

BIOLOGY

Time : 3 Hours

Maximum Marks : 70

General Instructions :

- (i) All questions are compulsory.
- (ii) The question paper has five sections and 33 questions.
- (iii) 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.
- (iv) 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.
- (v) Wherever necessary, neat and properly labeled diagrams should be drawn.

SECTION - A

Q. No. 1 to 12 are multiple choice questions. Only one of the choices is correct. Select and write the correct choice as well as the answer to these questions.

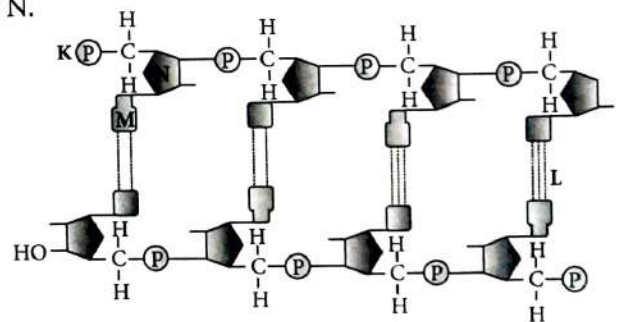
1. The three codons which result in the termination of polypeptide chain synthesis are

(a) UAA, UAG, GUA	(b) UAA, UAG, UGA
(c) UAA, UGA, UUA	(d) UGU, UAG, UGA.

2. Refer to the given figure.

Select the option which correctly identifies K, L, M and N.

	K	L	M	N
(a)	5' end	Phosphodiester bond	Thymine	Ribose sugar
(b)	3' end	Glycosidic bond	Guanine	Deoxyribose sugar
(c)	5' end	Hydrogen bond	Adenine	Ribose sugar
(d)	5' end	Hydrogen bond	Adenine	Deoxyribose sugar



3. Which of the following appeared during ice age between 75,000 - 10,000 years ago?

(a) Cro-Magnon man	(b) Neanderthal man
(c) Modern <i>Homo sapiens</i>	(d) Heidelberg man
4. Which of the following equations correctly represents Verhulst-Pearl logistic growth?

(a) $dN/dt = rN \left(\frac{K-N}{K} \right)$	(b) $dN/dt = \frac{rN}{K}$
(c) $dN/dt = \left(\frac{N(K-N)}{K} \right)$	(d) $dN/dt = \left(\frac{r(K-N)}{K} \right)$
5. Introduction of Nile Perch in lake Victoria of East Africa resulted in

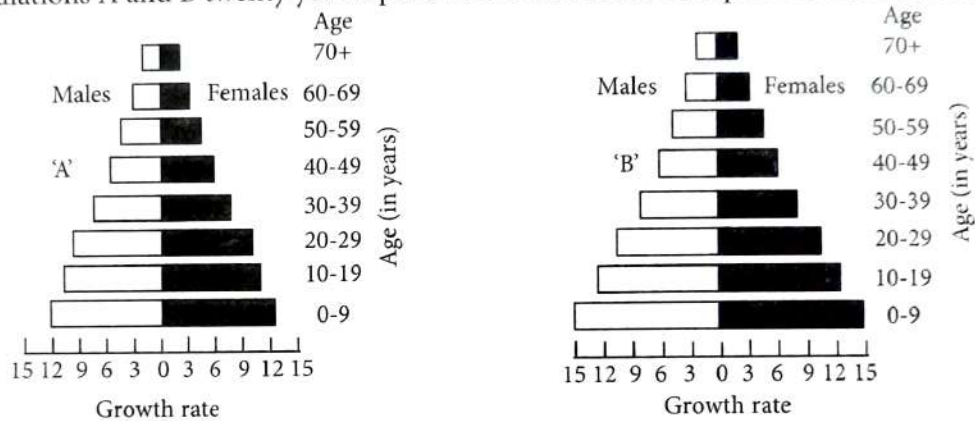
(a) excessive growth of water weeds	(b) elimination of water weeds
(c) elimination of many species of cichlid fish	(d) excessive growth of cichlid fish.

6. During isolation of genetic material, the chemical used to precipitate out the purified DNA is
 (a) bromophenol blue (b) chilled ethanol
 (c) ethidium bromide (d) both (b) and (c).

7. Match column I with column II and select the correct answer from the given codes.

	Column I		Column II
A.	<i>amp^R</i> gene	(i)	Artificial plasmid
B.	Separation of DNA fragments	(ii)	Selectable marker
C.	<i>EcoRI</i>	(iii)	Electrophoresis
D.	pBR322	(iv)	<i>Escherichia coli</i> RY13

- (a) A-(iii), B-(ii), C-(i), D-(iv) (b) A-(iv), B-(i), C-(iii), D-(ii)
 (c) A-(ii), B-(iii), C-(iv), D-(i) (d) A-(ii), B-(iv), C-(i), D-(iii)
8. A country with a high rate of population growth took measures to reduce it. The figure below shows age-sex pyramids of populations A and B twenty years apart. Select the correct interpretation about them.



Interpretations:

- (a) "B" is earlier pyramid and shows stabilised growth rate.
 (b) "B" is more recent showing that population is very young.
 (c) "A" is the earlier pyramid and no change has occurred in the growth rate.
 (d) "A" is more recent and shows slight reduction in the growth rate.
9. Everytime, when the dosage of a drug has to be increased to achieve the same 'kick' that initially occurred in response to a smaller dose, this condition is known as
 (a) rebound effect (b) tolerance
 (c) withdrawal symptoms (d) addiction.
10. Which of the following is widely used as a successful biofertiliser in Indian rice field ?
 (a) *Rhizobium* (b) *Acacia arabica* (c) *Acalypha indica* (d) *Azolla pinnata*
11. Match List I with List II and select the correct option from the given codes.

	List I		List II
A.	Parthenocarpy	(i)	Seed formation without fertilisation
B.	Polyembryony	(ii)	More than one embryo in same seed
C.	Apomixis	(iii)	Seedless fruits without fertilisation
D.	False fruit	(iv)	Thalamus contributes to fruit formation

- (a) A - (iv), B - (ii), C - (iii), D - (i) (b) A - (iii), B - (ii), C - (i), D - (iv)
 (c) A - (i), B - (iv), C - (iii), D - (ii) (d) A - (ii), B - (iii), C - (i), D - (iv)
12. Pollination in water hyacinth and water lily is brought about by the agency of
 (a) water (b) insects or wind (c) birds (d) bats.

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)** : Net primary productivity is equal to gross primary productivity minus respiration.

Reason (R) : Secondary productivity is produced by heterotrophs.

14. **Assertion (A)** : Artificially acquired passive immunity results when antibodies or lymphocytes produced outside the host are introduced into a host.

Reason (R) : A bone marrow transplant given to a patient with genetic immunodeficiency is an example of artificially acquired active immunity.

15. **Assertion (A)** : A network of food chains existing together in an ecosystem is known as a food web.

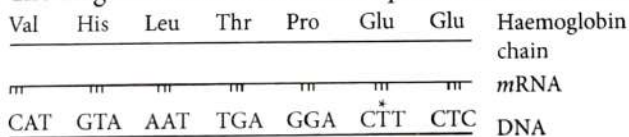
Reason (R) : An animal like kite cannot be a part of a food chain.

16. **Assertion (A)** : Water constitutes a major mode of pollination in most of the aquatic angiospermic plants.

Reason (R) : *Vallisneria* and *Zostera* are examples of water pollinated plants.

SECTION - B

17. The diagram below shows the sequence of amino acids in part of a haemoglobin molecule.

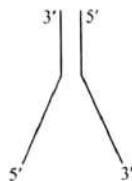


Key:	Val = valine	Thr = threonine
	His = histidine	Pro = proline
	Leu = leucine	Glu = Glutamic acid

- (a) If the base T* was substituted with A, how would it affect the haemoglobin chain?
- (b) Name the condition and the effects associated with the above substitution.

OR

Refer to the figure given below.



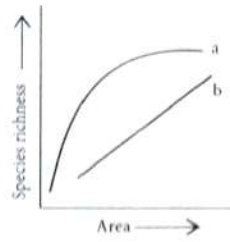
- (a) Redraw the structure as a replicating fork and label the parts.
 - (b) Write the source of energy for this replication.
18. Where is sporopollenin present in plants? State its significance with reference to its chemical nature.
19. What could be the possible treatments for a patient exhibiting ADA deficiency?

OR

Name the Indian crop variety for which in 1997 an American company got patent right through the US Patent and Trademark Office. Why did the company claim it to be an invention or a novelty?

20. Name the genus of baculovirus that acts as a biological control agent inspite of being a pathogen. Justify by giving three reasons that make it an excellent candidate for the job.

21. Refer to the given graph showing species-area relationship. Write the equation of the curve 'a' and explain it.



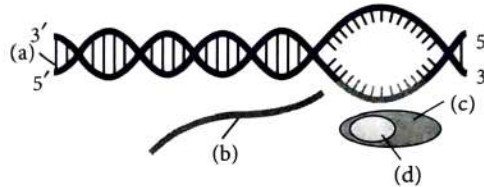
OR

How does over-exploitation of beneficial species affect biodiversity? Explain with the help of one example.

SECTION - C

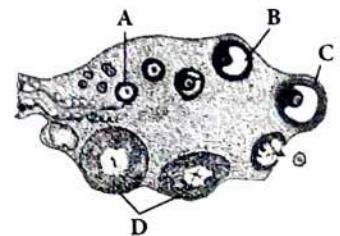
22. A cross was carried out between two pea plants showing the contrasting traits of height of the plants. The result of the cross showed 50% parental characters.
- (a) Work out the cross with the help of a Punnett square.
- (b) Name the type of the cross carried out.

23. (i) Identify the given process and name the labels a, b, c and d.



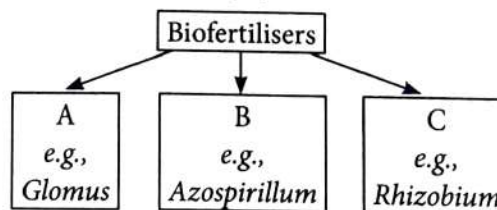
- (ii) State the functions of ribozyme and release factor in protein synthesis respectively.

24. 'Plasmid is a boon to biotechnology'. Justify this statement quoting the production of human insulin as an example.
25. Prior to a sports event, blood and urine samples of sports persons are collected for drug tests.
- (a) Why is there a need to conduct such tests?
- (b) Name the drugs the authorities usually look for.
- (c) Write the generic names of two plants from which these drugs are obtained.
26. (a) Explain "birth rate" in a population by taking a suitable example.
- (b) Write the other two characteristics which only a population shows but an individual cannot.
27. Study the transverse section of human ovary given below and answer the questions that follow.
- (a) Name the hormone that helps in growth of A → B → C.
- (b) Name the hormone secreted by A and B.
- (c) State the role of hormone produced by D.
28. Explain the post-pollination events leading to seed production in angiosperms.



SECTION - D

29. Study the given flow chart and answer the following questions.

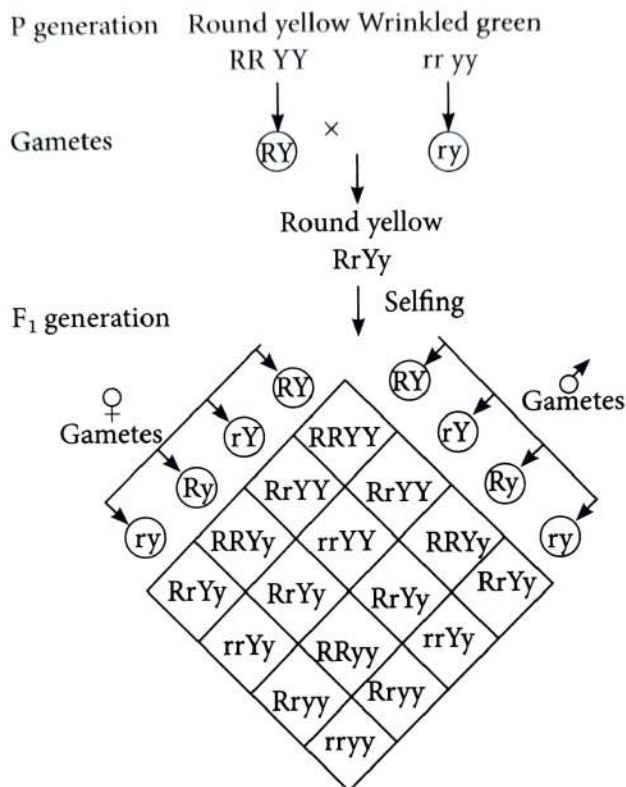


- Identify A, B and C in the given flow chart.
- Give one another example of biofertiliser B.
- How does the application of the fungal genus, *Glomus*, to the agricultural farm increase the farm output?

OR

Why is *Rhizobium* act as a biofertiliser?

30. A scientist crosses homozygous round yellow seeded pea plant to homozygous wrinkled green seeded pea plant and observed the inheritance of both traits as per the following pattern. He collected total 1600 seeds in F_2 generation.



- How many seeds would be homozygous for round shape and green colour in F_2 generation?

OR

How many seeds could be heterozygous for round shape and yellow colour in F_2 generation?

- What phenotypic ratio would be obtained if the plants of F_1 generation would be crossed with wrinkled green seeded plant?
- What would be the total number of seeds heterozygous for yellow colour and homozygous for round seed shape?

SECTION - E

31. Give reasons why:

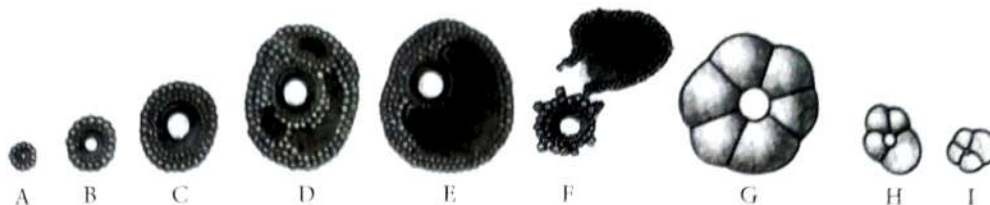
- DNA cannot pass into a host cell through the cell membrane.
- Proteases are added during isolation of DNA for genetic engineering.
- Single recognition site is preferred in a vector.
- Maintenance of sterile conditions in biotechnological processes.
- Genes encoding resistance to antibiotics considered as useful selectable markers for *E.coli* cloning vector.

OR

Causative agents of HIV-AIDS and COVID-19 belong to the same group of viruses. To diagnose and amplify the genetic material for further study of COVID-19 virus, 'RT-PCR' test is carried out.

- What does 'RT-PCR' stand for?
- Explain the various steps of PCR technique.

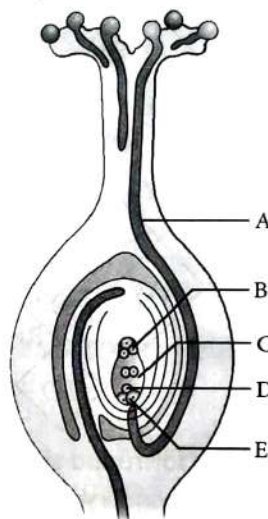
32. The following is the illustration of the sequence of ovarian events "A" to "I" in a human female.



- Identify the figure that illustrates ovulation and mention the stage of oogenesis it represents.
- Name the ovarian hormone and the pituitary hormone that have caused the above mentioned event.
- Explain the changes that occur in the uterus simultaneously in anticipation.
- Write the difference between 'C' and 'H'.
- Draw a labelled sketch of the structure of a human ovum prior to fertilisation.

OR

Refer the given below figure and answer the questions that follows:



- What phenomenon is represented in the above given figure ?
 - What is the path of entry of pollen tube ?
 - Identify the parts labelled as A to E.
 - What will happen after entering of pollen into one of the synergids?
33. An experiment 'X' provided evidence in support of 'Y'. In this experiment, four gases were circulated - 'A', 'B', 'C', and 'D' in an air tight apparatus and electrical discharge from electrodes was passed at 800°C. The mixture of gases were passed through a condenser. After a week, the chemical composition of the liquid inside the apparatus was analysed. The results provided evidence through which 'Y' was more or less accepted.
- Identify gases A, B, C, D.
 - Which theory of origin of life is supported by the above experiment?
 - Draw a diagrammatic representation of experiment X.
 - What does A, B, C and D together produced in the experiment X?

OR

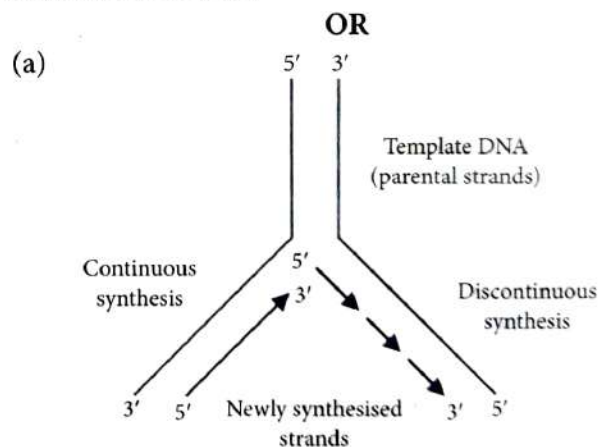
Explain three different ways in which natural selection can affect the frequency of a heritable trait in a population.

1. (b)
2. (d) : Given figure represents double stranded polynucleotide chain. Here, K-5' end, L-Hydrogen bond, M-Adenine, N-Deoxyribose sugar.
3. (c) 4. (a) 5. (c)
6. (b) : The purified DNA after treatment with various enzymes, precipitates out after addition of chilled ethanol. This is viewed as a collection of fine threads in the suspension and is easily collected. The process is known as DNA spooling.
7. (c) 8. (d)
9. (b) : Tolerance is the reduction or loss of the normal response to a drug or other substance that usually provokes a reaction in the body. Drug tolerance may develop after taking a particular drug over a long period of time. In such cases, increased doses are necessary to produce the desired effect. Some drugs that cause tolerance also cause dependence.
10. (d) 11. (b)
12. (b) : In aquatic plants with emergent flowers, e.g., water lily and water hyacinth, pollination takes place by wind or insects.
13. (b) : Net primary productivity is the rate of organic matter built up or stored by producers in their bodies in a unit area/volume per unit time. Net productivity is equal to gross primary productivity minus loss due to respiration and other reasons. Rate of assimilation of the food energy as organic matter or biomass by heterotrophs or consumers per unit time and area is known as secondary productivity.
14. (b)
15. (c) : The process of transfer of energy from producers through a series of organisms *i.e.*, from primary consumers to secondary consumers to tertiary consumers by process of eating and being eaten constitute a food chain, e.g., grassland ecosystem. Food chains can never occur independently in ecosystem but various food chains are inter-connected with each other forming an interlocked system known as food web. In grassland ecosystem food chains may be-
 - (i) Grass → Rabbit → Hawk/Kite
 - (ii) Grass → Mouse → Snake → Kite/Hawk
 - (iii) Grass → Grasshopper → Lizard → Kite/Hawk
 So, the food chain will always include kite.

16. (d) : Hydrophily is the mode of pollination (transfer of pollen grains from the mature anther of a flower to the stigma of another flower) which is accomplished through the agency of water. Pollination by water is quite rare in flowering plants and is limited to only about 30 genera, mostly monocotyledons, e.g., *Vallisneria*, *Zostera*, *Ceratophyllum*, etc. In many aquatic plants with emergent flowers, pollination occurs by wind or insects, e.g., lotus, water lily, water hyacinth, etc.

17. (a) If the base T* gets substituted with A, CTT would become CAT due to which complementary mRNA would be GUA that codes for valine. Thus, valine would replace glutamic acid at that point.

(b) The condition in sickle cell anaemia which is caused due to substitution of glutamic acid by valine at the sixth position of beta globin chain of haemoglobin molecule. The mutant haemoglobin molecule undergoes polymerisation leading to the change in the shape of the RBCs from biconcave disc to elongated sickle like structure.



(b) The sources of energy for the replication of DNA are phosphorylated nucleotides or deoxyribonucleoside triphosphates *i.e.*, dATP, dCTP, dGTP and dTTP.

18. Sporopollenin is present in exine layer of pollen grains. Sporopollenin is highly resistant fatty substance which is not degraded by any enzyme and not affected by high temperature, strong acid or strong alkali therefore pollen grains can be well preserved as microfossils.

19. The possible treatments that can be given to a patient exhibiting adenosine deaminase (ADA) deficiency are:

- (i) bone marrow transplantation
- (ii) enzyme replacement therapy.

OR

In 1997, an American company got patent rights on Basmati rice through the US Patent and Trademark Office. This allowed the company to sell a 'new' variety of Basmati, in the US and abroad. This 'new' variety of Basmati had actually been derived from Indian farmer's varieties. Indian Basmati was crossed with semi-dwarf varieties and claimed as an invention or a novelty.

20. *Nucleopolyhedrovirus*, a genus of baculovirus that act as a biological control agent inspite of being a pathogen.

- (i) They are species specific.
- (ii) They are narrow spectrum bioinsecticides.
- (iii) There is no side effect on plants, mammals, birds/fish and non-target insects. Beneficial insects are conserved.

21. The equation of curve 'a' is $S = CA^Z$ where,

S = Species richness

C = Y - intercept

A = Area

Z = Slope of the line (regression coefficient).

The graph of species - area relationship shows that within a region, species richness increases with increasing explorable area, but only upto a certain limit. The relation between species richness and area for a wide variety of taxa turns out to be rectangular hyperbola.

OR

Excessive exploitation of a species, whether a plant or animal, reduces size of its population so that it becomes vulnerable to extinct. For example, presently many marine fish population around the world are declining due to over harvesting results in endangering the continued existence of some commercially important species.

22. Two contrasting characters of height are tall and dwarf. In the given cross, if 50% of the progeny shows parental characters, then it must be a cross between a heterozygous tall and a homozygous recessive dwarf parent.

(a) Parent : Tall Dwarf

Genotype : Tt × tt

Gametes : (T) (t) (t) (t)

F₁ generation :

♀	♂	T	t
t	Tt	Tt	tt
	Tall	Dwarf	
t	Tt	Tt	tt
	Tall	Dwarf	

Phenotypic ratio ⇒ Tall : Dwarf = 1 : 1

(b) This type of cross is known as test cross.

23. (i) The given figure represents the termination of transcription and the labels are as follows:

(a) DNA molecule (b) mRNA transcript (c) RNA polymerase (d) Rho factor

(ii) Ribozyme (catalytic RNA) is present in ribosome and joins the amino acids together by peptide bond formation to form protein chains. Release factor (RF) is GTP dependent. It binds to the stop codon, terminates translation and release the complete polypeptide from the ribosome.

24. Plasmids are extra-chromosomal, self replicating, usually circular, double-stranded, DNA molecules found naturally in many bacteria.

Plasmid is a boon to biotechnology. It has certain characteristics which make it a good vector in production of human insulin. These are discussed as follows :

(i) It has specific restriction sites where the enzyme restriction endonucleases make a cut and segment of DNA which codes for human insulin is inserted.

(ii) It has number of origin of replication (*ori*) where replication starts.

(iii) Recombinant plasmid is introduced into *E.coli* host cell where it replicates and produces large amount of insulin.

25. (a) It is necessary to conduct such tests on sportspersons because they take various drugs like cocaine/coca alkaloids and cannabinoids to increase their muscle tone and performance in sports.

(b) Cocaine/coca alkaloids and cannabinoids.

(c) Cannabinoids are obtained from *Cannabis sativa* and cocaine is obtained from *Erythroxylum coca*.

26. (a) Birth rate refers to per capita births, i.e., average number of individuals produced per unit time. For example, if in a pond there were 20 lotus plants last year and through reproduction 8 new plants are added, then taking the current population to 28, we calculate the birth rate as $8/20 = 0.4$ offspring per lotus per year.

(b) Other attributes of population which individuals cannot show include -

(i) Death rate - An individual dies but a population has death rate. It refers to per capita deaths, i.e., average number of individuals that die per unit time.

(ii) Sex ratio - An individual has sex but a population has sex ratio, i.e., number of females and males per 1000 individuals.

27. (a) In the given figure A is primary follicle, B is tertiary follicle showing antrum and C is Graafian follicle.

Anterior lobe of pituitary gland secrete LH and FSH. FSH stimulates the growth of ovarian follicles, *i.e.*, from $A \rightarrow B \rightarrow C$.

- (b) Hormone secreted by A and B is estrogen.
 (c) D in the given figure is corpus luteum. It secretes progesterone which helps in the maintenance of endometrium.

28. Post-pollination events leading to seed formation in angiosperms are as follows :

- (i) After pollination, the pistil recognises the pollen whether it is of the right type (compatible) or of the wrong type (incompatible). Compatible pollens are accepted and germinate on the stigma to produce a pollen tube. Pollen tube grows and reaches the ovary and enters the ovule either through micropyle or chalaza or integuments.
 (ii) The pollen tube bursts open in one of the two synergids to release the two male gametes. One male gamete fuses with the egg to form a diploid zygote or oospore (syngamy). The second male gamete fuses with the diploid secondary nucleus of the central cell to form a primary triploid endosperm nucleus (triple fusion). The whole process is termed as double fertilisation.
 (iii) The primary endosperm nucleus gives rise to endosperm while the zygote develops into embryo.
 (iv) The integuments of fertilised ovule harden to form the seed coat.
 (v) The outer integument becomes hard and forms testa or outer seed coat which ensures survival of seeds.
 (vi) The inner integument, if persists, forms the tegmen.
 (vii) The micropyle remains in the form of a fine pore on the surface of seed. Funicle is transformed into stalk of the seed. The hilum marks the point of attachment to the stalk. Micropyle facilitates the entry of oxygen and water into the seed.

29. (a) In the given flow chart, A represents mycorrhiza, B represents free living nitrogen fixing bacteria and C represents symbiotic nitrogen fixing bacteria.

- (b) *Azotobacter* is free living nitrogen fixing bacteria.
 (c) Many members of the genus *Glomus* form symbiotic associations with plants to form mycorrhiza. *Glomus* helps to absorb phosphorus from soil and passes it to the plant. Plants having such associations show other benefits also, such as resistance to root-borne pathogens, tolerance to salinity and drought and an overall increase in plant growth and development. Therefore, *Glomus* increases the farm yield.

OR

Rhizobium is a soil bacterium which either lives freely in soil or lives in symbiotic association with roots of leguminous plants. The bacterium forms nodules or roots of leguminous plants where it lie in groups. When it occurs freely in soil, it cannot fix nitrogen. Nitrogen fixing ability develops only when it is present inside root nodules. Hence, *Rhizobium* is categorised as symbiotic bacterium. It acts as a biofertiliser as it helps plants in obtaining their nitrogen nutrition.

30. The given cross represents the dihybrid cross. The total number of seeds produced in F_2 generation are 1600.

(a) According to the given cross, the seeds homozygous for round shape and green colour are $1/16$. Therefore, the total number of round green seeds obtained is 100 (RRyy).

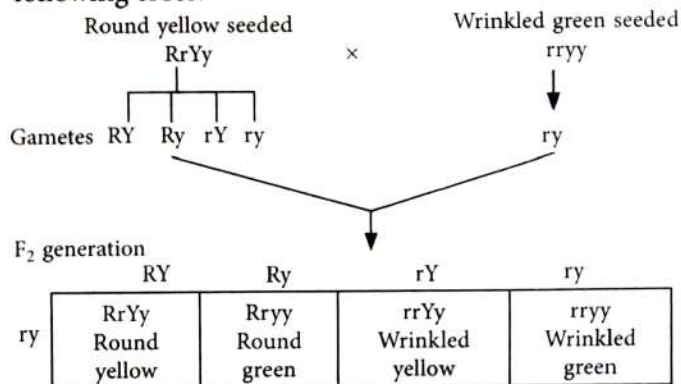
Homozygous round green seeds = $1/16 \times 1600 = 100$

OR

According to the given cross, the seeds heterozygous for round shape and yellow colour are $4/16$ (RrYy).

Therefore, the total number of round yellow seeds = $\frac{4}{16} \times 1600 = 400$

(b) The cross between F_1 hybrids with wrinkled green seeded plants (rryy) can be explained with the help of following cross:



The phenotypic ratio obtained in F_2 generation is 1:1:1:1 and the genotypic ratio obtained in F_2 generation is 1:1:1:1.

(c) The analysis of cross reveals that the number of seeds heterozygous for yellow colour and homozygous for round seed shape are 2 out of 16. (RRYy)

Therefore, the total number of seeds heterozygous for yellow colour and homozygous for round seed shape are:

$$= \frac{2}{16} \times 1600 = 200$$

31. (a) DNA is a hydrophilic molecule, so it cannot pass into a host cell through cell membrane. The cell membrane consists of lipid bilayers that are generally impermeable to hydrophilic molecules.

(b) DNA is intertwined with proteins like histones and RNA. To obtain purified DNA, proteases are added during isolation of DNA which convert proteins into amino acids. The purified DNA finally precipitates out after the addition of chilled ethanol.

(c) In order to link the alien DNA, the vector needs to have very few, preferably single recognition sites for the commonly used restriction enzymes. Presence of more than one recognition sites within the vector will generate several fragments, which will complicate the gene cloning process.

(d) Sterile conditions enable growth of only the desired microbe/eukaryotic cell in large quantities for the biotechnological products like antibiotics, enzymes, etc.

(e) Genes encoding resistance to antibiotics are considered useful selectable markers for *E. coli* cloning vector because they help in selecting transformant cell from non-transformant ones.

OR

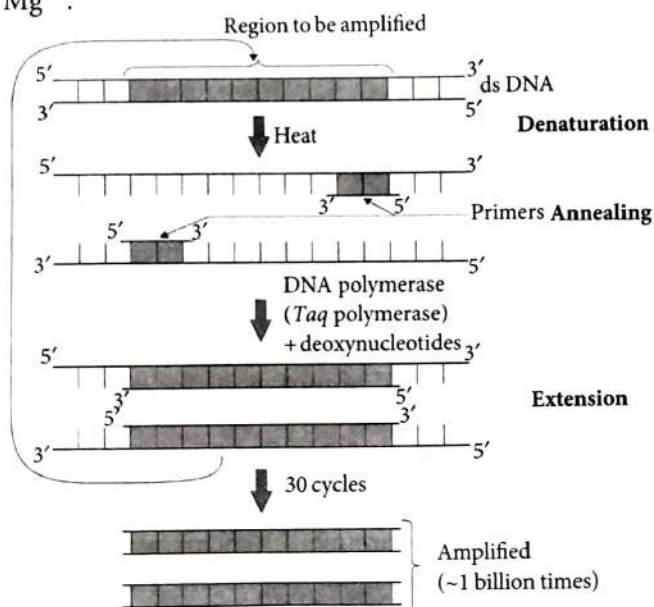
(a) RT-PCR stands for Reverse transcriptase – Polymerase Chain Reaction.

(b) The various steps of polymerase chain reaction are:

(i) Denaturation : The target DNA is heated to a high temperature of 92–94°C resulting in the separation of its two strands. Each single strand of the DNA then acts as a template for DNA synthesis.

(ii) Primer annealing : The two oligosaccharide primers hybridise to form each of the single stranded template DNA, since the sequence of the primer is complementary to the 3' end of the template DNA.

(iii) Extension of primer : The *Taq* DNA polymerase synthesises the DNA region between the primers, using dNTPs (deoxynucleoside triphosphate) and Mg^{2+} .



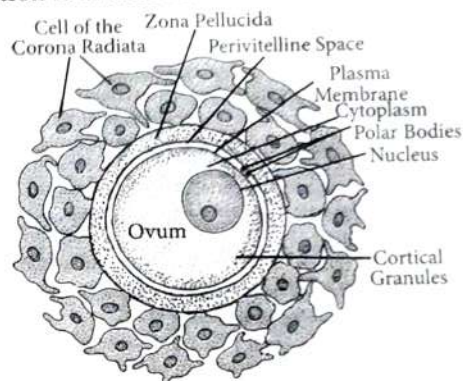
32. (a) 'F' illustrates ovulation. It represents secondary oocyte.

(b) Estrogen (ovarian hormone) and LH (pituitary hormone) surge cause ovulation.

(c) Endometrium becomes thicker by rapid cell multiplication which is accompanied by an increase of uterine glands and blood vessels.

(d) 'C' is developing follicle under the influence of FSH. 'H' is regressing corpus luteum under the influence of reduction of LH.

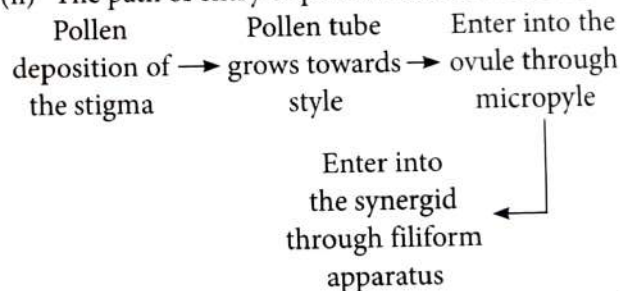
(e) The labelled structure of a human ovum prior to fertilisation is as follows:



OR

(i) The given figure represents L.S. of pistil showing path of pollen tube growth.

(ii) The path of entry of pollen tube is as follows:



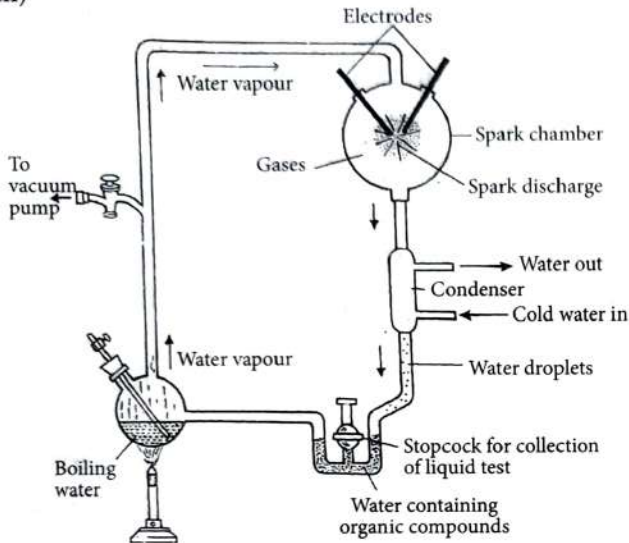
(iii) A - Pollen tube, B - Antipodal, C - Polar nuclei, D - Egg cell, E - Synergid.

(iv) After entering of pollen tube into one of the synergids, the pollen tube releases the two male gametes into the cytoplasm of the synergid. One of the male gametes moves towards the egg cell and fuses with its nucleus thus completing the syngamy (generative fertilisation). This results in the formation of a diploid cell, the zygote. The other male gamete moves towards the two polar nuclei located in the central cell and fuses with them to produce a triploid primary endosperm nucleus (PEN). As this involves the fusion of three haploid nuclei it is termed triple fusion (vegetative fertilisation).

33. (i) Gases A, B, C and D could be methane (CH_4) ammonia (NH_3), hydrogen (H_2) and water vapour (H_2O).

(ii) Miller's experiment (X) supported Oparin-Haldane theory which states that the life originated on early earth through physico-chemical processes of atoms combining to form molecules. These molecules in turn reacting to produce inorganic and organic compounds. Organic compounds interacting to produce all types of macromolecules which organised to form the first living system or cell.

(iii)



(iv) A, B, C and D together produces amino acids within a variety of organic compound in Miller's and Urey experiment (X).

OR



Natural selection can produce three different types of results and hence is divided into following three types :

(i) **Stabilising selection** : This type of selection favours average sized individuals while eliminates small sized individuals. It reduces variation and hence does not promote evolutionary change. However, it maintains the mean value from generation to generation. If we draw a graphical curve of population, it is bell-shaped. For example, there is an optimum wing length for a hawk of a particular size with a certain mode of life in a given environment. Stabilising selection, operating through differences in breeding potential will eliminate those hawks with wing spans larger or smaller than this optimum length.

(ii) **Directional selection** : In this selection, the population changes towards one particular direction. It is a progressive selection. It favours small or large-sized individuals and more individuals of that type will be present in next generation. The mean size of the population changes. For example - evolution of DDT resistant mosquitoes, industrial melanism in peppered moth, etc.

(iii) **Disruptive selection** : This type of selection simultaneously favours individuals at both extremes of the distribution curve. As a result, two peaks in distribution of a trait are produced. It is rare in occurrence but important for evolutionary changes.