CBSE Class 12

Biology

Previous Year Question Paper 2020

Series: HMJ/2 **Code no. 57/2/1**

- Please check that this question paper contains **11** printed pages.
- Code number given on the right-hand side of the question paper should be written on the title page of the answer-book by the candidate.
- Please check that this question paper contains **30** questions.
- **Please write down the Serial Number of the question before attempting it.**
- 15 minutes of time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the student will read the question paper only and will not write any answer on the answer script during this period.

BIOLOGY (Theory)

Time Allowed: **3** hours Maximum Marks: **70**

General Instructions:

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 weightage. 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.

SECTION – A

1. Cleistogamous flowers are self-pollinate because **1 Mark**

A. they are bisexual flowers which do not open at all.

B. they are bisexual and open flowers.

C. they are unisexual.

D. their stigma matures before the anthers dehisce.

Ans: They are bisexual flowers that do not open at all.

Or

Asexual reproduction by zoospores is observed in

A. Penicillium

B. Hydra

C. Sponge

D. Chlamydomonas

Ans: Chlamydomonas

2. The theory of evolution supported by the experiment conducted by Louis Pasteur is **1 Mark**

A. Spontaneous generation theory

B. Life comes only from pre-existing life

C. Abiogenesis of life

D. Big bang theory

Ans: Spontaneous generation theory

3. The diagnostic test that confirms typhoid in humans is **1 Mark**

A. ELISA

B. Widal

C. MRI

D. Amniocentesis

Ans: Widal

4. The bioactive molecule used as an immunosuppressive agent during organ transplant is **1 Mark**

A. Tetracycline

B. Cyclosporin-A

C. Statin

D. Streptomycin

Ans: Cyclosporin-A

Or

'Blue revolution' refers to

A. construction of water dams for conservation of water

B. production of fish in large quantities

C. sewage treatment

D. controlling algal bloom

Ans: production of fish in large quantities

5. Which one of the following is not the product of transgenic experiments? **1 Mark**

A. Pest-resistant crop variety

B. High nutritional value in grains

C. Production of insulin by rDNA technique

D. Drought-resistant crops

Ans: Production of insulin by rDNA technique

SECTION - B

6. Write the ploidy and number of chromosomes in human (a) meiocytes, and (b) gametes. 2 Marks

Ans: The number of chromosomes in a cell is measured by ploidy. Chromosomes are threadlike structures that contain DNA, which is the genetic material.

a) (Meiocytes) 2n, = 46

b) (Gametes) n, = 23

7. What is aneuploidy? Name a chromosomal disorder in humans caused due to (a) gain of an autosome, and (b) loss of a sex chromosome in females.

2 Marks

Ans: Aneuploidy is the presence of an abnormal number of chromosomes in a cell, such as 45 or 47 instead of 46 in a human cell. It does not include a difference in one or more complete sets of chromosomes. A euploid cell has any number of complete chromosome sets.

1. Turner's syndrome
2. Down's syndrome

8. State a functional difference between the following codons: 2 Marks

a) AUG and UAA

Ans:

AUG	UAA
It is Start codon	It is Stop codon
Initiator codon	Terminator Codon

b) Specific and Degenerate

Ans:

Specific	Degenerate
A codon that codes for only one amino acid.	A codon that codes for more than one amino acid.
Only one codon	More than one codon

9. (a) Identify any two marsupials from the list given below : 2 Marks

i. **Lemur**

ii. **Spotted cuscus**

iii. **Flying phalanger**

iv. **Bobcat**

v. **Tasmanian wolf**

vi. **Mole**

Ans: A marsupial is any mammalian infraclass belonging to the Marsupialia order. All extant marsupials live in Australasia and the Americas. Flying phalanger and Tasmanian wolf are marsupials, according to the above list.

(b) ‘‘Australian marsupials exhibit adaptive radiation.’’ Justify the statement.

Ans: Any member of the mammalian infraclass Marsupialia is referred to as a marsupial. Australasia and the Americas are home to all extant marsupials. Because Australian marsupials are descended from a common ancestor, they are all found on the Australian island continent.

10. Name the type of immunity the mother provides the newborn baby. How does it happen? 2 Marks

Ans: Passive immunity is present when a baby is born. Passive immunity is created when antibodies produced by another person are transferred to another person. Passive immunity protects for a short period, usually a few weeks or months. Because mother's milk contains yellowish fluid colostrum, which provides antibodies Ig A to protect the infant.

11. Name the two primary lymphoid organs. State the importance of T-lymphocytes. 2 Marks

Ans: The lymphatic system, also known as the lymphoid system, is a part of the circulatory and immune systems invertebrates. A large network of lymph, lymphatic vessels, lymph nodes, lymphatic or lymphoid organs, and lymphoid tissues make up the lymphatic system. The bone marrow and the thymus are examples of primary lymphoid organs. They produce lymphocytes, which are immune system cells.

Importance of T-lymphocytes:

(a) They aid B-cells in the production of antibodies

(b) They are responsible for graft rejection.

12. How are malignant tumors different from benign tumors? Why are some patients treated with α-interferons? 2 Marks

Ans:

(a) When cells grow and divide more than they should or do not die when they should, an abnormal mass of tissue forms. Tumors can be benign (non-cancerous) or malignant (cancerous). Benign tumors can grow to be quite large, but they do not spread to nearby tissues or other parts of the body.

(b) Tumors can range in size from a small nodule to a large mass, and they can appear almost anywhere on the body, depending on the type. Benign tumors stay put and don't spread to other parts of the body, whereas malignant tumors multiply and spread to other parts of the body. Malignant tumors are more harmful and cause serious damage. Benign tumors cause little damage. Because it is a biological response modifier that activates the immune system, some patients are treated with alpha - interferons.

Or

Name the hormone with which a cow is administered using MOET technology. State the function of this hormone. 2 Marks

Ans: MOET (Multiple Ovulation Embryo Transfer Technology) is a technique in which an animal's multiple eggs are fertilized and the embryo is harvested on the seventh day without surgery. It is a traditional method of producing embryos in cattle that is still used today. the hormone with which a cow is administered using MOET Technology Follicular Stimulating Hormone.

Functions of FSH:

(a) FSH aids in the regulation of the menstrual cycle in women and stimulates the production of eggs in the ovaries. Women's FSH levels fluctuate

throughout the menstrual cycle, with the highest levels occurring just before the ovary releases an egg. This is referred to as ovulation.

(b) FSH aids in the regulation of sperm production in men. FSH levels in men do not fluctuate much in most cases.

(c) FSH levels in children are typically low until puberty when they begin to rise. It aids in the production of estrogen by the ovaries in females. It aids the signaling of the testes to produce testosterone in boys.

SECTION - C

13. Draw a longitudinal section of the pistil from a flowering plant, where pollination has occurred. Label the following :

(a) Stigma showing germinating pollen grains

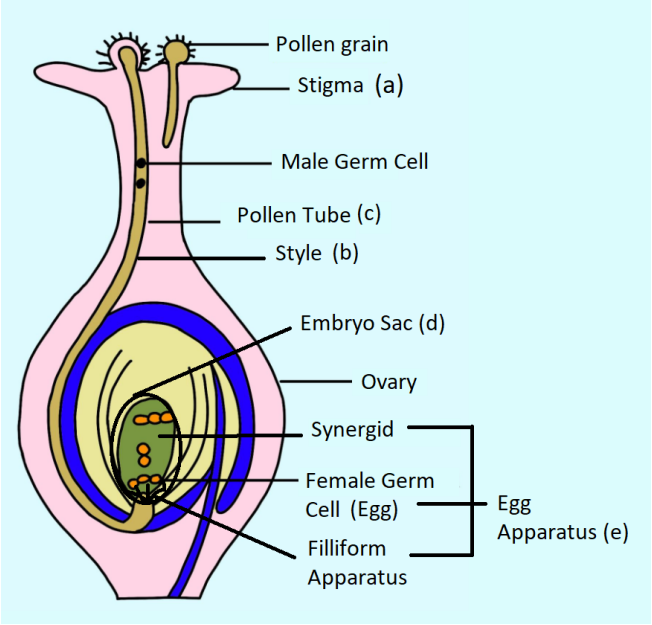
(b) Style

(c) Pollen tube reaching the micropyle of the ovule

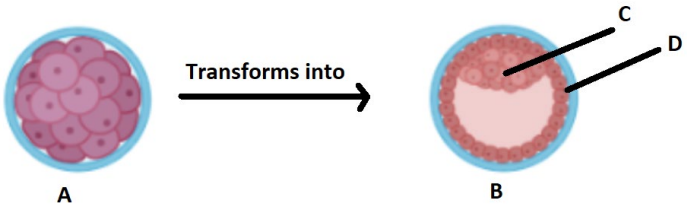
(d) Embryo sac

(e) Components of the egg apparatus

Ans:



14. Study the given diagram :



A is an embryonic stage that gets transformed into B, which in turn gets implanted in the endometrium in human females.

(a) Identify A, B, and its parts C and D.

(b) State the fate of C and D in the course of embryonic development in humans. **3 Marks**

Ans: Blastocyst is the embryonic stage that is implanted in the uterine wall of a human female. It's the stage after the morula stage when trophoblast cells form a ring around the periphery and an inner cell mass forms.

a) In the given figure,

A - Morula

B - Blastocyst

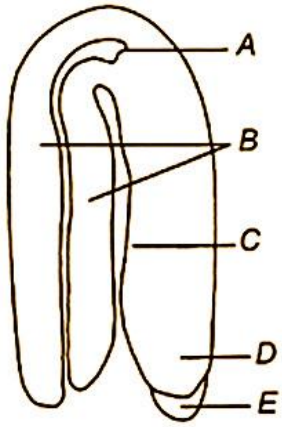
C - Stem cell

D – Trophoblast

b) Trophoblasts are the cells that make up a blastocyst's outer layer. In humans, they appear four days after fertilization. They nourish the embryo and form a significant portion of the placenta. Trophoblast aids in the attachment of the embryo to the endometrium as it forms the placenta, which is formed by stem cells.

Or

(a) Identify the figure given below and also identify the parts B, C, D, and E.



(b) State the function of E. **3 Marks**

Ans: The above is the figure of 'Mature Dicot Embryo'. The eudicot seed's two cotyledons are linked to the rest of the embryo by vascular tissue (xylem and phloem). Food reserves are stored in the endosperm of endospermic dicots.

(a) B-Suspensor

(b) C- Radicle

(c) D-Plumule

(d) E-Cotyledon

(b) A cotyledon is a seed leaf that grows inside the embryo of a seed. Cotyledons help a plant embryo get the nutrition it needs to germinate and grow into a photosynthetic organism. They can also be a source of nutritional reserves or aid the embryo in metabolizing nutrition stored elsewhere in the seed.

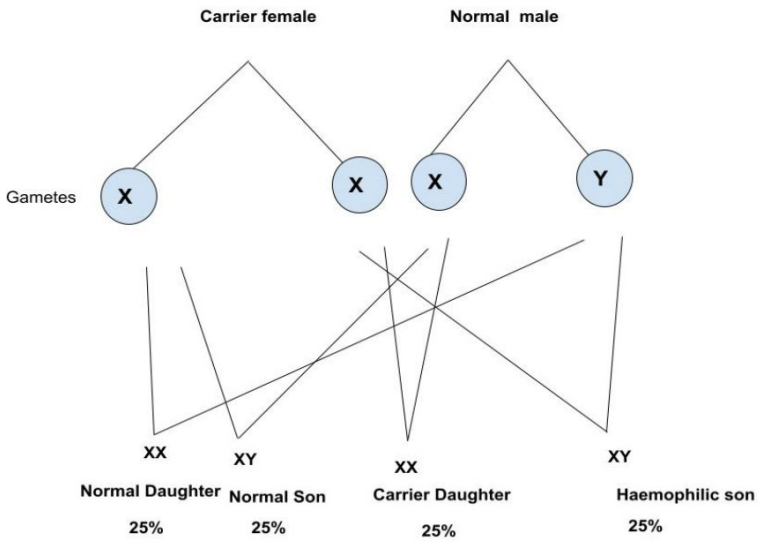
15. A normal couple has their first child, who is haemophilic. Work out a cross to show how it is possible. State the possibility of the normal and the hemophilic children, along with their sexes, that can be born to them.
3 Marks

Ans: Hemophilia is a bleeding disorder caused by an inherited inability for the blood to clot properly. This can cause bleeding on its own as well as bleeding after an injury or surgery. Clotting factors are proteins found in the blood that can help stop bleeding.

here,

Carrier female= XX^h

Normal male= XY



16. Starting from the pioneer species, trace the sequence that follows in an ecological succession on a bare rock, until the climax community is reached in an ecosystem. Name this type of succession. 3 Marks

Ans: Primary succession is a type of ecological succession that takes place in areas where there has never been any life.

a) It includes places like bare rocks, where the soil is incapable of supporting life. Volcanic eruptions, oil spills, floods, glacier retreat, and other natural disasters can all cause primary succession.

b) The pioneer species are those that have been around for a long time. After the pioneer species, intermediate species such as plants and other organisms colonize the soil and alter the soil composition and habitat. Finally, the climax community is formed, which allows for the survival of larger and more complex organisms.

c) Hardy species that are the first to colonize barren environments or previously biodiverse steady-state ecosystems that have been disrupted, such as by fire, are referred to as pioneer species.

d) Lichens, which grow on rocks without soil and break down the rocks into the soil for plants, may be among the first life forms.

e) The process of ecological succession describes how the structure of a biological community (that is, an interacting group of various species in a desert, forest, grassland, or marine environment, for example) changes over time. Lichens are the first species to appear on rocks because they secrete acid and dissolve rocks, assisting in soil formation and paving the

way for bryophytes, which hold a small amount of soil. Higher plants and scrub succeed it, and after a few stages, a stable climax forest community emerges.

17. The release of municipal wastewater and industrial waste into our natural water bodies is causing a disastrous effect on aquatic life. Explain the biological treatment that should be given to it before releasing it into the natural water bodies. 3 Marks

Ans: Municipal and industrial wastewater were combined and sent to a single drain for treatment during the first half of the twentieth century. Human and marine life were exposed to health risks as a result of this process, which necessitated the separation of municipal and industrial wastewater.

a) Municipal and industrial wastewater, when properly treated, can be a valuable source of energy and nutrients. Sludge from municipal wastewater, for example, can be used to extract energy and bio-solids for agricultural purposes, while phosphorous from eutrophication can be used to make fertilizers.

b) We are adding a disastrous effect on aquatic life by releasing municipal wastewater and industrial waste into our natural water bodies. These are the biological treatments that should be given to it before releasing it into natural water bodies to correct this.

c) To begin, the primary effluent is pumped into large aeration tanks, where it is mechanically constantly agitated and the air is pumped in, allowing useful aerobic microbes to grow into Flocs/masses of bacteria associated with fungal filaments.

d) The effluent is then passed into settling tanks where Flocs are allowed to sediment, resulting in activated sludge, as these microbes consume a large portion of the organic matter in the effluent, lowering BOD. A small portion of this is returned to the aeration tank as an inoculum, while the majority of the sludge is pumped into large tanks known as anaerobic sludge digesters, where anaerobic bacteria are grown.

e) As cities and industries expand, monetary and intellectual investments in efficient and long-term treatment of water discharged from municipal and industrial sources are required. Before releasing the nutrient-rich water back into the streams for marine life, wastewater should be viewed as a valuable resource from which energy can be extracted.

18. Mention any two advantages of the micropropagation technique. Write how its process is carried out in the laboratory. Name any two important food plants grown commercially by this method. 3 Marks

Ans:

a) Micropropagation is an artificial method for rapidly multiplication of plants in a controlled environment using tissue or cell culture techniques. The method is widely used to create genetically identical plants, pathogen-free plants, mass plant production, gene conservation, and other applications.

b) Plants are produced in vitro through asexual reproduction or vegetative propagation in this artificial propagation process. Plants can be produced asexually (via multiplication of vegetative parts) or sexually (via seed production). Clonal propagation, where plants can be populated from a single individual through asexual means of reproduction, is one method of asexual reproduction that involves multiplying genetic replicas of plants.

c) Because figs, grapes, bananas, and other plants do not produce functional seeds, asexual reproduction via the multiplication of vegetative parts is the only option for in vivo propagation. Potato, apple, and a variety of other ornamental plants have all been successfully propagated using clonal propagation techniques.

d) Micropropagation has proven to be beneficial in a variety of ways. Micropropagation has the following advantages in plant production:

e) It is an alternative method for vegetative propagation with a higher multiplication rate.

f) In a short amount of time, single plant tissue can produce a large number of identical plants.

19. When Bacillus thuringiensis enters a certain insect's body, the insect gets killed, but itself remains unaffected. Explain how it is possible. 3 Marks

Ans: Bt is a microbe that lives in the soil. It produces proteins that are poisonous to young insects (larvae). Bt comes in a variety of forms. Each one is aimed at a different type of insect. Beetles, mosquitoes, black flies, caterpillars, and moths are among the insects targeted.

1) Routine testing is required with Bt pesticides to ensure that unwanted toxins and microbes are not present. Since 1961, the US Environmental Protection Agency (EPA) has approved Bt for use in pesticides.

2) When Bacillus thuringiensis enters a certain insect's body, the insect gets killed, but itself remains unaffected because it contains some acids that produce protein from substances that are toxic to insects.

20. **3 Marks**

(a) Write how parasites have evolved with adaptation to co-exist with their hosts in an ecosystem.

Ans: Co-evolution between the host and the parasite is a special case of co-evolution. It's defined as the reciprocal adaptive genetic change of two antagonists (for example, different species or genes) as a result of reciprocal selective pressures. Hosts and parasites are subjected to reciprocal selective pressures, which can result in rapid reciprocal adaptation. The antagonists in the case of host-parasite coevolution are different.

If the parasite evolves a special mechanism to reject or resist the parasite, the parasite must (simultaneously) evolve, i.e. co-evolve, a mechanism to counteract and neutralize the parasite.

(b) Parasites are host-specific and tend to co-evolve. How would the parasite respond if the host evolves a certain mechanism to resist or reject the parasite?

Ans: To be successful with the same host species, the parasite must evolve a mechanism to counteract and neutralize the host's resistance or rejection of the parasite.

Or

(a) Name an ideal pyramid existing in an ecosystem. Construct it up to its three trophic levels along with their names. **3 Marks**

Ans: A graphical representation of the biomass or bio productivity at each trophic level in a given ecosystem is known as an ecological pyramid (also trophic pyramid, Estonian pyramid, energy pyramid, or food pyramid).

The pyramid of energy is the ideal pyramid:

carnivores - 100J

herbivores - 1000J

plants - 10000J

100000J

(b) The sun provides 1,000,000 J of sunlight (solar energy) to an ecosystem. Write the amount of energy that is available to the first and third trophic levels, respectively.

Ans: Solar energy is the radiant light and heat from the Sun that is captured through a variety of ever-evolving technologies like solar heating, photovoltaics, solar thermal energy, solar architecture, molten salt power plants, and artificial photosynthesis. Solar energy is combined with inorganic soil substances (nitrogen and other elements), as well as water and carbon dioxide in the air, by autotroph plants or producers to produce organic matter such as cellulose.

10,00,000J from sun, (1%) = 10,000 J

10,000J ⇒ 1000J ⇒ 100J

First trophic level Third trophic level

21. Global carbon is fixed in the biosphere through photosynthesis. 3 Marks

Ans: The two natural processes by which carbon is returned to the atmosphere are respiration by plants and animals and decomposition by bacteria and fungi.

Soil carbon storage is a critical ecosystem service that occurs as a result of ecological processes interacting. The effects of human activities on these processes can result in carbon loss or improved storage. The global carbon cycle is fueled by geologic processes as well as photosynthesis and animal respiration. Carbon dioxide is taken up by plants from the atmosphere and converted to carbon in plant tissue and oxygen in the atmosphere. Plants, like humans, use respiration to generate energy.

(a) Explain any two ways by which carbon is returned to the atmosphere through natural processes.

Ans: Various organic compounds decompose when plant residues are returned to the soil. Decomposition is a biological process in which complex organic molecules in the dead matter are physically broken down and biochemically transformed into simpler organic and inorganic molecules (Juma, 1998). The continuous addition of decaying plant residues to the soil surface contributes to soil biological activity and carbon cycling. These processes are aided by the breakdown of soil organic matter, as well as root growth and decay. Carbon cycling is the continuous transformation of organic and inorganic carbon compounds between the soil and the atmosphere by plants, micro, and macroorganisms.

(b) List any two human activities that have influenced the carbon cycle in nature.

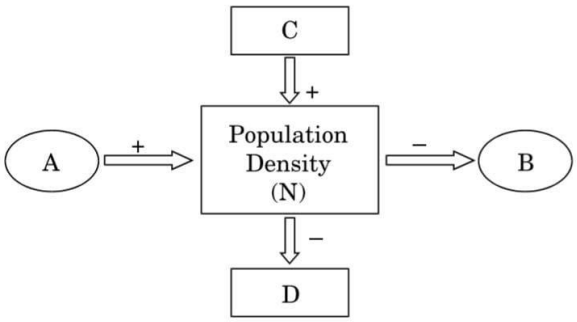
Ans: The carbon cycle in nature has been influenced by two human activities:

Fossil fuel combustion: Organic matter decays and becomes compressed beneath layers upon layers of sand, earth, rock, and ocean, resulting in fossil fuels such as coal, oil, and natural gas. The term "fossil fuel" is derived from the word "fossil," which refers to the mineralized remains of ancient creatures that once inhabited the planet. The process of burning fossil fuels produces carbon dioxide, water, and energy.

Forest fuelwood is burned: Wood fuel (also known as fuelwood) is a type of fuel that includes things like firewood, charcoal, chips, sheets, pellets, and sawdust. Source, quantity, quality, and application all influence the type of form that is used. Wood is the most readily available form of fuel in many areas, requiring no or few tools in the case of picking up dead wood, though specialized tools, such as skidders and rakes, are required in any industry.

SECTION - D

22.



Study the schematic representation given above and answer the following questions : 3 Marks

Ans: The above schematic representation shows population density. The success of organisms and the effects they have on their environment are determined by their population density. A population in biology is a group of individuals from the same species who live in the same area at the same time.

(a) Identify A in it.

Ans: In the above schematic representation, ‘A’ represents Natality. The birth rate in a population is referred to as natality. The growth or decrease in a population can be determined by comparing it to the death or mortality rate. The

total number of live births per 1,000 population divided by the number of years in the period equals the birth rate. The number of live births is usually derived from a birth registration system, while population counts are derived from a census.

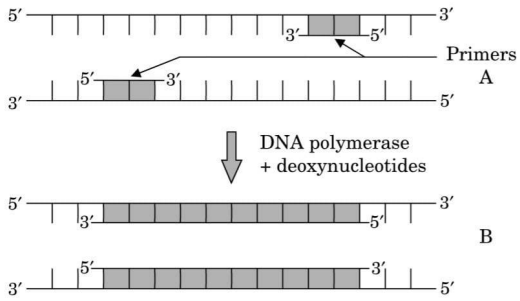
(b) Identify D in it.

Ans: In the above schematic representation, 'B' represents mortality. Mortality is the state of having to die one day or the rate of failure or loss. All animals will eventually die, which is an example of mortality. The number of high school students who do not graduate is an example of mortality. The death rate is high. A mortality rate is a measure of the frequency with which people die in a given population over a given period.

(c) When the population density at time t is N as shown above, write the population density at time t + 1 in the form of an equation using appropriate symbols.

Ans: When the population density at time t is N as shown above, but, if the population density at time t + 1 then the equation will be N (t+1)=Nt+[(B+I)-(D+E)].

23. (a) Identify steps A and B in a cycle of Polymerase Chain Reaction given below. **3 Marks**



self made

Ans: A chain reaction is a series of reactions in which a reactive product or by-product initiates more reactions. Positive feedback in a chain reaction causes a self-amplifying chain of events. The polymerase chain reaction (PCR) is a widely used method for rapidly making millions to billions of copies of a specific DNA sample, allowing scientists to take a small sample of DNA and amplify it to a large enough amount to study in-depth. in the above polymerase chain reaction,

A= Annealing: Annealing is a heat treatment process that alters a material's physical and sometimes chemical properties to increase ductility and reduce hardness, making it easier to work with.

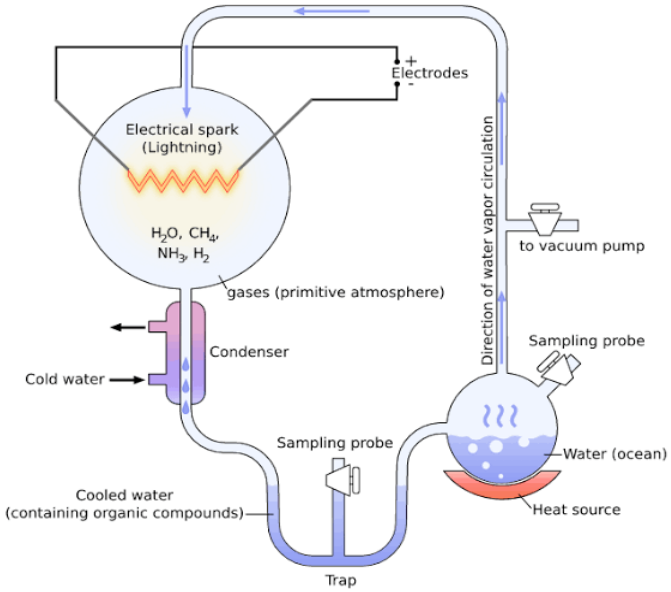
B=Extension: Each base's loosened nucleotides are used to grow the complementary DNA strand, resulting in extension. The final product is two double-stranded DNA products. The temperature used during the extension phase is determined by the type of DNA polymerase used.

(b) State the specific characteristic feature of the enzyme in carrying step B.

Ans: Proteins that act as biological catalysts are known as enzymes. Catalysts help to speed up chemical reactions. Substrates are the molecules on which enzymes can act, and the enzyme converts the substrates into different molecules called products. In repeated cycles of primer annealing, DNA synthesis, and duplex DNA dissociation to serve as new templates, a thermostable DNA polymerase is used.

The theoretical amplification of template DNA is 2^n, where n is the number of cycles, assuming no reagents are limited and the enzyme maintains full activity. so, step B carries the Thermostable (DNA Polymerase). For PCR amplification, Taq DNA polymerase is the most commonly used enzyme. With a half-life of 40 minutes at 95°C, this enzyme is extremely heat resistant. This is the specific characteristic feature of the enzyme in carrying step B.

24. Study the diagrammatic representation of S.L. Miller's experiment given below and answer the questions that follow : 3 Marks



Vedantu website

(a) How did S.L. Miller create the conditions which existed before the origin of any life on Earth?

Ans: The Miller–Urey experiment (also known as the Miller experiment) was a chemical experiment that simulated the conditions thought to exist on the early Earth in 1952 and tested the chemical origin of life under those conditions. At the time, the experiment backed up Alexander Oparin and J. B. S. Haldane's hypothesis that putative primitive Earth conditions favored chemical reactions.

(b) Name the organic compound formed and collected at the end of his experiment.

Ans: Conditions were created by electric discharge (high temperature) in a closed flask containing CH_4, NH_3, H_2, water vapors. Water (H_2O), methane (CH_4), ammonia (NH_3), and hydrogen were used in the experiment (H_2). All of the chemicals were kept in a sterile 5-liter glass flask that was connected to a 500-ml flask half-filled with water. The water in the smaller flask was heated to cause evaporation, and the resulting water vapor was allowed to enter the larger flask. Continuous electrical sparks were fired between the electrodes to simulate lightning in the water vapor and gaseous mixture, and then the simulated atmosphere was cooled, causing the water to condense and flow into a U-shaped trap at the bottom of the apparatus.

(c) Mention the kind of evolution his experiment supports.

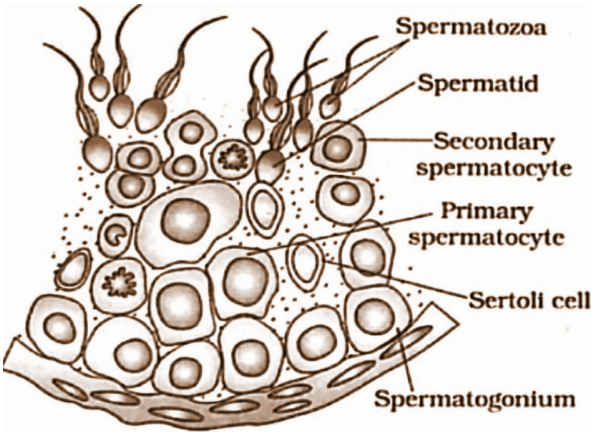
Ans: The solution collected at the trap turned pink after a day, and the solution was deep red and turbid after a week of continuous operation. To prevent microbial contamination, the boiling flask was removed and mercuric chloride was added. The reaction was halted with the addition of barium hydroxide and sulfuric acid, and the impurities were removed by evaporation. Miller identified five amino acids in the solution using paper chromatography: α-alanine, β-alanine were positively identified, while aspartic acid and -aminobutyric acid (AABA) were less certain due to the faint spots. Thus, the amino acid is the organic compound formed and collected at the end of his experiment.

Thus, the kind of evolution his experiment supports is called chemical evolution. The first step in the evolution of life on this planet was the formation of complex organic molecules (see also organic molecules) from simple inorganic molecules in the oceans during the early history of the Earth. Chemical evolution took place over less than a billion years.

SECTION - E

25. (a) Draw the sectional view of a seminiferous tubule of humans. Label it's six parts. **5 Marks**

Ans: a) Seminiferous tubules are tubules found in the testes that are mostly coiled. Spermatozoa (male gametes) are produced in these cells. Sertoli cells, which are sustentacular columnar cells, and spermatogenic cells, which give rise to sperm cells, make up the epithelial lining of the seminiferous tubule. The sectional view of a seminiferous tubule of humans is as follows:



(b) Name the pituitary hormones involved in the process of spermatogenesis. State their functions.

Ans: Your pituitary gland is a small but vital organ. Your brain, skin, energy, mood, reproductive organs, vision, growth, and other vital organs are all affected if your pituitary gland isn't functioning properly. It is known as the "master" gland because it directs the release of hormones from other glands. The pituitary gonadotropins FSH and LH are required for the development and maintenance of spermatogenesis. In response to the hypothalamic gonadotropin-releasing hormone, both hormones are secreted and regulated as part of the HPG axis (GnRH).

FSH: Your pituitary gland, a small gland beneath your brain, produces FSH. FSH is an important hormone for sexual development and function. FSH aids in the regulation of the menstrual cycle in women and stimulates the production of eggs in the ovaries.

LH: Your pituitary gland, a small gland beneath your brain, produces LH. LH is essential for sexual development and function. LH aids in the regulation of the menstrual cycle in women. It also causes an egg to be released from the ovary.

Or

5 Marks

(a) IUDs are said to be effective contraceptives. Name any two commonly used IUDs and write the mode of their actions.

Ans: When choosing the most appropriate contraceptive method, many factors must be considered by women, men, or couples at any point in their lives. These factors include safety, effectiveness, accessibility, and affordability, as well as acceptability. Contraceptive counseling, when provided, is an important guiding principle, as is a voluntary informed choice of contraceptive methods.

Progestasert- The Progestasert system combines the benefits of IUDs and oral mini dose progesterone preparations in one convenient package. For one year, an internal device delivers progesterone to the uterine lumen and endometrium. A T-shaped Progestasert with a daily release of 65 mcg has been chosen for clinical use on a large scale. It prevents implantation by making the uterus unsuitable.

CuT- Copper (Cu) T is another name for CuT. Because copper is spermicidal, it is a contraceptive device used by women. Contraceptives are an important method in family planning because they are used to prevent pregnancy. Copper ions reduce sperm motility.

(b) When is sterilization advised to married couples? How is it carried out in a human male and a female, respectively?

Ans: Sterilization is any of several medical birth control methods that prevent a person from reproducing. Surgical and non-surgical sterilization methods are available for both males and females. Sterilization is recommended for the male/female partner as a last resort to avoid further pregnancies.

In male: Male sterilization, also known as vasectomy, is a surgical procedure that involves cutting and tying the two tubes that carry sperm from the testes (testicles) to the penis (vas deferens). Vasectomy is a surgical procedure that provides long-term contraception. Vasectomies are performed on about 15,000 men in Australia each year.

In females: Tubectomy, also known as tubal sterilization, or female sterilization is a long-term contraception procedure for women. It is a surgical procedure that prevents the egg released by the ovary from reaching the uterus by blocking the fallopian tubes. Around the belly button, a few small incisions are made. A laparoscope, a telescopic device, is inserted through one of the cuts. The tip of the laparoscope has a small camera that transmits images to a screen, giving the surgeon a view of the internal organs. The surgeon inserts special instruments to seal the tubes by following the images and working through the tiny cuts.

26. Explain the expression of lac operon genes in E. coli growing in a lactose-containing culture medium. 5 Marks

Ans:

a) Lactose metabolism genes are found in the lac operon of E. coli. When lactose is present but glucose is not, it is expressed. The lac repressor and catabolite activator protein are two regulators that turn the operon "on" and "off" in response to lactose and glucose levels (CAP).

b) Lactose is sensed by the lac repressor. When lactose is present, it stops acting as a repressor and blocks transcription of the operon. Lactose is sensed indirectly by the lac repressor via its isomer allolactose.

c) CAP, or catabolite activator protein, is a glucose sensor. When glucose levels are low, it activates transcription of the operon. Through the "hunger signal" molecule cAMP, CAP detects glucose indirectly.

d) Lactose can be broken down by E. coli bacteria, but it is not their preferred fuel. They would much rather use glucose if it is available. Lactose is broken down in fewer steps and with less energy than glucose. If lactose is the only sugar available, however, E. coli will use it as an energy source right away.

e) The repressor is inactivated in the presence of an inducer, lactose, by interaction with the inducer, allowing RNA polymerase access to the promoter and transcription to proceed. Lac mRNA is then transcribed, followed by the synthesis of ß galactosidase, permease, and transacetylase.

Or

Name the types of cells and the process by which hnRNA is formed. Describe the processing mechanism it undergoes before it becomes functional.

a) Heterogeneous nuclear RNA is abbreviated as hnRNA. RNA Polymerase II produces large pre-mRNAs of various nucleotide sequences, which are processed in the nucleus to become cytoplasmic mRNAs.

b) The process of copying a segment of DNA into RNA is known as transcription. Messenger RNA is made up of DNA segments that have been transcribed into RNA molecules that can encode proteins (mRNA). Non-coding RNAs are made from segments of DNA that are not copied into RNA molecules (ncRNAs).

c) The amount of mRNA in a given tissue is more than 10 times that of ncRNA when measured across multiple cell types (though in particular single cell types ncRNAs may exceed mRNAs). Even though less than 2%

of the human genome can be transcribed into mRNA, at least 80% of mammalian genomic DNA can be transcribed into mRNA, the general preponderance of mRNA in cells is valid.

d) Nucleic acids, such as DNA and RNA, use base pairs of nucleotides as a complementary language. An RNA polymerase reads a DNA sequence during transcription and produces a complementary, antiparallel RNA strand called a primary transcript.

e) During transcription in eukaryotic cells, the primary transcript contains both exons and introns, which are non-functional. The primary transcript is then subjected to splicing, in which introns are removed and exons are joined in a defined order. A nucleotide (methyl guanosine triphosphate) is added to the 5' end of hnRNA during capping.

27. There is a great concern all over the world to conserve biodiversity for maintaining the ecological balance in nature. Explain giving three reasons. Write different ways that have helped in increasing the tiger population in our country. 5 Marks

Ans: Biodiversity refers to the variety of plants, animals, and microorganisms that exist, as well as the genes they contain and the ecosystems in which they live. We are fortunate to live in the lowland tropics, where biodiversity is abundant. Tropical areas are known to have more species per square kilometer than temperate areas, and biodiversity declines as the altitude rise.

The following three reasons should be considered when conserving biodiversity:

a) Narrowly utilitarian - Nature provides humans with numerous economic benefits, such as food, firewood, fiber, and industrial products.

b) Broadly utilitarian - Contribute to a variety of ecological services, such as the production of oxygen and pollination.

c) Ethical - Every species has intrinsic value, and we have a moral obligation to care for it and pass on our biological legacy to future generations in good condition.

To save tigers, there are two approaches:

a) in situ conservation (protecting the natural habitat of the forest where the tiger lives/protecting the entire ecosystem).

b) Ex situ conservation– threatened tigers are removed from their natural habitat and placed in special settings, such as zoological parks or wildlife sanctuaries, for protection and special care.

Or

What is integrated organic farming? How did Ramesh Chandra Dagar, a farmer from Sonepat, Haryana effectively use this procedure and succeed with zero waste?

Ans:

1. Organic farming is an agricultural system that emphasizes crop rotation and companion planting while utilizing organic fertilizers such as compost manure, green manure, and bone meal. It began in the early twentieth century as a reaction to rapidly changing agricultural practices.

2. Integrated farming is a type of agriculture that uses a variety of production enterprises, long and diversified crop rotations, and crop residue or animal excreta restitution to the soil to reduce the use of inputs from outside the farm.

3. Integrated Organic farming is a type of farming system that focuses on cultivating the land and raising crops in such a way that the soil remains alive and healthy. Organic wastes (crop, animal, and farm wastes, aquatic wastes) and other biological materials, mostly produced in situ, are combined with beneficial microbes (biofertilizers) to release nutrients to crops.

4. Integrated organic farming is a cyclical process that recycles waste products from one process as nutrients for another.

5. In a chain of processes, his farm includes beekeeping, dairy management, water harvesting, composting, and agriculture.

6. Chemical fertilizers are not required because cattle excreta (dung) is used as a natural fertilizer. Crop waste can be composted and used to generate natural gas to meet the farm's energy requirements.

Class XII
BIOLOGY (Theory) CBSE 2019

Time: 3 Hrs.
Max. Marks: 70

GENERAL INSTRUCTIONS:

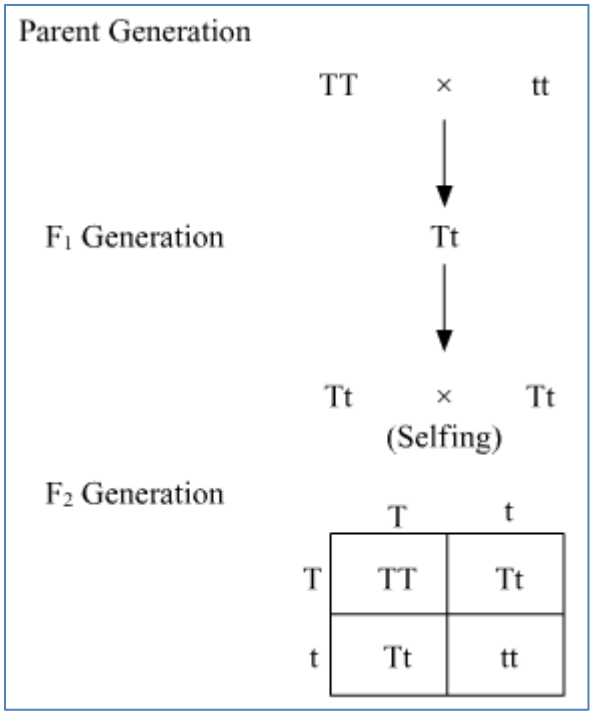
(i) There are total 27 questions and four sections in the question paper. All questions are compulsory.
(ii) Section A contains question number 1 to 5, very short answer type questions of one mark each.
(iii) Section B contains question number 6 to 12, short answer type-I questions of two marks each.
(iv) Section C contains question number 13 to 24, short answer type-II questions of three marks each.
(v) Section D contains question number 25 to 27, long answer type questions of five marks each.
(vi) There is no overall choice in the question paper, however, an internal choice is provided in two questions of one mark, two questions of two marks, four questions of three marks and all the three questions of five marks. In these questions, an examinee is to attempt any one of the two given alternatives.
(vii) Wherever necessary, the diagram drawn should be neat and properly labeled.

Section A

Question 1: British geneticist R.C. Punnett developed a graphical representation of a genetic cross called "Punnett Square". Mention the possible result this representation predicts of the genetic cross carried.

Solution:

Punnett Square for Mendelian monohybrid cross between pure line tall and dwarf plant will appear as following :



Result of F_2 generation phenotypic ratio of monohybrid cross is $3:1$.

Question 2: State the two principal outcomes of the experiments conducted by Louis Pasteur on origin of life.

Solution:

Louis Pasteur by careful experimentation demonstrated that:

(i) Life comes only from pre-existing life.

(ii) In pre-sterilized flasks, life did not come from killed yeast while in another flask open to the air; new organisms arose from killed yeast.

Question 3: Name the layer of the atmosphere that is associated with 'good ozone'.

OR

Mention the term used to describe a population interaction between an orchid growing on a forest tree.

Solution:

Good ozone is found in upper part of the atmosphere called the stratosphere.

OR

Between an orchid growing on a forest tree, the population interaction is commensalism in which orchid is benefitted and forest tree remains unaffected.

Question 4: What are 'flocs', formed during secondary treatment of sewage?

OR

Write any two places where methanogens can be found.

Solution:

Flocs are masses of bacteria associated with fungal filaments and they are helpful in increasing the decomposition rate and they are put in the aeration tank while secondary sewage treatment is in process.

Question 5: At what stage does the meiosis occur in an organism exhibiting haploidic life cycle and mention the fate of the products thus produced?

Solution:

Organisms exhibiting haploidic life cycle show meiosis at zygote stage of their life cycle. Products of meiosis, in their life cycle are haploid cells, which germinate/develop to produce new organisms.

Section B

Question 6: You are conducting artificial hybridization on papaya and potato. Which one of them would require the step of emasculation and why ? However for both you will use the process of bagging. Justify giving one reason.

Solution:

Potato plant bears bisexual flowers. This is the reason that the process of emasculation, that is, removal of stamen will be performed in potato and not in papaya that bears unisexual flowers. However, bagging is performed in both the flowers because the stigma needs to be protected from getting pollinated with undesired pollen.

Question 7: How would the gene flow or genetic drift affect the population in which either of them happens to take place?

Solution:

(i) Gene flow (gene migration multiple times) or genetic drift (sudden, chance event) affects the population by changing allele frequency in both old and new populations thereby altering the Hardy-Weinberg equilibrium.
(ii) (a) Disturbance in genetic equilibrium would be interpreted as resulting in evolution in a population.
(b) If the original drifted population becomes founders of a new population, the effect is called founder effect.

Question 8: Differentiate between the roles of B-lymphocytes and T-lymphocytes in generating immune responses.

OR

Principle of vaccination is based on the property of "memory" of the immune system. Taking one suitable example, justify the statement.

Solution:

T lymphocytes	**B lymphocytes**
Originate in the bone marrow and mature in the thymus.	They are born and also mature in bone marrow.
T cells multiply and differentiate into helper, regulatory, or cytotoxic T cells or become memory T cells.	B lymphocyte differentiates into a plasma cell, which secretes immunoglobulin.
T cells are involved in cell- mediated immunity	B cells are primarily responsible for humoral immunity (relating to antibodies).

OR

The principle of vaccination is based on the property of 'memory' of the immune system. In vaccination, a preparation of antigenic proteins of the pathogen or attenuated (inactivated/weakened) pathogen is introduced in the body. The antibodies produced in the body against these pathogens will neutralize the pathogenic agents during actual infection. The vaccine also generates memory B-cells and T-cells that recognize the pathogen quickly on subsequent exposure. For example, vaccination against polio prevents the actual pathogen from resulting in infection.

Question 9: Explain the relevance of "Totipotency" and "Somaclones" in raising healthy banana plants from virus infected banana plants.

Solution:

Totipotency can be defined as the ability of a cell/explant to give rise to the whole new plant. This property allows the meristem tissue of a Banana plant to be grown in a culture medium. As the meristematic cells are not infected (virus-free) and being totipotent, they can form the callus. The somaclones are produced via tissue culture and are called so because of their genetic and morphological similarity to the parent plant. These somaclones then give rise to the new plantlets that are infection free.

Question 10: How is a continuous culture system maintained in bioreactors and why?

Solution:

In continuous culture system, the used medium is drained out from one side while fresh medium is added from the other to maintain the cells in their physiologically most active

log/exponential phase. Continuous culture method produces a larger biomass leading to higher yield of desired protein.

Question 11: List any four ways by which GMO's have been useful for enhanced crop output.

Solution:

GMO's have been useful for enhanced crop output in different ways:

(i) genetically modified crops are more tolerant to abiotic stresses (cold, drought, salt, heat) (ii) These genetic modifications have helped to reduce post harvest losses implying less damage to crop yield. (iii) Genetic modification has reduced reliance on chemical pesticides by creating pest resistant crops. eg. Tobacco, leading to greater crop yield. (iv) Creation of insect resistant crops such as Bt cotton and Bt corn has enhanced crop yield. (v) Increased efficiency of mineral usage by GM plants prevents early exhaustion of fertility of soil resulting in increased yield.

Question 12: Mention four significant services that a healthy forest ecosystem provides.

OR

Substantiate with the help of one example that in an ecosystem mutualists

(i) tend to co-evolve and

(ii) are also one of the major causes of biodiversity loss.

Solution:

Ecosystem services provided by healthy forest ecosystems are

(i) Purification of air.
(ii) Maintenance of biodiversity.
(iii) Provide wild life habitat.
(iv) Storage site for carbon.
(v) Cycling of nutrients.
(vi) Mitigate droughts and floods.

OR

(i) In nature, mutualists often co-evolve such as in Mediterranean orchid Ophrys. Ophrys employs sexual deceit to get pollinated by a species of bee. One petal of flower resemble to female bee. If female bee changes its colour pattern ever slightly the success of pollination will be reduced unless orchid flower co-evolves to maintain resemblance with female bee.
(ii) Co-extinction is one of the 'Evil Quartet' in which organisms with obligatory relationship like plant pollinator mutualism will result in extinction of one partner if other is eliminated in nature.

Section C

Question 13: Pollen banks are playing a very important role in promoting plant breeding programme the world over. How are pollens preserved in the pollen banks? Explain. How are such banks benefitting our farmer? Write any two ways.

Solution:

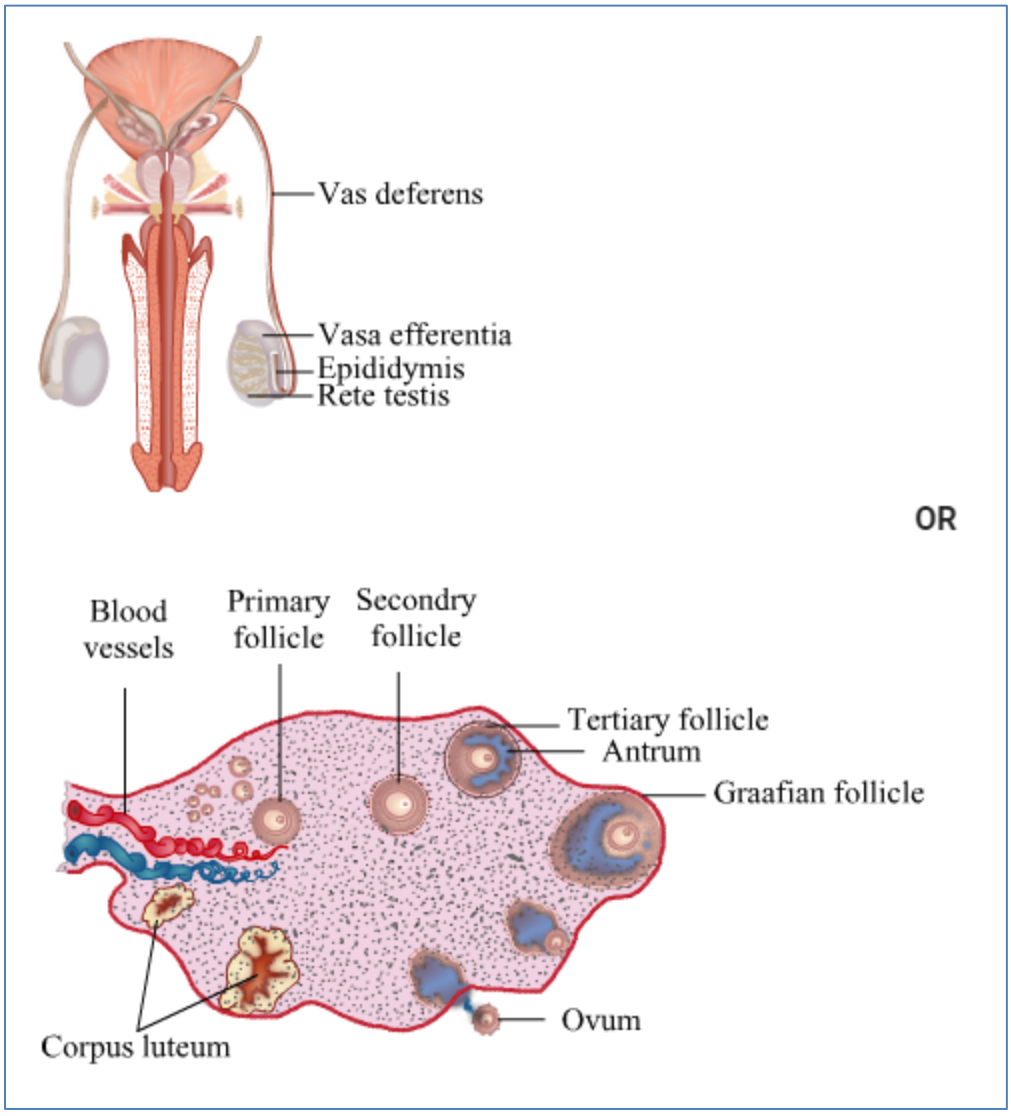
Pollen banks are used to store pollens for a very long period of time in viable conditions. Pollens are preserved in a bank using cryopreservation i.e., they are stored in a viable condition in low-temperature conditions (-196 degree Celsius) using liquid nitrogen.

The important applications of pollen banks for our farmers are the following:
1. To preserve the agricultural biodiversity in the form of preservation of valuable genetic resources.
2. These pollens can be used in various crop hybridization breeding programmes, biochemical and physiochemical studies such as the study of allergens etc.

Question 14: Draw a labelled diagram to show interrelationship of four accessory ducts in a human male reproductive system.

OR

Draw a sectional view of the human ovary showing the different stages of developing follicles, corpus luteum and ovulation.



Question 15: Compare in any three ways the chromosomal theory of inheritance as proposed by Sutton and Bovery with that of experimental results on pea plant presented by Mendel.

OR

(a) Explain linkage and recombination as put forth by T.H. Morgan based on his observations with Drosophila melanogaster crossing experiment.

(b) Write the basis on which Alfred Sturtevant explained gene mapping.
Solution:
Through any of the given ways chromosomal theory of inheritance and experimental results presented by Mendel can be compared:
(i) In a diploid organism, the factors (genes) and chromosomes occur in pairs.
(ii) Both chromosomes as well as genes segregate at the time of gamete formation such that only one of each pair is transmitted to a gamete.
(iii) A gamete contains only one chromosome of a type and only one of the two alleles of a trait.
(iv) The paired condition of both chromosomes as well as Mendelian factors is restored during fertilisation.

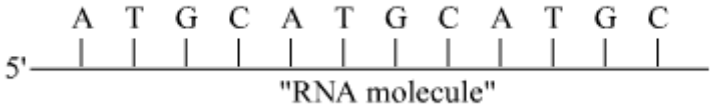
OR

(a) T.H. Morgan studied X-linked genes in Drosophila and saw that when the two genes in a dihybrid cross were situated on the same chromosome, the proportion of parental gene combinations was much higher than the non-parental type. He attributed this due to the physical association or linkage of the two genes on a chromosome and coined the term linkage and the term recombination describes the generation of non-parental gene combination.
(b) Alfred Sturtevant explained gene mapping by using the frequency of recombination between gene pairs on the same chromosome as a measure of the distance between genes and he mapped their position on the chromosome.

Question 16: Explain the mechanism of DNA replication with the help of a replication fork. What role does the enzyme ONA-ligase play in a DNA replication fork?

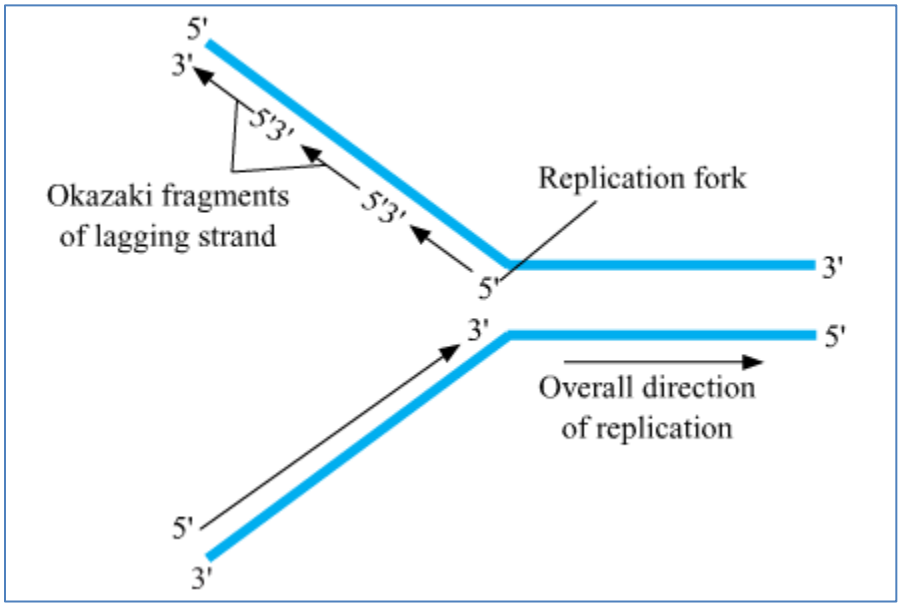
OR

Construct and label a transcription unit from which the RNA segment given below has been transcribed. Write the complete name of the enzyme that transcribed this RNA.



Solution:
DNA replication occurs in small replication forks. It does not occur in its entire length in one time as DNA is a very large molecule and only that part of DNA opens up which is being replicated. The opening of the whole DNA molecule would be an energetically more expensive process.
The main enzyme involved in DNA replication is the DNA-dependent DNA polymerase. This enzyme catalyzes the polymerization of deoxynucleotides along the $5' \rightarrow 3'$ direction, and hence, replication is continuous along the $3' \rightarrow 5'$ strand (leading strand) and discontinuous along the template, i.e., the $5' \rightarrow 3'$ direction (lagging strand).
Okazaki fragments are short DNA segments on the lagging strand, formed in the $5' - 3'$ direction, starting from RNA primers. A separate RNA primer is needed for the synthesis of each Okazaki fragment. These discontinuously synthesized fragments are later joined by the enzyme DNA ligase.

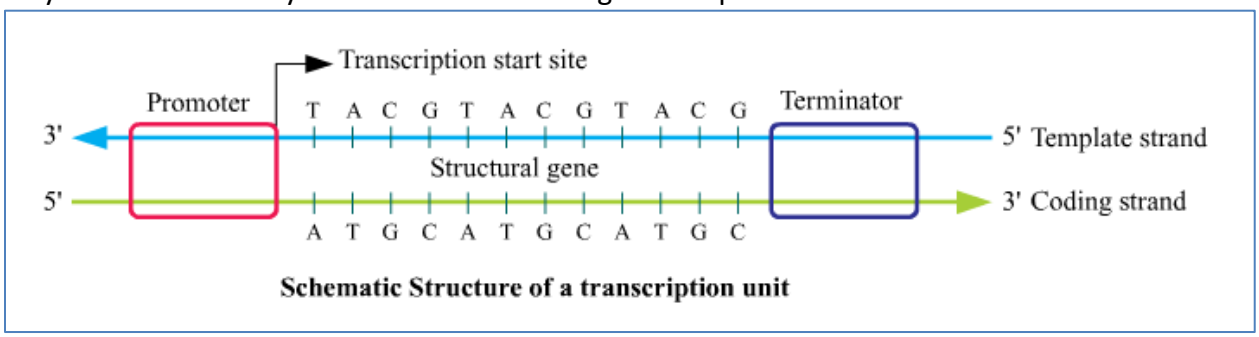
Ori stands for Origin of replication. This site has the highly conserved sequence of DNA among various species. The replication of DNA starts here because this site attracts some proteins which help in the opening and unwinding of DNA and this leads to the initiation of replication. The function of DNA Ligase is to join the two nucleotides. During the DNA replication process, it joins the Okazaki fragments of the daughter DNA to form the complete DNA molecule on the lagging strand.



OR

As per the question, the RNA strand given is having Thymine which is not possible. Hence, the question is wrong.

Taking U (Uracil) instead of T (Thymine) in the given strand the possible solution shall be RNA Polymerase is the enzyme which is used during transcription.



Schematic Structure of a transcription unit

Question 17:

(a) Write two differences between Homo erectus and Homo habilis.

(b) Rearrange the following from early to late geologic periods :

Carboniferous, Silurian, Jurassic.

Solution:

(a)

Character	Homo erectus	Homo habilis
(i) Brain capacity	900 cc	650-800 cc
(ii) Eating habit	They probably ate meat	They probably did not eat

		meat

(b) The correct sequence from early to late geological period is :

$\text{Silurian period} \rightarrow \text{Carboniferous period} \rightarrow \text{Jurassic period}$

Question 18: Name the group of bacteria involved in setting milk into curd. Explain the process they carry in doing so. Write another beneficial role of such bacteria.

Solution:

Lactobacillus and other Lactic Acid Bacteria (LAB) are responsible for the curdling of milk. These bacteria utilise and act upon the milk sugar lactose leading to its oxidation to lactic acid. This lactic acid produced in turn leads to partial digestion and coagulation of milk proteins to form curd. Action by LAB also leads to an increase in vitamin B_{12} content of the curd.

On consumption of curd, these bacteria add to the healthy and beneficial gut flora outcompeting the growth of harmful gut flora.

Question 19: Bee keeping practice is a good income generating industry. Write the different points to be kept in mind for successful bee keeping. Write the scientific name of the most common Indian species used for the purpose.

Solution:

The important points for successful bee keeping are as follows.

(i) Knowledge about habits and nature of bees

(ii) Selection of suitable location for placing beehives

(iii) Catching and hiving of group of bees

(iv) Management of beehives during various seasons The scientific name of the most common Indian species used for apiculture is Apis indica.

Question 20:

(a) Match the microbes listed under Column-A with the products mentioned under Column-B.

Column -A	**Column -B**
(H) Peniciffium notatum	**(i) Statin**
(I) Trichoderma polysporum	**(ii) ethanol**
(J) Monascus purpures	**(iii) antibiotic**
(K) Saccharomyces cerevisia	**(iv) Cyclosporin-A**

(b) Why does 'Swiss Cheese' develop large holes?

Solution:

(a)

(H) Peniciffium notatum	(iii) antibiotic
(I) Trichoderma polysporum	(iv) Cyclosporin -A
(J) Monascus pupurea	(i) Statin
(K) Saccharomyces cerevisiae-	(ii) ethanol

(b) Swiss cheese develops large holes because of the large amount of carbon dioxide produced by the bacterium Propionibacterium shermanii.

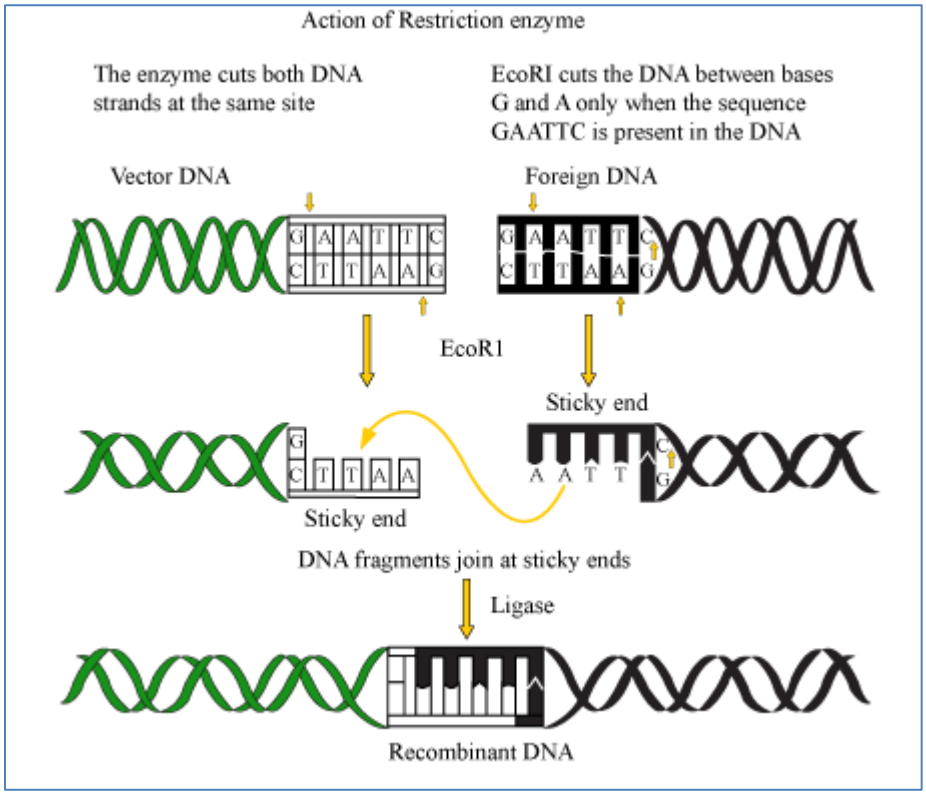
Question 21: Describe the formation of recombinant DNA by the action of EcoRI.

OR

Describe the process of amplification of "gene of interest" using PCR technique.

Solution:

Restriction endonuclease enzyme EcoRl is used in the molecular biology to cut the foreign DNA and vector DNA to form overhangs (called sticky ends). These sticky ends then form hydrogen bonds with their complementary counterparts. The segments with the help of DNA ligases are joined to produce recombinant DNA.



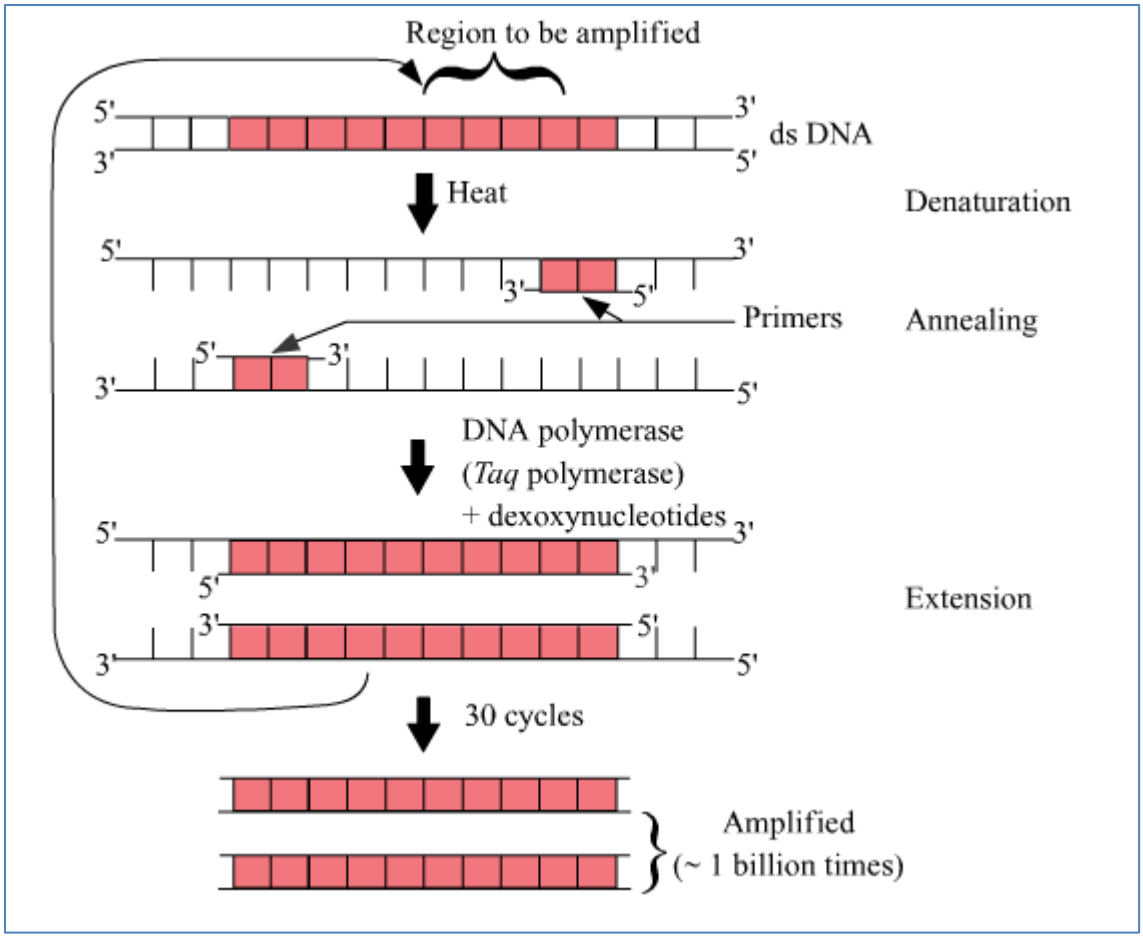
OR

To amplify the gene segment of the interest we should know the sequence of the gene of interest. Primers are designed for amplifying the gene of interest. Two sets of primers (chemically synthesized oligonucleotide stretches) that are complementary to the gene of interest, DNA polymerase enzyme, and deoxynucleotides are added. PCR can then be carried out for its amplification.

PCR consists of 3 steps: • Denaturation - Double-helical DNA is denatured by providing high temperature(95-degree Celsius). DNA polymerase does not get degraded in such high temperatures. The DNA polymerase used in this reaction is thermostable and is isolated from the thermophilic bacteria, Thermus aquaticus(Taq).

• Annealing- It is the step in which primers are annealed to single-stranded DNA templates. Two sets of primers are used. The temperature of the reaction mixture is lowered to 50- 65°C for some seconds to allow annealing of primers. DNA polymerase extends the primer in 5' to 3' direction.

• Extension - Replication of DNA occurs in vitro.



-This cycle is repeated several times to generate up to 1 billion identical copies of the DNA.

Question 22: Two children, A and B aged 4 and 5 years respectively visited a hospital with a similar genetic disorder. The girl A was provided enzyme-replacement therapy and was advised to revisit periodically for further treatment. The girl, B was, however, given a therapy that did not require revisit for further treatment.

(a) Name the ailments the two girls were suffering from ?

(b) Why did the treatment provided to girl A required repeated visits ?

(c) How was the girl B cured permanently ?

Solution:

(a)

ADA (adenosine deaminase) deficiency is a form of SCID (severe combined immunodeficiency)- a type of disorder that affects the immune system. The disease is caused by a mutation in a gene on chromosome 20. The gene codes for the enzyme adenosine deaminase (ADA). Without this enzyme, the body is unable to break down a toxic substance called deoxyadenosine. The toxin builds up and destroys infection-fighting immune cells called T and B lymphocytes.

(b)

Girl A was given Enzyme replacement therapy in which lymphocytes isolated from patient's blood are cultured in-vitro. Functional ADA cDNA are then introduced into the cultured lymphocytes. These lymphocytes are returned back to the patient's body. Lymphocytes are not

immortal. Therefore, repeated infusion of genetically engineered lymphocytes is required and hence it is not a permanent treatment and the patient have to revisit periodically in the future.
(c)
Girl B was treated with gene therapy through the gene isolated from bone marrow cells producing ADA is introduced into cells at early embryonic stages which are a permanent cure so the patient is cured permanently.

Question 23: List six advantages of "ex-situ' approach to conservation of biodiversity.

Solution:

The Ex-situ conservation involves protection of the plants and animals away from the natural habitat. Zoological parks, botanical gardens, and wildlife safari parks serve this purpose. It offers the following advantages:
(i) The endangered organisms are protected from their exploitation and can be maintained in artificial habitats.
(ii) Their breeding programs can be regulated and the gametes, as well as embryos, can be preserved in viable and fertile conditions.
(iii) Seeds from different genetic strains can be made to undergo hybridization and can be kept for future experiments.
(iv) The health of individuals can be monitored and medical assistance can be given as required.
(v) Modern reproductive technology can increase the chances of reproductive success.
(vi) Research into reproductive physiology, lifestyle, and ecology of an endangered species is made easier.

Question 24: While on a visit to a pond in the city-neighbourhood, the visitors were delighted to find large expanse of water covered with colourful algal mass.
(a) As a student of biology, do you agree with their delight? Give reasons in support of your answer.
(b) Explain the cause of such algal growth.

Solution:

(a) What the villagers saw and are delighted about is algal bloom over a stationary water body. This algal bloom will cut off the supply of light and oxygen to the submerged flora and fauna of the water body. It will outcompete the water bodies flora and fauna for nutrients and will rapidly grow and deplete other organisms in the given water body ecosystem of necessary nutrients. This will quickly lead to the death, decay and destruction of the already existing water body ecosystem.

(b) The flushed out and washed nutrients from the excess fertilisers of the nearby fields had accumulated and promoted the sudden burst in the growth of algal bloom on the water body. This phenomenon is often termed as Cultural or Accelerated Eutrophication.

Section D

Question 25: (a) Explain one application of each one of the following:
(A) Amniocentesis
(B) Lactational amenorrhea
(C) ZIFT
(b) Prepare a poster for the school programme depicting the objectives of : "Reproductive and Child Health Care Programme".

OR

(a) Explain any two ways by which apomictic seed can develop.

(b) List one advantage and one disadvantage of a apomictic crop.

(c) Why do farmers find production of hybrid seeds costly?

Solution:

(a)

(A) Amniocentesis is a process by which amniotic fluid (fluid present inside the uterus surrounding the unborn baby) from the uterus of a pregnant lady is taken out by a needle to test the developmental abnormalities of the baby inside the mother's womb. This test can detect genetic disorders like thalassemia, Down's syndrome, anaemia, and many other abnormalities before birth.

(B) Lactational amenorrhea: It is the absence of menstruation during lactation. So, in the lactation period, the chances of conception are almost zero.

(C) ZIFT: It stands for zygote intrafallopian transfer. In ZIFT, the sperm from a donor male and the ova from a donor female are fused in the laboratory. The zygote so formed is transferred into the fallopian tube at the 8 blastomeres stage. This process is used to treat the condition of infertility.

OR

(a) The two ways in which apomictic seeds can develop are:-

1. Recurrent Apomixis: An embryo sac develops from the megaspore mother cell with disturbed meiosis due to which the egg-cell is diploid. The embryo subsequently develops directly from the diploid egg-cell without fertilization.
2. Adventive Polyembryony: Embryos arise from a cell or a group of cells either in the nucellus or in the integuments, e.g. in oranges and roses. Since it takes place outside the embryo sac, it is not grouped with recurrent apomixis. Embryo within the embryo sac may also develop simultaneously, thus giving rise to polyembryony condition, as in Citrus, Opuntia.
(b) An advantage of apomictic crop is that the vigor is maintained and these seeds can be raised to grow new crop year after year resulting in tremendous crop production. A disadvantage of the apomictic crop is that it reduces genetic diversity.
(c) The production of hybrid seeds involves a process of artificial hybridization that comes along with steps such as emasculation, bagging, raising of seedlings in nursery beds etc. This process requires intensive labor and is also not feasible economically for all farmers. Also, the hybrid seeds cannot be used for the next season. This further adds to their cost.

Question 26: Differentiate between incomplete dominance and co-dominance. Substantiate your answer with one example of each.

OR

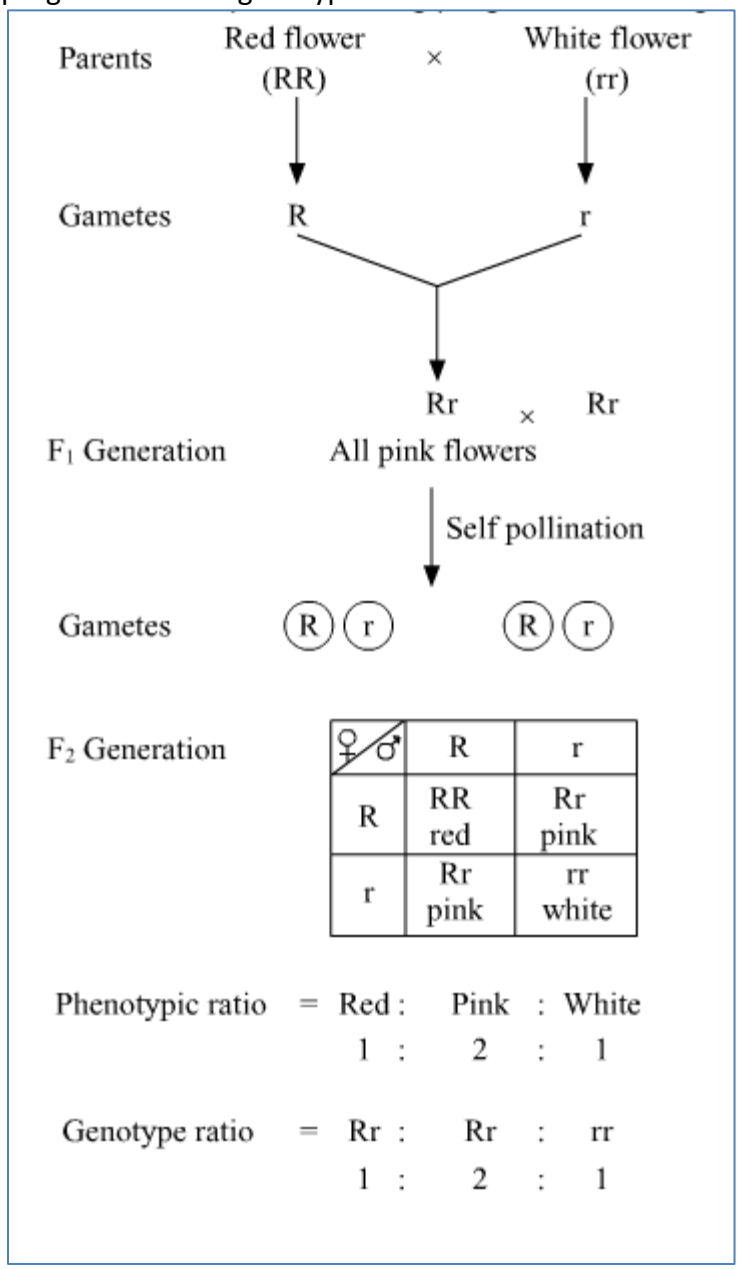
(a) Write the contributions of the following scientists in deciphering the genetic code.
Georce Gamow ; Hargobind Khorana ; Marshall Nirenberg ; Severo Ochoa
(b) State the importance of a Genetic code in protein biosynthesis.

Solution:

Co-dominance is the phenomenon in which both the alleles of a contrasting character are expressed in the heterozygous condition. Both the alleles of a gene are equally dominant. ABO blood group in human beings is an example of co-dominance. The blood group character is controlled by three sets of alleles, namely 4^3. The alleles, I^A and I^B, are equally dominant and are said to be co-dominant as they are expressed in the AB blood group. Both these alleles do not interfere with the expression of each other and produce their respective antigens. Hence, the AB blood group is an example of co-dominance.

Allele from Parent 1	Allele from Parent 2	Genotype of offspring	Blood type of offspring
I^A	I^A	$I^A I^A$	A
I^A	I^B	$I^A I^B$	AB
I^A	i	I^A i	A
I^B	I^A	$I^A I^B$	AB
I^B	I^B	$I^B I^B$	B
I^B	i	I^B i	B
i	i	i i	O

Incomplete dominance is a phenomenon in which one allele shows incomplete dominance over the other member of the allelic pair for a character. For example, a monohybrid cross between the plants having red flowers and white flowers in Antirrhinum species will result in all pink flower plants in the F_1 generation. The progeny obtained in F_1 generation does not resemble either of the parents and exhibits intermediate characteristics. This is because the dominant allele, R, is partially dominant over the other allele, r. Therefore, the recessive allele, r, also gets expressed in the F_1 generation resulting in the production of intermediate pink flowering progenies with Rr genotype.



OR

(a) George Gamow proposed that if 20 amino acids are to be coded by 4 bases, then the code should be made up of three nucleotides.

$43 = 64 (42 = 16)$, which is less than 20; so, the codon was proposed to be a triplet. Har Gobind Khorana developed a chemical method to synthesise RNA molecules with defined combination of bases. Marshall Nirenberg developed cell-free systems for protein synthesis, which helped the code to be deciphered. Severo Ochoa discovered an enzyme (polynucleotide phosphorylase) which helped in the synthesis of RNA with defined sequences in a template-independent manner.

(b) The genetic code is a set of three different nucleotides taken at a time which code for a specific amino acid.

1. A codon is a triplet. 4^3 = 64 (61 codons code for amino acids while 3 are stop codons)
2. One codon codes for a single specific amino acid. Codons are unambiguous.
3. Codons are degenerate since some amino acids are coded by more than one codon.
4. The genetic code is universal. 1 codon codes for the same amino acid in all species.
5. Codons are read continuous. They lack punctuations.
6. AUG has dual functions - Codes for Methionine and acts as a start codon

Question 27:

(a) What is "population" according to you as a biology student?

(b) "The size of a population for any species is not a static parameter." Justify the statement with specific reference to fluctuations in the population density of a region in a given period of time.

OR

(a) What is hydrarch succession?

(b) Compare the pioneer species and climax communities of hydrarch and xerarch succession respectively.

(c) List the factors upon which the type of invading pioneer species depend in secondary hydrarch succession. Why is the rate of this succession faster than that of primary succession?

Solution:

(a) The term 'Population' refers to the group of individuals of a species living together in a group in a well-defined geographical area, sharing or competing for resources and potentially interbreeding. Although the term interbreeding implies sexual reproduction, a group of individuals resulting from even asexual reproduction is also considered a population.

(b) The size of a population of any species is not a static parameter. It keeps changing in time, depending on various factors including food availability, predation pressures, and weather. The population density in a given period can fluctuate due to the following four factors:

(i) Natality: It refers to the number of births during a given period in the population that are added to the initial density.

(ii) Mortality: It refers to the number of deaths during a given period that reduced the size.

(iii) Immigration: It is the number of individuals of the same species that have come into the habitat from elsewhere during the given period.

(iv) Emigration: It is the number of individuals who left the habitat and have gone elsewhere.

OR

(a) Succession that occurs in wetter areas and the successional series progress from hydric to the mesic condition is called the hydrarch succession.

(b) The species that invade a bare area are called the pioneer species while the climax community is established over the process of succession and it is in near equilibrium with the environment. The pioneer species of hydrarch succession are phytoplankton and the climax community is the xerophytic forest. The pioneer species of xerarch succession are lichens and the climax community is the mesophytic forest.
(c) In secondary succession the species that invade depend on the condition of the soil, availability of water, the environment and the seeds and propagules already present. Since the soil is in existence already, the rate of secondary succession is faster than the primary succession, in which the soil is gradually produced.

CBSE
Class XII Biology (Theory)
Board Paper 2018 All India (Set 3)

Time allowed: 3 hrs **Maximum Marks: 70**

General Instructions:

1. There are total **26** questions and five sections in the question paper. **All** questions are compulsory.
2. *Section **A*** contains questions number **1 to 5**; very short answer type questions of **1** mark each.
3. *Section **B*** contains questions number **6 to 10**, short-answer type **I** questions of **2** marks each.
4. *Section C* contains questions number **11 to 22**, short answer type **II** questions of **3** marks each.
5. *Section **D*** contains question number **23**, value based question of **4** marks.
6. *Section **E*** contains questions number **24 to 26**, long-answer type questions of **5** marks each.
7. There is no overall choice in the question paper; however, an internal choice is provided in one question of **2** marks, one question of **3** marks and all the three questions of **5** marks. In these questions, an examinee is to attempt any of the two given alternatives.

SECTION A

1. How do cytokine barriers provide innate immunity in humans? [1]

2. Write the dual purpose served by deoxyribonucleoside triphosphates in polymerisation. [1]

3. Write the names of the following : [1]
(a) A 15 mya primate that was ape-like
(b) A 2 mya primate that lived in East African grasslands

4. Mention the chemical change that proinsulin undergoes, to be able to act as mature insulin. [1]

5. Name two diseases whose spread can be controlled by the eradication of Aedes mosquitoes. [1]

SECTION B

6. How did a citizen group called Friends of Arcata Marsh, Arcata, California, USA, help to improve water quality of the marshland using Integrated Waste Water Treatment? Explain in four steps. [2]

7. Your advice is sought to improve the nitrogen content of the soil to be used for cultivation of a non-leguminous terrestrial crop. [2]

(a) Recommend two microbes that can enrich the soil with nitrogen.

(b) Why do leguminous crops not require such enrichment of the soil?

8. You have obtained a high yielding variety of tomato. Name and explain the procedure that ensures retention of the desired characteristics repeatedly in large populations of future generations of the tomato crop. [2]

9.

(a) Name the source plant of heroin drug. How is it obtained from the plant?

(b) Write the effects of heroin on the human body. [2]

10. With the help of an algebraic equation, how did Hardy-Weinberg explain that in a given population the frequency of occurrence of alleles of a gene is supposed to remain the same through generations? [2]

OR

Although a prokaryotic cell has no defined nucleus, yet DNA is not scattered throughout the cell. Explain.

SECTION C

11.

(a) Differentiate between analogous and homologous structures.

(b) Select and write analogous structures from the list given below: [3]

(i) Wings of butterfly and birds.

(ii) Vertebrate heads

(iii) Tendrils of bougainvillea and cucurbita

(iv) Tubers of sweet potato and potato

12. How has the use of Agrobacterium as vectors helped in controlling *Meloidegyne incognitia* infestation in tobacco plants? Explain in correct sequence. [3]

13.

(a) "India has greater ecosystem diversity than Norway". Do you agree with the statement? Give reasons in support of your answer.

(b) Write the difference between genetic biodiversity and species biodiversity that exists at all the levels of biological organization. [3]

OR

Explain the effect on the characteristics of a river when urban sewage is discharged into it. [3]

14. Explain the mechanism of 'sex determination' in birds. How does it differ from that of human beings? [3]

15. Explain out-breeding, out-crossing and cross-breeding practices in animal husbandry. [3]

16.

(a) Organic farmers prefer biological control of diseases and pests to the use of chemicals for the same purpose. Justify.

(b) Give an example of a bacterium, a fungus and an insect that are used as biocontrol agents. [3]

17.

(a) How has the development of bioreactor helped biotechnology?

(b) Name the most commonly used bioreactor and describe its working. [3]

18. Explain the roles of the following with the help of an example each in recombinant DNA technology: [3]

(a) Restriction Enzymes

(b) Plasmids

19. Differentiate between parthenocarpy and parthenogenesis. Give one example of each. [3]

20. Medically it is advised to all young mothers that breastfeeding is the best for their newborn babies. Do you agree? Give reasons in support of your answer.[3]

21. Draw a diagram of a mature human sperm. Label any three parts and write their functions. [3]

22.

(a) Expand VNTR and describe its role in DNA fingerprinting

(b) List any two applications of DNA fingerprinting technique. [3]

SECTION D

23. Looking at the deteriorating air quality because of air pollution in many cities of the country, the citizens are very much worried and concerned about their health. The doctors have declared health emergency in the cities where the air quality is very severely poor. [4]

(a) Mention any two major causes of air pollution.

(b) Write any two harmful effects of air pollution to plants and humans.

(c) As a captain of your school Eco-club, suggest any two programmes you would plan to organise in the school so as to bring awareness among the students on how to check air pollution in and around the school.

SECTION E

24.

(a) Write the scientific name of the organism Thomas Hunt Morgan and his colleagues worked with for their experiments. Explain the correlation between linkage and recombination with respect to genes as studied by them.

(b) How did Sturtevant explain gene mapping while working with Morgan? [5]

OR

(a) State the 'Central dogma' as proposed by Francis Crick. Are there any exceptions to it? Support your answer with a reason and an example.

(b) Explain how the biochemical characterization (nature) of 'Transforming Principle' was determined, which was not defined, from Griffith's experiments. [5]

25.

(a) Following are the responses of different animals to various abiotic factors. Describe each one with the help of an example.

(i) Regulate

(ii) Conform

(iii) Migrate

(iv) Suspend

(b) If 8 individuals in a population of 80 butterflies die in a week, calculate the death rate of population of butterflies during that period. [5]

OR

(a) What is a trophic level in an ecosystem? What is 'standing crop' with reference to it?

(b) Explain the role of the 'first trophic level' in an ecosystem.

(c) How is the detritus food chain connected with the grazing food chain in a natural ecosystem? [5]

26.

(a) Describe any two devices in a flowering plant which prevent both autogamy and geitonogamy.

(b) Explain the events up to double fertilisation after the pollen tube enters one of the synergids in an ovule of an angiosperm. [5]

OR

(a) Explain menstrual cycle in human females.

(b) How can the scientific understanding of the menstrual cycle of human females help as a contraceptive measure? [5]

CBSE
Class XII Biology
Board Paper 2018 (Set 3) Solution

SECTION A

1. Cytokines, such as interferons, are directly involved in protecting the non-infected cells from viral infection or by activating mechanisms for cells such as macrophages.

2. Deoxyribonucleoside triphosphates are used as substrates in DNA polymerisation.They also provide energy to drive the DNA polymerisation reaction.

3.

(a) Dryopithecus existed about15 million years ago and were more ape-like.

(b) Australopithecus roamed the Eastern African Grasslands about 2 million years ago.

4. Proinsulin contains polypeptide chains A and B, which are linked together by disulphide bridges, and another polypeptide called C peptide. The C peptide is removed during maturation, which converts the inactive proinsulin into mature insulin.

5. Dengue fever and chikungunya are diseases whose spread can be controlled by the eradication of Aedes mosquitoes.

SECTION B

6. Wastewater, including sewage, can be treated in an integrated manner by utilising a mix of the artificial and natural processes.
It has been done in the town of Arcata, in the northern coast of California.
The treatment is done in four stages:

i. In the first stage, physical impurities are removed by the conventional sedimentation, filtering and chlorine treatment.
ii. In the second stage, biologists developed a series of six connected marshes over 60 hectares of marshland.
iii. Appropriate plants, algae, fungi and bacteria were seeded into this area which help in neutralising, absorbing and assimilating pollutants.
iv. Finally, as the water flows through the marshes, it gets purified naturally.

7.

(a) Two microbes which can enrich the soil with nitrogen are Nostoc and Azospirillium.
(b) Leguminous plants contain rhizobium bacteria in their root nodules. These bacteria convert atmospheric nitrogen to a form which can be used by plants. This decreases nitrogen deficiency in the soil and makes it fertile.

8. Plant breeding is the purposeful manipulation of plant species in order to create desired plant types which are better suited for cultivation, give better yields and are disease resistant.
Main steps in breeding a new genetic variety of a crop:
(a) Collection of variability
(b) Evaluation and selection of parents
(c) Cross hybridisation among selected parents
(d) Selection and testing of superior recombinants
(e) Testing, release and commercialisation of new cultivars

9.

(a) Heroin is obtained from *Papaversomniferum* which is commonly known as the poppy plant. Chemically, heroin is a diacetylmorphine which is obtained by acetylation of morphine.

(b) Heroin acts as a depressant which means it slows body functions. It can lead to slower rates of breathing, slower heart beats, vomiting, nausea etc.

10. The Hardy–Weinberg principle states that the frequency of occurrence of alleles of a gene in a population remains constant through generations unless disturbances such as mutations and non-random mating are introduced.

Let us assume that a gene has two alleles in a population, A and a. If p is the frequency of occurrence of dominant allele A, and q is the frequency of occurrence of dominant allele a, the genotype frequency in the offspring is represented as

$(p + q)^2 = p^2 + 2pq + q^2 = 1$,

wherethe frequency of genotypes, AA is p^2, that of aa is q^2 and that of Aa is 2pq.

Hence, the total of all allelic frequencies remains constant, i.e. 1.

OR

In prokaryotes, such as*E. coli*, although they do not have a defined nucleus, DNA is not scattered throughout the cell. DNA (being negatively charged) is held with some proteins (whichhave positive charges) in a region termed 'nucleoid'. DNA in the nucleoid is organised in large loops held by proteins.

SECTION C

11.

(a) Differences between analogous and homologous structures:

Analogous Structure	**Homologous Structure**
These structures have similarity in function, but different internal structures.	These structures have similarity in internal structures, but different functions.
They are based on convergent evolution.	They are based on divergent evolution.
Example: Flippers of penguin and dolphin	Example: Forelimbs of human and bat

(b) Among the given alternatives, examples of analogous structures are Wings of butterfly and birds: Both are used for flying, but both have different internal structures.

Tubers of sweet potato and potato: Both are used for food storage. However, the tuber of sweet potato is a modification of an underground root, while the tuber of potato is a modified stem.

12. The following steps were taken utilising Agrobacterium as a transforming vector for tobacco plants to make them immune against the infestation of the nematode *Meloideogyneincognitia*:

1. Suitable plasmid vectors are chosen and the specific nematode gene is inserted into it.
2. The recombinant plasmids are introduced into the competent Agrobacterium cells.
3. The transformed Agrobacterium cells are screened and selected to infect the tobacco plants.
4. Agrobacterium infection on the tobacco plant cultures leads to insertion and integration of nematode-desired DNA fragment within the tobacco plant.
5. Correct insertion of nematode gene into the host tobacco plants leads to silencing of an essential housekeeping gene of the *Meloideogyneincognitia* pest by RNAi.

13.

(a) It is correct to state that India has greater ecosystem diversity than Norway. The primary reason for the same is that India lies primarily in the tropical and sub-tropical zones, whereas Norway lies near the Arctic region. This exposes India to greater amounts of sunshine and hence greater level of productivity at all trophic levels as compared to Norway. Also, India has greater geographical, topological and climatic diversity compared to Norway, leading to greater biodiversity.

(b)

Genetic Biodiversity	**Species Biodiversity**
Genetic biodiversity refers to the number of genes and their alleles found in organisms.	Speciesbiodiversity refers to the number of species per unit area.
It is the trait of the species.	It is the trait of the community.
It always increases as we move up the biological organisation.	It may or may not increase to a greater extent as we move up the ladder of biological organisation.

OR

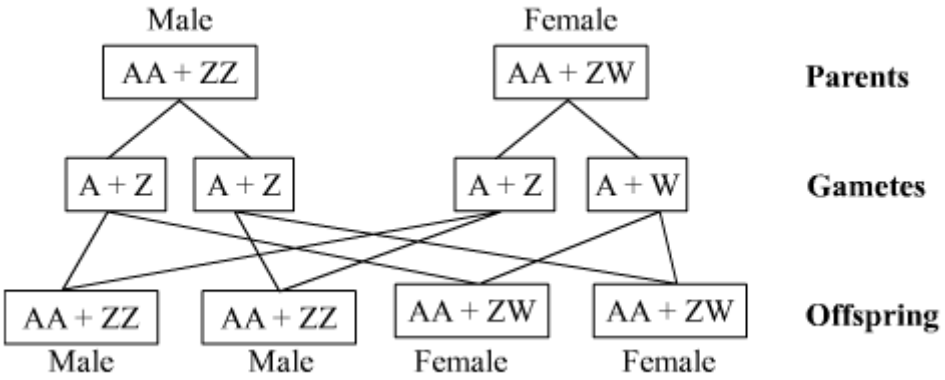
(i) Due to the discharge of urban sewage into the river body, growth of micro-organisms involved in the degradation of organic sewage by utilising oxygen rapidly increases, leading to a huge increase in the BOD (Biological Oxygen Demand) of the river body. This will also generate an oxygenic condition within the river body leading to the widespread death of aquatic lifeforms, resulting in destruction of the aquatic ecosystem and degrading water quality of the river.

(ii) Micro-organisms involved in biodegradation of organic matter in the receiving water body consume a lot of oxygen, and as a result there is a

sharp decline in dissolved oxygen downstream from the point of sewage discharge. This causes mortality of fish and other aquatic creatures.

(iii) Presence of large amounts of nutrients in waters also causes excessive growth of algae, called an algal bloom, which imparts a distinct colour to water bodies. Algal blooms cause deterioration of the water quality and fish mortality. Some bloom-forming algae are extremely toxic to human beings and animals.

14. The sex chromosomes in birds are determined as Z and W. The male is homomorphic (ZZ) and the female is heteromorphic (ZW). W chromosome carries female sex-determining genes and duplication of Z chromosome indicates the male sex. So, in case of chicks, the sex is determined by the egg and not by the sperm.



The difference between sex mechanisms of humans and birds is that the male is homomorphic (ZZ) and the female is heteromorphic (ZW) in birds, whereas the male is heteromorphic (XY) and the female is homomorphic (XX) in humans.

15. Out-breeding: Out-breeding is the breeding of unrelated animals of the same breed or of different breeds or different species.

Out-crossing: Mating of animals within the same breed but having no common ancestor on either side of their pedigree up to 4–6 generations is known as out-crossing. Offspring of such mating is called an outcross. A single out-cross often helps to overcome inbreeding depression.

Cross-breeding: In cross-breeding, the superior male of one breed is mated with a superior female of another breed. It allows the desirable qualities of two different breeds to be combined.

16.

(a) Organic farmers prefer the biological control of diseases and pests over the use of chemicals and pesticides because

(i) They do not kill the useful and harmful life forms indiscriminately.

(ii) They are not toxic to human beings.

(iii) The natural predator–prey relationship and food chains will not get distorted.

(iv) It is a non-polluting practice.

(b) Bacteria: *Bacillus thuringiensis* (Bt) is used to control butterfly caterpillars.

Fungus: *Trichoderma* living in roots of plants acts as a bio-control agent against several plant pathogens.

Insects: Ladybirds and dragonflies are used to get rid of aphids and mosquitoes.

17.

(a) The importance of using a bioreactor is that in a bioreactor the raw materials are biologically converted to specific products. Bioreactors provide the optimal conditions to obtain the desired product by providing growth conditions such as temperature, pH, vitaminsand oxygen.

(b) The most commonly used bioreactor is a simple stirred type bioreactor. A stirred-tank reactor is usually cylindrical or with a curved base to facilitate the mixing of the reactor contents. The stirrer facilitates even mixing and oxygen availability throughout the bioreactor. Alternatively, air can be bubbled through the reactor. The bioreactor has an agitator system, oxygen delivery system,foam control system, temperature control system and pH control system, and sampling ports so that small volumes of the culture can be withdrawn periodically.

18.

(a) Restriction enzymes are specialised enzymes which recognise and cut a particular sequence of DNA. They are specifically important and are extensively used in recombinant DNA technology. They are capable of cutting DNA fragments in two ways, resulting in the formation of either blunt or sticky ends.

Restriction enzymes cut a little away from the centre of the palindrome site, but between the two bases on opposite strands. For example, restriction enzyme Eco-RI is one such restriction endonuclease which gives sticky ends.

$$\downarrow$$
$$5'-GAATTC-3'$$
$$3'-CTTAAG-5'$$
$$\uparrow$$

Hence, structures called overhangs (or sticky ends) are generated on each strand. Overhangs are the structures obtained after palindromic sequences are cut by molecular scissors.

$5'-G$ and $AATTC\,3'$

$3'-CTTAA$ $\quad$ $G5'$

They are significant because these sticky ends form hydrogen bonds with their complementary counterparts with the help of DNA ligases.

(b) A plasmid is an autonomously replicating, circular, extra-chromosomal DNA present in bacteria.
Plasmidscarry extra genes which are not essential for bacterial survival but provide their hosts with extra advantages, such as antibiotic resistance. Plasmids which are used in genetic engineering are called vectors as they are used as a vehicle for transferring a piece of DNA (attached to it) to the host organism. The piece of DNA from the source organism is integrated within the plasmid. The plasmid and the gene insert are cut at specific sites (with the help of restriction enzymes) and are joined with the help of DNA ligase. The recombinant plasmid is then transferred inside the host. Once inside the host, the vector can replicate and express the desired gene. An example of such vector is pBR322.

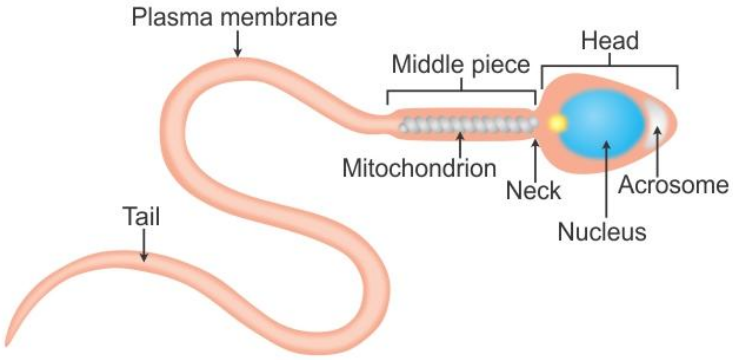
19.

Parthenogenesis	**Parthenocarpy**
1. It is a type of reproduction in which an unfertilised egg or ovule develops into a new organism.	1. It is a process in which an unfertilised ovule develops into a seedless fruit.
2. It produces haploid organisms.	2. It results in the production of seedless fruits.
3. It is common toboth plants and animals.	3. It is common in flowering plants.
4. It occurs in honeybees, rotifers, some lizards and birds.	4. It occurs in bananas and seedless watermelons.

20. Yes, breastfeeding is very important fornewborns. The milk produced during the initial few days of lactation called colustrum is a rich source of antibodies and has balanced nutrient content which is good for the newborn. Benefits of breastfeeding:

i. It consists of several antibodies which protects the baby from external viral and bacterial infections.
ii. It has a calorific value of 70 per 100 ml of milk which meets the requirement of the infants.
iii. It is available at a correct temperature and proportion for the baby.

21.



Head: It is the flat oval part of the human sperm which contains the nucleus, containing genetic material, and acrosome, a small anterior part which is formed from Golgi complex. It secretes hyaluronidase enzyme which helps in the entry of sperm into the egg.

Middle piece: It is the middle, cylindrical portion of the sperm, which contain numerous mitochondriaproviding energy (ATP) to the sperm for movement.

Tail: It is a long, tapering structure composed of the cytoplasm. It helps in the movement of the sperms inside the uterus.

22.

(a) VNTR: Variable Number Tandem Repeat
DNA fingerprinting involves identifying differences in the number of some specific short nucleotide repeats, called VNTR, that vary in number from person to person and are inherited.

(b) The DNA fingerprinting techniquecan be used in forensic science during a criminalinvestigation to establish the identity of the victim or perpetrators of the crime.

23.

(a) Air pollution means any undesirable change in the quality of fresh air.
Some major causes of air pollution in our major cities:

1. Suspended particulate matter generation due to dust raised by construction activity.
2. Smoke-emitting industries and power plants in cities.
3. Burning of crop residue, garbage, fallen leavesetc.
   (Mention any two)

(b) Effect on air pollution on

Plants	Animals
(i) Reduce growth and yield of plants	(i) Decreased respiratory capacity and increased prevalence of respiratory disorders
(ii) Cause premature death of plants	(ii) Lower visibility

(c) Two programmes are as follows:

1. Organise a seminar for students, teachers and parents to create awareness regarding the harmful effects of air pollution and how it can cause serious health issues to the next generation and deteriorate the environment.
2. Organise a monthly pollution-free week in the school where teachers and students will not use vehicles which run on fossil fuels and encourage theuse of bicycles or carpooling if possible.

24.

(a) Thomas Hunt Morgan and his colleagues used fruitfly (*Drosophila melanogaster*)to study linkage.
Morgan performedvarious experiments involving dihybrid crosses in Drosophila to study the sex-linked genes. In one such experiment, he crossed yellow-bodied, white-eyed flies with brown-bodied, red-eyed ones. The resultant F_2 ratio deviated from the Mendeliandihybrid ratio of 9:3:3:1. Morgan suggested that this was due to the phenomenon of linkage. He found that the genes for both characters were present on the X chromosome. When two genes are located close to each other on the same chromosome, the chances of formation of new recombination are very less. This is due tophysical associations of genes present on the same chromosome. Morgan named this phenomenon 'linkage'. Thus, it can be stated that higher the linkage between two genes, lesser are the chances of recombination.

(b) Alfred Sturtevant used the frequency of recombination between gene pairs on the same chromosome as a measure of the distance between

genes and 'mapped' their position on the chromosome. Today, genetic maps are extensively used as a startpoint in sequencing whole genomes as was done for the Human Genome Sequencing Project.

OR

(a) Francis Crick had proposed the 'Central Dogma', which states that the genetic information within a cell flows from DNA to RNA through transcription and from RNA to proteins through translation.

However, there are some exceptions to this process. In some viruses, the genetic material is in the form of RNA. In such cases, direction of this information flow is reversed. The RNA is first converted to DNA through reverse transcription. DNA thus formed follows the usual path of central dogma, i.e. it first converts to RNA, which is then translated into proteins.

(b) Biochemical characterisation of transforming principle was determined by Oswald Avery, Colin Macleod, and Maclyn McCarty. They conducted a series of experiments to test the biochemical nature of genetic material. They purified various biochemicals (proteins, DNA, RNA) from heat-killed S cells to check which ones can transform the live R cells into S cells.

Heat – killed S strain + Live R strain $\xrightarrow[\text{Digest RNA and proteins}]{\text{RNase, Proteases}}$ Transformation occurs and mouse dies

Heat – killed S strain + Live R strain $\xrightarrow[\text{Digest DNA}]{\text{DNase}}$ Transformation does not occurs and mouse survives

These series of experiments suggested that DNA alone could transform the R cells into S cells. Thus, they concluded that DNA is the hereditary material.

25.

(a)

(i) Regulate: Some organisms maintain homeostasis by physiological and sometimes behavioural means. In mammals, during summer, sweating occurs profusely and evaporation brings down the temperature of the body.

(ii) Conform: About 99% of animals and almost all plants cannot maintain a constant internal environment. Their body temperature changes with the ambient temperature.In aquatic organisms, the osmotic concentration of the body fluids changes with that of the osmotic concentration of the ambient water. These animals and plants are called osmoconformers.

(iii) Migrate: It is the temporary movement from a stressful habitat to a more hospitable area and return when the stressful period is over.Every winter, the famous Keoladeo National Park in Bharatpur (Rajasthan) hoststhousands of migratory birds coming from Siberia and other cold Northern regions every winter.

(iv) Suspend: Under unfavourable conditions bacteria, fungi and lower plants slow down their metabolic rate and form a thick-walled spore to overcome stressful conditions. These spores germinate on onset of the suitable conditions.

(b)

$$\text{Death rate} = \frac{\text{Total number of death}}{\text{Total population}} \times 100$$

$$= \frac{8}{80} \times 1000 = 100$$

Thus, the death rate is equal to 100 deaths per 1000 individuals per week.

It can also be calculated directly as

8/80=0.1 deaths/week

OR

(a) A trophic level is a level of species in an ecosystem on the basis of the source of nutrition such as producers, primary consumers, secondary consumersetc.

Producers form the first trophic level as they make food. Primary consumers form the second, secondary consumers form the thirdand tertiary consumers form the fourth trophic level.

Standing crop is the quantity or total weight of dried biomass of the organism which is present in a specific location at a particular time. Each tropic level has a certain mass of living material at a particular time called standing crop. It is measured as the mass of living organism or the number in a unit area.

(b) The first trophic level is also known as the producer. At this level, the organisms are autotrophic which means they prepare their own food with the help of sunlight which is the only source of energy for Earth. So, producers have the job to transform light energy into chemical energy so that it can be useful to the other trophic levels and for the sustenance of the ecosystem.

(c) In the detritus food chain, energy comes from organic matter (or detritus) generated in trophic levels of the grazing food chain.

26.

(a) Two devices which prevent both autogamy and geitonogamy in flowering plants:

1. In some species, pollen release and stigma receptivity are not synchronised. In this case, either the pollen is released before the stigma becomes receptive or the stigma becomes receptive much before the release of the pollen.
2. In another method, the anther and stigma are placed at different positions so that the pollen does not come in contact with the stigma of the same flower.

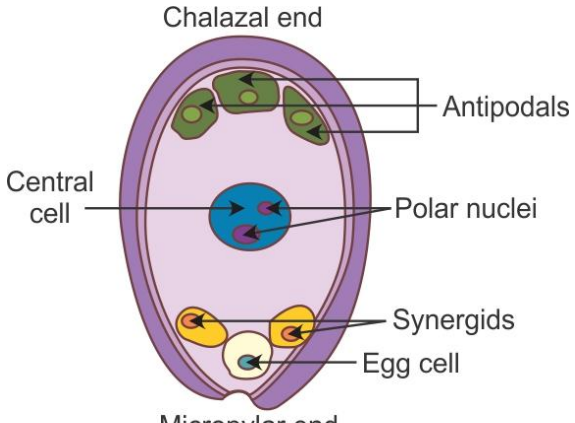
(b) Events which occur during double fertilisation:

(i) Two male gametes are released by the pollen tube into the cytoplasm of a synergid.

(ii) One of these male gametes moves towards the egg cell and fuses with the nucleus. This process is called syngamy and results in the formation of a diploid cell, the zygote,which eventually forms an embryo.

(iii) The other male gamete moves towards the polar nuclei located in the central cell and fuses with them to form a triploid primary endosperm nucleus (PEN). This process is called triple fusion.

(iv) Since two types of fusion, syngamy and triple fusion, take place here, the phenomenon is called double fertilisation.



Embryo sac

OR

(a)

1. The menstrual cycle is the reproductive cycle in all primates and begins at puberty (menarche). In human females, menstruation occurs once in 28–29 days. The menstrual phase refers to the beginning of menstruation wherein the endometrium along with its rich blood supply is shed (menses). During this phase, the levels of both ovarian and pituitary hormones are low. The level of follicle-stimulating hormone (FSH) starts to increase during the later stages of this phase.
2. The menstrual phase is followed by the follicular phase wherein the primary follicles mature into the Graafian follicle under the influence of FSH and LH. The developing follicles release oestrogen which causes the regeneration of the endometrium. Sincethe follicles and the endometrium proliferate during the follicular phase, it is also known as the proliferative phase.
3. At the time of ovulation, the release of gonadotropins (LH and FSH) increases. LH and FSH are at their peak in the middle of the cycle (14^{th} day)and cause the rupture of the Graafian follicle to release ovum (ovulation). The remains of the Graafian follicle get converted to the corpus luteum, which secretes progesterone for the maintenance of the endometrium in case of pregnancy.
4. In the absence of pregnancy, the corpus luteum degenerates which causes disintegration of the endometrium leading to mensuration and marking a new cycle.

(b) Scientific understanding of the menstrual cycle can be helpful in women as a contraceptive measure as it can help in demarcatingthe dates during which the chances of contraception are higher. For example, periodical abstinence is one such natural method which is based on the fact that couples avoid coitus during the 10–17 day of the menstrual cycle when ovulation is expected. Coitus can be avoided during the time span in which the chances of fertilisation are higher if there is a scientific understanding of the menstrual cycle.

CBSE-XII-2017 EXAMINATION

Series GBM

BIOLOGY

Paper & Solution

SET-1

Code : 57/1

Time : 3 Hrs. **Max. Marks : 70**

General Instructions :

(i) All questions are compulsory.

(ii) Section **A** contains questions number **1 to 5,** very short-answer type questions of **1** mark each.

(iii) Section **B** contains questions number **6 to 10,** short-answer type **I** questions of **2** mark each.

(iv) Section **C** contains questions number **11 to 22,** short-answer type **II** questions of **3** mark each.

(v) Section **D** contains questions number **23,** value based question of **4** marks

(vi) Section **E** contains questions number **24 to 26,** long-answer type questions of **5** marks each.

(vii) There is no overall choice in the question paper, however, an internal choice is provided in one question of 2 marks, one question of 3 marks and all the three questions of **5** marks. In these questions, an examinee is to attempt any one of the two given alternatives.

SECTION - A

1. Name the type of cross that would help to find the genotype of a pea plant bearing violet flowers. **[1]**

Sol. Test Cross.

2. State two postulates of Oparin and Haldane with reference to origin of life. **[1]**

Sol. Oparin and Haldane proposed that life originated from pre-existing non-organic molecules and the diverse organic molecules were formed from these inorganic constituents by chemical evolution.

3. A herd of cattle is showing reduced fertility and productivity. Provide one reason and one suggestion to overcome this problem. **[1]**

Sol. The cattle's productivity is decreased due to inbreeding depression. A single outcross i.e. breeding with animals of same breed but should not have common ancestors on either side upto 4-6 generations can restore its fertility.

4. What are *Cry* genes ? In which organism are they present ? **[1]**

Sol. *Cry* genes codes for a toxin which is poisonous to some insects thus giving resistant to the plants. They are present in bacterium *Bacillus thuriengiensis*.

5. An electrostatic precipitator in a thermal power plant is not able to generate high voltage of several thousands. Write the ecological implication because of it. **[1]**

Sol. It will not be able to remove particulate matter present in the exhaust of thermal power plants & hence cannot control pollution.

SECTION - B

6. A pollen grain in angiosperm at the time of dehiscence from an anther could be 2-celled or 3-celled. Explain. How are the cells placed within the pollen grain when shed at a 2-celled stage ? **[2]**

Sol. In majority angiosperms, pollens are released in 2-celled stage whereas in other species, the generative cell divides into 2 male gametes & forms 3-celled stage.

When the pollen grain is shed at 2-celled stage - it has two unequal cells - bigger vegetative cell and smaller generative cell.

7. Differentiate between the genetic codes given below : **[2]**

(a) Unambiguous and Universal

(b) Degenerate and Initiator

Sol. **(a) Unambiguous and Universal : -**

Unambiguous : - The code is specific, i.e. one codon codes for only one amino acid.

Universal : - The code is same in all organisms.

(b) Degenerate and Initiator : -

Degenerate : - When an amino acid is coded by more than one codon, it is said to be degenerate.

Initiator : - AUG is an initiator codon i.e. it initiates the translation process & also codes for methionine.

8. Mention one application for each of the following : **[2]**

(a) Passive immunization

(b) Antihistamine

(c) Colostrum

(d) Cytokinin-barrier

Sol. **(a) Passive Immunization : -** When ready made antibodies are introduced into the body, it is called as passive immunization. It provides quick immune response in body.

(b) Anti Histamines : - These are the chemicals which are given against allergic reactions.

(c) Colostrum : - It is the yellow fluid produced during the initial days of lactation. It is rich in antibodies and is necessary to develop resistance in a new born baby.

(d) Cytokinin-Barrier : - is Interferon. These are the glycoproteins which protect non-infected cells from further viral infection.

9. Name the microbes that help production of the following products commercially : **[2]**

(a) Statin

(b) Citric acid

(c) Penicillin

(d) Butyric acid

Sol. (a) Statin : - Monascus purpureus (fungus)

(b) Citric acid : - Aspergillus niger (fungi)

(c) Penicillin : - Pencillium notatum (fungi)

(d) Butyric acid : - Clostridium butylicum (Bacteria)

10. List four benefits to human life by eliminating the use of CFCs . **[2]**

OR

Suggest two practices giving one example of each, that help protect rare or threatened species.

Sol. (1) Ozone depletion will be prevented.
(2) Green house effect will be controlled
(3) Global warming will be controlled.
(4) It will prevent old climatic changes that takes place due to rise in temperature.

OR

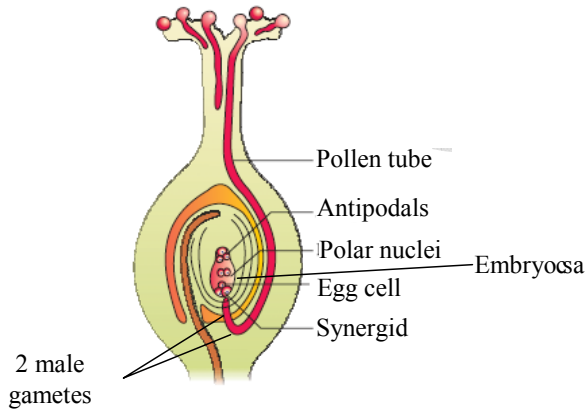
(i) By using cryopreservation (preservation at –196ºC) technique, sperms, eggs, tissues, and embryo can be stored for long period in gene banks, seed banks etc.
(ii) Plants are propagated in vitro using tissue culture methods.

SECTION - C

11. (a) Can a plant flowering in Mumbai be pollinated by pollen grains of the same species growing in New Delhi ? Provide explanations to your answer.
(b) Draw the diagram of a pistil where pollination has successfully occurred. Label the parts involved in reaching the male gametes to its desired destination. **[3]**

Sol. (a) It is possible by Artificial Hybridisation where pollen grain of one flower is introduced artificially on the stigma of another flower. But there should not be self-incompatibility.
* For this in One flower *emasculation* is removal of anthers & by choice by then flower is *bagged*.
* After some time, the bag is removed and then desired pollen grains are introduced on its stigma.

(b)



The pollen tube reaching the ovule.

12. Both Haemophilia and Thalassemia are blood related disorders in humans. Write their causes and the difference between the two. Name the category of genetic disorder they both come under. **[3]**

Sol. Both are Mendelian disorders.
* Haemophilia is a sex linked recessive disorder. The gene for haemophilia is located on X-chromosome. The gene passes from a carrier female to her son.
* Thalessemia is an autosomal linked recessive disease.
* It occurs due to either mutation or deletion resulting in reduced rate of synthesis of one of globin chains of haemoglobin.
* The difference between Haemophilia and Thalessemia is : - In haemophilia, clotting is affected, i.e. there can be a non-stop bleeding even after a minor cut.
* In Thalessemia, anaemia is the characteristic of this disease.

13. (a) List the two methodologies which were involved in human genome project. Mention how they were used.
(b) Expand 'YAC' and mention what was it used for. **[3]**

Sol. **(a) 2 Methodologies of HGP : -**

(1) Expressed Sequence Tags (EST's) : - This method focusses on identifying all the genes that are expressed as RNA.

(2) Sequence Annotation : - It is an approach of simply sequencing the whole set of genome that contains all the coding and non-coding sequences, and later assigning different regions in the sequence with functions.

(b) 'YAC' → Yeast Artificial Chromosome : -

It is used as a cloning vector for cloning DNA fragments in suitable host so that DNA sequencing can be done.

14. Write the characteristics of *Ramapithecus*, *Dryopithecus* and Neanderthal man. **[3]**

Sol. **Characteristics of *Ramapithecus* : -**

* It evolved around 15 mya.
* More man-like, walked more erect, teeth like modern man.

Characteristics of *Dryopithecus* : -

* It evolved around 25 mya.
* Ape like, hairy arms and legs of same length, large brain, ate soft fruits and leaves, walked like gorillas and chimpanzees.

Characteristics of Neanderthal Man : -

* It evolved around 1,00,000-40,000 year ago.
* Fossil found in east and central Asia, brain size 1400 cc used hides to protect body, buried their dead.

15. Name a human disease, its causal organism, symptoms (any three) and vector, spread by intake of water and food contaminated by human faecal matter. **[3]**

OR

(a) Why is there a fear amongst the guardians that their adolescent wards may get trapped in drug/alcohol abuse ?
(b) Explain 'addiction' and dependence' in respect of drug/alcohol abuse in youth.

Sol. Amoebic dysentry [Amoebiasis]

* **Causal Organism : -** Entamoeba histolytica, a protozoa.
* **Symptoms : -** (a) Abdominal pain (b) Constipation (c) Cramps.
* **Vector : -** Housefly.

OR

(a) Reasons for alcohol abuse in adolescents : -
(i) Social pressure
(ii) Curiosity and need for adventure, excitement and experiment.
(iii) To escape from stress, depression and frustration.
(iv) To overcome hardships of life.
(v) Unstable or unsupportive family structure

(b) The psychological attachment to certain effects such as euphoria and a temporary feeling of well-being, associated with drugs and alcohol is called **ADDICTION**.

Dependence : - The tendency of the body to manifest a characteristic and unpleasant **withdrawal syndrome** on abrupt discontinuation of regular dose of drug/alcohol is called **Dependence.**

16. (a) Write the desirable characters a farmer looks for in his sugarcane crop.
(b) How did plant breeding techniques help north Indian farmers to develop cane with desired characters ? **[3]**

Sol. (a) The desirable characters that should be present in sugarcane crop are : -
(a) High yield (b) Thick stem (c) High sugar content (d) ability to grow in North India.
(b) With the help of plant breeding, the two varieties of sugarcane i.e. *Saccharum barberi* [sugarcane of North India] and *Saccharum officinarum* [sugarcane of South India] were crossed to obtain sugarcane varieties having desirable qualities. So that a good quality sugarcane variety could be grown in North India.

17. Secondary treatment of the sewage is also called Biological treatment. Justify this statement and explain the process. **[3]**

Sol. **Secondary treatment or Biological treatment :**
* Primary effluent is passed into large aeration tanks with constant mechanical **agitation** and air supply.
* Useful aerobic microbes grow rapidly and form **flocs**.
* Flocs are masses of bacteria and consumes organic matter and thus reduce the biochemical oxygen demand (BOD).
* When BOD of sewage has reduced, the effluent is passed into **Settling tank**.
* Here, the bacterial flocs settle and sediment is called **activated sludge**.
* A small part of the sludge is used as an inoculum in the aeration tank and the remaining part is passed into large tanks called **anaerobic sludge digesters**.
* In the digesters, **heterotrophic microbes** anaerobically digest bacteria and fungi in sludge producing mixture of gases such as methane, H_2S, CO_2 which forms the biogas.

18. (a) Explain the significance of palindromic nucleotide sequence in the formation of recombinant DNA.
(b) Write the use of restriction endonuclease in the above process. **[3]**

Sol. (a) The palindromic sequences i.e. the sequence of base pairs read the same on both the DNA strands, when orientation of reading is kept the same, eg : -

5' —— GAATTC —— 3'
3' —— CTTAAG —— 5'

* Every endonuclease inspects the entire DNA sequence for palindromic recognition sequence.

(b) On finding the palindrome, the endonuclease binds to the DNA.
* It cuts the opposite strands of DNA, but between the same bases on both the strands & forms STICKY ENDS. This sticky ends facilitate the action of enzyme DNA ligase and helps in the formation of recombination DNA.

19. Describe the roles of heat, primers and the bacterium *Thermus aquaticus* in the process of PCR. **[3]**

Sol. **Role of Heat :** - It helps in **denaturation** process in PCR. The ds DNA is heated in this process at very high temperature (95ºC) so that both the strands separates.

Role of primers : - Primers are chemically synthesised small oligonucleotides of about 10-18 nucleotides that are complementary to a region of template DNA and helps in the extension of new chain.

Role of Bacterium *Thermus aquaticus* : - From this bacterium, a thermostable Taq DNA polymerase is isolated which can tolerate high temperatures and forms new strand.

20. Explain the various steps involved in the production of artificial insulin. **[3]**

Sol. **Genetically Engineered Insulin : -**

* Insulin contains two short polypeptide chains: chain A and chain B linked together by disulphide bridges.
* In mammals insulin is synthesised as a pro-hormone. It contains an extra stretch called C-peptide.
* C-peptide is absent in the mature insulin and is removed during maturation into insulin.
* Production of insulin by rDNA techniques was achieved by an American company, Eli Lilly in 1983. It prepared two DNA sequences corresponding to A and B, chains of human insulin and introduced them in plasmids of *E. coli* for production.

  The A and B chains produced were separated, extracted and combined, by creating disulfide bonds to form human insulin.

21. (a) ‘‘Organisms may be conformers or regulators.’’ Explain this statement and give one example of each.

(b) Why are there more conformers than regulators in the animal world ? **[3]**

Sol. (a) **"Regulators" : -** The organism is able to maintain homeostasis by physiological and behavioural means. All birds and mammals and few lower vertebrates and invertebrates species maintain homeostasis by thermoregulation and osmoregulation.

For eg : - Birds & Mammals.

"Conformers" : - Majority (99%) of animals and nearly all plants cannot maintain a constant internal environment. Their body temperature is not constant. They are simply conformers.

Eg; - Fishes, Frogs etc.

(b) Because they lack the capability maintain a constant internal environment or homeostasis.

22. Describe the inter-relationship between productivity, gross primary productivity and net productivity. **[3]**

Sol. The rate of biomass production per unit area, over a time period by plant during photosynthesis is called **productivity**.

* It is expressed in (kcal m^{-2})yr^{-1} or g/m^2/ yr or g m^{-2} y^{-1}.
* The amount of biomass or organic matter produced per unit area over a time period in plants during photosynthesis is called **primary production**.

Primary Productivity

Gross primary Productivity (GPP)

* It is the rate of production of organic matter during photosynthesis in an ecosystem.
* Some of GPP is utilised in respiration.

Net primary Productivity (NPP)

* It is the weight of the organic matter stored by the produces in a unit area/volume per unit time.

$\boxed{NPP = GPP - R}$

R = Respiration losses.

SECTION - D

23. It is commonly observed that parents feel embarrassed to discuss freely with their adolescent children about sexuality and reproduction. The result of this parental inhibition is that the children go astray sometimes.

(a) Explain the reasons that you feel are behind such embarrassment amongst some parents to freely discuss such issues with their growing children.

(b) By taking one example of a local plant and animal, how would you help these parents to overcome such inhibitions about reproduction and sexuality ? **[4]**

Sol. Parents feel embarrassed as : -

(a) Indian Society is not that broad minded and parents feel shy talking openly regarding these matters to their children due to which their children go astray sometimes.

But parents should consider that at adolescence parents should behave like friends to their child. So that child could also share his problems with parents.

Parents should give right information about the reproductive aspects, sexual practices, adolescence changes to their children so that their children will never be misleaded.

(b) By an example of male honey bee and orchid ophyrys flower, it is evident that sexual attraction is a natural phenomenon, the honey bee is attracted to a ophrys flower and assumes its one petal as its female partner & pseudo copulates with it.

So it is a natural phenomenon & parents should talk regarding this matter to their children.

SECTION - E

24. (a) When a seed of an orange is squeezed, many embryos, instead of one are observed. Explain how it is possible.

(b) Are these embryos genetically similar or different ? Comment. **[3+2=5]**

OR

(a) Explain the following phases in the menstrual cycle of a human female :

(i) Menstrual phase

(ii) Follicular phase

(iii) Luteal phase

(b) A proper understanding of menstrual cycle can help immensely in family planning. Do you agree with the statement ? Provide reasons for your answer. **[4+1=5]**

Sol. (a) It is due to polyembryony.

Occurrence of more than one embryos in a seed is called as POLYEMBRYONY.

In orange, the nucellar cells, synergid or integument cells develops into a number of embryos of different sizes.

eg : - Citrus.

* Sometimes formation of more than one egg in an embryo sac can lead to polyembryony.

(b) In such embryos parental characters are maintained hence they are genetically similar.

In this process, there is no segregation of characters in the offspring (progeny).

OR

(a) **(i) Menstrual phase : -**

* The soft tissue of endometrial lining of the uterus disintegrates causing bleeding.
* The unfertilised egg and soft tissues are discharged.
* It lasts for 3-5 days.

(ii) Follicular phase/Proliferative Phase : -

* The primary follicles in the ovary grow and become a fully mature Graafian follicle.
* The endometrium regenerates.
* It lasts for about 10 to 14 days.

(iii) Luteal phase (15 days to 28/29 days)

* In this phase the ruptured follicle changes into corpus luteum in the ovary and it begins to secrete hormone progesterone.
* The endometrium thickens further.
* If ovum is not fertilised, the corpus luteum undergoes degeneration and this causes disintegration of endometrium leading to menstruation.

(b) Yes, a proper understanding of menstrual cycle can help immensely in family planning.
As day 10 to 17 of the menstrual cycle is called as FERTILE PERIOD of human female. If coitus done during this period increases the chances of conception but coitus is abstained in this period, pregnancy can be prevented.

25. (a) Compare, giving reasons, the J-shaped and S-shaped models of population growth of a species.
(b) Explain 'fitness of a species'' as mentioned by Darwin. **[3+2=5]**

OR

(a) What is an ecological pyramid ? Compare the pyramids of energy, biomass and numbers.
(b) Write any two limitations of ecological pyramids. **[4+1=5]**

Sol. (a) There are 2 models of population growth :
(i) The exponential growth
(ii) Logistic growth

(i) Exponential growth : This growth occurs where the resources (food + space) are unlimited. The equation can be represented as

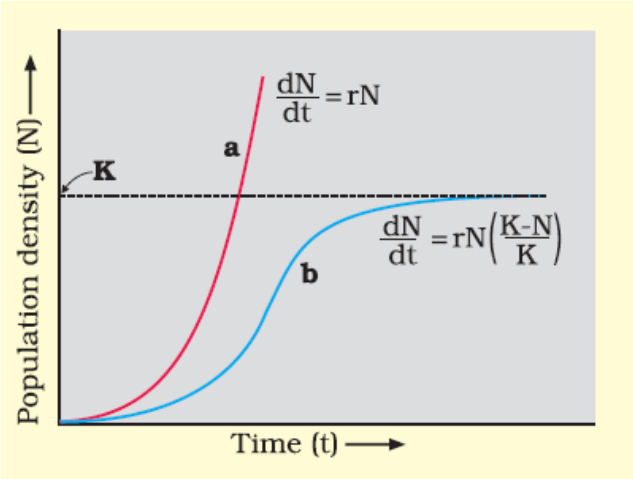
$$\frac{dN}{dt} = (b - d) \times N$$

Let $(b - d) = r$

$$\boxed{\frac{dN}{dt} = rN} \text{ or } \boxed{N_t = N_0 e^{rt}}$$

N = population size
N_t = population density after time t.
N_0 = population density at time zero
r = growth rate
b = birth rate
d = death rate
In this growth, when N in relation to time is plotted on graph, the curve becomes J-shaped.

(ii) Logistics growth model : This is a realistic approach as the resources become limited at a certain point of time.



(a) J-shaped curve ⇒ exponential growth

(b) S-shaped curve ⇒ logistics growth

Every ecosystem has limited resources to support a particular maximum **carrying capacity (K).**

When N is plotted in relation to time t, a sigmoid-S-shaped curve is obtained & is also called as VERHULST-PEARL logistic growth. The equation is :

$$\frac{dN}{dt} = rN\frac{(K-N)}{K}$$

N = population density at time t.

r = growth rate

K = carrying capacity.

(b) ''Fitness of a species'' according to Darwin means reproductive fitness. All organisms after reaching reproductive age have varying degree of reproductive potential some organisms produce more offspring and some organism produce only few offspring. This phenomenon is also called as DIFFERENTIAL REPRODUCTION.

Hence the species which produces more offsprings are selected by nature.

OR

(a) Ecological pyramid : The relation between producers and consumers in an ecosystem can be graphically represented in the form of a pyramid called ecological pyramid.

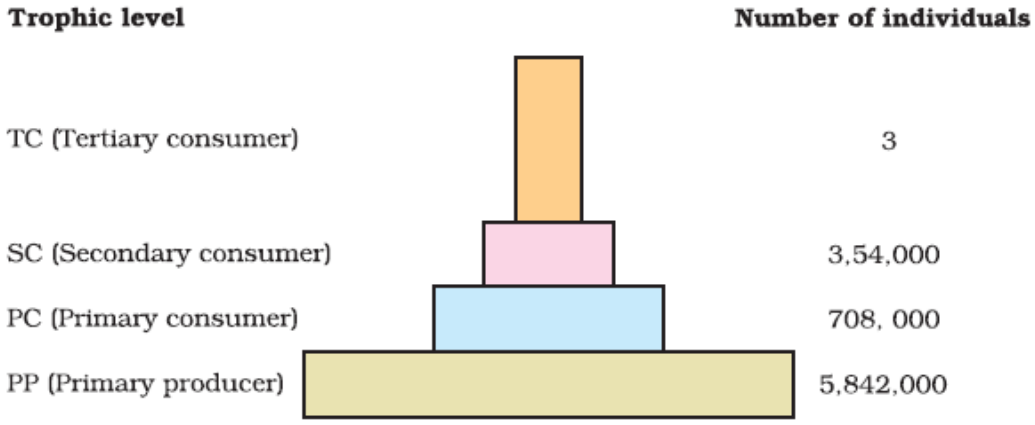
Ecological pyramids are of 3 types :

(i) Pyramid of number

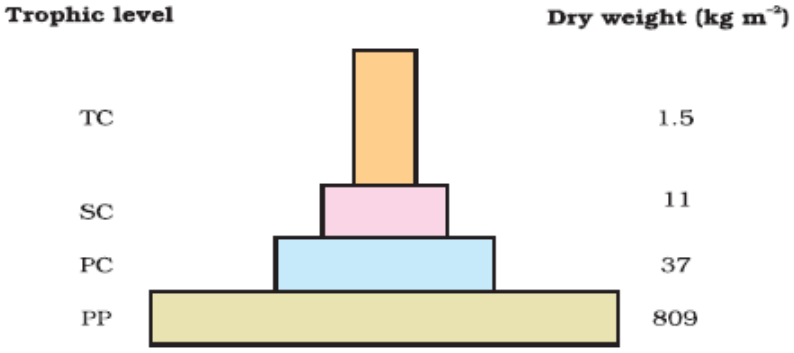
(ii) Pyramid of biomass

(iii) Pyramid of energy

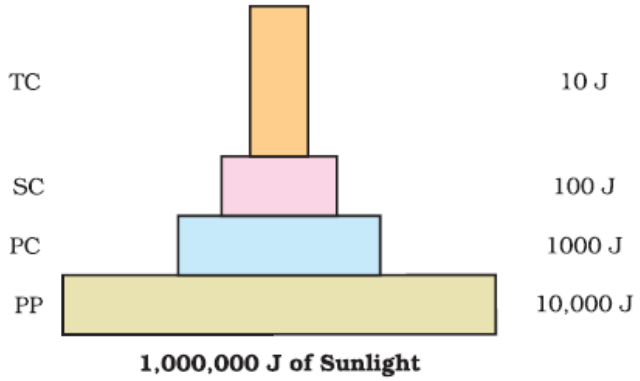
(i) Pyramid of number : - The relationship between producers and consumers in an ecosystem can be represented in the form of a pyramid in terms of number is called pyramid of number.



(ii) Pyramid of Biomass : - The relationship between producers and consumers in an ecosystem can be represented in the form of a pyramid in terms of biomass is called pyramid of biomass. It can be upright or inverted.



(iii) Pyramid of energy :- The relationship between producers and consumers in an ecosystem can be represented in the found of pyramid in terms of flow of energy called pyramid of energy.
Always upright as energy is lost as heat at each step.



(b) Limitations of ecological pyramids : -

(i) It never takes into account the same species belonging to two or more trophic levels.

(ii) It assumes a simple food chain, which never exists in nature.

26. (a) Describe the structure and function of a t-RNA molecule. Why is it referred to as an adapter molecule ?

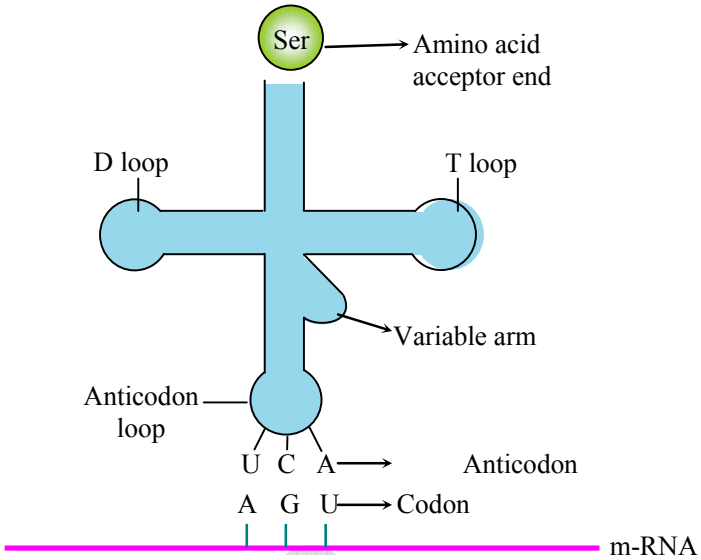
(b) Explain the process of splicing of hn-RNA in a eukaryotic cell. **[3+2=5]**

OR

Write the different components of a *lac*-operon in *E. coli*. Explain its expression while in an 'open' state. **[5]**

Sol. (a) t-RNA (transfer RNA) reads the genetic code on one hand & transfers amino acids on the other hand, so it is called as adapter molecule by Francis Crick. It is also called as soluble RNA (SRNA).

Structure of t-RNA :



The secondary structure of t-RNA is clover leaf like but the 3-D structure is inverted L-shaped.

t-RNA has five arms or loops

(i) Anticodon loop : - Which has bases complementary to the code.

(ii) Amino acid acceptor end : - To which amino acid binds.

(iii) T-loop : - Which help in binding to ribosome.

(iv) D-loop : - Which help in binding amino acyl synthetase.

(v) Variable loop : - No function known.

(b) The primary transcript formed in eukaryotes are non-functional, containing both the coding region, exon and non-coding region, intron in RNA and are called *heterogeneous RNA* or *hn-RNA*.

hn-RNA undergoes a process where the introns are removed and exons are joined to form m-RNA (Functional) by the process called SPLICING.

OR

The lac operon (Inducible operon)

Operon : - The concept of operon was first proposed in 1961, by Jacob and Monod

Components of an operon : -

(i) Structural genes : - The fragment of DNA which transcribe mRNA for polypeptide synthesis.

(ii) Promoter : - The sequence of DNA where RNA polymerase binds and initiates transcription.

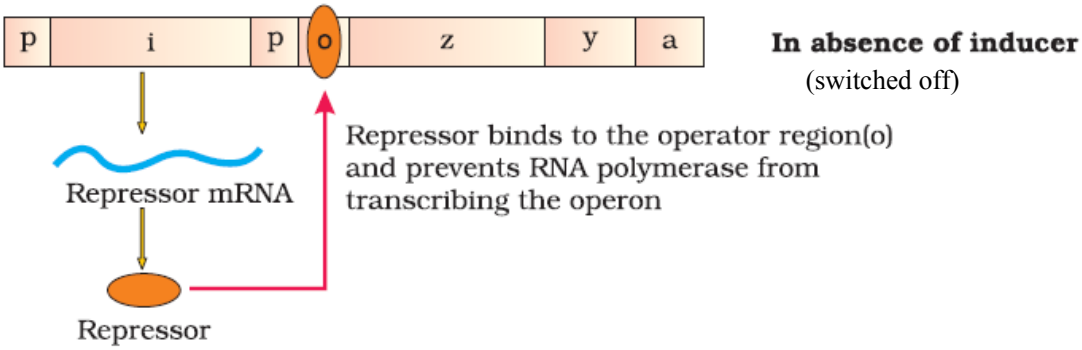
(iii) Operator : - The sequence of DNA adjacent to promoter is called OPERATER.

(iv) Regulator gene : - It is the gene that codes for repressor protein which binds to operator due to which operon is switched ''off''

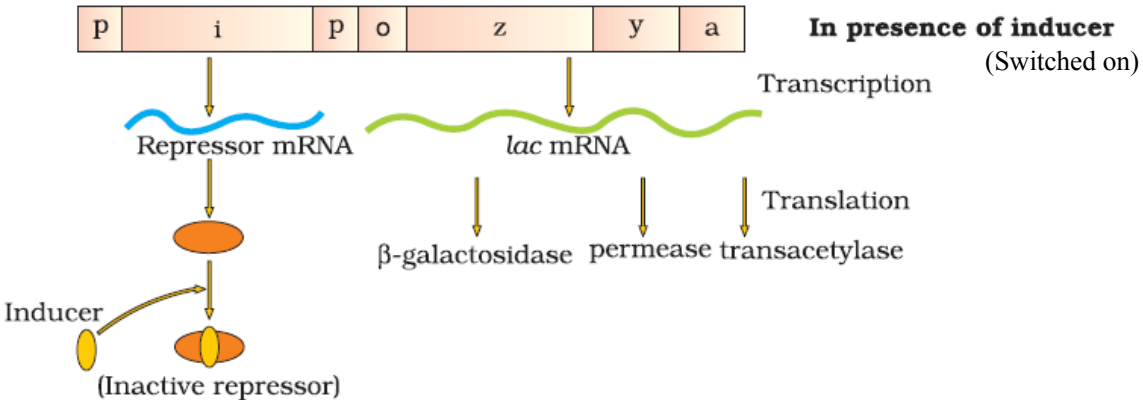
(v) Inducer : - Lactose is inducer which helps in switching ''on'' of operon.

Lac operon consists of there structural genes (z, y, a), operator (o), promoter (p), regulatory gene (i)

(a)



(b)



- Gene z codes for β-galactosidase
- Gene y codes for permease.
- Gene a codes for enzymes transacetylase.

When lactose is absent:-

When lactose is absent, i.e. gene produces repressor protein.

This repressor protein binds to operator and as a result prevents RNA polymerase to bind to operon.

The operon is switched off.

When lactose is present : -

- Lactose act as inducer which binds to the repressor and forms inactive repressor.
- The repressor cannot bind to operator.
- Now the RNA polymerase binds to operator and transcribes lac mRNA.
- Lac mRNA is polycistronic i.e. produces all three enzymes β–galactosidase, permease and trans-acetylase.
- The lac operon is switched on.

CBSE

Class XII Biology (Theory)

Board Paper 2016 – All India (Set 1)

Time: 3 hrs **Total Marks: 70**

General Instruction:

1. There are total **26** questions and five sections in the question paper.
2. All questions are compulsory.
3. *Section A* contains questions number **1 to 5**; very short answer type questions of **1** mark each.
4. *Section B* contains questions number **6 to 10**, short-answer type **I** questions of **2** marks each.
5. *Section C* contains questions number **11 to 22**, short answer type **II** questions of **3** marks each.
6. *Section D* contains question number **23**, value based question of **4** marks.
7. *Section E* contains questions number **24 to 26**, long-answer type questions of **5** marks each.
8. There is no overall choice in the question paper; however, an internal choice is provided in one question of **2** marks, one question of **3** marks and all the three questions of **5** marks. In these questions, an examinee is to attempt any of the two given alternatives.

SECTION A

1. A male honeybee has 16 chromosomes whereas its female has 32 chromosomes. Give one reason. [1]

2. Mention the role of 'genetic mother' in MOET. [1]

3. What is biopiracy? [1]

4. Mention two advantages for preferring CNG over diesel as an automobile fuel. [1]

5. Write the probable differences in eating habits of *Homo habilis and Homo erectus*. [1]

SECTION B

6. A single pea plant in your kitchen garden produces pods with viable seeds, but the individual papaya plant does not. Explain. [1]

7. Following are the features of genetic codes. What does each one indicate?
Stop codon; Unambiguous codon; Degenerate codon; Universal codon. [1]

8. Suggest four important steps to produce a disease resistant plant through conventional plant breeding technology. [1]

9. Name a genus of baculovirus. Why are they considered good bio-control agents? [2]

10. Explain the relationship between CFC's and Ozone in the stratosphere.

OR

Why are scared groves highly protected? [2]

SECTION C

11.

(a) Name the organic material exine of the pollen grain is made up of. How is this material advantageous to pollen grain?

(b) Still it is observed that it does not form a continuous layer around the pollen grain. Give reason.

(c) How are 'pollen banks' useful? [2]

OR

(a) Mention the problems that are taken care of by Reproduction and Child Health Care programme.

(b) What is amniocentesis and why there is a statutory ban on it?

12. What is a test cross? How can it decipher the heterozygosity of a plant? [2]

13.

(a) What do 'Y' and 'B' stand for in 'YAC' and 'BAC' used in Human Genome Project (HGP). Mention their role in the project.

(b) Write the percentage of the total human genome that codes for proteins and the percentage of discovered genes whose functions are known as observed during HGP.

(c) Expand 'SNPs' identified by scientists in HGP [2]

14. Differentiate between homology and analogy. Give one example of each. [2]

15.

(a) It is generally observed that the children who had suffered from chicken – pox in their childhood may not contract the same disease in their adulthood. Explain giving reasons the basics of such immunity in an individual. Name this kind of immunity.

(b) What are interferons? Mention their role. [2]

16.

(a) Write the two limitations of traditional breeding technique that led to promotion of micro propagation.

(b) Mention two advantages of micro propagation.

(c) Give two examples where it is commercially adopted. [2]

17.

(a) How do organic farmers control pests? Give two examples.

(b) State the difference in their approach from that of conventional pest control methods.

18.

(a) Name the selectable markers in the cloning vector pBR322? Mention the role they play.

(b) Why is the coding sequence of an enzyme β - galactosidase a preferred selectable marker in comparison to the ones named above? [2]

19.

(a) Why must a cell be made 'competent' in biotechnology experiments? How does calcium ion help in doing so?

(b) State the role of 'biolistic gun' in biotechnology experiments. [3]

20. Explain enzyme – replacement therapy to treat adenosine deaminase deficiency. Mention two disadvantages of this procedure. [3]

21. Name and explain the type of interaction that exists in mycorrhizae and between cattle egret and cattle [3]

22. Differentiate between primary and secondary succession provided one example of each. [3]

SECTION D

23. A large number of married couples the world over are childless. It is shocking to know that in India the female partner is often blamed for the couple being childless.

(a) Why in your opinion the female partner is often blamed for such situations in India? Mention any two values that you as a biology student can promote to check this social evil.

(b) State any two reasons responsible for the cause of infertility.

(c) Suggest a technique that can help the couple to have a child where the problem is with male partner [3]

SECTION E

24.

(a) Explain the menstrual phase in a human female. State the levels of ovarian and pituitary hormones during this phase.

(b) Why is follicular phase in the menstrual cycle also referred as proliferative phase? Explain.

(c) Explain the events that occur in a graafian follicle at the time of ovulation and thereafter.

(d) Draw a graafian follicle and label antrum and secondary oocyte [3]

OR

(a) As a senior biology student you have been asked to demonstrate to the students of secondary level in your school, the procedure (s) that shall ensure cross – pollination in a hermaphrodite flower. List the different steps that you would suggest and provide reasons for each of the item.

(b) Draw a diagram of a section of a megasporangium of an angiosperm and label funiculus, Micropyle, embryosac and nuclleus.

25. Describe Meselson and Stahl's experiment that was carried in 1958 on *E.Coli.* Write the conclusion they arrived at after the experiment. [3]

OR

(a) Describe the process of transcription in bacteria

(b) Explain the processing the hnRNA needs to undergo before becoming functional mRNA eukaryotes.

26.

(a) Name the two growth models that represent population growth and draw the respective growth curves they represent.

(b) State the basics for the difference in the shape of these curves

(c) Which one of the curves represents the human population growth at present? Do you think such a curve is sustainable? Give reason in support of your answer.

OR

(a) Taking an example of a small pond, explain how the four components of an ecosystem function as a unit.

(b) Name the type of food chain that exists in a pond.

CBSE
Class XII Biology
Board Paper 2016 – All India (Set 1)
SOLUTION

SECTION A

1. Male honey bees are born from unfertilised eggs, whereas female honey bees are born from fertilised eggs. Because the unfertilised egg carries half the number of chromosomes as compared to the fertilised egg, male honey bees have half the number of chromosomes as compared to female honey bees.

2. In multiple ovulation embryo transfer (MOET), the genetic mother is administered with hormones which induce follicular maturation and superovulation. After fertilisation, the eggs are transferred to a surrogate mother at the 8–32 cell stage for further development. The genetic mother can then be used for another round of superovulation.

3. Biopiracy is the term given to unauthorised use of bioresources by multinational companies and other organisations without proper authorisation and compensatory payments to the people concerned.

4. Two advantages of compressed natural gas (CNG) over diesel fuel:
1. CNG burns more efficiently and very little residue is left unburnt.
2. It is cheaper than diesel and chances of adulteration are negligible.

5. *Homo habilis* did not eat meat, whereas *Homo erectus* was probably a meat eater.

SECTION B

6. Pea plant is a dioecious plant bearing bisexual flowers, i.e. the stamen and pistil are present on the same flower. Thus, the single pea plant can produce viable seeds after self-pollination.

Papaya is a monoecious plant bearing unisexual flowers and requires cross-pollination for viable seed production. Thus, a single papaya plant cannot produce viable seeds.

7. Features of the genetic code:
Stop codon: Signals termination of translation and does not code for any amino acid.
Unambiguous codon: Each codon codes for only one amino acid.
Degenerate codon: More than one codon can code for a specific amino acid.
Universal codon: One codon codes for the same amino acid in all species.

8. Important steps involved in conventional breeding technology:
(i) Selection of parent plant with desired combination of characters
(ii) Hybridisation of selected plants
(iii) Selection and evaluation of hybrids
(iv) Testing and release of new varieties for commercial production

9. *Nucleopolyhedrovirus* is a genus of a baculovirus which are efficient biocontrol agents. They are considered good biocontrol agents because they are species-specific and have no negative impacts on plants, mammals, birds, fish or even on non-target insects.

10. The ozone layer is getting depleted by the action of chlorofluorocarbons (CFCs) used as a coolant in refrigerators and in perfumes. When CFCs are released into the stratosphere, they end up being broken up by ultraviolet light, resulting in chlorine being released. Chlorofluorocarbons bind to ozone, and the chemical reaction releases a chlorine free-radical capable of destroying thousands of molecules of ozone.

OR

Sacred groves are forest fragments which are highly protected by certain communities because they are of religious importance to these communities.

SECTION C

11.

(a) The exine of the pollen grain is made of sporopollenin. Sporopollenin is one of the most resistant organic compounds. It can withstand high temperature, strong acids and alkalis and cannot be degraded by any of the known enzymes. Hence, it acts as a shield and protects the pollen grain from getting damaged.

(b) Exine does not form a continuous layer around the pollen because it is absent in certain sections called germ pores which serve as an outlet for the formation of the pollen tube.

(c) Pollen grains can be stored for years by cryopreservation. After this treatment, they are stored in pollen banks. Such conserved pollen grains can be used in plant breeding programmes.

OR

(a) Problems addressed through reproduction and child health care programmes:

(i) Creating awareness among people about the various aspects related to reproduction.

(ii) Providing facilities and support required for building and maintaining a reproductively healthy society.

(b) Amniocentesis is a disorder test based on the chromosomal pattern in the amniotic fluid surrounding the developing embryo. It is used to detect any chromosomal defect in the embryo. However, recently, amniocentesis is being used to detect the gender of the foetus resulting in several female foeticides. This declines the gender ratio. Therefore, there is a statutory ban on amniocentesis to avoid female foeticides.

12. Test cross is a cross between F_1 progeny and its homozygous recessive parent.
This cross determines whether the dominant character is coming from homozygous dominant genotype or heterozygous genotype (e.g. tallness coming from TT or Tt). When TT is crossed with tt, we obtain all Tt (tall) individuals in the progeny, whereas when Tt is crossed with tt, we obtain Tt (tall) and tt (dwarf) individuals in the progeny. Thus, a test cross can be used to determine the heterozygosity of the plant.

13.

(a) BAC (bacterial artificial chromosomes) and YAC (yeast artificial chromosomes) are cloning vectors which are used in the Human Genome Project for cloning or amplification of human DNA fragments.

(b) The total number of genes (coding for protein) in the human genome is 30,000, which is less than 2% of the total genome and almost 50% of the discovered genes have unknown functions.

(c) SNP stands for Single Nucleotide Polymorphism.

14.

Homology	Analogy
Organs which have similar origin but different functions are called homologous organs.	Organs which have the same function but are different in origin are called analogous organs.
This condition is known as homology.	This condition is known as analogy.
Example: Wings of birds and forelimbs of humans	Example: Wings of birds and wings of insects

15.

(a) People who have suffered from chickenpox in their childhood may not contract the disease again because of acquired immunity which is characterised by memory.

Acquired immunity is pathogen-specific. At the incidence of the first encounter with the microbe, the body produces a primary response of low intensity. On subsequent encounters with the same pathogen, a secondary response occurs which is of high intensity. This is attributed to the fact that our body has memory of the pathogen from the first encounter which had resulted in the production of antibodies against the pathogen.

(b) Interferons are proteins secreted by virus-infected animal cells. These interferons protect the non-infected cells from getting infected by inhibiting viral replication.

16.

(a) Two limitations of traditional breeding which led to the promotion of micropropagation:

(i) It failed to fulfil the demand.

(ii) It failed to provide an efficient and fast crop improvement system.

(b) Two advantages of micropropagation:

(i) Production of larger number of plants in very short duration of time

(ii) Recovery of healthy plants from diseased plants

(c) Micropropagation technology is adopted in the commercial production of many important food plants such as tomato and banana.

17.

(a) Organic farmers control pests by using natural predation instead of introduced chemicals. Microbial biocontrol agents are species-specific pesticides.

(i) Example: *Bacillus thuringiensis* is a bacterium which produces a toxin which specifically kills insect larvae such as lepidopterans (armyworms), coleopterans (beetles) and dipterans (flies/mosquitoes), leaving aside all other non-targeted organisms.

(ii) Another biocontrol agent is *Trichoderma* sp. which is a free-living fungus and works as a biocontrol agent against several plant pathogens.

(b) As compared to conventional pest control methods, organic farmers do not try to completely get rid of pests but keep them at manageable levels. They believe that complete eradication of pests is not beneficial and has certain adverse effects which lead to the death of those beneficial creatures which are dependent on them for food.

18.

(a) In the cloning vector pBR322, ampicillin and tetracycline resistance genes serve as selectable markers. They help in the selection of transformed cells from non-transformed cells. They also help distinguish recombinant cells from non-recombinant cells.

(b) The gene for the enzyme β-galactosidase is an alternative selectable marker. When the foreign gene is inserted within the β-galactosidase gene, the enzyme β-galactosidase gets inactivated. Then the bacteria are grown on a chromogenic substrate. Non-recombinants will produce blue-coloured colonies, while recombinants will produce colourless colonies.

19.

(a) In most biotechnology experiments, host cells are needed to be transformed with recombinant DNA. To fulfil this purpose, the cells are made competent so that they can take up the DNA molecule inside them. Treatment of bacterial cells with divalent cations such as calcium makes them competent and helps them to take up the DNA through the pores in the cell wall.

(b) Biolistic gun or gene gun delivery is a method of DNA delivery in case of plants. In this method, the host cells are bombarded with high-velocity microparticles of gold and tungsten coated with DNA molecules.

20. Adenosine deaminase (ADA) deficiency is a genetic disorder. In this disorder, the gene coding for the enzyme ADA gets deleted leading to deficiency of ADA and problems in the immune system. ADA deficiency in patients can be treated by enzyme replacement therapy. In this treatment, patients are regularly injected with the functional ADA enzyme.

Disadvantages of this process:

(i) It does not eradicate the disease.

(ii) Requirement of repeated doses of the enzyme makes it expensive.

21. Mycorrhizae are associations between fungi and the roots of higher plants. It is an example of mutualism in which both fungi and plants are dependent on each other for nutritional needs. Fungi absorb and transport essential nutrients to plants and in turn plants supply sugar molecules to the fungi.

The interaction which exists between cattle egret and cattle is known as commensalism. In this type of interaction, one species is benefited, whereas the other is neither benefited nor harmed. The cattle egret (bird) usually moves in proximity to the grazing cattle. As cattle move in the grass, they stir up the grass and flush out the insects which then become an easy target for the egret. In this way, the cattle is neither benefited nor harmed, but the egret is benefited.

22.

Primary Succession	Secondary Succession
It starts in areas where no previous life ever existed.	It starts in areas where previous life forms have been destroyed.
Soil is absent in the area at the beginning of primary succession.	Soil is present in the area where secondary succession begins.
It is a very slow process.	It is faster than primary succession.
Example: Succession on newly cooled lava	Example: Succession in a burnt forest

SECTION D

23.

(a) Females are often blamed for the couple being unable to reproduce because there is lack of awareness about the issue. As a biology student, I would promote the following two values among people:

(i) Either of the partners could be responsible for the couple being childless.

(ii) We must not blame females for infertility without proper diagnosis.

(b) Two reasons for infertility could be congenital disease and drugs.

(c) There are various techniques which can help in the condition when the male partner is infertile. One such technique is artificial insemination.

In this technique, the semen collected from the husband or a donor is introduced into the vagina or uterus. This cures infertility arising from the inability of the male partner to ejaculate or due to his low sperm count.

SECTION E

24.

(a) The menstrual cycle is the reproductive cycle in all primates and begins at puberty (menarche).

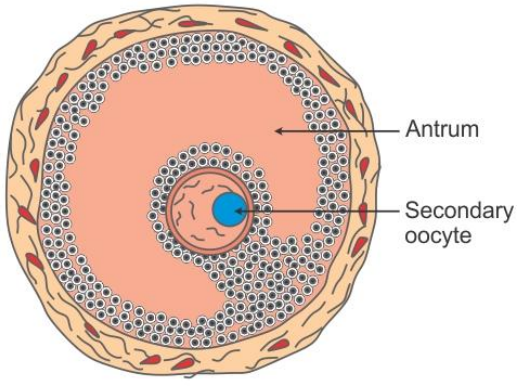
- Menses takes place on the 3rd–5th day of the menstrual cycle of 28 days.
- The production of LH is considerably reduced.
- This causes degeneration of the corpus luteum and reduction in the production of progesterone and oestrogen.
- The uterine endometrium breaks down and menstruation starts.
- Cells of the endometrium, secretions, blood and the unfertilised ovum constitute menstrual flow.

During this phase, the levels of ovarian and pituitary hormones are low.

(b) The menstrual phase is followed by the follicular phase wherein the primary follicles mature into the Graafian follicle under the influence of FSH and LH. Because the follicles and the endometrium proliferate during the follicular phase, it is also known as the proliferative phase.

(c) At the time of ovulation, the release of gonadotropins (LH and FSH) increases. The LH and FSH are at their peak in the middle of the cycle (14th day) and cause the rupture of the Graafian follicle to release the ovum. The remains of the Graafian follicle get converted to the corpus luteum, which secretes progesterone for the maintenance of the endometrium in case of pregnancy.

(d) Mature Graafian Follicle

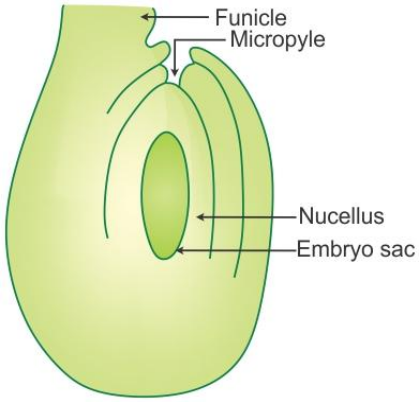


OR

(a) Cross-pollination of a hermaphrodite flower (flower bearing both stamen and pistil) can be achieved by

(i) Emasculation: The anther is removed from one of the flowers.
(ii) Bagging: The emasculated flower is covered by a bag so as not to allow contamination of the stigma by unwanted pollen grains. When the stigma of the bagged flower becomes receptive, the pollen grains collected from the other flower are dusted onto the stigma and then the flower is rebagged.

(b)



25.

Experiment

The experiment was performed by Meselson and Stahl. The following steps were followed in the experiment:

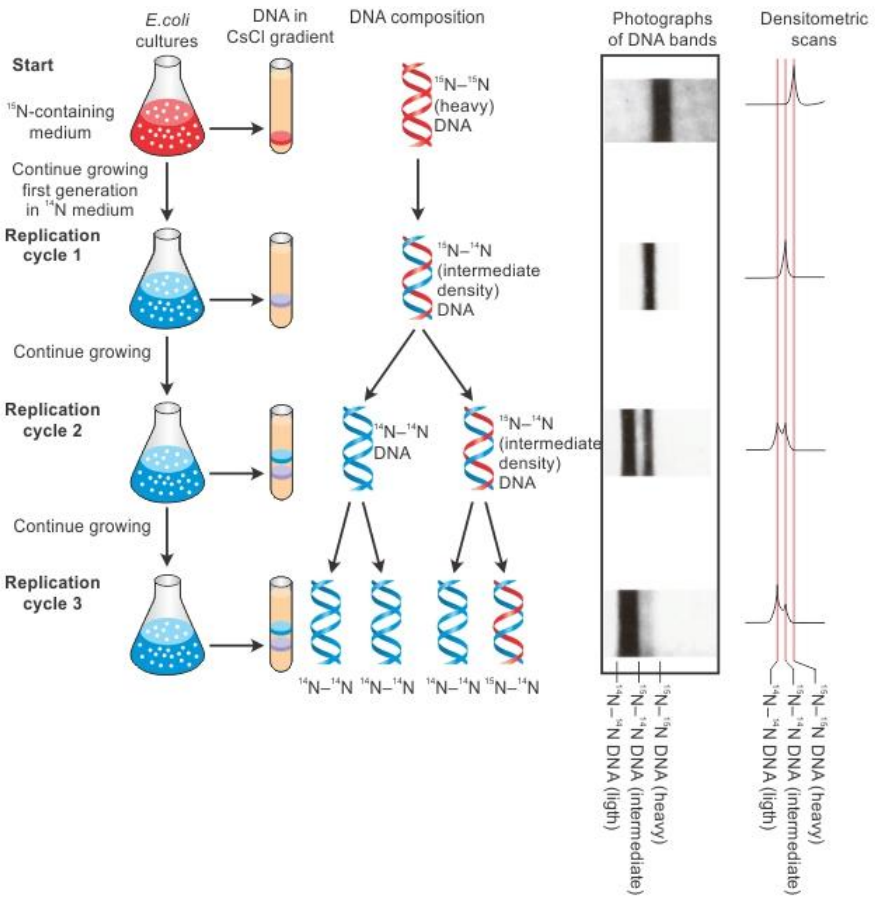
(i) *E. coli* was grown in a medium containing the heavy isotope ^{15}N as the sole nitrogen source.
(ii) This led to the incorporation of ^{15}N into the newly synthesised DNA, which ultimately made the DNA heavy.
(iii) This heavy DNA was separated from the normal DNA by density gradient centrifugation using caesium chloride as the gradient.
(iv) The cells were then transferred into a medium with ^{14}N as the nitrogen source.
(v) Samples were taken from this medium and the DNA was extracted.

Observation

Because *E. coli* divides every 20 minutes, the DNA extracted after 20 minutes in the experiment had a hybrid density. DNA extracted after 40 minutes had equal amounts of hybrid and light densities.

Conclusion

This implies that the newly synthesised DNA obtained one of its strands from the parent. Thus, replication was semi-conservative.



OR

(a) Transcription has three steps—initiation, elongation and termination.

Initiation:

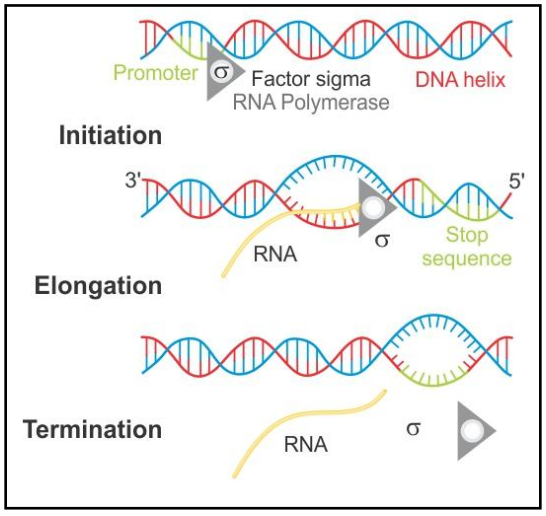
RNA polymerase binds with the promoter to initiate the process of transcription. Association with the initiation factor (σ) alters the specificity of RNA polymerase to initiate transcription.

Elongation:

RNA polymerase uses nucleoside triphosphate as the substrate, and polymerisation occurs according to complementarity.

Termination:

Termination occurs when the termination factor (rho) alters the specificity of RNA polymerase to terminate transcription. As the RNA polymerase proceeds to perform elongation, a short stretch of RNA remains bound to the enzyme. As the enzyme reaches the termination region, this nascent RNA falls off and transcription is terminated.



(b) The precursor of mRNA, i.e. hnRNA, contains both introns and exons.
Introns are removed and exons are joined by a process called splicing.
The remaining mRNA is processed in two ways:

(i) Capping: Methyl guanosine triphosphate is added to the 5′ end of hnRNA.
(ii) Tailing: Adenylate residues are added to the 3′ end of hnRNA.

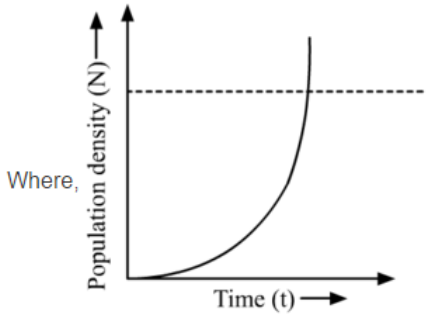
When hnRNA is fully processed, it is known as mRNA, which is transported out of the nucleus to get translated.

26.

(a) Two types of growth models:

(i) Exponential growth: When resources are unlimited, the population tends to grow in an exponential pattern.
If the population size is N and the birth and death rates are b and d, respectively, then the increase or decrease in N at t (time period) is

$dN/dt = (b - d) \times N$
If $(b - d) = r$, then
$dN/dt = rN$
r is the intrinsic rate of natural increase.
Or
$N_t = N_o e^{rt}$



Exponential Growth

N_t: Population density at time t
N_0: Population density at time 0
r: Intrinsic rate of natural increase
e: Base of natural logarithm (2.71828)

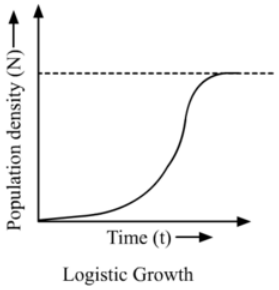
Logistic growth: When the resources are limited leading to competition between individuals and survival of the fittest, the population tends to grow logistically.

In this kind of growth, there is an initial lag phase followed by acceleration or deceleration phases, and finally asymptote, when it reaches its carrying capacity (K).

When N in relation to t is plotted, it results in a sigmoid curve which is

$$dN/dt = rN\left(\frac{K-N}{K}\right)$$

N: Population density at time t
r: Intrinsic rate of natural increase
K: Carrying capacity



Logistic Growth

(b) The difference in the shape of these curves is the amount of resources available for the given population. For exponential growth, the amount of resources is considered infinite, while in logistic growth, there is limited amount of resources available.

(c) The present human population is following the logistic growth curve because the number of human beings is increasing rapidly but the available resources are not increasing at the same pace. Such a growth pattern is not sustainable because at one point the human population would reach a place where there would not be enough resources for everyone. For sustainable growth, we must find ways to develop and use already present resources more intelligently.

OR

(a) Various aspects taken into consideration to study the functioning of the ecosystem:

(i) Productivity
(ii) Decomposition
(iii) Energy flow
(iv) Nutrient cycling

Productivity: In a pond ecosystem, phytoplanktons capture the energy of the Sun for photosynthesis. Thus, they contribute to primary productivity.

Energy flow: Phytoplankton are then consumed by zooplankton. Zooplanktons are eaten by small fish, which are in turn eaten by large fish. Hence, there is a constant flow of energy between different trophic levels.

Decomposition and nutrient cycling: When any organism dies at any trophic level, the various microbes present in the pond water decompose the dead remains. The nutrients which are released in the process of decomposition are again available to the producers for primary productivity.

(b) A grazing food chain is present in a pond ecosystem.

CBSE
Class XII Biology
Board Paper – 2015 – Outside Delhi (Set 1)

Time: 3 hrs **Total Marks: 70**

General Instructions:

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SECTION A

1. How many chromosomes do drones of honey bees possess? Name the type of cell division involved in the production of sperms by them. [1]

2. What is a cistron? [1]

3. Retroviruses have no DNA. However, the DNA of the infected host cell does possess viral DNA. How is it possible? [1]

4. Why do children cured by enzyme-replacement therapy adenosine deaminase deficiency need periodic treatment? [1]

5. List two advantages of the use of unleaded petrol in automobiles as fuel. [1]

SECTION B

6. Why do moss plants produce very large number of male gametes? Provide one reason. What are these gametes called? [2]

7. [2]

(a) Select the homologous structures from the combinations given below:

(i) Forelimbs of whales and bats

(ii) Tuber of potato and sweet potato

(iii) Eyes of octopus and mammals

(iv) Thorns of *Bougainvillea* and tendrils of *Cucurbita*

(b) State the kind of evolution they represent.

8. [2]

(a) Why are the plants raised through micropropagation are termed as somaclones?

(b) Mention two advantages of this technique.

9. Explain the different steps involved during primary treatment phase of sewage. [2]

10. What is mutualism? Mention any two examples where the organisms involved are commercially exploited in agriculture. [2]

OR

List any four techniques where the principle of *ex-situ* conservation of biodiversity has been employed. [2]

SECTION C

11. State what is apomixis. Comment on its significance. How can it be commercially used? [3]

12. During a monohybrid cross involving a tall pea plant with a dwarf pea plant, the offspring populations were tall and dwarf in equal ratio. Work out a cross to show how it is possible. [3]

13. Explain the significance of satellite DNA in DNA fingerprinting technique. [3]

14. What does the following equation represent? Explain. [3]

$p^2 + 2pq + q^2 = 1$

15. A heavily bleeding and bruised road accident victim was brought to a nursing home. The doctor immediately gave him an injection to protect him against a deadly disease. [3]

(a) Write what did the doctor inject into the patient's body.

(b) How do you think this injection would protect the patient against the disease?

(c) Name the disease against which this injection was given and the kind of immunity it provides.

16. Enumerate any six essentials of good, effective Dairy Farm Management Practices. [3]

17. State the medicinal value and the bioactive molecules produced by *Streptococcus*, *Monascus* and *Trichoderma*. [3]

OR

What are methanogens? How do they help to generate biogas? [3]

18. Rearrange the following in the correct sequence to accomplish an important biological reaction: [3]

(a) In vitro synthesis of copies of DNA of interest

(b) Chemically synthesized oligonucleotides

(c) Enzyme DNA-polymerase

(d) Complementary region of DNA

(e) Genomic DNA template

(f) Nucleotides provided

(g) Primers

(h) Thermostable DNA-polymerase (from *Thermus aquaticus*)

(i) Denaturation of ds-DNA

19. Describe any three potential applications of genetically modified plants. [3]

20. How did an American Company, Eli Lilly use the knowledge of r-DNA technology to produce human insulin? [3]

21. How do snails, seeds, bears, zooplanktons, fungi and bacteria adapt to conditions unfavourable for their survival? [3]

22. With the help of a flow hart, show the phenomenon of biomagnifications of DDT in an aquatic food chain. [3]

SECTION D

23. Your school has been selected by the Department of Education to organize and host an interschool seminar on "Reproductive Health – Problems and Practices". However, many parents are reluctant to permit their wards to attend it. Their argument is that the topic is "too embarrassing."

Put forth four arguments with appropriate reasons and explanation to justify the topic to be very essential and timely. [4]

SECTION E

24. [5]

(a) Plan an experiment and prepare a flow chart of the steps that you would follow to ensure that the seeds are formed only from the desired sets of pollen grains. Name the type of experiment that you carried out.

(b) Write the importance of such experiments.

OR

Describe the role of pituitary and ovarian hormones during the menstrual cycle in a human female. [5]

25. [5]

(a) Why are thalassemia and haemophilia categorized as Mendelian disorders? Write the symptoms of these diseases. Explain their pattern of inheritance in humans.

(b) Write the genotypes of the normal parents producing a haemophilic son.

OR

How do m-RNA, t-RNA and ribosomes help in the process of translation? [5]

26. [5]

(a) List the different attributes that a population has and not an individual organism.

(b) What is population density? Explain any three different ways the population density can be measured, with the help of an example each.

OR

"It is often said that the pyramid of energy is always upright. On the other hand, the pyramid of biomass can be both upright and inverted."

Explain with the help if examples and sketches. [5]

CBSE
Class XII Biology
Board Paper – 2015 – Outside Delhi (Set 1)
SOLUTION

SECTION A

1. Drones of honey bee possess 16 chromosomes. The sperms in honey bee are produced by mitosis.

2. A cistron is a segment of DNA which codes for a polypeptide.

3. Retroviruses have RNA as genetic material. After the entry of a virus into the body of the host, the virus attacks the macrophage cells of the body where the RNA genome of the virus replicates to form viral DNA with the help of the reverse transcriptase enzyme.

4. Adenosine deaminase deficiency can be cured by enzyme replacement therapy, but the cure is not permanent even after infusion of genetically engineered lymphocytes into a patient as cells do not always remain alive.

5. Advantages of unleaded petrol in automobiles as fuel:

(i) Automobiles equipped with a catalytic converter should use unleaded petrol because lead in the petrol inactivates the catalysts of the converter.

(ii) Use of unleaded petrol prevents the release of poisonous gases (e.g. nitrous oxide) in the environment.

SECTION B

6. Moss plants produce a large number of male gametes to increase the chances of fertilisation, as the eggs are located in the archegonium and the male gametes have to swim in water to reach the eggs for fertilisation to occur. The male gametes are called antherozoids.

7.

(a) The combinations with homologous structures are

(i) Forelimbs of whales and bats

(ii) Thorns of *Bougainvillea* and tendrils of Cucurbita

(b) These homologous structures represent divergent evolution.

8.

(a) Plants raised through micropropagation are termed somaclones because they are genetically identical to the original plant from which they are grown.

(b) Advantages of micropropagation:

(i) A large number of plants can be raised from a single individual plant within a relatively short period and in a limited space.

(ii) Virus-free healthy plants can be produced from the shoot apical meristem.

9. The primary treatment phase of sewage involves the removal of coarse solid materials through filtration and sedimentation. The diluted sewage is passed through a series of filters of sequentially small pore sizes to remove large floating objects. Then the filtered sewage is passed into the grit chamber where the coarse solid materials settle by gravity. After this, the sewage is allowed to pass into a sedimentation tank where the suspended materials settle and form the primary sludge. The effluent is then taken for the secondary treatment.

10. Mutualism is the relationship between two organisms where both organisms are benefited in terms of food, shelter and substratum for attachment.

Two examples:

(i) Mycorrhizae are the mutualistic relationship between fungi and roots of higher plants. The fungus helps in mineral nutrition of the plant with which they are associated and obtains, in turn, carbohydrates from the plant.

(ii) Nitrogen-fixing bacteria, *Rhizobium*, live in the root nodules of legumes where the bacterium derives nutrition from the host plant but fixes the atmospheric nitrogen and makes it available to the plants.

OR

Ex situ conservation is the conservation of selected rare plants or animals in places outside their natural homes. Ex situ conservation of biodiversity has been employed in

(i) Gene banks: These are the institutes which maintain stocks of viable seeds, live growing plants, tissue culture and frozen germplasm with the whole range of genetic variability.

(ii) Cryopreservation: Cryopreservation can maintain tissue culture, embryos, gametes, animal cells or tissues. Endangered organisms are being cryopreserved so that they can be revived to help in conservation.

(iii) Orchards: Plants with recalcitrant seeds are grown in orchards where all possible strains and varieties are maintained.

(iv) Tissue culture: It is carried out through callus formation, embryoids, pollen grain culture and shoot tip culture in plants which are either seedless, have recalcitrant seeds, variable seed progeny or where clones are to be maintained.

SECTION C

11. Apomixis is the mode of reproduction which does not involve formation of zygote through gametic fusion.

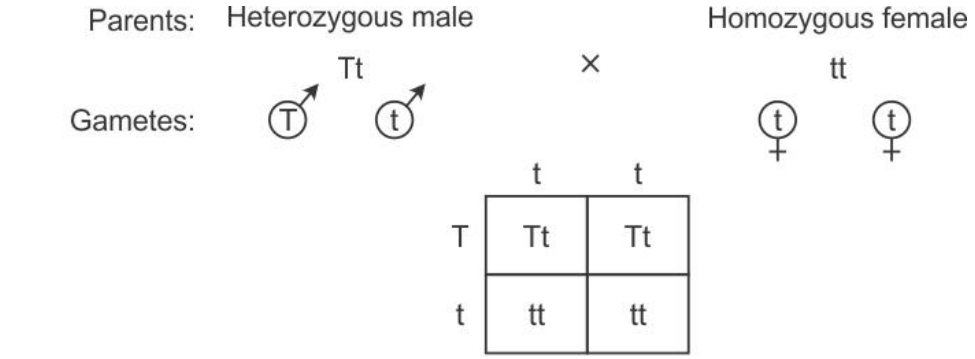
Significance of apomixis:

(i) Adventives embryos are better clones than cuttings.

(ii) Embryos formed through apomixes are generally free from infections.

Hybrid varieties provide higher and better yield. If hybrid seeds are produced every year, they do not maintain hybrid characters because of segregation of traits. Moreover, production of hybrid seeds every year is very costly. This can be avoided by introducing apomixes in hybrid seeds.

12. 50% of dominant traits and 50% of recessive traits during a monohybrid cross can be obtained by a test cross between a homozygous pea plant and a heterozygous pea plant.



13. Satellite DNA are small non-coding but inheritable sequences of bases which can be separated as satellite from bulk DNA during density gradient centrifugation. Satellite DNA shows polymorphism which forms the basis of DNA fingerprinting. There are short nucleotide repeats in the DNA which are specific in each individual and vary in number from person to person but are not inherited. These are called 'variable number tandem repeats' or mini-satellites. Individuals inherit these repeats from their parents which are used as genetic markers in a personal identity test.

14. The given equation represents the gene frequency of the total population according to Hardy–Weinberg law. In this equation, suppose a gene has two alleles *A* and *a*, and *p* is the frequency of occurrence of dominant allele *A* and *q* is the frequency of occurrence of recessive allele *a* in the parental generation.

Then according to the equation,

$P^2 + 2pq + q^2 = 1$

where p^2 = frequency of occurrence of individuals with homozygous dominant alleles (*AA*)

$2pq$ = frequency of occurrence of heterozygous individuals (*Aa*)

q^2 = frequency of occurrence of individuals with homozygous recessive alleles (*aa*)

15.

(a) The doctor injects the preformed antitoxin into the patient's body.

(b) The vaccine stimulates the production of antibodies against the antigen for inducing active acquired immunity.

(c) The injection was given to prevent tetanus. It provides acquired immunity.

16. Essentials of good, effective dairy farm management practices are

(i) Good breeds of dairy farm animals should be selected.

(ii) Suitable environmental conditions such as adequate ventilation, suitable temperature, sufficient light, water, air and well-drained housing accommodation should be provided.

(iii) Each animal should be fed on a balanced ration.

(iv) Hygiene and proper cleanliness should be included in the housing of animals.

(v) Animals should be vaccinated at regular time intervals in order to protect them from diseases.

(vi) Regular visits by a veterinary doctor are must.

17.

Organism	Medicinal value	Bioactive molecule
a. *Streptococcus*	Clot buster for removing clots from blood vessels of heart attack patients	Enzyme
b. *Monascus*	Blood cholesterol lowering agents	Statins
c. *Trichoderma*	Immunosuppressant drug	Cyclosporine A

OR

Methanogens are the methane-producing bacteria used during the production of biogas. The methanogenic bacteria digest the organic mass to produce marsh gas during the secondary treatment of sewage. Marsh gas is a mixture of gases containing methane, hydrogen sulphide and carbon dioxide which form biogas.

18. The correct sequence of the steps involved in biotechnological reaction are

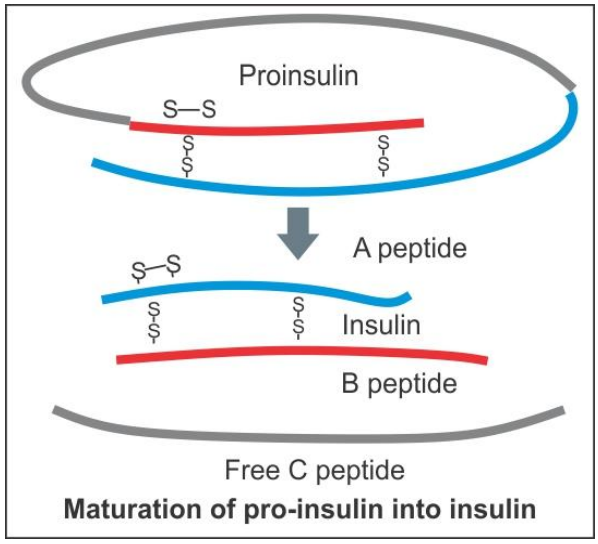
Genomic DNA template
↓
Denaturation of ds-DNA
↓
Nucleotides provided
↓
Primers
↓
Thermostable DNA polymerase (from *Thermus aquaticus*)
↓
Enzyme DNA polymerase
↓
Chemically synthesised oligonucleotides
↓
Complementary region of DNA
↓
In vitro synthesis of copies of DNA of interest

19. Potential applications of genetically modified plants:

(i) GMO crops are more tolerant to abiotic stresses.
(ii) They have reduced the dependency on chemical pesticides.
(iii) They have enhanced the nutritional value of food such as vitamin A-enriched rice.

20. The structure of insulin consists of two short polypeptide chains—chain A and chain B—linked together by disulphide bridges. In mammals, including human beings, insulin is synthesised as a pro-hormone which contains an extra stretch called the C peptide which is removed during maturation into insulin. The rDNA technique is used for assembling insulin into the mature form.

In 1983, Eli Lily, an American company, prepared two DNA sequences corresponding to A and B chains of human insulin and introduced them in the plasmids of *E. coli* to produce insulin chains. Chains A and B were produced separately, extracted and combined by creating disulphide bonds to form human insulin.



Maturation of pro-insulin into insulin

21. Adaptations in unfavourable conditions in the following organisms:

(i) Snails: Snails undergo aestivation to avoid summer-related problems such as heat and desiccation.

(ii) Seeds: The seeds undergo dormancy to tide over the adverse environmental conditions. They reduce their metabolic activity and remain quiescent till the suitable environmental conditions return.

(iii) Bears: They undergo hibernation during winters to escape harsh winter conditions.

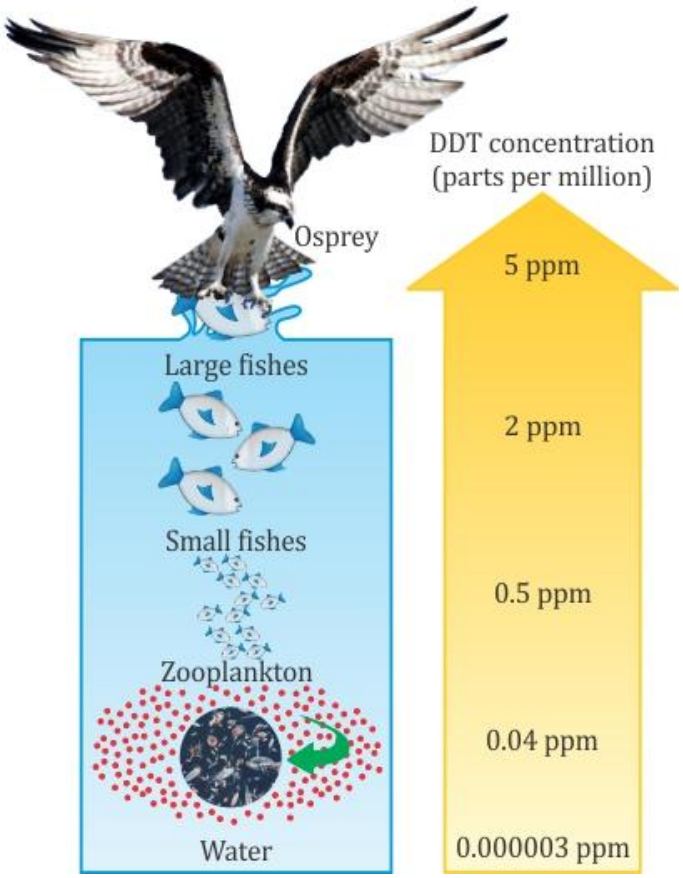
(iv) Zooplankton: Under unfavourable conditions, zooplankton species in lakes and ponds enter diapause, a stage of suspended development.

(v) Fungi: Various kinds of thick-walled spores are formed which help them to survive in unfavourable conditions. The spores germinate on return of favourable conditions.

(vi) Bacteria: Bacteria form thick spores which help them to survive under unfavourable conditions.

22. The increased concentration of toxic materials at each trophic level of a food chain is called biomagnification or biological concentration.

When the agricultural fields are sprayed with dichlorodiphenyltrichloroethane (DDT), it is carried into water bodies with low concentration. It gets accumulated by the zooplankton and its concentration goes on increasing at each trophic level in a food chain—from small fish to large fish and birds.



SECTION D

23. It is very important to attend the seminar on 'Reproductive Health – Problems and Practices' as it deals with the problems and strategies of reproductive health. It makes children aware of the following points:

(i) It makes them aware about reproduction.

(ii) It prevents sex abuse and sex-related crime. People should think and take up necessary steps to prevent sex abuse and build up a reproductively healthy society.

(iii) Students will have proper knowledge of reproductive organs, adolescence and sexually transmitted diseases.

(iv) It provides information about reproduction-related problems and menstrual problems so students can seek timely medical help.

SECTION E

24.

(a) Artificial hybridisation is a technique which ensures that the seeds are formed only from the desired set of pollen grains. It includes emasculation and bagging. Removal of stamens or anthers or killing of pollen grains of a bisexual flower without affecting the female reproductive organs is called emasculation. The emasculated flower is immediately enclosed in a plastic or butter paper bag to avoid pollination by unwanted pollen. This process is called bagging.

Experiment and flow chart of artificial hybridisation:

Remove the anthers of a bisexual flower using a pair of forceps.

↓

Immediately cover the emasculated flower with a plastic or butter paper bag.

↓

Collect the mature and viable pollen grains from the anthers of the male parent.

↓

Dust the pollen grains on the stigma of the female plant.

↓

Replace the bag immediately and allow the fruits to develop.

(b) Importance of artificial hybridisation:

(i) It helps plant breeders to cross a particular plant with desired pollen grains.

(ii) This technique helps in the production of hybrids without contamination by unwanted pollen grains.

OR

Follicle-stimulating hormone (FSH) and luteinising hormone are pituitary hormones. Oestrogen and progesterone are ovarian hormones.

Functions of pituitary and ovarian hormones:

Hormone	Functions
FSH	i. Stimulates the ovarian follicles to secrete oestrogen. ii. Stimulates the proliferation of the endometrium of the uterine wall. iii. Stimulates the maturation of Graafian follicles.
LH	i. Stimulates the release of ovum. ii. Develops corpus luteum and secretion of progesterone. iii. Maintains pregnancy.
Oestrogen	i. Controls the changes in the secondary sex organs in the first half of the menstrual cycle. ii. Stimulates growth, maturation and functions of secondary sex organs. iii. Repairs the damaged tissues of the uterus and fallopian tubes after menstruation. iv. Stimulates the maturation of ova development of uterine lining and mammary glands.
Progesterone	i. Facilitates the preparation of the endometrium for implantation. ii. Inhibits the contraction of the uterus and the development of new follicles.

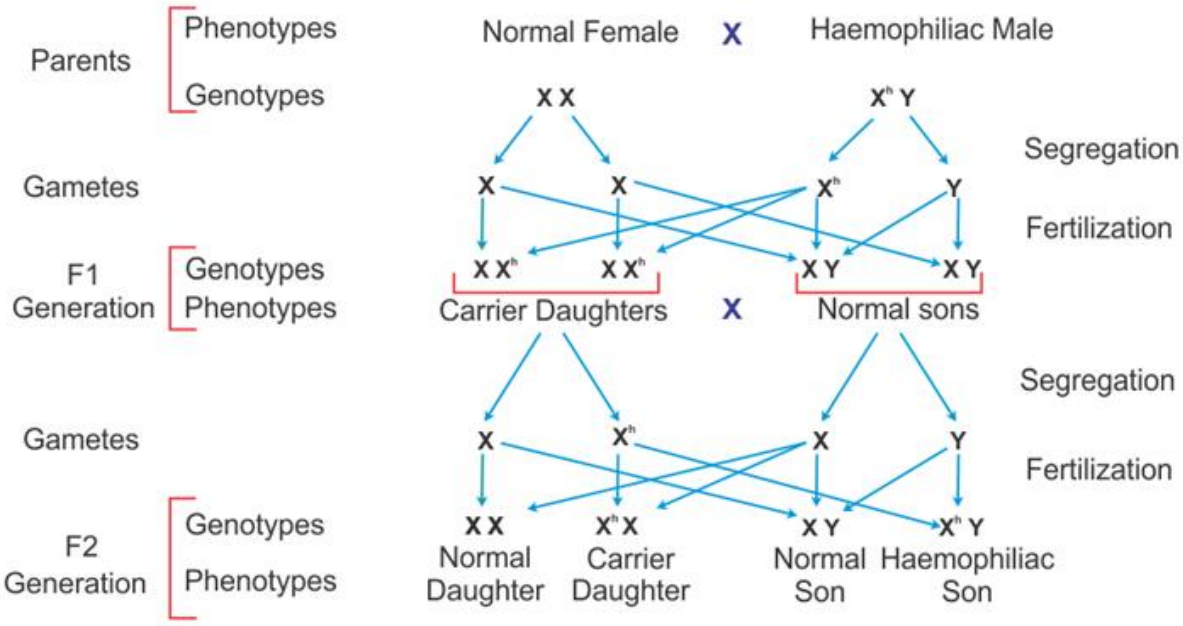
25.

(a) Thalassaemia and haemophilia are categorised as Mendelian disorders because these are determined by alternation or mutation in a single gene.

Symptoms of thalassaemia: The main symptoms of thalassaemia are anaemia, jaundice, hepatosplenomegaly, cardiac enlargement and skeletal deformities.

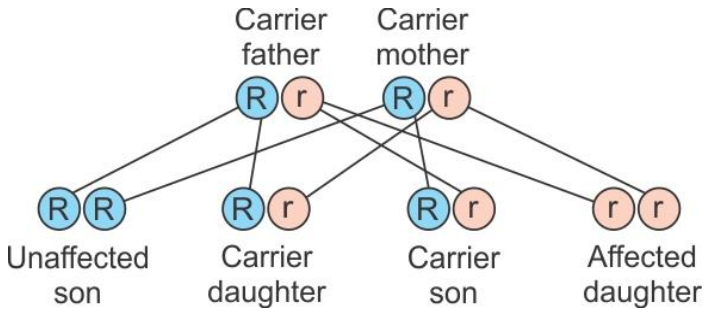
Symptoms of haemophilia: Haemophilia is also called bleeder's disease in which a single cut leads to non-stop bleeding. It prevents clotting of blood. A seriously affected person may bleed to death after even a minor skin cut.

Inheritance pattern of haemophilia:
This is a sex-linked recessive disease which shows its transmission from an unaffected carrier female to some of the male progeny. It shows criss-cross inheritance. The heterozygous female (carrier) for haemophilia may transmit the disease to sons. The possibility of a female becoming a haemophilic is extremely rare because the mother of such a female would have to be at least a carrier and the father should be haemophilic.

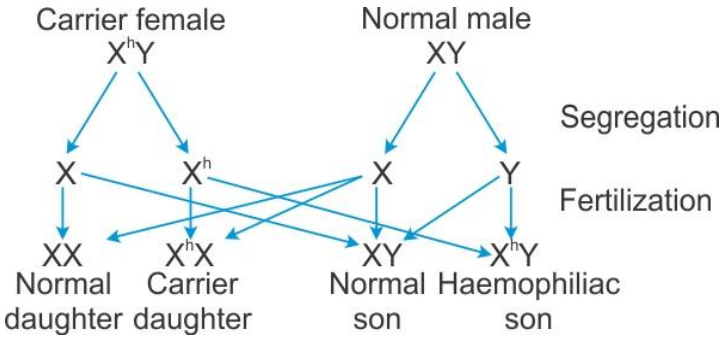


Inheritance pattern of thalassaemia:

Thalassaemia is an autosomal, recessively inherited blood disorder transmitted to the offspring when both parents are heterozygous. The defect arises because of either mutation or deletion which results in the reduced rate of synthesis of one of the globin chains of haemoglobin.



(b) The genotype of the parents producing a haemophilic son will be X^hX (carrier female) and XY (normal male).



OR

Role of m-RNA, t-RNA and ribosomes in protein synthesis:

(i) m-RNA: The messenger RNA brings coded information from DNA and takes part in its translation by bringing amino acids in a particular sequence during the synthesis of a polypeptide. The same m-RNA can be reused many times.

(ii) t-RNA: They transfer RNAs which pick up particular amino acids in the process called charging, and they carry them to m-RNA over particular codons corresponding to their anticodons. Each t-RNA has an area for coming in contact with ribosome and the enzyme amino acyl tRNA synthetase.

(iii) Ribosomes: Ribosomes are protein factories. Each ribosome has two subunits—smaller and larger subunits. The larger subunit has a groove for pushing out the newly formed polypeptide and for protecting the same from cellular enzymes. The smaller subunit fits like a cap over the larger one and leaves a tunnel for m-RNA. The smaller subunit has a point for recognising m-RNA and binding area for initiation factors.

26.

(a) Natality, mortality, population density, population growth, population dispersal, sex ratio and age distribution are the different attributes which a population has but not an individual organism.

(b) Population density: It is defined as the number of individuals present in a unit area at a given time. The different ways by which population density can be measured are

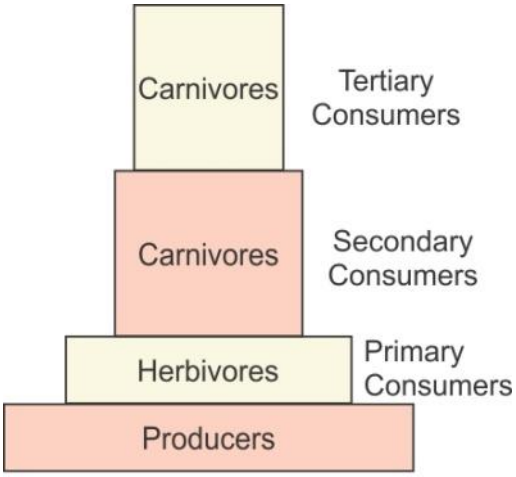
(i) Population density can be measured by counting all the individuals in a region, but if the population is large, then counting may not be possible. Example: Counting Siberian cranes at Bharatpur wetlands.

(ii) Percent cover or biomass is also used to measure the population density in huge populations. Example: Dense laboratory culture of bacteria in a Petri dish can be measured only by biomass.

(iii) Relative density is also used to measure population density. Example: The number of fish caught per trap is used to measure its total population density in a lake.

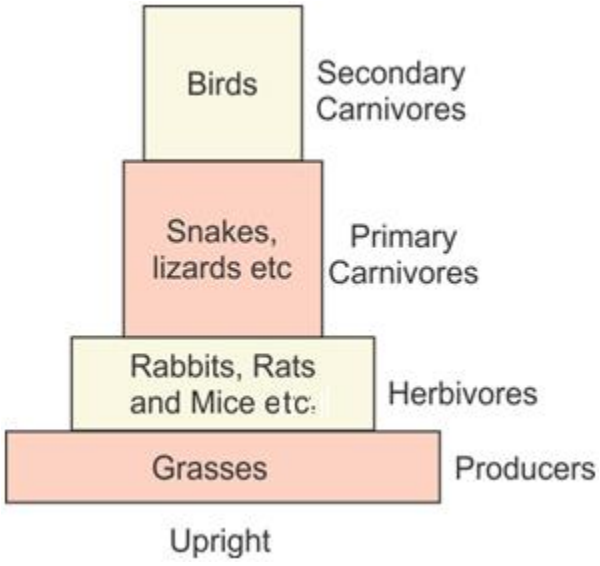
OR

Pyramid of energy is a graphical representation of amount of accumulated energy per unit area in different trophic levels of a food chain. An energy pyramid is always upright because there is a gradual decrease in energy at successive trophic levels. This happens according to the 10% law of energy transfer, where only 10% of the total energy is transferred from one trophic level to another. The energy is the highest at the producer level, and it gradually decreases on moving from herbivores to carnivores.

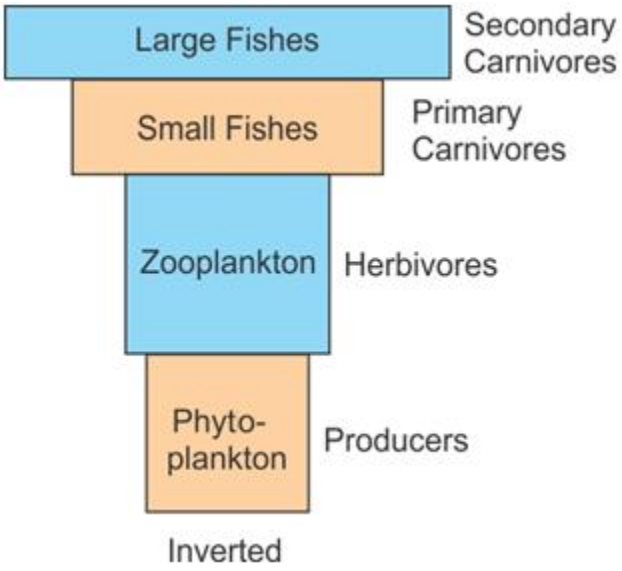


Pyramid of Energy

Pyramid of biomass is a graphic representation of biomass present per unit area in different trophic levels. It can be both upright and inverted. Examples: In a grassland forest ecosystem, there is a gradual decrease in biomass of organisms at successive trophic levels from producers to top carnivores which shows a straight or upright pyramid.



In a pond ecosystem, the pyramid is inverted as there is a gradual increase in biomass of organisms at successive trophic levels from producers to top carnivores. The producers are the smallest organisms, while the carnivores are larger in size.



CBSE-XII-2014 EXAMINATION

BIOLOGY

Code : 57/1

Paper & Solution

Time : 3 Hrs. **Max. Marks : 70**

General Instruction :

(i) **All** questions are compulsory.

(ii) 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.

(iii) There is no overall choice. However, an internal choice has been provided in one questions of **2** marks, one questions of **3** marks and all the three questions of **5** marks weightage. A student has to attempt only one of the alternatives in such questions.

(iv) Wherever necessary, the diagrams drawn should be neat and properly labelled.

SECTION A

1. Name the part of the flower which the tassels of the corn-cob represent. **1**

Sol. Style.

2. Mention any two contrasting traits with respect to seeds in pea plant that were studied by Mendel. **1**

Sol. Seed shape : Round and Wrinkled
Seed colour **:** Yellow and Green

3. Why is secondary immune response more intense than the primary immune response in humans ? **1**

Sol. Our body appears to have memory of first encounter that's why secondary immune response is more intense than primary immune response.

4. Why is it not possible for an alien DNA to become part of a chromosome anywhere along its length and replicate normally. **1**

Sol. Because origin of replication is not present in recombinant DNA.

5. State the role of C peptide in human insulin. **1**

Sol. C peptide maintains the insulin in its inactive or Dormant stage proinsulin.

6. Name the enzymes that are used for the isolation of DNA from bacterial and fungal cells for recombinant DNA technology. **1**

Sol. Enzyme used to isolate DNA from bacteria: Lysozyme
Enzyme used to isolate DNA from Fungi : Chitinase

7. State Gause's Competitive Exclusion Principle. **1**

Sol. It states that two closely related species competing for the same resourses can not co exist indefinitely and the competitively inferior one will be eliminated evantually.

8. Name the type of association that the genus Glomus exhibits with higher plants. **1**

Sol. Ectomycorrhiza

SECTION B

9. Why are the human testes located outside the abdominal cavity ? Name the pouch in which they are present. **2**

Sol. Human testes are located outside the abdominal cavity in a pouch called scrotum because scrotum helps in maintaining low temperature of testes that is 2 – 2.5°C lower than internal body temperature which is necessary for spermatogenesis
Testes are located in scrotum.

10. In Snapdragon, a cross between true-breeding red flowered (RR) plants and true-breeding white flowered (rr) plants showed a progeny of plants with all pink flowers. **2**
(a) The appearance of pink flowers is not known as blending. Why?
(b) What is this phenomenon known as ?

Sol. (a) The appearance of pink flower is not known as blending because different alleles don't mix to each other in pink flower and segregate to each other during gamete formation (Law of Segregation)
(b) This phenomenon is known as incomplete Dominance.

11. With the help of one example, explain the phenomena of co-dominance and multiple allelism in human population. **2**

Sol. Co-dominance when both the alleles of a gene express themselves completely in heterozygous condition it is known as co-dominance.
AB Blood group individual
Blood group A contain a antigen
Blood group B contain b antigen
While Blood group AB contain a&b both antigen
There are three allele for ABO blood group is present in human population
e.g. ABO blood group in human
Multiple allelism: When more than two allele for a gene is present in a population it is known as multiple allelism

12. Write the scientific name of the fruit-fly. Why did Morgan prefer to work with fruit-flies for his experiments? State any three reason

OR

Linkage and crossing-over of genes are alternatives of each other. Justify with the help of an example. **2**

Sol. Fruit fly : *Drosophila melenogaster*
Morgan use fruit fly as experimental material because of
1. Its short life span
2. It can be easily cultivated / cultured
3. Contrasting feature are easily observed
4. Produce large no. of offspring

OR

Linkage & crossing over are alternative or opposite phenomenon.
Linkage is transfer of two gene from one generation to another together, while crossing over is separation of two linked gene.

13. List the symptoms of Ascariasis. How does a healthy person acquire this infection ? **2**

Sol. Symptoms of Ascariasis ⇒
(1) Vit. A deficiency
(2) Fever
(3) Intestinal obstruction
(4) Eiosinophilia
(5) Appendicitis
(6) Internal bleeding
(7) Muscular pain
(8) Anemia
Mode of infection :- A healthy person aquires this infection through water, food fruits, vegetable etc. contaminated with embryonated egg of ascaris.

14. Explain the significant role of the genus *Nucleopolyhedrovirus* in an ecological sensitive area. **2**

Sol. Nucleopolyhedrovirus is a type of bacculovirus that attacks insect and other arthropodes and control the population of insect & arthropodet.

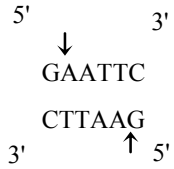
These viruses are excellent candidates for species specific narrow spectrum insecticidal application. They have been shown to have no negative impact on higher animals and plant and human. This is desirable when beneficial insect are being conserved to aid in overall IPM or when an ecological sensitive area is being treated.

15. How does a restriction nuclease function? Explain. **2**

Sol. Restriction endonuclease is a hydrolytic enzyme. This enzyme is commonly present in bacteria. This enzyme breaks the internal phosphodiester bond present between two specific nucleotide on restriction site. This enzyme breaks the DS DNA molecule internally

These enzymes are highly specific

e.g. ECORI enzyme



16. How have transgenic animals proved to be beneficial in : **2**

(a) Production of biological products

(b) Chemical safety testing

Sol. Use of Transgenic animals in

(a) Production of biological product: biological product are used in medicine are generally expensive. These product can be produced from transgenic animals which have the appropriate gene which produce the particular product.

e.g. production of α-1-antitrypsin from animals which is used in emphysema

(b) Transgenic animals are also used to test the chemical safety. Transgenic animals are created by insertion of gene which make them more sensitive to toxic substance than normal animals. They are then exposed to chemical & effect are studied.

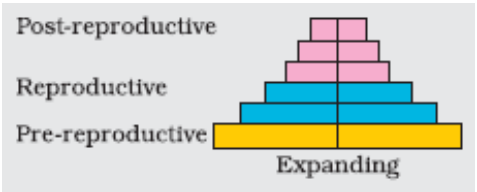
17. Describe the mutual relationship between fig tree and wasp and comment on the phenomenon that operates in their relationship. **2**

Sol. Mutualism is present between wasp and fig tree. female wasp lays its egg inside developing fruit of fig tree. Female wasp use fig fruit as oviposition site and also use its developing seed for nourishing its larva. The wasp pollinate the fig inflorescence while searching for suitable site for egg laying.

Thus fig and wasp both get benefited from this phenomenon .

18. Construct an age pyramid which reflects an expending growth status of human population. **2**

Sol.



SECTION C

19. Make a list of any three outbreeding devices that flowering plants have developed and explain how they help to encourage cross-pollination.

OR

Why are angiosperm anthers called dithecous ? Describe the structure of its microsporangium. **3**

Sol. Out breeding devices present in flowering plant

1. Unisexual flower: unisexual flower in monoecious plant prevent the autogamy but does not prevent geitanogamy but in dioecious plant only Allogamy occurs that is when ever unisexual flower are present cross pollination occur.

2. Dichogamy: when pollen release and stigma is not synchronized then self pollination can not occurs.

It can be of two type

1. Protoandry : pollen release before stigma become receptive .
2 Protogyny : stigma become receptive before pollen release .

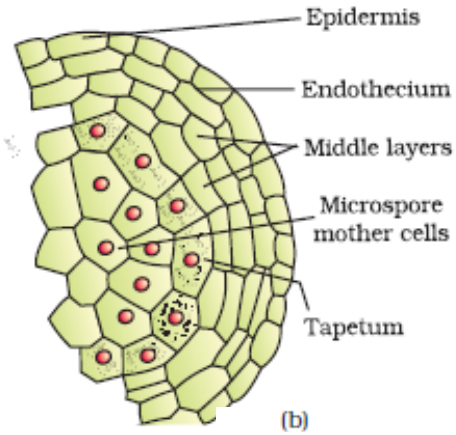
3. Self Incompatibility : This is genetic mechanism and prevent self pollen to fertilize the ovule by inhibiting pollen tube growth or pollen germination.

4. Presence of anther and stigma placed at different position so autogamy can not occur

OR

Angiosperm anther is known as dithecous because each anther has two anther lobe

Structure of microsporangium: In a transverse section, a typical microsporangium appears near circular in outline. It is generally surrounded by four wall layers the epidermis, endothecium, middle layers and the tapetum. The outer three wall layers perform the function of protection and help in dehiscence of anther to release the pollen. The innermost wall layer is the **tapetum.** It nourishes the developing pollen grains. Cells of the tapetum possess dense cytoplasm and generally have more than one nucleus. Can you think of how tapetal cells could become bi-nucleate? When the anther is young, a group of compactly arranged homogenous cells called the **sporogenous tissue** occupies the centre of each microsporangium.



20. If implementation of better techniques and new strategies are required to provide more efficient care and assistance to people, then why is there a statutory ban on amniocentesis ? Write the use of this technique and give reason to justify the ban. **3**

Sol. Statutory ban on amniocentesis for sex determination to legally check increasing female foeticides, massive child immunization etc.

Technique of Amniocentesis → Amniocentesis a foetal sex determination test based on chromosomal pattern in amniotic fluid surrounding the developing embryo.

21. Why is pedigree analysis done in the study of human genetics ? State the conclusions that can be drawn from it. **3**

Sol. Pedigree analysis is done in the study of human genetics because control crosses can not be possible in human being and age of human is more.

Pedigree analysis can be use to trace the inheritance of a specific trait abnormality or disease.

study of family history about inheritance of a particular trait in a several generation of a family is called pedigree analysis.

22. Identify 'a', 'b', 'c', 'd', 'e' and 'f' in the table given below : **3**

No.	Syndrome	Cause	Characteristics of affected individuals	Sex Male/Female/Both
1.	Down's	Trisomy of 21	'a' (i) (ii)	'b'
2.	'c'	XXY	Overall masculine development	'd'
3.	Turner's	45 with XO	'e' (i) (ii)	'f'

Sol.

a. (i) Short statured with small round head
   (ii) Furrowed tongue
   (iii) Partially open mouth
   (iv) Broad palm with palm crease
   (v) physical, psychometor and mental development retarded

b. Both

c. Klinefelter syndrome

d. male

e. (i) sterile female with rudimentry ovaries
   (ii) lack of secondary sexual character

f. Female

23. Community Service department of your school plans a visit to a slum area near the school with an objective to educate the slum dwellers with respect to health and hygiene. **3**

(a) Why is there a need to organise such visits ?

(b) Write the steps you will highlight, as a member of this department, in your interaction with them to enable them to lead a healthy life.

Sol. (a) Need to Organize Community Service Department to visit a slum area $\Rightarrow$

To aware people of slum area about health & hygiene because heath may affected by

(i) Infection

(ii) Life style including food and water we take, rest & exercise we give to our body and habitate we have or lack etc.

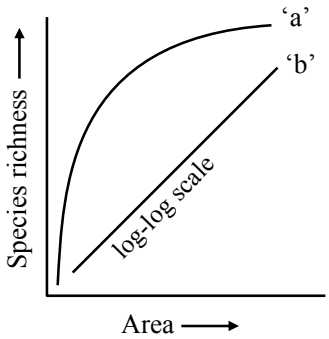
(b) Our interactual points with people of slums

(i) When people are healthy they are more efficient at work

(ii) Health also increases productivity, economy, longevity and reduces infants & maternal mortality

(iii) We have to also aware tham about disease & their effect vaccination proper disposal of waste, control of vector & maintenance of hygieniners of environment.

24. The following graph shows the species – area relationship. Answer the following questions as directed. **3**



(a) Name the naturalist who studied the kind of relationship shown in the graph. Write the observations made by him.

(b) Write the situations as discovered by the ecologists when the value of 'Z' (slope of the line) lies between
(i) 0.1 and 0.2
(ii) 0.6 and 1.2
What does 'Z' stand for ?

(c) When would the slope of the line 'b' become steeper ?

Sol. (A) Species area relationship was studied by Alexander Von Humboldt. He observed that within a region, species richness increased with increasing explored area but only upto a limit.

(B) (i) z = 0.1 to 0.2: for small area regardless of taxonomic group
(ii) z = 0.6 to 1.2 : for large area for example entire continent

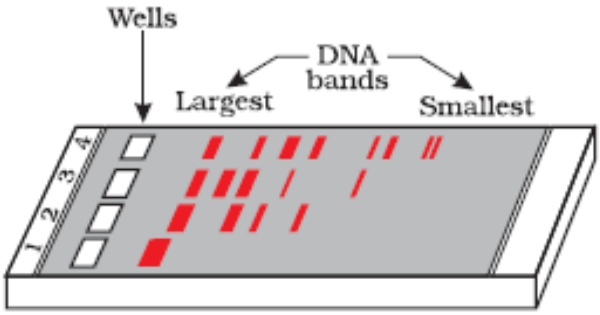
(C) The slope of the like b become steeper when species area relationship is analyzed in a very large area like the entire continents.

25. Name and describe the technique that helps in separating the DNA fragments formed by the use of restriction endonuclease. **3**

Sol. Agarose gel electrophoresis is used to help the separating restricted DNA fragment

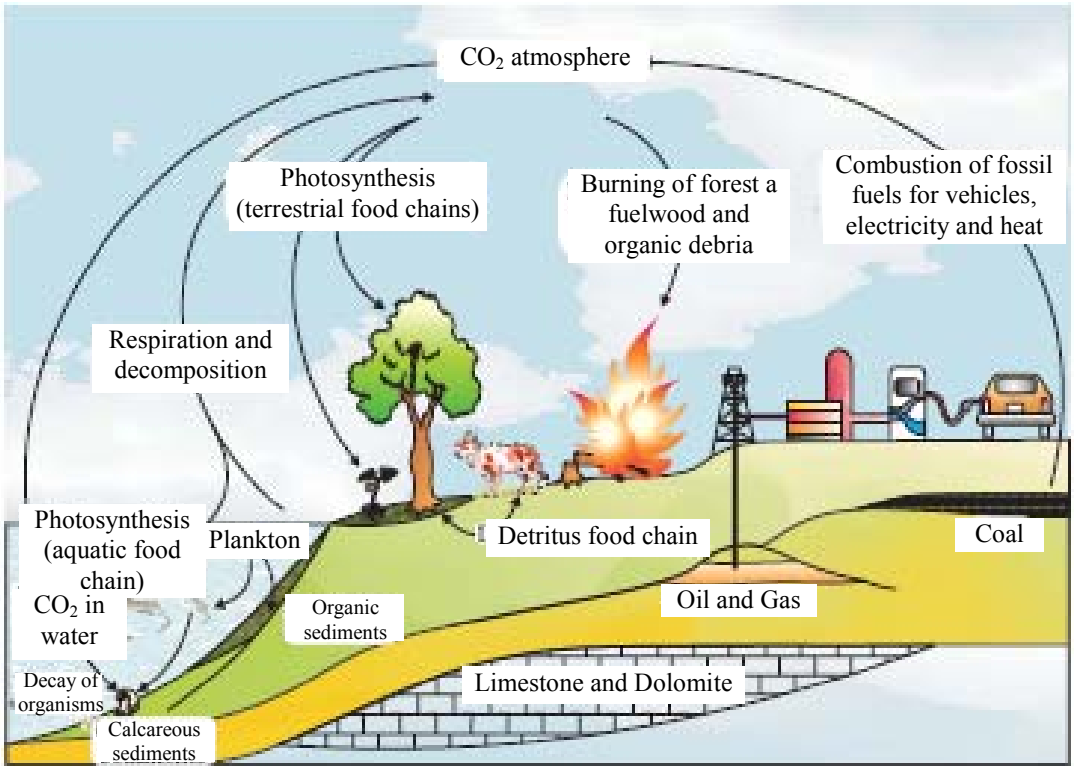
Agarose gel electrophoresis:

The cutting of DNA by restriction endonucleases results in the fragmentes of DNA. These fragments can be separated by a **gel electrophoresis**. Since DNA fragments are negatively charged molecules they can be separated by forcing them to move towards the anode under an electric field through a medium/matrix. The DNA fragments separate (resolve) according to their size through sieving effect provided by the agarose gel. Hence, the smaller the fragment size, the farther it moves. The separated DNA fragments can be visualised only after staining the DNA with a compound known as ethidium bromide followed by exposure to UV radiation (you cannot see pure DNA fragments in the visible light and without staining).



26. State the function of a reservoir in a nutrient cycle. Explain the simplified model of carbon cycle in nature. **3**

Sol. The function of reservoir is to meet with the deficit which occurs due to imbalance in the rate of influx and efflux.



27. Since the origin of life on Earth, there were five episodes of mass extinction of species. **3**

(i) How is the 'Sixth Extinction', presently in progress, different from the previous episodes?

(ii) Who is mainly responsible for the 'Sixth Extinction' ?

(iii) List any four points that can help to overcome this disaster.

Sol. (a) Sixth extinction rates are estimated to be 100 to 1000 times faster than in pre human times.

(b) Human activities in ecosystem is mainly responsible for sixth extinction.

Main reason for this extinction is

1. Habitat loss and fragmentation.
2. Over exploitation
3. Alien species introduction
4. Co extinction

(c) Sixth extinction can be slow down or prevented by

1. Afforestation
2. By preventing habitat loss
3. By use of Diverse species
4. By insitu conservation & ex-situ conservation

SECTION D

28. (a) Where does fertilization occur in humans? Explain the events that occur during this process.

(b) A couple where both husband and wife are producing functional gametes, but the wife is still unable to conceive, is seeking medical aid. Describe any one method that you can suggest to this couple to become happy parents.

OR

(a) Explain the different ways apomictic seeds can develop. Give an example of each.

(b) Mention one advantage of apomictic seeds to farmers.

(c) Draw a labelled mature stage of a dicotyledonous embryo. **5**

Sol. (a) In human fertilization occurs in junction of ampulla & isthmus of fallopian tube -

Mechanism of fertilization ⇒

During fertilization sperm comes in contact with zona pellucida of ovum & induces changes in membrane than block the entry of additional sperms to prevent polyspermy.

The secretion of acrosome helps the sperm enter into the cytoplasm of ovum through zona pellucida & the plasma membrane –

This induces completion of meiotic division of the secondary oocyte. Which as a result produces one smaller second polar body & a large haploid ovum/ootid. Soon haploid nucleus of sperm fused with that of ovum to form a diploid zygote.

(b) Couple able to produce functional gamete but unable to conceive can assist to have children through one of following techniques commonly called as – Assisted Reproductive Technologies (ART)

(1) In vitroferlilization followed by embryo transfer.

(2) Zygote intra fallopian transfer (ZIFT)

(3) Gamete Intra fallopian transfer (GIFT)

OR

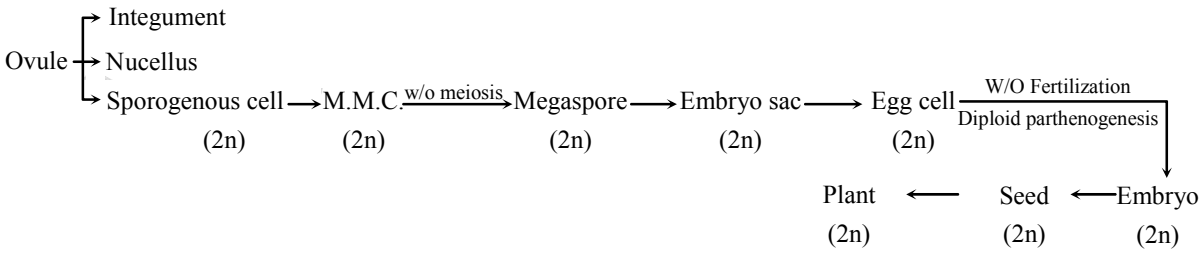
Types of Apomixsis

Diplospory ⇒

In this method **archesporium** differentiates to form a **megaspore mother cell** but this **megaspore mother cell directly gives rise to an embryo sac without meiosis.** This **embryo sac is diploid** and a diploid embryo is formed without fertilization from diploid **egg** of this embryo sac.

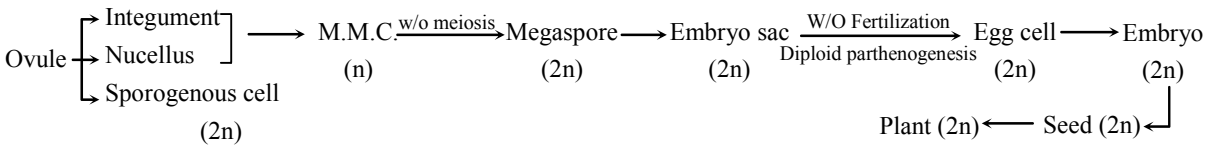
Ex. Parthenium, Taraxacum.

Diplospory is also known as **diploid parthenogenesis**.



Apospory ⇒ Ex. *Heiracium*, *Ranunculus*, *Rubus*.

It is discovered by **Rosenberg** in **Heiarcium** plant. In this method **embryo sac or female gametophyte is directly formed from any diploid cell of the ovule** (nucellus/integument) **except megaspore mother cell** without meiosis is known as **apospory**. In this **gametophyte** always remains **diploid.**



Adventive Embryony ⇒

In this method, an embryo is formed from any **diploid cells (Nucellus or integuments)** of the **sporophyte**. This **diploid cell** behave like a **zygote and develop** (No embryo sac formation) Adventive embryo.

Ex. from **Nucellus** – **Citrus, Mangifera, Opuntia, Mamillaria**

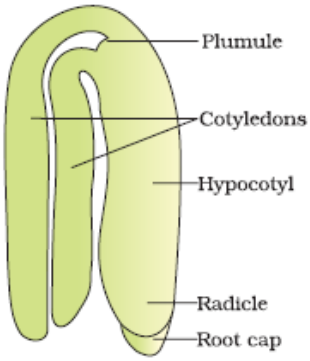
from **Integuments** – **Spiranthus australis**.

Ovule → Integument, Nucellus, Sporogenous cell (2n) —w/o meiosis & w/o fertilization→ Embryo (2n) ⟶ Seed (2n) ⟶ Plant (2n)

Parthenogenesis : In this process haploid egg cell of female gametophyte is responsible to form a haploid embryo without fertilization.
Apogamy : In this process any haploid cell of female gametophyte except egg cell is responsible to form a haploid embryo without fertilization.
Parthenogenesis and Apogamy both are not included in agamospermy.

Advantage of apomixsis for farmers :

As apomictic seed formation does not involves meiosis and fertilization, they are genetically identical to their parents. If the hybrid seeds become apomictic they will maintain their traits generation after generation as does not involves meiosis so lack of saggregation of characters & not involves fertilization so no recombination and trait will be maintained for several generations, so the farmers does not requires to present the hybrid seeds for every two to three years



29. (a) Describe the various steps of Griffith's experiment that led to the conclusion of the 'Transforming Principle'.

(b) How did the chemical nature of the 'Transforming Principle' get established ?

OR

Describe how the *lac* operon operates, both in the presence and absence of an inducer in *E.coli.* **5**

Sol. Griffith transformation experiment → Griffith preformed his experiment on *Streptococcus pneumoneae* bacteria which cause pneumonia is mice.

He used two strain of bacteria

Rough strain: Non capsulate Avirulant Rough colonies on culture media

Smooth strain: Capsulated virulent form smooth colonies on media

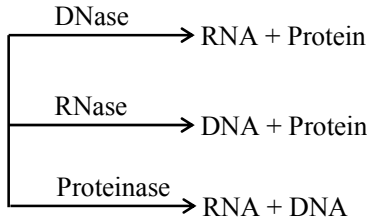
experiment :- Mice + Smooth strain bacteria ⟶ Dead mice

Mice + Rough strain bacteria ⟶ Living mice

Mice + Heat killeds bacteria + Rough bacteria ⟶ Dead Bacteria

on the basis of third experiment he proposed that R bacteria absorb some heat stable material from dead S bacteria and transformed in S bacteria which killed the mice

(b) Nature of transforming principle was established by avery mcleod & Mc carthy experiment



Purified Biochemical from heat killed s-bacteria (DNA + RNA + protein)
They discovered that RNase and protinase treatement does not affect the transformation but DNase treatment inhibit the transformation. It indicate that DNA is transforming principle.

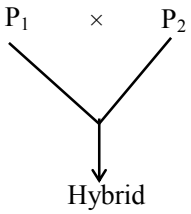
30. With advancements in genetics, molecular biology and tissue culture, new traits have been incorporated into crop plants.
Explain the main steps in breeding a new genetic variety of a crop.

OR

(a) State the objective of animal breeding.
(b) List the importance and limitations of inbreeding. How can the limitations be overcome?
(c) Give an example of a new breed each of cattle and poultry. **5**

Sol. Different steps involved in breeding a new crop variety.

(1) Collection of variability : Genetic variability is essential for breeding program. If genetic variability is not present than new variety can not be develops thus it is pre requisite condition for breeding
(2) Evaluation and selection of parent : Different germplasm is evaluated for desired trait and plant having the desired character are selected as parent.
(3) Cross hybridization among the selected plant : Hybridization is performed to combine the character of two different parent



(4) Selection and testing of superior recombinants : On the basis of presence of desired character in hybrid, superior recombinant are selected.
(5) Testing, release and commercialization of new cultivars : These new recombinant are evaluated in different agro climatic condition for several years along with best available local check variety. These lines are evaluated for their yield and other agronomic traits. If these line are superior than local check then they are released for commercial cultivation by CVRC

OR

(a) Animal Breeding aims at increasing the yield of animal & improving the desirable qualities of product.
(b) Importance of Inbreeding
  (1) Superior male & superior female of same breed are identified for mating.
  (2) Inbreeding increase homozygosity thus it provide pure line of animal
  (3) It exposes harmful recessive gene that are eliminated by selection
  (4) Also accumulates superior genes & elimination of less desirable gene
  (5) Increases the productivity of inbreed population

Limitation of Inbreeding :-
  (1) Continued inbreeding specially closed inbreeding usually reduces fertility & productivity. This is called as inbreeding depression.

(c) New breed of cattle → Hissardale
New breed of poultry → Leghorn.

CBSE-XII-2013 EXAMINATION

(BIOLOGY)

Code : 57/1

General Instructions :

(i) All questions are compulsory.

(ii) 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

(iii) There is no overall choice. However, an internal choice has been provided in one question of **2** marks, one question of **3** marks and two questions of **5** marks weightage. A student has to attempt only one of the alternatives in such questions.

(iv) Wherever necessary, the diagrams drawn should be neat and properly labelled.

SECTION A

1. Name an organism where cell division in itself is a mode of reproduction. **1**

Sol. Amoeba.

2. When does a human body elicit an anamnestic response? **1**

Sol. Subsequent encounter with same pathogen elicit anamnestic or secondary response when body have memory of first encounter.

3. Name any two diseases the 'Himgiri' variety of wheat is resistant to. **1**

Sol. Leaf rust, Stripe rust, Hill bunt.

4. State the role of transposons in silencing of mRNA in eukaryotic cells. **1**

Sol. This is method of cellular defence.

5. Why are green algae not likely to be found in the deepest strata of the ocean? **1**

Sol. Green algae lack the photosynthetic pigments like phycoerythrin, which can able to absorb shorter wavelength of light.

6. State what does 'standing crop' of a trophic level represent. **1**

Sol. Standing crop – is total amount of living matter or organic matter present in an ecosystem in unit area and unit time.

7. Why is the use of unleaded petrol recommended for motor vehicles equipped with catalytic converters ? **1**

Sol. Lead corrode the catalytic rods of polladium, Rhodium, Platinum which acts as the catalyst in catalytic converter and decrease the efficiency of catalytic converter.

8. Name the type of biodiversity represented by the following : **1**

(i) 1000 varieties of mangoes in India.

(ii) Variations in terms of potency and concentration of reserpine in *Rauwolfia vomitoria* growing in different regions of Himalayas.

Sol. (i) Genetic Diversity

(ii) Genetic Diversity

SECTION B

9. In angiosperms, zygote is diploid while primary endosperm cell is triploid. Explain. **2**

Sol. Zygote is product of syngamy which participate the fusion of haploid male gamete and haploid female gamete i.e. egg cell.

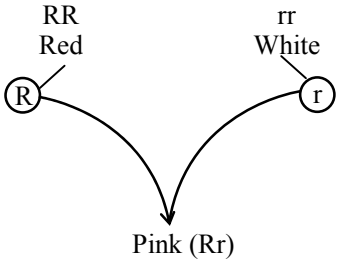
Male gamete + Egg $\rightarrow$ Zygote
(n) (n) (2n)

Primary endosperm cell is product of fusion of secondary nucleus (diploid) and haploid male gamete so triploid

Secondary nucleus + Male gamete $\rightarrow$ Primary endosperm cell
(2n) (n) (3n)

10. A cross between a red flower bearing plant and a white flower bearing plant of *Antirrhinum* produced all plants having pink flowers. Work out a cross to explain how this is possible. **2**

Sol.



	R	r
R	RR Red	Rr Pink
r	Rr Pink	rr White

Phenotypic ratio 1 : 2 : 1
Genotypic ratio 1 : 2 : 1
R(Red) factor is not completely dominant over r(white) factor is incomplete dominance.

11. List the two main propositions of Oparin and Haldane. **2**

Sol. Oparin-Haldane theory of origin of life

(1) At the time of origin of life free O_2 was absent, so first life was **anaerobic.**

(2) In the primitive atmosphere free oxygen was present but complete oxygen consumed in composition so primitive atmosphere of earth was **reducing.**

12. Write the events that take place when a vaccine for any disease is introduced into the human body. **2**

OR

Why is a person with cuts and bruises following an accident administered tetanus antitoxin ? Give reasons.

Sol. Vaccine is Antigen it stimulate the production of Antibody and memory cell is called primary response it does not cause harm when this pathogen enter second time this memory cell show rapid and massive response so body become immune to this pathogen.

OR

Tetanus antitoxin contain Antibody against pathogen it attach and inactivate pathogen (passive immunity).

13. Name the bacterium responsible for the large holes seen in ''Swiss Cheese''. What are these holes due to ? **2**

Sol. The large holes in Swiss cheese' are due to production of a large amount of CO_2 by a bacterium named propionibacterium sharmanii.

14. Name the source of the DNA polymerase used in PCR technique. Mention why it is used. **2**

Sol. Thermus aquaticus because it is heat stable DNA polymerase.

15. Write any four ways used to introduce a desired DNA segment into a bacterial cell in recombinant technology experiments. **2**

Sol. (1) Chemical method – Poration by divalent cation such as calcium
(2) Micro injection
(3) Biolistic or gene gun
(4) Disarmed pathogen vectors

16. Why is proinsulin so called ? How is insulin different from it ? **2**

Sol. Proinsulin is like a pro enzyme or pro harmone it contain an extra strech of C-peptide so it need to be processed to become fully mature and functional hormone like insulin, insulin is mature hormone which contain only A and B peptide.

17. Where would you expect more species biodiversity – in tropics or in polar regions ? Give reasons in support of your answer. **2**

Sol. High species or biodiversity lies in tropical areas because tropics are
(i) Undisturbed habitats since millions of year in comparison to temperate and polar region which face frequent glaciation. It favours speciation, as speciation is product of time.
(ii) Less seasonal variation than polar areas.
(iii) High availability of solar radiations than polar area, which harbours more plant species.

18. ''It is possible that a species may occupy more than one trophic level in the same ecosystem at the same time.'' Explain with the help of one example. **2**

Sol. Yes, as the trophic level of a species represents the functional role of organism in energy flow which is determined by the food if take. The food of an organism is depends on availability of food and what the organism wants to eat so have more than one tropic level at a time
Ex. Sparrow – Primary consumer
When eating seeds
– Secondary consumer
When eating insects

SECTION C

19. Explain the steps in the formation of an ovum from an oogonium in humans. **3**

OR

Suggest and explain any three Assisted Reproductive Technologies (ART) to an infertile couple.

Sol. In humans (and most vertebrates), the first polar body does not undergo meiosis II, whereas the secondary oocyte proceeds as far as the **metaphase** stage of meiosis II. However, it then stops advancing any further, it awaits the arrival of the spermatozoa for completion of second meiotic division. Entry of the sperm restarts the cell cycle breaking down **MPF** (M-phase promoting factor and turning on the **APC** (Anaphase promoting complex). Completion of meiosis II converts the secondary oocyte into a fertilized egg or zygote (and also a second polar body).
oogenesis process also can be divided into three stages :

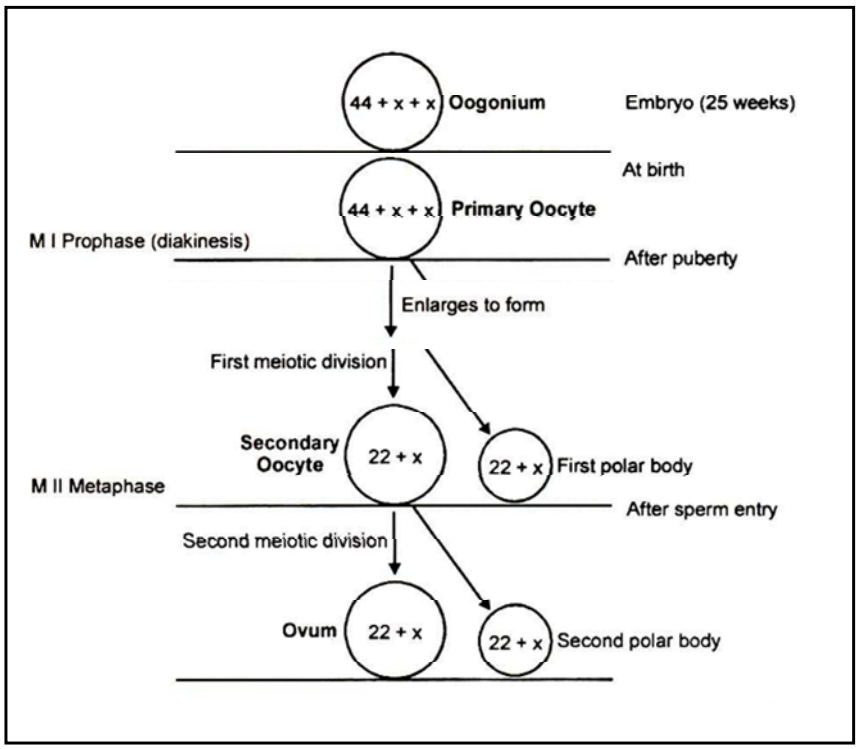
(A) Multiplication **(B) Growth phase** **(C) Maturation phase**

(A) Multiplication phase : In this stage primordial germ cells or ovum mother cells repeatedly divide by mitosis to form large number of diploid oogonia.

This process completes in embryo stage of female in most higher animals.

(B) Growth phase : Like spermatogenesis, in this process oogonia grow in size and form primary oocytes. The growth phase is the longest phase oogenesis (except humans). During growth phase size of egg increases many times.

Maturation phase : Oogenesis takes place in the ovaries. In contrast to males the initial steps in egg production occur prior to birth. By the time the foetus is 25 weeks old, all the oogonia that she will ever produce, are already formed by mitosis. Hundreds of these diploid cells develop into **primary oocytes**, begin the first steps of the first meiotic division, proceed up to diakinesis, and them stop any further development. The oocytes grows much larger and completes the meiosis I, forming a large **secondary oocyte** and a small **polar body** that receives very little amount of cytoplasm but one full set of chromosomes.



OR

Assisted reproductive technologies (ART)

***In vitro* fertilisation** (IVF–fertilisation outside the body in almost similar conditions as that in the body) followed by **embryo transfer** (ET) is one of such methods. In this method, popularly known as **test tube baby** programme, ova from the wife/donor (female) and sperms from the husband/donor (male) are collected and are induced to form zygote under simulated conditions in the laboratory. The zygote or early embryos (with upto 8 blastomeres) could then be transferred into the fallopian tube (ZIFT–**zygote intra fallopian transfer**) and embryos with more than 8 blastomeres, into the uterus (IUT – **intra uterine transfer**), to complete its further development.

Embryos formed by **in-vivo fertilisation** (fusion of gametes within the female) also could be used for such transfer to assist those females who cannot conceive. Transfer of an ovum collected from a donor into the fallopian tube (GIFT – **gamete intra fallopian transfer**) of another female who cannot produce one, but can provide suitable environment for fertilisation and further development is another method attempted.

Intra cytoplasmic sperm injection (ICSI) is another specialised procedure to form an embryo in the laboratory in which a sperm is directly injected into the ovum.

Infertility cases either due to inability of the male partner to inseminate the female or due to very low sperm counts in the ejaculates, could be corrected by **artificial insemination** (AI) technique. In this technique, the semen collected either from the husband or a healthy donor is artificially introduced either into the vagina or into the uterus (IUI – **intra-uterine insemination**) of the female.

20. Why are human females rarely haemophilic ? Explain. How do haemophilic patients suffer ? **3**

Sol. Mother of such a female has to be at least carries and father should be hamophilic (unviable in entire stage of life) so rare in females.

In an affected individual simple cut will result in non stop bleeding due to increased bleeding time.

21. In a maternity clinic, for some reasons the authorities are not able to hand over the two new-borns to their respective real parents. Name and describe the technique that you would suggest to sort out the matter. **3**

Sol. DNA Fingerprinting or DNA test (i) isolation of DNA, (ii) digestion of DNA by restriction endonucleases, (iii) separation of DNA fragments by electrophoresis, (iv) transferring (blotting) of separated DNA fragments to synthetic membranes, such as nitrocellulose or nylon, (v) hybridisation using labelled VNTR probe, and (vi) detection of hybridised DNA fragments by autoradiography. Half of the band of child will resemble to father and half to mother.

22. Explain the increase in the numbers of melanic (dark winged) moths in the urban areas of post-industrialisation period in England. **3**

Sol. Before industrial revolution, the dull grey forms of prepared moth-**Biston betularia** – were dominant; the **Carbonaria** form (Black) was rare because it was susceptible to predation by birds.

The industrial revolution, resulted in large scale smoke which got deposited on tree trunks tuning them Black. Now grey varieties became susceptible – the black forms flourished.

Replacement of coal by oil and Electricity reduced production of black moth so the frequency of grey moths increased again.

23. Describe how biogas is generated from activated sludge. List the components of biogas. **3**

Sol. Biogas produced by anaerobic fermentation of waste biomass.

Anaerobic fermentation of waste biomass can be visualized in three stages : -

1. The **facultative anaerobic microbes** degrade the complex **polymers** to simple monomers by enzymatic action.
   The Polymer like cellulose, hemicellulose, proteins and lipids get degraded into monomers but **lignins** and inorganic salts are left as residue because they do not degrade.
2. In second stage, monomers are converted in to **organic acids** by microbial action under partially aerobic conditions which are finally converted to **acetic acid.**
3. In third stage acetic acid is oxidized in to **methane** by the activity of anaerobic methanogenic bacteria. These bacteria are commonly found in the anaerobic sludge during sewage treatment. These bacteria are also present in the rumen (a part of stomach) of cattle. A lot of cellulosic material present in the foods of cattle is also present in the rumen. In rumen, these bacteria help in the breakdown of cellulose and play an important role in the nutrition of cattle. In this whole process digestion of **cellulose** takes place at very slow rate so that it is the **"rate limiting factor in biogas production.**

24. Name the pest that destroys the cotton bolls. Explain the role of *Bacillus thuringiensis* in protecting the cotton crop against the pest to increase the yield. **3**

Sol. A soil bacterium **Bacillus thuringiensis,** produce **crystal** [Cry] **Protein.** This Cry protein is toxic to Larvae of certain insects. Each Cry protein is toxic to a different group of insects. The gene encoding cry protein is called "**cry gene**". This Cry protein isolated and transferred into several crops. A crop expressing a cry gene is usually resistant to the group of insects for which the concerned Cry protein is toxic. There are a number of them, for example, the proteins encoded by the genes cryIAc and cryIIAb control the cotton bollworms, that of cryIAb controls corn borer.

Bt Cotton : some strains of Bacillus thuringiensis produce proteins that kill certain insects such as lepidopterans (tobacco budworm, armyworm), coleopterans (beetles) and dipterans (flies, mosquitoes). B. thuringiensis forms protein crystals during a particular phase of their growth. These crystals contain a toxic **insecticidal protein.** The Bt toxin protein exist as inactive protoxins but once an insect ingest the inactive toxin, it is converted into an active from of toxin due to the alkaline pH of the gut which solubilise the crystals. The activated toxin binds to the surface of midgut epithelial cells and create pores that cause cell swelling and lysis and eventually cause death of the insect.

25. (a) Write the importance of measuring the size of a population in a habitat or an ecosystem **3**

(b) Explain with the help of an example how the percentage cover is a more meaningful measure of population size than mere numbers.

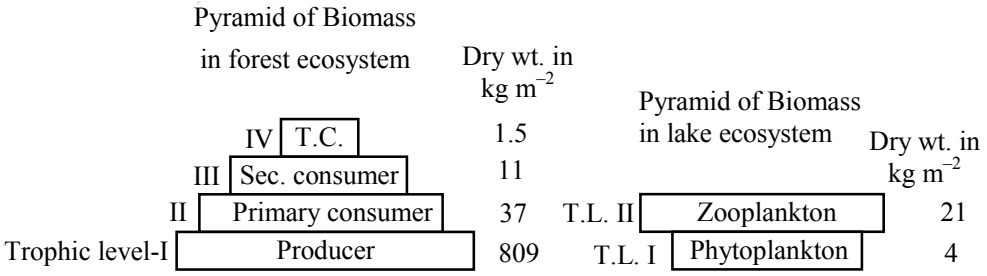
Sol. (a) Measurement of population in a habitat determines the relative abundance of that particular species and the effect of the species on the available resources of habitat.

(b) Percentage cover is more meaning measure of population size than mere numbers because the relative abundance of a species is not only determined by number of individual but by both i.e. the relative abundance in number and relative abundance in biomass.

Ex. In unit area the number of a grass species individuals or relative abundance in number is high but not in relative abundance of biomass, if the same area have one or two *ficus benghalensis* (Bargad) tree as it is very low in relative abundance in number while high in relative abundance of biomass.

26. Differentiate between two different types of pyramids of biomass with the help of one example of each. **3**

Sol. Pyramid of biomass are of both types upright and inverted. Upright pyramid of biomass in forest and grassland ecosystems while inverted pyramid of biomass in lake and ocean ecosystem as the biomass on next trophic level

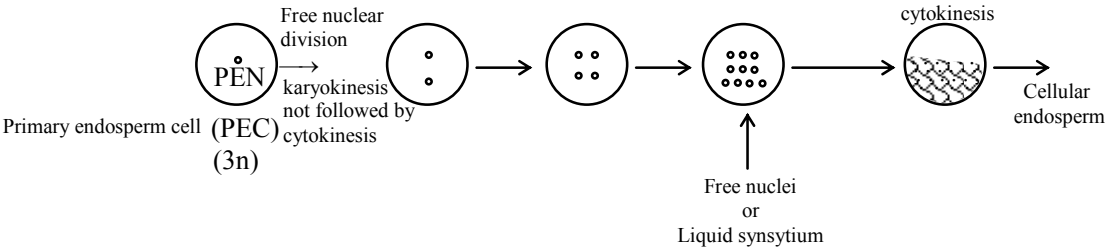


27. (a) Describe the endosperm development in coconut. **3**

(b) Why is tender coconut considered a healthy source of nutrition ?

(c) How are pea seeds different from castor seeds with respect to endosperm ?

Sol. (a) Coconut endosperm is formation is nuclear type



(b) Soft coconut is endosperm rich in nutrients like fat, proteins, carbohydrates, minerals, vitamines, as endosperm provide nutrition to developing embryo.

(c) Pea seed is **non endospermic** as endosperm is absent because endosperm is consumed completely during embryo development while Castor seed is **endospermic** as endosperm is present because endosperm is not utilized completely during embryo development.

SECTION D

28. (a) Draw a L.S. of a pistil showing pollen tube entering the embryo-sac in an angiosperm and label any six parts other than stigma, style and ovary. **5**

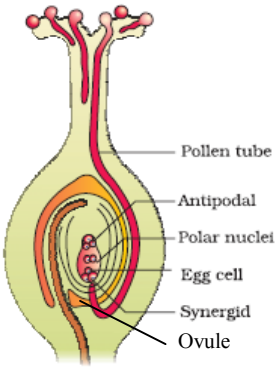
(b) Write the changes a fertilized ovule undergoes within the ovary in an angiosperm plant.

OR

(a) Draw a diagrammatic sectional view of a human seminiferous tubule, and label Sertoli cells, primary spermatocyte, spermatogonium and spermatozoa in it.

(b) Explain the hormonal regulation of the process of spermatogenesis in humans.

Sol. (a)



Longitudinal section of a flower showing growth of pollen tube

(b) Unfertilized ovule ⇒ Fertilized ovule = Seed

→ Funiculus → Present

→ Hilum → Present

→ Integument → Seed Coat

Outer integument → Testa

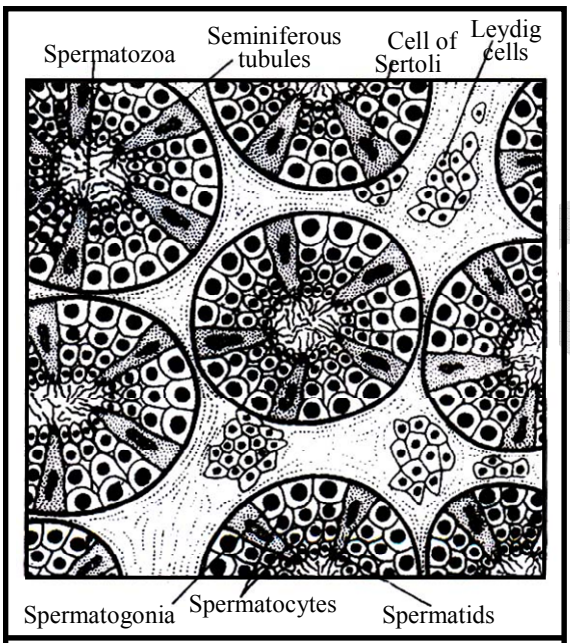
Inner integument → Tegman

→ Chalaza → Present
→ Micropyle → Present
→ Nucellus → Absent or utilized But if present called perisperm
→ Embryo sac

- → Antipodal cells → Degenerate
- → Synergid cells → Degenerate
- → Central cell → Endosperm
- → Egg → Embryo

OR

(a)



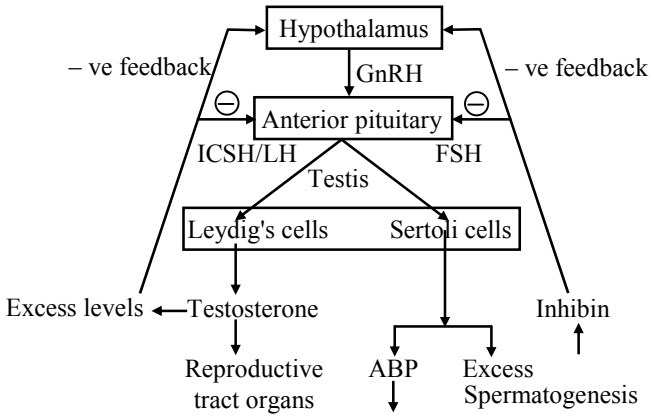
HISTOLOGY OF TESTIS

(b) **FSH :** Binds with FSH receptors attached to the Sertoli cells in seminiferous tubules. This causes these cells to grow and secrete various spermatogenic substances and androgen binding proteins (ABP)

ABP : Concentrates the testosterone inside seminiferous tubules.

LH/ICSH : - It stimulates the leydig cells to secrete testosterone. Leydig's cells mature at 10 years of age .

Inhibin : : It is secreted by Sertoli cells in response to excess spermatogenesis. The inhibin gives a negative feedback to the hypothalamus and anterior pituitary, this results in suppression of synthesis and release of FSH ($\therefore$ Spermatogenesis decreases).



(1) Stimulation of spermatogenesis
(2) Concentration of testosterone in seminiferous tubules

29. (a) Write the conclusion drawn by Griffith at the end of his experiment with *Streptococcus pneumoniae.*
(b) How did O. Avery, C. MacLeod and M. McCarty prove that DNA was the genetic material? Explain. **5**

OR

(a) Explain the mechanism of sex-determination in humans.
(b) Differentiate between male heterogamety and female heterogamety with the help of an example of each.

Sol. (a) When *Streptococcus pneumoniae* (pneumococcus) bacteria are grown on a culture plate, some produce smooth shiny colonies (S) while others produce rough colonies (R). This is because the S strain bacteria have a mucous (polysaccharide) coat, while R strain does not. Mice infected with the S strain (virulent) die from pneumonia infection but mice infected with the R strain do not develop pneumonia.

S strain ⟶ Inject into mice ⟶ Mice die

R strain ⟶ Inject into mice ⟶ Mice live

Griffith was able to kill bacteria by heating them. He observed that heat-killed S strain bacteria injected into mice did not kill them. When he

S strain (heat-killed) ⟶ Inject into mice ⟶ Mice live

S strain (heat-killed) + R strain (live) ⟶ Inject into mice ⟶ Mice live

injected a mixture of heat-killed S and live R bacteria, the mice died. Moreover, he recovered living S acteria from the dead mice. He concluded that the R strain bacteria had somehow been **transformed** by the heat-killed S strain bacteria. Some 'transforming principle', transferred from the heat-killed S strain, had enabled the R strain to synthesise a smooth polysaccharide coat and become virulent. This must be due to the transfer of the genetic material.

(b) They purified biochemicals (proteins, DNA, RNA, etc.) from the heat-killed S cells to see which ones could transform live R cells into S cells. They discovered that DNA alone from S bacteria caused R bacteria to become transformed. They also discovered that protein-digesting enzymes (proteases) and RNA-digesting enzymes (RNases) did not affect transformation, so the transforming substance was not a protein or RNA. Digestion with DNase did inhibit transformation, suggesting that the DNA caused the transformation. They concluded that DNA is the hereditary material.

OR

(a) The sex determining mechanism in case of humans is XY type. Out of 23 pairs of chromosomes present, 22 pairs are exactly same in both males and females; these are the autosomes. A pair of X-chromosomes are present in the female, whereas the presence of an X and Y chromosome are determinant of the male characteristic. During spermatogenesis among males, two types of gametes are produced. 50 per cent of the total sperm produced carry the X-chromosome and the rest 50 per cent has Y-chromosome besides the autosomes. Females, however, produce only one type of ovum with an X-chromosome. There is an equal probability of fertilisation of the ovum with the sperm carrying either X or Y chromosome. In case the ovum fertilises with a sperm carrying X-chromosome the zygote develops into a female (XX) and the fertilisation of ovum with Y-chromosome carrying sperm results into a male offspring. Thus, it is evident that it is the genetic makeup of the sperm that determines the sex of the child. It is also evident that in each pregnancy there is always 50 per cent probability of either a male or a female child.

(b) There has two types of sex determining mechanisms, i.e., XO type and XY type. But in both cases males produce two different types of gametes, (a) either with or without X-chromosome or (b) some gametes with X-chromosome and some with Y-chromosome. Such types of sex determination mechanism is designated to be the example of **male heterogamety**. In some other organisms, e.g., birds a different mechanism of sex determination is observed. In this case the total number of chromosome is same in both males and females. But two different types of gametes in terms of the sex chromosomes, are produced by females, i.e., **female heterogamety**. The two different sex chromosomes of a female bird has been designated to be the Z and W chromosomes. In these organisms the females have one Z and one W chromosome, whereas males have a pair of Z-chromosomes besides the autosomes.

30. A person in your colony has recently been diagnosed with AIDS People/residents in the colony want him to leave the colony for the fear of spread of AIDS. **5**

(a) Write your view on the situation, giving reasons.

(b) List the possible preventive measures that you would suggest to the residents of your locality in a meeting organised by you so that they understand the situation.

(c) Write the symptoms and the causative agent of AIDS

Sol. (a) AIDS is infectious but not contagious it does not spread by shaking hand and use of common utensil so there is no need of fear to live with AIDS patient.

(b) Making blood (from blood banks) safe from HIV, ensuring the use of only disposable needles and syringes in public and private hospitals and clinics, free distribution of condoms, controlling drug abuse, advocating safe sex and promoting regular check-ups for HIV in susceptible populations, are some such steps taken up.

(c) AIDS is caused by the Human Immuno deficiency Virus (HIV), a member of a group of viruses called **retrovirus.** Which have an envelope enclosing the RNA genome 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 patient becomes so immuno-deficient that he/she is unable to protect himself/herself against these infections.