen (H_2). The chemicals were all sealed inside a sterile array of glass flasks and flasks connected in a loop, with one flask half-full of liquid water and another flask containing a pair of electrodes. The liquid water was heated to induce evaporation, sparks were fired between the electrodes to simulate lightning through the atmosphere and water vapour, and then the atmosphere was cooled again so that the water could condense and trickle back into the first flask in a continuous cycle. They observed production of acetic acid, urea, fatty acids, lactic acid and amino acids such as glycine, alanine and aspartic acid. Other investigators observed the formation of sugars and nitrogen bases by using ultraviolet light. Hence, this experiment supported that life has evolved from pre-existing non-living organic molecules.



24. Ans.

- This representation indicates a normal human because glutamic acid is present at the sixth position in the respective amino acid chain.
- In the sufferer who exhibits sickle cell trait, the defect is caused by the substitution of glutamic acid (Glu) by valine (Val) at the sixth position of the β -chain of haemoglobin.
- Both males and females suffer equally because sickle cell anaemia is not a sex-linked disease. It is an autosomal disease and sickle-shaped RBCs will cause equal deficiency of oxygen in both males and females.

25. Ans.

- Colourful polystyrene and plastic packaging used for protecting food are considered an environmental menace as plastic is non-biodegradable. Its recycling process is a very costly and produces toxic substances.
- Ahmed Khan found a remedy for efficient use of plastic waste by making Polyblend, a fine powder of recycled modified plastic. Polyblend is mixed with bitumen to lay roads.

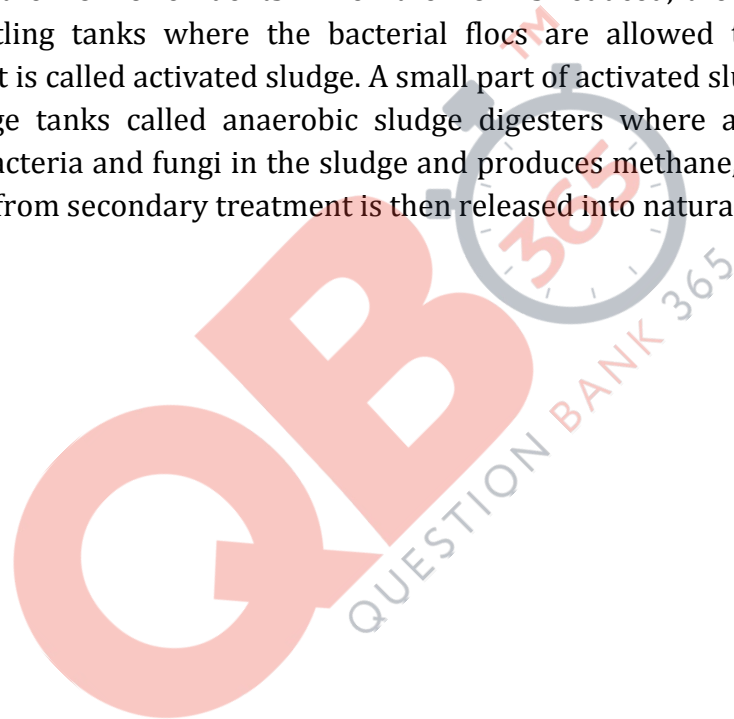
In collaboration with R. V. College of Engineering and Bengaluru City Corporation, he proved that a mixture of polyblend and bitumen were better for road carpeting as it had a better water-repellent property. It increased road life by a factor of three.

26. Ans. The genes responsible for making the Bt cotton plant resistant to bollworms are *cryIAC* and *cryIIAB*. These genes are secreted in the form of protein crystals during a particular phase of their growth which contain insecticidal proteins that exist in the inactive form. When an insect ingests the

inactive toxin, it gets converted to an active form in the gut under alkaline conditions. This solubilises the crystals, and the active toxin binds to the surface of epithelial cells and creates pores which cause cell swelling, lysis and death of the insect.

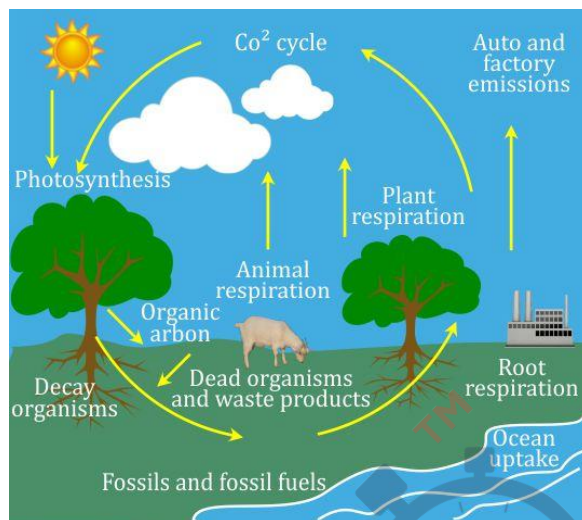
27.Ans. Different microbes occurring in sewage water are aerobic and anaerobic bacteria, protozoans and filamentous fungi.

The primary effluent is passed into large aeration tanks where it is constantly agitated. This allows abundant growth of aerobic microbes (bacteria and filamentous fungi) into flocs, mesh-like structures. The growth of these microbes reduces the BOD of effluents. When the BOD is reduced, the effluent is passed into settling tanks where the bacterial flocs are allowed to sediment. This sediment is called activated sludge. A small part of activated sludge is introduced into large tanks called anaerobic sludge digesters where anaerobic bacteria digest bacteria and fungi in the sludge and produces methane, H₂S and CO₂. The effluent from secondary treatment is then released into natural water bodies.



SECTION D

28.Ans.



Steps involved in the carbon cycle:

- (i) The main source of carbon in this Universe is CO_2 which is dissolved in water and present in air (0.03–0.04%).
- (ii) Plants take up carbon dioxide from the atmosphere and form organic compounds during photosynthesis. These organic compounds are transferred to animals as their food.
- (iii) The carbon dioxide is returned to the atmosphere during respiration, decay and combustion of plants and animals.
- (iv) The organic compounds of plants and animals are buried deep in the soil where they are acted by decomposers to change them into petroleum, coal, oil and carbonate rocks. These substances on their combustion release carbon dioxide in the atmosphere.
- (v) Some carbon dioxide is found in the dissolved state in water. This gets converted to calcium carbonate in limestone. The weathering and combustion of carbonate-containing rocks or treatment of their minerals give CO_2 .
- (vi) The hot springs and volcanic eruptions also give out CO_2 in the atmosphere.

OR

- (a) Such a succession is called xerarch succession. In this succession,
- (i) The pioneer species is lichens which secrete acids to dissolve rock causing weathering and soil formation.
 - (ii) The next seral stage will be bryophytes which can hold a small amount of soil.
 - (iii) Bryophytes are then succeeded by grasses.
 - (iv) Grasses eventually will pave the way for larger trees which will form the stable climax community. This remains stable as long as the environment remains unchanged.

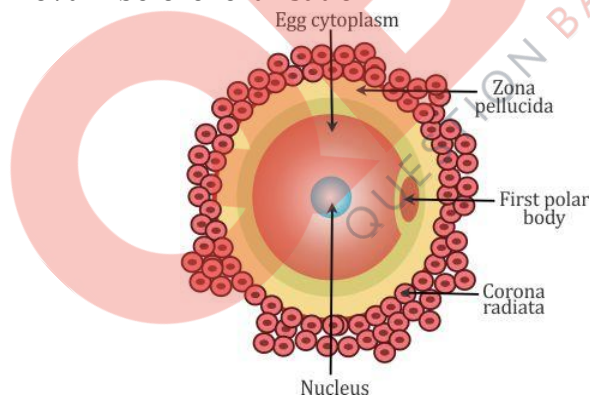
(b) Effluents from industries contain large amounts of nutrients. This causes excessive growth of free-floating algae causing algal bloom. Algae start consuming oxygen which decreases the BOD of the water body and causes the death of all aquatic life, thus leading to choking of the water body.

29. Ans.

- (i) Figure 'f' illustrates ovulation, and it is the ovulatory stage of oogenesis.
- (ii) The ovarian hormone is progesterone which is released during ovulation. The pituitary hormones are the follicle-stimulating hormone (FSH) and luteinising hormone (LSH) which are released during ovulation.
- (iii) The endometrium of the uterus gets thickened and blood supply to the endometrium increases.
- (iv) Figure 'c' represents the secondary follicle and figure 'h' represents the degenerating corpus luteum.

Secondary Follicle	Corpus Luteum
1. It is surrounded by layers of granulosa cells.	1. Absence of granulosa cells.
2. Theca layer is present.	2. Theca layer is absent.

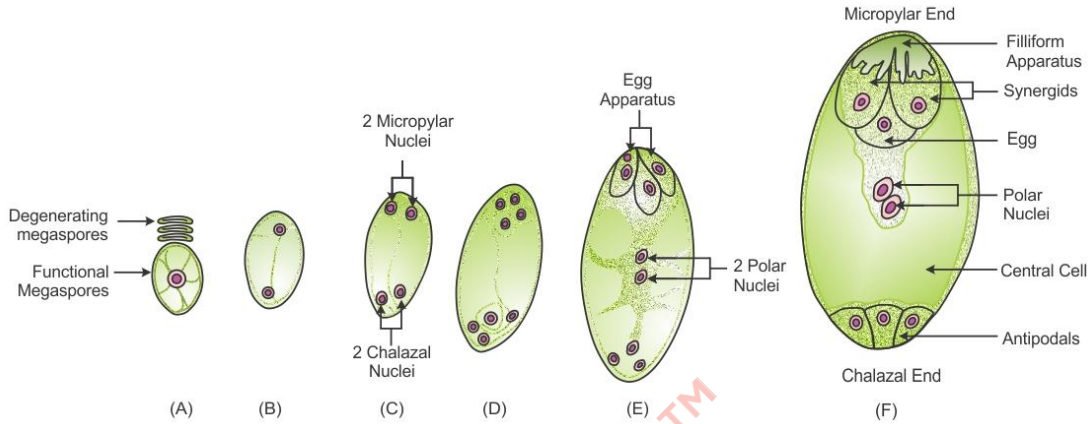
(v) Human ovum before fertilisation:



OR

- (i) The functional megaspore enlarges and undergoes three free nuclear mitotic divisions. The first division produces a binucleate embryo sac.
- (ii) The two nuclei shift to the two ends and divide there twice, forming a four-nucleate and then an eight-nucleate structure.
- (iii) One nucleus from each side moves to the middle. They are called polar nuclei. The remaining three nuclei form cells at the two ends—3-celled egg apparatus at the micropylar end and three antipodal cells at the chalazal end.
- (iv) The egg apparatus consists of two synergids and one egg cell.
- (v) The synergids have special cellular thickenings at the micropylar tip called the filiform apparatus which plays an important role in guiding the pollen tube into the embryo sac.

(vi) Thus, a typical angiosperm embryo sac, at maturity, is 8-nucleate but 7-celled.



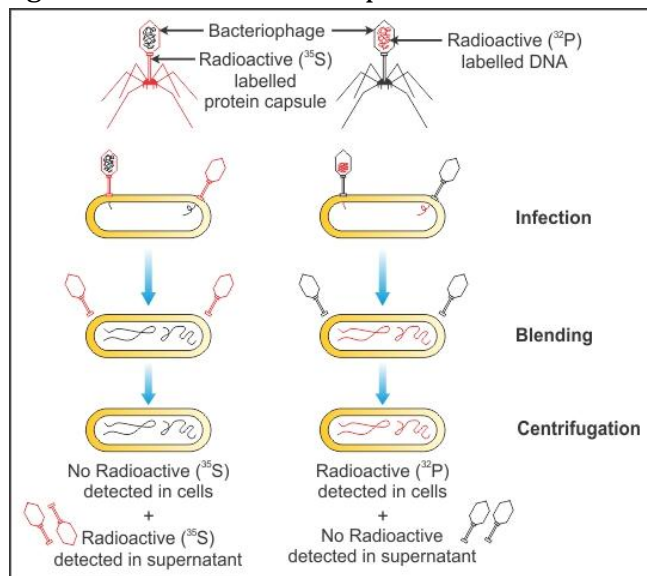
30. Ans. The proof for DNA as the genetic material came from the experiments of Alfred Hershey and Martha Chase (1952) who worked with bacteriophages.

The bacteriophage on infection injects only the DNA into the bacterial cell and not the protein coat. The bacterial cell treats the viral DNA as its own and subsequently manufactures more virus particles. They made two different preparations of the phage. In one, the DNA was made radioactive with ^{32}P , and in the other, the protein coat was made radioactive with ^{35}S .

These two phage preparations were allowed to infect the bacterial cell separately. Soon after infection, the cultures were gently agitated in a blender to separate the adhering protein coats of the virus from the bacterial cells.

The culture was also centrifuged to separate the viral coat and the bacterial cells. When the phage containing radioactive DNA was used to infect the bacteria, its radioactivity was found in the bacterial cells (in the sediment) indicating that the DNA has been injected into the bacterial cell.

So, DNA is the genetic material and not proteins.



OR

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The three different allelic forms of 'I' genes are

- (i) i
- (ii) I^A
- (iii) I^B

Genotype	Blood Group
ii	O
$I^A I^A$, $I^A i$	A
$I^B I^B$, $I^B i$	B
$I^A I^B$	AB

(b) Possibility I,

Parents: Mother with blood group 'A' and father with blood group 'O'.

Genotypes: $I^A I^A$ × ii

Gametes produced: I^A I^A ; i i

	I^A	i
I^A	$I^A i$	$I^A i$
i	$I^A i$	$I^A i$

Yes, A blood group only.

Possibility II,

Parents: Mother with blood group 'A' and father with blood group 'O'.

Genotypes: $I^A i$ × ii

Gametes produced: I^A i; i i

	I^A	i
i	$I^A i$	ii
i	$I^A i$	ii

Yes, 50% of children are produced with blood group A and 50% of children are with blood group O.