

**CBSE**  
**Class XII Biology (Theory)**  
**Board Paper 2012 – Delhi (Set 1)**

**Time: 3 hrs**

**Total Marks: 70**

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**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 unique flower phenomenon exhibited by *Strobilanthus kunthiana* (neelakuranaji). [1]
2. How does smoking tobacco in human lead to oxygen deficiency in their body? [1]
3. A garden pea plant produced inflated yellow pod and another plant of the same species produced constricted green pods. Identify the dominant traits. [1]
4. Why is *Eichhornia crassipes* nicknamed as “Terror of Bengal”? [1]
5. Write the location and function of the sertoli cells in humans. [1]
6. Name the following: [1]  
(a) The semi-dwarf variety of wheat which is high-yielding and disease resistant.  
(b) Any one inter-specific hybrid mammal.
7. Write the similarity between the wing of a butterfly and the wing of a bat. What do you infer from the above with reference to evolution? [1]
8. Write what do phytophagous insects feed on. [1]

## SECTION B

9. Draw a neat labeled sketch of a replicating fork of DNA. [2]
10. Where is sporopollenin present in plants? State its significance with reference to its chemical nature. [2]
11. [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.
12. Explain the work carried out by Cohen and Boyer that contributed immensely in biotechnology. [2]
13. Why do clown fish and sea anemone pair up? What is this relationship called? [2]
14. [2]  
(a) State the difference between meiocyte and gamete with respect to chromosome number.  
(b) Why is a whiptail lizard referred to as parthogenetic?
15. Name the plant source of the drug popularly called "smack". How does it affect the body of the abuser? [2]

OR

Why is *Rhizobium* categorized as a 'symbiotic bacterium'? How does it act as a biofertiliser?

16. [2]  
(a) State the role of DNA ligase in biotechnology.  
(b) What happens when *Meloidogyne incognita* consumes cells with RNAi gene?
17. Some organisms suspend their metabolic activities to survive in unfavorable conditions. Explain with the help of any four examples. [2]
18. [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?

### SECTION C

**19.** It is established that RNA is the first genetic material. Explain giving three reasons. [3]

**OR**

(a) Name the enzyme responsible for the transcription of tRNA and the amino acid the initiator tRNA gets linked with.

(b) Explain the role of initiator tRNA in initiation of protein synthesis.

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

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

**22.** Write the function of each one of the following: [3]

(a) (Oviducal) Fimbriae

(b) Coleoptile

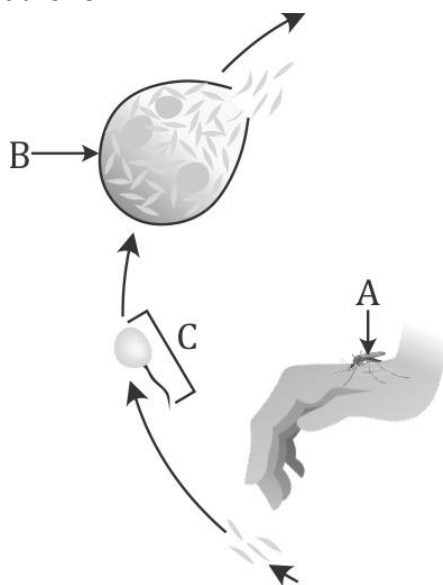
(c) Oxytocin

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

**24.** Study a part of the life cycle of malarial parasite given below.

Answer the questions that follow:

[3]

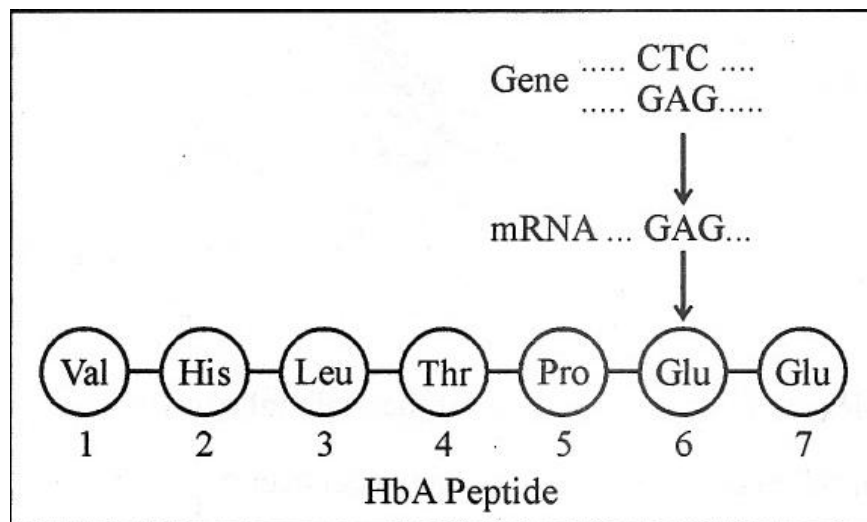


(a) Mention the roles of 'A' in the life cycle of the malarial parasite.

(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.

25. Given below is the representation of amino acid composition of the relevant translated portion of  $\beta$ - 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 a 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?
26. By the end of 2002, the public transport of Delhi switched over to a new fuel. Name the fuel. Why is this fuel considered better? Explain. [3]
27. 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

### SECTION D

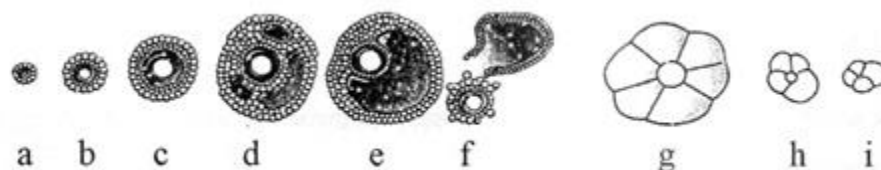
28. Explain the carbon cycle with the help of a simplified model. [5]

OR

Explain how does:

- (a) A primary succession starts on a bare rock and reach a climax community?
- (b) The algal bloom eventually chokes 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 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 'c' and 'h'.
- (v) Draw a labelled 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 labelled diagram of a mature embryo sac.

30. What is the inheritance pattern observed in the size of starch grains and seed shape of *Pisum sativum*? Work out the monohybrid cross showing the above traits. How does this pattern of inheritance deviate from that of Mendelian law of dominance? [5]

OR

State the aim and describe Messelson and Stahl's experiment.

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**SOLUTION**

**Time: 3 hrs**

**Total Marks: 70**

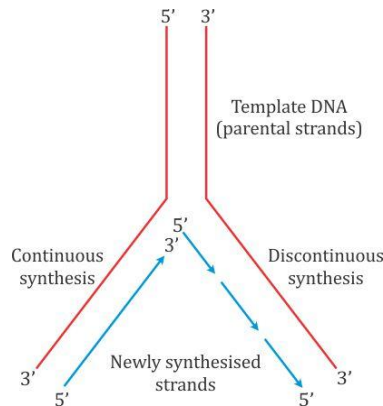
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**SECTION A**

1. **Ans.** Neelakurinji (*Strobilanthes kunthiana*) is a shrub which grows in the grasslands of the Western Ghats in South India. The main phenomenon of this flowering plant is that it produces flowers after a gap of 12 years.
2. **Ans.** Smoking of tobacco releases carbon monoxide in the body, thereby depleting the oxygen content which is bound to haemoglobin.
3. **Ans.** Inflated yellow seeds are dominant over constricted green seeds.
4. **Ans.** *Eichhornia crassipes* is called 'Terror of Bengal' because it grows very fast in the water body. It increases the oxygen demand in low quantity of light, thereby causing the death of aquatic organisms.
5. **Ans.** Sertoli cells are located in the germinal epithelium of seminiferous tubules. They provide nourishment for the growing spermatozoa.
6. **Ans.**
  - (a) Sonalika is the semi-dwarf variety of wheat which is high-yielding and disease resistant.
  - (b) Zonkey is an interspecific hybrid mammal which is a cross between zebra and donkey.
7. **Ans.** Bat wings and butterfly wings are analogous to each other because both are structurally different but functionally same. They perform similar functions. Evolutionary relationships can be inferred from the above reference.
8. **Ans.** Phytophagous insects feed on plant sap and other parts of plants.

## SECTION B

9. Ans.



10. 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.

11. 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 have entered the host cells. Helper T-cells stimulate B-cells to produce antibodies, and killer T-cells migrate to the site of infection.

12. Ans. In 1972, Stanley Cohen and Herbert Boyer invented the technique of DNA cloning, which allowed genes to be transplanted between different biological species. It was the beginning of genetic modification techniques. Cohen worked on the ways to isolate genes using plasmids and clone them into *E. coli* bacteria. 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.

13. 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.

**14.Ans.**

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

**15.Ans.** Smack is popularly called 'Heroin'. It is derived from the latex of the poppy plant *Papaver somniferum*. It is a stronger analgesic than morphine. It reduces heartbeat, blood pressure and increases blood sugar.

**OR**

*Rhizobium* lives in the root nodules of leguminous plants. This association is mutually beneficial, so *Rhizobium* is called symbiotic bacteria. *Rhizobium* gets food and shelter from the leguminous plant and the leguminous plant gets nitrogen in return. Because *Rhizobium* can fix atmospheric nitrogen, it acts as a biofertiliser.

**16.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.

**17.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.



**18. 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.

## SECTION C

**19.Ans.** RNA is the first genetic material because

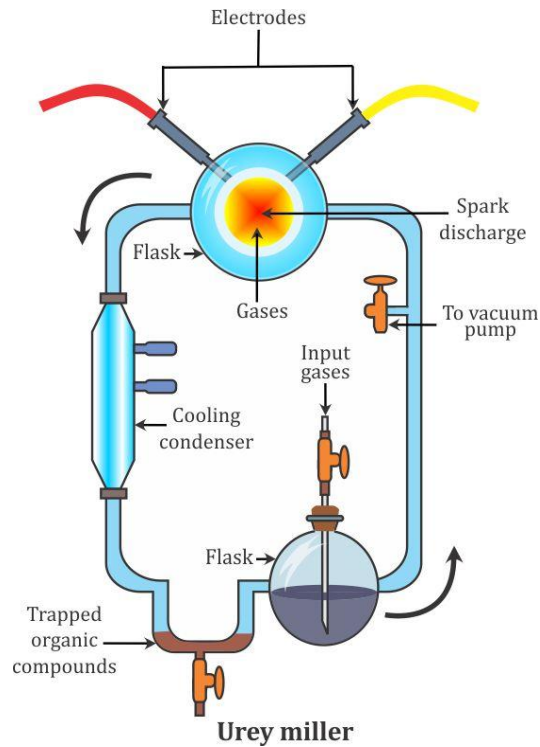
- (i) RNA can store genetic information like DNA and acts as an enzyme to catalyse reactions.
- (ii) RNA is involved in metabolism, genetic translation and transcription.
- (iii) RNA is capable of self-replication.

**OR**

- (a) RNA polymerase in prokaryotes and RNA polymerase III in eukaryotes are responsible for transcription of tRNA. Initiator tRNA gets linked with formulated methionine in prokaryotes and methionine in eukaryotes.
- (b) Initiator tRNA combines with methionine in the presence of amino acyl-tRNA enzyme resulting in the formation of charged tRNA. This initiator tRNA combines with two subunits of ribosomes and mRNA forming a translation initiation complex. First, mRNA attaches to a small subunit of ribosome and charged initiator tRNA. The initiator tRNA joins the initiation codon AUG and signals the start of translation. Now, the large subunit of ribosome combines with the small subunit. Initiator tRNA lies at the P site of the ribosome.

**20.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 complex organic substances from the mixture of water ( $\text{H}_2\text{O}$ ), methane ( $\text{CH}_4$ ), ammonia ( $\text{NH}_3$ ) and hydrogen ( $\text{H}_2$ ). 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 the production of acetic acid, urea, fatty acids, lactic acid and amino acids like glycine, alanine and aspartic acid. Other investigators observed the formation of sugars and nitrogen bases by using UV light. Hence, this experiment supported that life has evolved from pre-existing non-living organic molecules.



**21.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 the abundant growth of aerobic microbes (bacteria and filamentous fungi) into flocs, mesh-like structures. The growth of these microbes reduces the BOD of effluents. Once 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 produce methane,  $\text{H}_2\text{S}$  and  $\text{CO}_2$ . The effluent from secondary treatment is then released into natural water bodies.

**22.Ans.**

- (a) Fimbriae are finger-like projections which are present at the end of the fallopian tube and helps in the collection of the ovum after ovulation.
- (b) Coleoptile is a protective covering of plumule present inside the monocot seed.
- (c) Oxytocin is a hormone secreted by the posterior pituitary and it stimulates the contraction of uterine muscles during childbirth. It also helps in the production of milk during the lactation period.

**23.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 contains insecticidal proteins which 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.

**24.Ans.**

- (a) A represents female *Anopheles* mosquito which acts as the 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.

**25.Ans.**

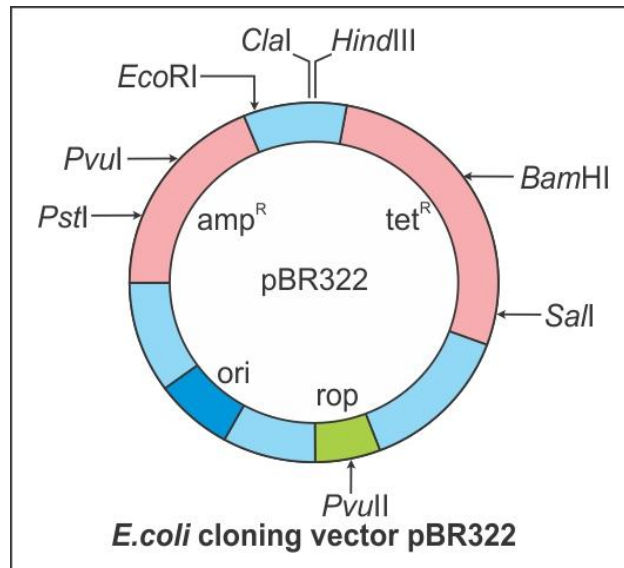
- (a) This representation indicates a normal human because glutamic acid is present at the sixth position in the respective amino acid chain.
- (b) In the sufferer who exhibits sickle cell trait, the defect is caused by the substitution of glutamic acid (Glu) by valine (Val) at the sixth position of the  $\beta$ -chain of haemoglobin.
- (c) 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.

**26.Ans.** Delhi is the fourth most-polluted city in the world. So, in 2002, Delhi switched over to a new fuel, compressed natural gas (CNG), to reduce pollution. This fuel is considered better because

- (i) CNG is a clean burning fuel. Its combustion leaves little or no residue compared to gasoline or diesel.
- (ii) CNG is cheaper than petrol and diesel, and it cannot be adulterated.
- (iii) CNG also produces 45% less hydrocarbons than gasoline. So, this helps reduce the harmful effects of greenhouse gases to the environment particularly through global warming.

**27.Ans.**

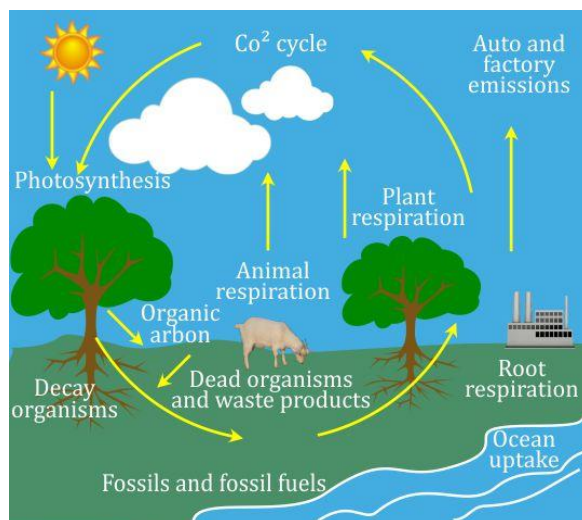
- (a) Two restriction sites – *BamHI* and *PvuII*
- (b) *Ori* and *rop* genes – *Ori* is the site of origin of replication. *Rop* codes for the proteins involved in the replication of the plasmid.
- (c) Antibiotic-resistant genes –  $\text{amp}^R$  and  $\text{tet}^R$



Schematic sketch of plasmid pBR322

## SECTION D

28.Ans.



Steps involved in the carbon cycle:

- (i) The main source of carbon in this Universe is CO<sub>2</sub>, 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 and change into petroleum, coal, oil and carbonate rocks. These substances on 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<sub>2</sub>.
- (vi) The hot springs and volcanic eruptions also give out CO<sub>2</sub> in the atmosphere.

**OR**

- (a) Such a succession is called xerarch succession. In this succession,
- (i) 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 pave the way for larger trees which will form the stable climax community. This remains stable as long as the environment remains unchanged.

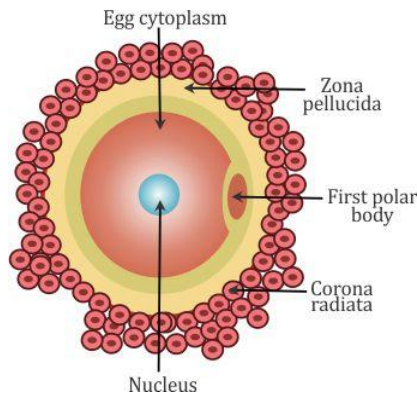
- (b) Effluents from industries contain large amounts of nutrients. This causes excessive growth of free-floating algae causing algal bloom. Algae start consuming oxygen which decreases the BOD of the water body and causes the death of all aquatic life, thus leading to the choking of the water body.

**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 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.

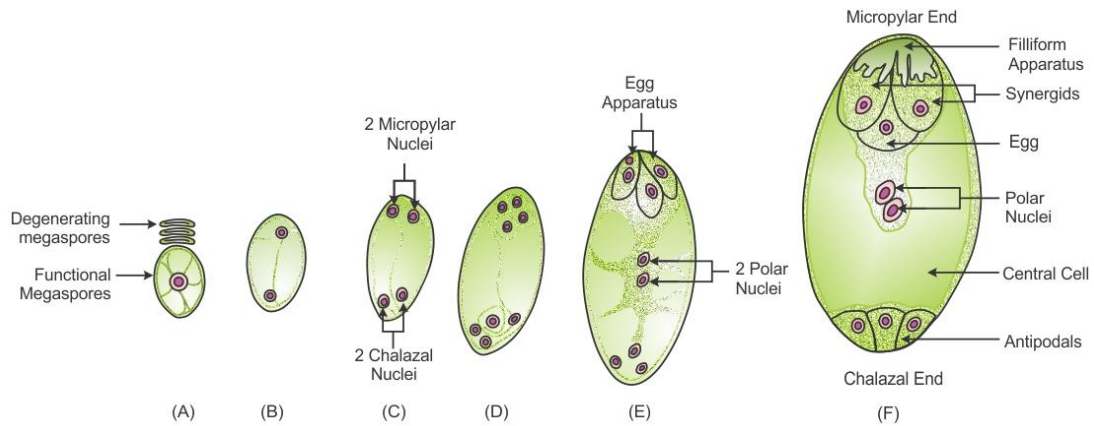
- (v) Human ovum before fertilisation:



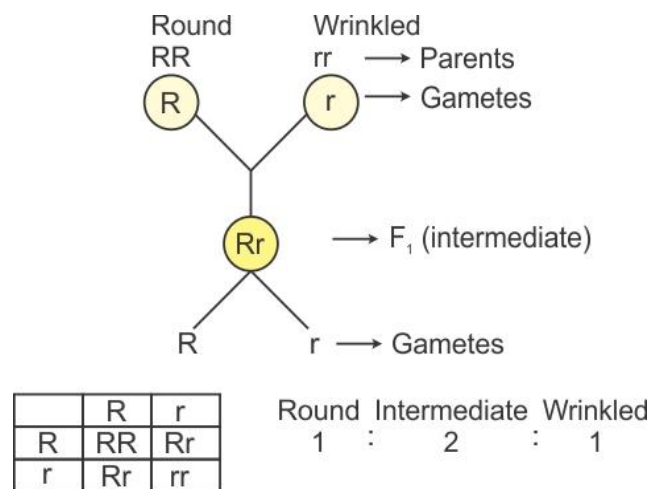
**OR**

- (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 filiform apparatus which play an important role in guiding the pollen tubes into the synergid.

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



**30.Ans.** A cross between round seed which has well-developed starch grains and wrinkled seeds which do not have starch grains will give an intermediate situation. Such a cross is a monohybrid cross.  
Suppose R is an allele for round seed and r is an allele for wrinkled seed.



This is an example of incomplete dominance, whereas Mendelian inheritance shows complete dominance.

In Mendel's pea plant experiment, dominance was essentially complete. There was no difference between homozygous and heterozygous plants in the expression of a dominant character. However, this is not true for all characters or organisms. There are characters or alleles which are neither dominant nor recessive. In such cases, both alleles of contrasting conditions of a character express as a blend or mixture. As a result, the hybrid produced by crossing two pure individuals does not resemble either of them but is midway.



The expression of the traits of two pure parents as an intermediate condition or fine mixture in the  $F_1$  hybrids is known as incomplete, partial or blended dominance.

Blended inheritance is an exception to the outcome of Mendel's crosses.

**OR**

In 1958, the aim of Matthew Meselson and Franklin Stahl was to prove that DNA replicates in a semi-conservative way. The DNA consists of two helices which are combined. When the two helices are copied, each will have one part coming from the original cell (parental). The other part will be newly made.

Experimental Procedure:

- (i) *E. coli* was grown for several generations in a medium with  $^{15}\text{NH}_4\text{Cl}$ . As a result,  $^{15}\text{N}$  was incorporated into newly synthesised DNA. This DNA could be distinguished by centrifugation in  $\text{CsCl}$  density gradient.
- (ii) These *E. coli* cells are then transferred to normal  $^{14}\text{NH}_4\text{Cl}$  medium and the DNA was extracted as a double-stranded helix. The various samples were separated independently on  $\text{CsCl}$  gradients to measure the density of DNA.
- (iii) DNA extracted from the culture after another generation (second generation) was composed of equal amounts of hybrid and light DNA.

